M. VAN LOO
Cont.

#112 - Cont.

CH 3869 - Fire Retardant Flat

Titanium Dioxide	16.7%
Borax	27.6%
Calcium Sulphate	13.7%
Vegetable Oils and Resins	16.7%
Drier and Mineral Spirits	25.3%
	100.0%

CH 3870 - Fire Retardant Semi-Gloss

Titanium Dioxide	22.2%
Borax	23.6%
Calcium Sulphate	8.2%
Calcium Carbonate	7.8%
Vegetable Oils and Resins	18.7%
Drier and Mineral Spirits	19.5%
	100.0%

These type materials when tested for fire retardance showed that the semi-gloss was somewhat better than the flat. This is to be expected on the basis of porosity of the flat paint.

A washability test showed that a fire retardant flat applied over Wall Primer and Sealer had much lower washability than the semi-gloss applied over the same undercoater.

During the month a batch of special fire retardant paint was made up on a type of formulation suggested by the Forest Products Laboratory in their latest publication. The specific batch made up consisted of 54 parts by weight of $(NH_4)H_2PO_4$, 6 parts by weight of mica and 40 parts by weight of 2% sodium alginate gel. This composition gives a medium heavy brushing consistency, which can be applied as a heavy transparent coating which dries to a flat white. When tested for fire retardant properties it seemed the best of any tested to date. For interior usage under average conditions its fire retardant properties, according to Forest Products Laboratory, should be retained indefinitely. This, of course, does not include washing.

#177 - Pigment Studies

Titanium Calcium Pigments

Report of tests mentioned in the December report: Pigments under test included rutile titanium calcium pigments Ti Cal R 20 Special C 1290, Titanox RC HT new production, and Titanox RC HT "X" type. Titanox C and Ti Cal MX 104 were used as reference standards in the Paintercraft #10 Flat and Flat-Tone formulas respectively. Paintercraft #10 Flat is ground at Kensington on the roller mill, and Flat-Tone on the pebble mill.

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A - Opacity

The rutile titanium calcium pigments have a marked opacity advantage over the anatase types. In these tests it appeared that Titanox RC HT is slightly higher in opacity than the Ti Cal R-20 Special C 1290.

Contrast ratios at 715 sq. ft./gal. - Paintercraft #10 Flat:

90% Titanox C, 1271 dry Titanium Calcium
91% Ti Cal R 20 Special " "
92% Titanox RC HT " "

A similar relationship carried through the Flat-Tone series.

B - Color

Color differences between the pigments tested are very slight. However, it is our impression that the Ti Cal R 20 is slightly more blue in tone than the Titanox RC HT. The rutile calcium pigments are all about 1% higher in brightness than are the anatase materials.

C - Consistency

1. Paintercraft #10 Flat

At three days, titanium calcium pigments Titanox C, Titanox RC HT and Titanox RC HT X all gave comparable body, 14.4", 19", and 16.6" respectively, with a 700 gm. load timed at 50 revolutions on the Stormer. However, Ti Cal R 20 Special was much higher in body, giving a reading of 70" under similar conditions. The reduced paints of all brushed very well, even though the increased body of the R 20 was still evident when stirring with a spatula.

2. Flat-Tone

In Flat-Tone, all paints were comparable in body, giving readings of 98, 86, 94, and 92 Krebs' units at three days' age. Values are in the order named for titanium calcium pigments Ti Cal MX 104, Ti Cal R 20 Special, Titanox RC HT, and Titanox RC HT X.

The consistency picture being quite different in the Paintercraft and the Flat-Tone, we checked the above relationship and found them to be reproducible. However, by grinding the Flat-Tone on the roller mill, we have been able to duplicate the condition arrived at in the Paintercraft formulation. That is, R 20 is then the highest in body instead of the lowest as occurred in the normal Flat-Tone grind. Indications are that the R 20 is a hard material to wet and that as complete wetting cannot be accomplished in a few passes on the roller mill as in the pebble mill. With a very tight set of the mill, we can reduce the differential between the R 20 and the standard pigment in the Paintercraft formula.

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Cont.

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A check on consistencies of the above paints after aging one month shows that although the bodies of the paints change, the relationship between the pigments is comparable to those values determined at three days' age.

D - Ghosting

All of the titanium calcium pigments were bad with respect to ghosting. However, the Ti Cal R 20 is equal to the anatase TiO_2 in this respect, while the RC HT normal and X type are both considerably worse from a ghosting standpoint.

E - Sheen

Titanox RC HT normal and X types, as well as the standard, are all fairly high in sheen and equal to each other. Ti Cal R 20 Special is definitely lower in sheen with the uniformity being only slightly lower.

F - Carbon Black Undertone

Anatase titanium calcium pigments tint with a very desirable blue under-tone when using carbon black tint base, whereas rutile titanium calcium pigments normally have a dirty under-tone.

Titanox RC HT is a normal rutile material in this respect, but the Ti Cal R 20 appears to be somewhat of an improvement over other rutiles that have been examined. This factor is mentioned only as an observation and does not imply that the Ti Cal R 20 is equal to the anatase materials for blue under-tone.

New Titanium Dioxide Pigments

The following pigments have been made up into SWP Undercoater - Rex 450 and SWP Gloss White - Rex 471, and have been painted out on cedar for exposure at Coffeyville, 90° south and Chicago, 90° south and 90° north. Colonial Yellow tints of each of these will be prepared and will be placed on exposure as soon as possible.

TiO_2 pigments under test:

Titanox A - 1403 T
Ti Pure R 110
Titanox RA
50/50 blend Titanox RA/1403 T
Ti Pure R 200 (old production, about January, 1942)
Unitane R 250
Ti Pure R 200, lot 4773 (current receipts)

M. VAN LOO
Cont.

#162 - Studies of Flat Wall Paint Formulation

Due to the difficulties encountered by Newark and Cleveland in the manufacture of the flat wall paint SO_2 bodied oil vehicle (2394), various oils were tested as possible replacements. Several heat bodied oils were tested, as well as special (2394)S' prepared by the Resin Research Department, also a fast bodied linseed oil ARV 2945 submitted by Mr. Walton.

All oils tested to date except standard (2394) produced low viscosity paints, with the exceptions of bodied linseed oils (509), (321), and (324). Bodied linseed (509) was not very satisfactory due to poor color, while in general the 300 series of oils have stickier brushing properties than (2394). To date the most logical replacement is bodied linseed (321), although it is not an actual replacement insofar as maintenance of all qualities is concerned. The experimental batches are grayer in color. Work is continuing in cooperation with the Resin Research Department.

#103 - Metal Protective Paints

A series of J magnesium alloy panels were placed on test to study primers for aircraft usage. One series was coated by dipping with two coats of 43806-L zinc chromate primer using S-W zinc chromates 12054 and D 2689, and competitive zinc chromate pigments Kentucky Color's #2813, Reichold's 1410 and Krebs' KJ 1306. Another series were coated with two coats of the above primer and one coat of Rex 47870 - Aircraft Enamel Lime Yellow.

One batch of panels from each series was placed in a 3% salt spray cabinet and another batch of each series was placed in an alternate immersion dip apparatus using a 3% salt solution as suggested by the Dow Chemical Co. This same series will be put out on exposure on 8" x 24" hot rolled steel panels and exposed at Chicago and Florida to determine the relative rust inhibitive properties of these pigments, particularly as affected by the chloride content. The top half of each primer panel will be given a finish coat of Metalastic Black, Rex 5891.

At our request, Monsanto Chemical Company prepared two samples of ferric orthophosphate to determine whether it possessed any merit as a rust inhibitive pigment. Sample #1 was ground and air separated to scalp out oversize particles. The particle size was approximately 96% through a 325 mesh screen. Sample #2 was obtained as a dust fraction during the air separation of Sample #1.

The two samples were substituted for zinc dust as a pound for pound replacement in G and G Primer, Rex 27783, and the vehicle was revised to use Mixing Varnish V 11118 to replace Mixing Varnish (2841)C. Sample No. 1 produced a primer similar in consistency to the regular zinc dust primer, but Sample No. 2 produced a very high consistency not suitable for application.

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Cont.

#103 - Cont.

The samples were brushed out on galvanized steel panels against the standard primer. The results of these tests indicated that the ferric orthophosphate seriously increased the drying time of the paints. Allowing sufficient time for drying, these paints will be put on exposure in Chicago only on both galvanized steel and cold rolled steel panels.

Panels 6920-6931 C, 8" x 24" steel panels, were painted for exposure at Chicago only, covering the reformulations of Rex 9550 Metalastic Dark Gray and Rex 27399 - Metalastic Light Gray to reduce flow and increase build as discussed in the December report. The gray primer using blue lead in the pigmentation of the Kromik vehicle, as described in earlier reports, was included.

#77 - Mildew Inhibitors

In the November, 1942 report mention was made of the study of possible substitutes for tetrachlorphenol as fungicides for use in mildew resistance treatment of paints. The various experimental batches have now been applied on cedar and yellow pine panels for exposure in Florida only, under conditions conducive to mildew growth. The fungicides included are: (a) 2052 dry - Dowicide 6, (b) technical grade tetrachlorphenol, (c) phenol mercuric oleate (1 to 1000 and 1 to 500), (d) Stabilizer #6, and (e) Roccal (high molecular alkyl-dimethyl-benzyl-ammonium chloride 10% solution). The panels are 6913-19 F.

Special Studies

Finishes for Military Hutments and Barracks

As a result of a discussion of results of the moisture absorption tests carried out on various primers and sealers, as reported in December, a much more extensive primer and sealer study has been started. The Airplane and Automotive sections of the Lacquer Department, the Furniture Technical Service, and the Varnish Laboratory cooperated in planning the program and test procedure, and in the preparation of some of the panels.

The general plan is to test eight panels for each material or system, four of which are to be run continuously in the humidity cabinet at 110° F. and 100% relative humidity and the other four to be put through a daily cycle as follows: (a) over night in the humidity cabinet, (b) three hours at low temperature, -20° F. or less most of this time, (c) two hours in a 140° F. oven, and (d) two hours' exposure to the carbon arc. In each set, two panels are matched duplicates of Ponderosa pine and two are of birch. The panels are 6 x 8 x 3/8" and are sealed on the edges with asphalt enamel, thus having two test surfaces exposed. A total of 168 panels will be tested, with weight increases and film failure to be checked every day or as often as possible. Initial moisture content of sample panels will be checked.

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This shows clearly the value of ZnO in the film in early drying of the film. These extractions will be repeated on this series at six and 12 months, as well as on another series which will be put out in late spring, to determine the ultimate effect of zinc oxide on sol-gel ratios present in the film at given times.

#12 - Exterior Primers

In order to check the feasibility of using Vanderbilt's pyrophyllite inert, Pyrax B, in SWP 450 Undercoater a plant batch was ground under normal production conditions. The Pyrax B has a small amount of coarse particles compared with magnesium silicate 20 L, which militates against its grinding properties. The special batch of 450 Undercoater came out with a grind of 1 P against the standard of 2 M, and it was necessary to strain the batch through silk. The sheen was lower than standard. The viscosity was equal to standard.

At the same time a special production scale batch of SWP Gloss White was ground substituting Pyrax B for the magnesium silicate 20 L. Again the gloss was low, requiring the addition of extra bodied linseed to bring up the gloss. The viscosity was satisfactory.

#177 - Pigment Studies

New Titanium Dioxide Pigments

During the past month exposures of various TiO_2 pigments have been made in the Rex 450 - Rex 471 2-coat paint systems. These paints were also tinted to Rex 375 - SWP Colonial Yellow and exposed as a second group.

Both north and south exposures at Chicago were made on the above set of panels so that we might study dirt retention and tint retention more critically. We have recently seen exposures made by du Pont in which they encountered peculiar differences between paints when they were exposed facing north as compared with the normal south exposures.

The TiO_2 pigments included in the above test were: Titanox A, Ti Pure R 200, old production and current receipts, Ti Pure R 110, Unitane R 250, Titanox RA, and a 50/50 blend of Titanox RA and Titanox A.

In order that we may have complete information as regards this TiO_2 picture a set of paints has been made for the study of tint retention. Paints were made on the SWP Gloss White - Rex 471 formula and are to be tinted to match Rex 375 Colonial Yellow and Rex 363 Slate. In this set non-chalking and semi-nonchalking rutile titaniums are being compared with lead titanate for tint retention. TiO_2 pigments included in test: Ti Pure R 610, Ti Pure R 510, Ti Pure R 200, 1895 dry - Titanox L.

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Cont.

#177 - Cont.

Cleveland reported on comparisons of Titanox A #24 - 2147 dry and rutile R 610 - 2174 dry in Kem X-47 enamels. They found no appreciable difference in grinding qualities. 2174 dry was slightly stronger than 2147 dry, and produced a slightly yellow tinge which had to be overcome by shading. It is interesting to note that when exposed under the National Carbon lamp, the 2174 dry chalked slightly more than the 2147 dry. This is unexpected and may be contradicted by exterior exposures which will be reported on later. The chalk which accumulated after 320 hours and 630 hours in the lamp cleaned up readily with Opex Polish.

#162 - Studies of Flat Wall Paint Formulation

Since some production batches of Flat-Tone have been running low in viscosity using the lithopone-zinc sulphide pigmentation, investigations indicate that relief may be obtained using the higher consistency lithopone 461 H. A factory batch is being ground using half 461 S and half H.

Work is under way to study the possibilities of conservation of oil in Flat-Tone by a 20% reduction in oil content. Work to date indicates a considerable reduction in tightness, recoatability, and washability of the films. Work continues.

A preliminary investigation is under way investigating the possibilities of Congo varnish V 11838 in Wall Primer and Sealer, and also as a replacement for modified phenolic varnish (3810)G in Triseal. The Congo varnish appears to be a satisfactory replacement, although further work is required on the varnish to eliminate some critical ingredients.

#103 - Metal Protective Paints

A sample of calcium chromate was recently submitted for test by Diamond Alkali. This was made up into airplane primer 43806-L together with our regular zinc chromate - 12054 dry. At 20 days in the 3% salt spray cabinet $CaCrO_4$ seems to be slightly superior to 12054 dry. In the humidity cabinet there is no rusting on either panel at the present time (20 days). However, the calcium chromate has leached out badly from the film. This is to be expected on the basis of the solubility of the material, which will probably limit its use. (Ca. 16 grams in 100 of H_2O at 20° C.)

#77 - Mildew Inhibitors

An oil conservation formula was developed for Rex 63057 - SWP Gloss White Mildew Resistant Treated, along the vehicle lines used in the oil conservation formula for SWP Gloss White.

An earlier set of mildew resistant treated paints were prepared in November, 1942, which included regular 2052 dry tetrachlorphenol, a technical grade of tetrachlorphenol, Roccal, Stabilizer #6, phenyl mercuric oleate, and SWP Mildew Resistant Treated Gloss White. Due to the shortage and restrictions

ALLIED RESEARCH LABORATORIES

Report of Investigations for March, 1943

M. VAN LOO

#97 - SWP 471

In the February report mention was made of plant trials to be made on SWP Gloss White replacing bodied linseed oil (48) by Mr. Walton's fast bodied Z-2 linseed V 11125. In spite of the darker color as compared with (48), when used in SWP Gloss White, the color of the paint appears entirely acceptable. Since V 11125 can be brought to Z-2 body in two hours, this oil appears very interesting from an economy standpoint as regards fire-hours.

Occasionally the Kensington factory, as well as other points, has experienced color difficulties due to "manganese float" on certain batches of SWP Gloss White. To check the floating tendencies of various types of manganese driers, batches were prepared on the current formula introducing the manganese on equal metal basis as (543) Manganese Linoleate drier, 4% Manganese Nuolate, 4% Manganese Advasol drier, 6% Manganese Soligen (Modified), 6% Shepherd Liquid Manganese No. 6, and 4% Ferro Manganese Tallate drier. No differences in color were observed, but the tests will be repeated to verify these results. Granulation and durability tests will be run.

During the month considerable time was spent in handling production problems of SWP Gloss White and Undercoater being manufactured at outside plants.

Final examination was made of Florida exposures at 24 months testing the regular lead titanate-titanium oxide blend of Rex 385 - Straw, Rex 470 - Golden Yellow, and Rex 375 - Colonial Yellow of 1-5-40 against a previous formulation carrying no lead titanate and against a special formulation very high in lead titanate. The regular formulas used chrome and ochre tinting colors, the special used ferrites, and it is difficult to estimate the influence of these on the final results. The high lead titanate paints are surprisingly good all around; chalking starts relatively late, fading is much less, and check-resistance is possibly better, though differences in the latter respect are very slight. Dirt-collection apparently was not excessive, although rather serious in the early stages.

#164 - Reformulation Studies of House Paint to Reduce Dirt Collection

Chicago exposures of oil conservation whites were examined after six months (October through March). These are exposed both over Rex 450 and as one-coat work on Ponderosa pine and Douglas fir siding, vertical south, with regular Rex 471 Gloss White as guide. The use of bodied oil, and, in some cases, elimination of inert, produced the desired pigment volume concentration at a saving in linseed oil. The basic formula used was Rex 471 of 4-8-42, which carries 200 pounds of leaded zinc as 414 W and 130 pounds of free-chalking titanium as 1403 T. The following chart shows briefly the vehicle characteristics of the paints tested:

#164 - Cont.

work. Titanox R-200, used in one case, showed increased dirt collection. The outstanding panel is that of OJ 298 F, a special with very low p.v.c. It shows very bad dirt collection; but without undercoater the chalking is so rapid that most of the heavy dirt film has cleaned off. Gardner's oil-saving formula is comparatively good. (Florida reports show earlier tendencies toward checking.) Since OJ 296 F, to cite one of the most clear-cut examples of the use of heavy bodied oil and low inert, is at least as good in appearance as Rex 471, the basic idea of this method of oil conservation seems to be upheld so far.

#86 - Durability of Pigments with Special Reference to Leaded Zinc and White Lead

Panels testing a special grind of S-W white lead prepared by the Pulverizing Machinery Company were examined after 51 months at Chicago. All were 3-coat self-primed work on Ponderosa pine. Both Rex 17 Paste White Lead and Martin-Senour Rex 100 Monarch Outside White formulas were used as a basis for the comparison of this specially pulverized material with representative samples from our white lead plant. Definite to very bad checking, cracking and flaking have developed, and the only clearly significant differences are in favor of the regular stock guides (Rex 17 and Rex 100) as opposed to the laboratory batches making up the main feature of the test. The special pulverization shows no particular good effects. Incidentally, the self-cleaning properties of this formula of Rex 100 ready-mixed paint now revised are not particularly better than those of straight lead-in-oil, but resistance to checking and cracking is definitely better with Rex 100. (Panels 2330-5 C.)

#77 - Mildew Inhibitors

At the request of Mr. H. Einbecker, work is being done on Mildew Resistant Treated Undercoater and Gloss White to develop a formula which could use the SWP Gloss White and Undercoater pastes as shipped in, thus reducing oil consumption. It appears to date that the most desirable method of handling the Dowicide is to dissolve it in some oil and add the solution to the thin-down. Previous efforts to introduce it into the grind resulted in excessive body of the paint. Using the solution it would be necessary to add extra oil so that the final p.v.c. would be about 30%. Work continues.

#12 - Exterior Primers

A special Iron Oxide Prefab Primer CH 4001 was prepared during the month, along the same lines as Prefab Primer White, CH 3285, to be used as a primer for Roof and Bridge Paint by the Gordon Griffin Corporation on secondary farm buildings. Exposures will be put out at Chicago on Ponderosa and Yellow Pine.

M. VAN LOO
Cont.

#162 - Studies of Flat Wall Paint Formulation

The work under way to correct the viscosity of Flat-Tone has been completed and revisions have been sent through to Cleveland. Work on oil conservation continues. Various inerts such as Atomite, Surfex, Blanc Fixe, #200 Fibrous Talc, #282 Clay, and 566 dry whiting have been tested to determine their influence on sealing. The results to date indicate no particular advantage in the use of the different inerts in conservation paints at lower oil contents, since all were poor in sealing as compared with the regular formula. Micro Velva A has now been received and will be tested.

An investigation is being made of the possibilities of using 10% and 20% replacement of the oils with Vistac #1, manufactured by the Advance Solvents and Chemical Corporation.

New formulas were developed for Wall Primer and Sealer and Triseal using the congo varnish V 11838. This varnish is now based on linseed oil. The formulas will be placed on file in Cleveland for reference when needed.

Experimental batches of Enameloid White and Ivory using vehicles containing raw materials still available were compared with previous standards in this line. Tests indicate that a satisfactory White Enameloid could be made from a 25 gallon linseed-Piccolyte-Polypale varnish. Drying time, print resistance, water resistance and washability of the enamel compared favorably with older formulations.

A 25 gallon-linseed-Velsicol Polypale vehicle was one of the most promising possibilities for Enameloid tints. Also promising but more expensive and requiring greater oil consumption were formulations based on a straight 25 gallon Polypale varnish and the Piccolyte-Polypale combination mentioned above for the white. Varnishes using limed rosin, zinc resinate or blends of limed rosin and Polypale even in 30 gallon lengths did not produce Enameloids of good quality. Drying was slower than standard, the enamels printed badly and water resistance and washability were poor.

Some work was done with the short Congo-Linseed Varnish, (2831)C. It produced a white enamel definitely off-color as compared with our standard for Enameloid White. When used for tints the enamels produced had fast initial drying but even after 24 hours the film was soft and"cheesy." Gloss of the congo enamels was a trifle low.

The following data was collected for presentation at the vehicle meeting, April 1:

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Cont.

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Evaluation of Vehicles in Enameloid Formula

Formula	Vehicle	Type Vehicle	Material Cost Per 100 Gals	Gals. Oil Used/100 g. Output	Drying Time - Hrs. Touch	Handle	Hard
Rx 710	(3848)E	PE Rosin	$113.75	29.42	3-3-1/2	6-8	24
BC 13	V-11097	Polypale	123.95	37.23	3-3-1/2	6-8	24
BC 23	ARV 2998	Piccolyte	122.76	30.29	2-1/2-3	6-8	24
BC 49	(2831)C	Congo	117.52	26.70	2-2-1/2	6-8	24-cheesy
BC 22	(2843)GS-(2841)G	Mod. Phen.	120.03	27.94	3-3-1/2	6-8	24
BC 21	(2843)G	Mod. Phenolic	110.60	28.34	3-3-1/2	6-8	24
BC 16	(3848)E	PE Rosin	98.40	28.54	3-3-1/2	6-8	24
BC 17	V-11097	Polypale	109.55	36.72	2-1/2-3	6-8	24
BC 18	ARV-2978	Zinc Resinate	101.93	30.59	3-1/2-4	8 +	24
BC 19	ARV-2980	Limed Rosin	97.54	30.41	3-1/2-4	8 +	24
BC 20	ARV-2984	Polypale-Limed Rosin	102.63	33.48	3-1/2-4	8 +	24
BC 32	ARV-3006	Piccolyte	110.44	30.50	3-3-1/2	6-8	24
BC 31	ARV-3005	Velsicol-25	98.91	29.68	3-3-1/2	6-8	24
BC 50	(2831)C	Congo	101.61	25.72	2-2-1/2	6-8	24-cheesy
BC 51	ARV-3011	Velsicol-18	96.08	26.35	3-3-1/2	6-8	24

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Formula	Water Resistance 24 Hr. Imm.	Spot Test*	Soap and Water Wash Test	Print Test**	Embrittlement (24 Hr. Bake at 105° C.)	Viscosity Sec. on #3 Orifice Orig.	3-31
Rx 710	OK	2	OK	3	OK	--	--
BC 13	OK	3	OK	4	OK	27.2	23
BC 23	OK	3	OK	4	OK	34	41
BC 49	—		—		—	45	41
BC 22	V.S. dulling	2	OK	2	OK	39	35
BC 21	V.S. dulling	4	OK	4	OK	37	30
BC 16	OK	4	OK	3	OK	55.4	44
BC 17	OK	4	OK	4 +	OK	34	30
BC 18	Dull; white	10	Dulled	10	Sl. brittle	38.2	33
BC 19	Dull; white	10	Dulled	10	Sl. brittle	39.4	34
BC 20	Sl.dull; sl. white	8	Dulled	9	OK	39	32.4
BC 32	OK	2	OK	3	OK	31.2	30
BC 31	OK	3	OK	4	OK	36	33
BC 50	—		--		--	26	25
BC 51	—		--		—	29	28

*Rated from 1 - no effect to 10 - badly affected.

**Rated from 1 - no printing to 10 - very bad.

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Cont.

#162 - Cont.

(Following the discussion at the vehicle meeting, a group of varnishes were selected for final check in Enameloid White and tints, and Semi-Lustre White and tints.)

#177 - Pigment Studies

During the past month we have received samples of Titanox RA-10 in both the low and medium oil absorption grades. This material is described by Titanium Pigments as follows:

Titanox RA-10 may be termed a "free chalking" rutile oxide, and in this respect exhibits the same order of chalking as Titanox A-MO (anatase). They also have stated that "Titanox RA-10 is a grade of rutile titanium oxide comparable to the competitive R-200 type."

These claims are to be investigated. Samples of both oil absorption grades will be exposed in both whites and tints of the SWP line. For tint retention they will be included in the series mentioned in the February report which includes Ti-Pure R 610, Ti-Pure R 510, Ti-Pure R 200, and Titanox L as the pigment variations.

#112 - Fire Retardant Paints

As an extension of work reported previously, a series of batches of modifications of the 52-P-18 specification zinc chromate primer were made up with the hope of finding what p.v.c. would have the maximum fire retardant properties and at the same time good anti-corrosion properties.

The batches made up were as follows:

1. 52-P-18 - p.v.c. increased to 45% by inert.
2. " " " " 50% " "
3. " " " " 55% " "
4. " " " " 45% by zinc chromate.
5. " " " " 50% " " "
6. " " " " 50% by inert, plus antimony oxide replacing TiO_2 on a volume basis.)

Fire retardant tests on steel panels gave the following results, when tested as a two coat system consisting of a 0.005" draw-down of primer followed by a 0.005" draw-down at right angles of 52-P-22 fire retardant gloss. This method of test was suggested by the Navy Dept. rather than using multiple coats of 52-P-22. The temperature of test was approximately 1850° F.

#150 - Cont.

zinc sulphide 1538 dry, mica, and magnesium silicate, besides the leaded zinc. As an added comparison a revision was included carrying the zinc sulphide-mica-magnesium silicate pigment Cryptone MS-130, with certain vehicle changes. The latter formula performed as well as the previous regular, but for some reason all the substituted zinc sulphides were inferior to the guide, which apparently carried a New Jersey sulphide other than the lots included in the tests.

Panels 2246-8 C were examined after 48 months' exposure at Chicago, comparing two samples of Coffeyville zinc sulphide-calcium sulphate pigments versus Cryptone MS-130 in Acme's Big "6" Outside White. The test panels were in an advanced stage of break-down, while the guides were in fair condition. The Coffeyville materials are therefore definitely inferior to Cryptone MS-1 in durability.

Panels 2249-55 C were examined after 47 months' exposure at Chicag comparing foliated glass used in various amounts up to 100% of the extender versus the regular formulas of Acme's Big "6" and Rex 320 - Family Paint Iv It appears that foliated glass performs as well as asbestine, but in one instance a blend with ZS-20 zinc sulphide or Coffeyville sulphide and asbes did not equal Cryptone MS-130. Thus the foliated glass did not function in same manner as mica, unless the results are distorted by differences in the zinc sulphides.

#148 - Examination of White Lead

The White Lead Department has submitted a sample of S-W Soft Paste White Lead (straight Q. P. high tinting strength lead) to be compared on exposure with Dutch Boy (3/4 Carter - 1/4 Old Dutch) and Eagle (all Old Dutch).

Panels 1953-8 C were examined after 50 months' exposure at Chicago comparing MacGregor's white lead versus 18 dry, S-W Q. P. lead carbonate in Rex 17, Soft Paste White Lead, Rex 496 - SWP Ivory, and Martin-Senour's Rex 100 Outside White. There were no cases of bad failure considering the long exposure. In SWP there was no choice between the white leads, but in the Martin-Senour paints the MacGregor sample showed a slightly greater tendency to crack and erode. In the Soft Paste paintings, both are still giving good protection, with the MacGregor sample showing horizontal line checking, and the S-W carbonate rather bad alligatoring.

Panels 2256-78 C were examined after 47 months' exposure at Chicago, comparing two samples of MacGregor's white leads, and National's #111 and #333 carbonates, versus S-W Q. P. white lead in Rex 17 Soft Paste, SWP White and Ivory, and Martin-Senour's Rex 100 Outside White. The MacGregor samples differ in that one showed a marked tendency toward long line checking and cracking but both are inferior to the others, which are all substantially equal in performance.

M. VAN LOO
Cont.

1162 - Studies of Flat Wall Paint Formulation

In our investigation of the possible conservation of oil in Flat-Tone, we have tested Vistac #1 and Tallol sample 9592 B supplied by Resin Research. The Vistac was introduced as 10% and 20% of the oil present, and produced a paint of satisfactory drying properties, but poor sealing properties. The Tallol was introduced as 23-1/2% of the oil content. It produced a thin body with slower drying, high porosity, and poor washability, and cannot be used as such.

New formulas were sent through on Flat-Tone White and Tint Base to eliminate the use of 461 H, high consistency lithopone. The principal change is the use of 2188 dry, Micro Velva A. A temporary formula was put through on Paintercraft Flat #10 to use (2499)R gloss oil to replace Zinol, temporarily short.

Considerable work has been under way on the reformulation of Semi-Lustre White and tint base. Temporary formulas were sent through based on V 18440 maleic linseed varnish to use up resins on hand, and V 11146 - 25 gallon Polypale varnish. V 11147 - 25 gallon Piccolyte-Polypale varnish was recommended as the regular vehicle for the white, and V 11148 - 25 gallon Velsicol varnish for the tints. The new formulations have been formulated with an oil content of 1.7 pounds per gallon. The revisions are quite similar to current standards as to brushability, flow, drying, and washability. Subsequent discussions with Cleveland indicate slightly lower sheen may be desirable. The results were as follows:

		Viscosity			Washability			Drying Time	
Batch	Varnish Used	Fresh	1 day	2 days	Wax Pencil	Red Ink	Stencil Ink	Set-to-touch	Thru Dry 24 hrs.
Rex 16270 A 413 White	Standard Sample	-	-	-	65 rubs to remove stain	3 rubs to remove stain	90 rubs to remove stain	49 min.	Hard
79 GG White	V 11147	31.6	39	38.6	30 "	3 "	25 "	40 "	"
85 G White	V 18440	26	28	--	80 "	3 "	38 "	44 "	"
Rex 16276 A 883 Cream	Standard Sample	--	--	--	70 "	3 "	35 "	49 "	"
73 G Cream	V 11146	31	--	38	40 "	3 "	20 "	45 "	"
76 G "	V 11148	31	--	37	30 "	3 "	37 "	53 "	"

M. VAN LOO
Cont.

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Batch	Oil Content	Resin Content	Vehicle Oil Length	P.V.C.	Hiding Units	Cost
Rex 16270 - White A 413	1.83#/gal.	.58#/gal.	39.5 g.	50.2%	20,960	96.86
79 GG - "	1.72#/gal.	.57#/gal.	37.3 g.	43.3%	20,948	91.91
85 G - "	1.71#/gal.	.58#/gal.	36.9 g.	50.9%	20,948	91.84
Rex 16276 - Cream A 883	1.72#/gal.	.64#/gal.	33.3 g.	49.2%	19,240	81.12
73 G - "	1.72#/gal.	.58#/gal.	37.1 g.	47.6%	19,240	89.50
76 G - "	1.71#/gal.	.61#/gal.	35.0 g.	47.9%	19,240	82.06

A comparison was run of texture, mixing, and grinding properties of 2188 dry Micro Velva A and Superfine Talc from Carbola Talc Company, using Floor Enamel Oak, formula of 3-25-43 for the test. The Superfine Talc proved to be equal to Micro Velva in mixing properties, slightly coarser and harder in texture, and produces slightly lower consistency.

- - -

During April evaluation of vehicles for use in Enameloid was continued. Some attention was also paid to the effect of different pigmentations, and preliminary work on conservation formulas for Enameloid was started.

General Comments on White Formulations

1. V 11147, Piccolyte should make a satisfactory vehicle for Rex 710. It is not as brittle as the standard on aging.

2. V 18440, maleic-linseed. Chicago's supply of resin can be worked off in this vehicle for Temporary Alternate 710 formula.

3. V 11146, V 15650, RR 10749, do not show much promise for Enameloid White vehicle. The latter two are too limited in their mineral spirits tolerance. (2851)R by itself is too brittle.

4. Lengthening 25 gallon vehicles with (48) gave more film plasticity but slower drying and less print resistance.

M. VAN LOO
Cont.

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5. Replacement of 1403 dry - free chalking anatase TiO_2 with 2173 - R 200 rutile TiO_2 and 2188 - Micro Velva A on equivalent hiding and volume basis generally gave poorer color and lower gloss with slightly more water sensitivity.

6. Tests of Cook's V 1047 in Enamel looked favorable.

7. Conservation formulas with 2 pounds or slightly less oil per gallon indicate a pigment combination of 2228 - R 110 rutile TiO_2 and 1817 - Surfex as being most promising from color and gloss standpoint. However, drying of the Piccolyte vehicle seemed to be retarded and suspension properties also may have to be improved. Further work is being conducted.

8. It seems possible to lower oil content to 2 pounds or less without resorting to use of inerts if a percentage of high viscosity-low solids varnish is used in formulation. See following table where a blend of V 11147 Piccolyte and (2851)R was made.

Enameloid White

Formula	Vehicle	Pigment	Color	Gloss	Drying	Printing 1#/Sq.In.	Soap Resistance	Water Resistance (Spot Test)
BC 56	V 11147 + (48)	1403	Std.	Std.	Slower than std.	Worse than std.	Poorer than std.	O.K.
BC 57	V 11147 + (48)	2173 + 2188	Off-color	Tr. dull	"	"	"	Sl. worse than std.
BC 58	V 11146 + (48)	1403	"	Std.	"	"	"	O.K.
BC 59	V 11146 + (48)	2173 + 2188	"	Tr. dull	"	"	"	Sl. worse than std.
BC 60	(2851)R	1403	Tr. off-color	Tr. lower than std.	Faster than std.	Like std.	Tr. worse than std.	O.K.
BC 61	(2851)R	2173 + 2188	Off-color	Std.	"	Tr. worse than std.	Worse than std.	Dulled - white
BC 63	V 16440	2173 + 2188	"	Std.	Slower than std.	Std.	Tr. worse than std.	Tr. worse than std.

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Cont.

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Enameloid White
(Cont.)

Formula	Vehicle	Pigment	Color	Gloss	Drying	Printing 1#/Sq.In.	Soap Resistance	Water Resistance (Spot Test)
(Std.) BC 72	(3848) E	1403	Std.	Std.	Std.	Std.	Std.	Std.
BC 77	V 18440	1403	"	"	Tr. slower than std.	Like std.	Tr. worse than std.	V.S.worse than std.
BC 78	V 15650	1403	Off-color	Lower than std.	O.K.	Like std.	Worse than std.	Worse than std.
BC 79	V 15650	2173 + 2188	Off-color	Semi-gloss	O.K.	" "	"	"
BC 80	V 11147	1403	Tr. off-color	Std.	Tr.faster than std.	" "	Like std.	Std.
BC 81	V 18440	1403	Tr. off-color	Std.	Tr.slower than std.	Like std.	Tr. worse than std.	Like std.
BC 82	V 11146	1403	Off-color	Std.	Slow	Worse than std.	Worse than std.	Worse than std.
BC 87	RR 10749	1403	Tr. off-color	Std.	O.K.	Like std.	Worse than std.	Worse than std.
BC 88	Cook's V 1047	1403	Std.	Std.	Trifle faster	Like std.	Equal to std.	Equal to std.
BC 93*	V 11147	2228 + 2188	Off-color	Very low	-	-	-	-
BC 94*	V 11147	1403 + 2188	Tr. off-color	Sl. below std.	-	-	-	-
BC 97*	V 11147	2173 + 2188	Off-color	Low	-	-	-	-
BC 99*	(3848) E	1403 + 2188	Sl. off-color	O.K.	Std.	Std.	Tr. worse than std.	Like std.
BC 107*	V 11147	2228 + 2188	Yellow-ish	Very low	Slower than std.	-	-	-
BC 108*	V 11147	2228 + 2247	Trifle Cream	Tr. low	"	-	-	-

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Cont.

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Enameloid White
(Cont.)

Formula	Vehicle	Pigment	Color	Gloss	Drying	Printing 1#/Sq.In.	Soap Resistance	Water Resistance (Spot Test)
BC 109*	V 11147	2228 + 1817	O.K.	O.K.	Slower than std.	-	-	-
BC 110*	V 11147	2228 Superfine Carbola	Gray	Low	"	-	-	-
1/2BC60*) 1/2BC80)	(2851)R V 11147	1403	Sl. off-color	O.K.	Tr. faster than std.	Like std.	Tr. worse than std.	Like std.
4 BC80*) 1 BC60)	V 11147 (2851)R	1403	V.S. off-color	O.K.	"	" "	"	" "

* "Conservation" formula - less than 2 lbs. oil per gal.

Code

(48)	Bodied Linseed Oil
V 11147	25 gallon Piccolyte-Polypale Varnish
V 11146	25 gallon Polypale Varnish
(2851)R	25 gallon Linseed-Limed Rosin Varnish
V 18440	Maleic Linseed Varnish
V 15650	Inter-ester Varnish (without glycerine)
(3848)E	P. E. Rosin Varnish
RR 10749	Revision of V 15650
V 1047	Cook's equivalent of (3848)E
1403	Anatase Titanium Oxide
2173	R 200 Rutile Titanium Oxide
2188	Micro Velva A
2228	R 110 Rutile Titanium Oxide
2247	Atomite
1817	Surfex

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General Comments on Enamel Tint Formulations

1. The Velsicol varnish, V 11148, seems satisfactory for use in tints.

2. (2851)R by itself is not satisfactory for tints. It is inclined to get too brittle.

3. (2831)C and (2896)C combined in 30 gallon length do not give Enameloid tints equal to standard.

4. 461 S lithopone and 2173 - R 200 rutile TiO_2 gave better water resistance than 1403 - anatase TiO_2 and 2132 - rutile titanium calcium combination in Enameloid formulations.

5. Cook's V 1047 looks satisfactory in tests to date.

6. More work is necessary to produce satisfactory conservation formulas for tints.

Enameloid Tints

Formula	Vehicle	Pigment	Gloss	Drying	Printing 1#/Sq.In.	Soap Resistance	Water Resistance (Spot Test)
BC 64	(213) + ARV 3005	1403, 2132	O.K.	Slower than std.	Sl. worse than std.	Better than std.	Sl. whitening
BC 65	(213) + ARV 3005	461 S, 2173	O.K.	"	"	"	Not affected
BC 68	(2851)R	1403, 2132	Tr. lower than std.	Tr. faster than std.	Like std.	Better than std.	Sl. worse than std.
BC 69	(2851)R	461 S, 2173	"	"	" "	"	Equal to std.
BC 73	(2831)C + (2896)C	1403, 2132	O.K.	Slower than std.	Worse than std.	Worse than std.	White and dull
BC 74	(2831)C + (2896)C	461 S, 2173	O.K.	Slower than std.	Worse than std.	Worse than std., bet. than 73.	White and dull(bet. than 73)
BC 83	V 11146	461 S, 2173	O.K.	O.K.	Much worse than std.	Worse than std.	Like std.

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Cont.

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Enameloid Tints
(Cont.)

Formula	Vehicle	Pigment	Gloss	Drying	Printing 1#/Sq.In.	Soap Resistance	Water Resistance (Spot Test)
BC 84	V 11148	1403, 2132	O.K.	O.K.	Much worse than std.	Worse than std.	Worse than std.
BC 85	V 11148	461 S, 2173	O.K.	O.K.	Sl. worse than std.	Tr. better than std.	Sl. dull
BC 86	V 11148	1403, 2132	O.K.	O.K.	"	Better than std.	Sl. dull and white
BC 90	Cook's V 1047	1403, 2132	Like std.	Tr.faster than std.	Like std.	Likd std.	Like std.
BC 98	ARV 3023	461 S, 2173	O.K.	Very slow	Worse than std.	" "	" "
BC 100* (Std.)	(3848)E	1403, 2132, 2188	Low	Like std.	Less than std.	Like std.	Worse than std.
BC 16	(3848)E	1403, 2132	O.K.	O.K.	V. S.	Affected	Sl. white
BC 96*	V 11148	461, 2173, 2188	Low	O.K.	Worse than std.	Like std.	Worse than std. (Viscosity too heavy.)
BC 95*	V 11148	1403, 2132, 2188	O.K.	Tr. faster than std.	Like std.	Like std.	White and dull; cons. worse than std.
1/2 BC85)* 1/2 BC69)	V 11148 (2851)R	461 S, 2173	O.K.	"	" "	Tr. better than std.	Like std.
4 BC 85)* 1 BC 69)	V 11148 (2851)R	461 S, 2173	O.K.	"	"	"	Tr. better than std.

*Conservation formula (oil content 2 pounds or under per gallon).

Code numbers not identified under "Enameloid White" are as follows:

461 S - Lithopone 2132 - Rutile titanium calcium.
(213) Blown Linseed Oil
ARV 3005 25 gallon Velsicol varnish
(2831)C Congo linseed varnish
(2896)C " " "
V11148 Equivalent of ARV 3005
ARV 3023 25 gallon Velsicol-linseed varnish

0007-SWP-044800

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#177 - Pigment Studies

Titanium Calcium for Interior Flat formulations:

A preliminary report was made in January of an experimental rutile titanium calcium pigment offered by du Pont as Ti-Cal R 20 Special C 1290. This pigment showed an advantage as to control of "ghosting" and blue carbon black undertone but was difficult to wet, and gave a low uneven sheen in Paintercraft Flat #10. A replacement identified as Ti-Cal R 20 C 1403 proved to be slow in initial wetting in #10 Flat but continued to wet in and thin down to standard body in the package. It is thixotropic in Flat-Tone as compared with MA 104 titanium calcium. The sheen is higher and more uniform and the good carbon black undertone has been maintained, but the control of "ghosting" has been lost.

The December report gave data on color and opacities of various regular and new titanium oxides. Chalking rates were determined in (32) damar varnish for an accelerated test and may now be compared with results of 88 days' exposure, 45° south, at Coffeyville.

Pigment		Weather-O-Meter 8 days	Chalking Rates: Coffeyville Time to reach slight chalking	Coffeyville Order of chalking after 88 days
1403 T	Titanox A - anatase	VB	23 days	1 (Greatest)
2030 T	Titanox AA - "	C	36 "	2
2173	Ti-Pure R 200 rutile	(C)	36 "	3
Unitane	R-250 rutile	(C)	49 "	6
2228	Ti-Pure R 110 rutile	(C)	-	-
2147	Titanox A #24 Anatase	S	41 "	4
Titanox	RA rutile	S	49 "	5
2031 T	Titanox A-NC	Tr	52 "	7

Reasonably good duplication was obtained between the Weather-Ometer tests and the outdoor exposures except for Unitane R 250, which is comparable to R 200 in the Weather-Ometer but much more chalk resistant in the outdoor tests. We are repeating this and other tests in connection with the replacement of R 200, also in a linseed oil type vehicle which it is hoped will more closely approximate house paint performance. This low binder formula carries only TiO_2 and magnesium silicate in the pigmentation, with low oil content. The titanium oxides under test in this formulation in the Weather-Ometer include Titanox A and AA, R 200, Titanox RA-10 MO and LO, suggested as equivalents of R 200, and Unitane R 250. After two weeks in the Weather-Ometer, the paints are showing no chalking. They will be exposed under the National Carbon arc.

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The Titanium Pigment titanium oxides RA-10 MO and LO were also made up in the damar vehicle, and were rated as follows:

No.	Pigment	Texture	Viscosity #4	Color	Draw-down Opacity	Tinting Strength
RB 146	Titanox A 1403 T	4M-6-1/2	31.2 sec.	2	2	3
147	Titanox AA 2030 T	4M-6-3/4	28.6 "	1	3	4
148	Ti Pure R 200 2173	4M-6-1/4	25 "	4	1 (F)	2
149	Titanox RA 10 MO	4P-7	27.8 "	5	1 (D)	1 (C)
150	Titanox RA 10 LO	4 M-6-3/4	24 "	3	1 (E)	1 (A)
151	Titanox RA-NC	4M-6-1/2	21 "	6	1 (C)	1 (E)
152	Ti-Pure R 610 2174	4M-6-1/4	21.2 "	4	1 (A)	1 (D)
153	Ti Pure R 510	4P-7	21 "	4	1 (B)	1 (B)
154	Ti Pure O 2031 K	4M-6-3/4	17 "	7	4	5

Grinding was done at a fixed setting of the roller mill, using the usual formula:

320 grams TiO_2
690 " (32) Damar solution
30 " (293) Pine Oil

Texture: Rated on the S-W grind gauge.

Viscosity: Cup viscosities were determined using the S-W cup with the #3 orifice at 75° F.

Color: Rated visually by comparison of 8-1/2" x 11" paint-outs over uniformly primed surfaces.

Draw-down opacity: Draw-downs were made using a .003" clearance gauge on Morest sheets form 03 B. After drying the paint films were rated visually for comparative hiding. In some cases the opacity was practically equal as indicated by their being rated with the same number. Small differences are indicated by the attached letter rating, e.g., 1 (A), 1 (B), etc.

Tinting strength: To 100 grams of each paint was added 10 grams of BB 111. This was mixed thoroughly and painted out. It served adequately as a comparative tinting strength comparison between the pigments of the series.

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du Pont Exposures of R 200 Rutile TiO_2 (free chalking type)

Concern regarding the retarded chalking of R 200 TiO_2 in the above tests was reported to the du Pont Pigments Division. Mr. Dawson exhibited 18 months exposure panels showing that R 200 chalked more freely than Titanox AA, and cleaned up earlier. They found results duplicating our damar results in their own accelerated tests in alkyd enamels, but R 200 exhibited definite chalking in house paint outdoor exposures.

#103 - Metal Protective Paints

In the last report a series of tests was outlined to determine the value of zinc chromate as a component of a structural metal primer for regular sales. Salt spray tests have now been completed. After 40 days' exposure to a 5% salt spray the panels were removed from the cabinet and the paint films were stripped from the lower half of each panel. Results were as follows:

Paint - RB 113 30% Zinc Chromate by weight
70% Magnesium Silicate

Bad rusting for area of 1/4" - 1/2" around the X scratch.

RB 114 50% Zinc Chromate
50% Magnesium Silicate

Controlled rust within 1/8" of X scratch.

RB 117 64.5% Zinc Chromate
35.5% Magnesium Silicate

Controlled rust within 1/16" of X scratch.

RB 115 70% Zinc Chromate
30% Magnesium Silicate

Controlled rust within 1/16" of X scratch.

RB 116 89% Zinc Chromate
11% Magnesium Silicate

Film has become quite porous, characterized by a wide spread lightly etched or rusted pattern about the X scratch. Rust control of the $ZnCrO_4$ is apparent however, a washing away of the soluble portion has taken place.

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#161 Emulsion Binder Paints

A. Kem-Tone Deep Shades

The present production formula for the new Kem-Tone deep shades, Rx 65413 through Rx 65417 is given below:

2228	Ti-Pure R-110 - Titanium Dioxide	184 lbs.
CW 1640	Hydrite Clay	67 "
2247	Atomite-Calcium Carbonate	167 "
2077	Celite 289 - Diatomaceous earth	100 "
CW 1495	Nacconol NRSF	7 "
*BX 606	Corn Protein Base	205 "
2261	Keltex - Sodium Alginate	2/3 "
2259	Casein	30 "
41	Borax	2 "
1715	Dowicide A	2 "
2264	Mica	50 "
W 2126	Lecithin	6 "
(12)W	Water	32 gal.
(443)	Ammonium Hydroxide	1/2 gal.
(5083)	Anti-Foam H	6 lbs.
(2898)R	Linseed Oil-Limed Rosin Varnish	12 gal.
(2120)	Linseed Fatty Acids	21 fl. oz.
(31)	Lead Drier	1/2 gal.
(152)	Cobalt Drier	21 fl. oz.
		100 gal.

*BX 606 - Corn Protein Base

CW 1656	Corn Protein	76 lbs.
2260	Dowicide G	2½ "
637	Water White Rosin	25½ "
(12)W	Water	46½ gal.
(293)	Pine Oil	1-3/4 gal.
(443)	Ammonium Hydroxide	1-3/4 gal.
		500 lbs.

The following colors are used in tinting the above base formula to match the five new shades:

Ferrite Yellows
Red Iron Oxide
Permansa Green B
Monastral Blue
Carbon Black

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1779 dry - Kraft 325 mesh mica.

Concord 325 Mesh Mica
Wishnick Tumpeer 325 Mesh Mica

C. Wetting and Emulsifying Agents

The scarcity of our regular emulsifying agents and also the desirability of finding satisfactory salt-free emulsifying agents has required the testing of a large number of these compounds.

The following table gives the results of the evaluation of wetting agents. The wetting agents have been tested both as partial and full substitutions for Nacconol NRSF.

Name	Brushing	Settling	Washability	Salt	Brush Washability
Nacconol NRSF-Control	V. Good	None	OK	10%	OK
Nekal BX-S.F.	Good	None	OK	12%	OK
Nacconol NRSF and Wetting Agent C	Good	None	OK	-	OK
Wetting Agent C	Good	Slight	OK	None	OK
Nacconol NRSF and W.A. 822	Fair	Slight	OK	-	OK
W.A. 822	Good	Considerable	OK	None	OK
Nacconol NRSF and Triton NE	Poor	Slight	OK	-	OK
Triton NE	Fair	Bad	OK	None	OK
Emulfor A.G.	Good	Slight	OK	None	OK
Emulfor ON	Fair	Cons.	Poor	None	OK
Nacconol NRSF and Advawet #10	Good	Slight	OK	-	OK
Advawet #10	Good	Considerable	OK	None	OK
Igepon T-H.C.	Good	Definite	OK	20%	OK
Igepon T and Wetting Agent C	Good	Definite	OK	-	OK
Nekal BX-S.F. and Wetting Agent C	Good	Slight	OK	-	OK
Nacconol NRSF and Igepol CA-extra	Fair	Slight	OK	-	OK
Nacconol NRSF and Igepol CTA-HC	Fair	Slight	OK	-	OK
Igepol CA-extra	Fair	Slight	OK	None	OK
Igepol CTA-HC	Fair	Slight	OK	None	OK
Nacconol NRSF and Advawet #20	Fair	Slight	OK	-	OK

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Name	Brushing	Settling	Washability	Salt	Brush Washability
Nacconol NRSF and Advawet #30	Good -	V. Slight	OK	-	OK
Advawet #30	V. Good	V. Slight	OK	None	OK
Nacconol NRSF and Advawet #40	Fair	Slight	OK	-	OK
Advawet #40	Fair	Slight	OK	None	OK
XXX Leucanol type	Fair	Slight	OK	1%	Less than std.
XXIX " "	Fair	Slight	OK	1%	"

Wetting Agent C and Advawet #30, both produced by Advance Solvents, have been tested in factory production as partial replacements for Nacconol NRSF and have found to be satisfactory. When the Nacconol NRSF is replaced in full with this type of wetting agent, the flow and leveling properties of the paint are effected to some extent. A sample of General Dyestuffs' Nekal BX -Salt Free has been ordered for production tests on this material.

The last two wetting agents appearing in the above table were submitted by the Dry Color Department. The Leucanol type of wetting agent showed some promise in Kem-Tone, but was undesirable because of its high salt content. The Dry Color Department is attempting to produce a wetting agent of this type containing only a very small amount of salt. Further samples are expected and will be tested as soon as they are received.

D. Evaluation of Protein Substitutes for Casein

Corn Protein

Because of our high casein requirements and the present shortage of this material, it has been necessary to revise the Kem-Tone formulas to a lower casein content. This was accomplished by the substitution of corn protein for part of the casein in Kem-Tone. The casein content of Kem-Tone was reduced by 40% by this means. This change obviously necessitated other changes in the formulation.

A comparison of the old and new formula for Kem-Tone Yorktown White is given below:

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Old Formula	Material	New Formula
450 lbs.	2185 - Permolith W 320	400 lbs.
	2173 - Ti-Pure R 200	110 "
96 "	1403 - Titanox A-MO	-
48 "	2077 - Celite 281	75 "
48 "	2257 - D.R.G. Clay	40 "
32 "	2263 - Fibrous Talc	25 "
80 "	2183 - Mineralite Mica	75 "
4 "	2182 - Nacconol NRSF	3 "
-	CW (1685) - Wetting Agent C	3 "
23-1/2 gal.	(12)W - Water	18-1/2 gal.
-	*BX 606 - Corn Protein Base	187 lbs.
285 lbs.	**BX 619 - Casein Base	171 "
18 gal.	(2898)R - Linseed oil-Limed rosin varnish	15 gal.
1-1/4 gal.	(31) - Lead Drier	3/4 gal.
21 fl. oz.	(152) - Cobalt Dryer	1/4 gal.
-	W 2126 - Lecithin	3 lbs.

* BX 606 - Corn Protein Base

76 lbs.	CW 1656	Corn Protein
2-1/2 lbs.	2260	Dowicide G
25-1/2 "	637	Water White Rosin
46-1/2 gal.	(12)W	Water
1-3/4 "	(293)	Pine Oil
1-3/4 "	(443)	Ammonium Hydroxide
500 lbs.		

** BX 619 - Casein Base

81 lbs.	2259	Casein
1-1/2 lbs.	2261	Keltex
3 lbs.	1715	Dowicide A
3 lbs.	2260	Dowicide G
6 "	41	Borax
18 "	(5083)	Anti-Foam H
48 gal.	(12)W	Water
1-1/8 gal.	(443)	Ammonium Hydroxide
3/4 gal.	(293)	Pine Oil
500 lbs.		

The new formula has worked out very well. It has been unnecessary to sacrifice quality in making this change.

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Cont.

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The p.v.c. of the Rex 610 is 23% and for Rex 436 is 29%, which is interesting from the standpoint of good durability for Rex 610 at low p.v.c. Rex 436 undoubtedly was vulnerable to cracking due to the titanium barium pigment.

#77 - Mildew Inhibitors

A special formulation was prepared for Rex 203 S-W Mildew Resistant Paste to use East India Varnish (1720) for the modified phenolic varnish (2843)G.

Panels 6245-8 C and 6182-5 C were examined after 14 and 16 months' exposure, respectively, at Chicago. The first set compares SWP Gloss White treated with 3% Dowicide 6 with Cook's House Paint which was sold in the south. The second series compares SWP Gloss White with SWP Mildew Resistant Treated White. There is no mildew or discoloration on the Chicago panels, nor any signs of the erosion detected on some of the Miami panels.

#12 - Exterior Primers

Panels 3006-13 C, CY were examined after 43 months' exposure at Chicago. The panels were comparisons of SWP Cream Rex 462 1938 formula (3% TiO_2) and Cook's Ivory, all two coat work, either self-primed or over their respective primers. Both cedar and yellow pine were used. Cook's tint showed definitely worse fading and more rapid chalking and erosion than the SWP Cream. In both cases, the self-primed panels were inferior to each paint over its own undercoater.

#162 - Studies of Flat Wall Paint Formulation

Flat Wall Paints

Since the use of all Micro Velva A as the inert in Flat-Tone produced more puff than was desirable, the formulas have now been set up using half the inert as 566 Mineral Whiting and half Micro Velva A.

In connection with the program on oil conservation we have reduced the oil content of Paintercraft Flat Wall Paint #10 to 1.2 pounds per gallon. This required the use of more zinc resinate to hold the washability. The vehicle/pigment volume ratio was increased from 0.75 to 0.81. Formulas and samples have been sent to Cleveland.

Wall Primer and Sealer

A temporary formula, OJ 166 G was developed for Rex 19681 Wall Primer and Sealer to use up the stock of Congo linseed varnish V 11838. A temporary formula was made using half Congo and half Velsicol to improve the alkali resistance.

We also submitted an East India-Velsicol formula 124 G which appeared to perform very well compared to the regular East India formulation. A special all Congo-Linseed and the Congo-Maleic-Linseed formula were inferior in alkali resistance.

ALLIED RESEARCH LABORATORIES

Report of Investigations for May, 1943

M. VAN LOO

#97 - SWP 471

Water ground mica has been found to reduce tendencies toward checking and cracking in certain conventional types of house paints. In order to determine its effect in the newer oil conservation formulations, paints were prepared for exposure carrying 3%, 5%, 7% and 10% of the pigment as micaceous extenders. The micas used include Aratone Mica, Mineralite CW 1581, and Alsibronz #12.

Panels 3090-6 C were examined after 37 months' exposure at Chicago, checking on the effect of varying amounts of diatomaceous silica Celite substituted for 0%, 50%, 75%, and 100% by volume of the magnesium silicate in SWP Gloss White. As the amount of Celite is increased there is a proportionate increase in erosion, until at 100% substitution it becomes serious.

Panels 7055-61 were prepared for exposure at Chicago and Miami using the oil conservation type of formulation of SWP varying the p.v.c. from 30% up to 45%, to see how the durability varied with this factor.

#86 - Durability of Pigments with Special Reference to Leaded Zinc and White Lead

Panels 2209-27 C were examined after 49 months' exposure at Chicago. In this series our regular SWP Gloss White formula of 1938 #10% anatase (TiO_2) was used three coats self-primed on Ponderosa Pine. The comparison covered the use of regular 412 dry 35/65 leaded zinc versus special lots in which the pigment was collected at different temperatures in the baghouse. Certain competitive co-fumed and mechanically mixed leaded zincs were also included.

The co-fumed leaded zincs in all cases were superior to the mechanical mixes. All the S-W samples, including the specials, were at least slightly better than the competitive leaded zincs with the possible exception of Anaconda's #404. New Jersey's Lehigh #6 and #61 were clearly inferior, while Azo 35H, 35M, and 35L, Eagle-Picher and Tomahawk brand leaded zincs were only fair. There appears to be no particular difference in the behavior of leaded zincs collected at approximately 700° F. as compared with 460° F. In the mechanical mixes, acicular zinc oxide and non-acicular lead sulphate make the best combination.

#150 - Durability Studies of Zinc Sulphide Pigment Combinations

Panels 2229-38 C were examined after 5½ months' exposure at Chicago. The paints were based on the 1938 Acme "Big 6" Outside White formula and were three coat paintings, self-primed, on Ponderosa siding. None of the Coffeyville zinc sulphide-mica-asbestine blends used to replace New Jersey's composite pigment Cryptone MS-131 are equal to the regular guide paint. Alsibronz and Kraft micas were practically equivalent. The addition of 0.2% zinc naphthenate to approach the better wetting properties of Cryptone MS-131 had no particular effect on film performance.

M. VAN LOO
Cont.

177 - Pigment Studies

During the past month a special report on the chalking rates of various TiO_2 pigments was distributed to our regular mailing list. The details presented in that report will not be repeated here. It was concluded from the outdoor chalking test and the low binder accelerated "House Paint" tests that the TiO_2 pigments should be rated for chalking as follows:

1403 T	Titanox A	Most free chalking
2173	Ti Pure R 200	Next most free chalking, approaching Titanox A
	Titanox RA 10 MO	Slightly slower to chalk than 2173
	Titanox RA 10 LO	" " " " " "
2030 T	Titanox AA	Quite chalk resistant
	Unitane R 250	Most chalk resistant of this series

This relationship is being checked by outside exposures of paints made on standard formulations rather than the low durability types used for obtaining accelera tion in these tests.

1105 - Metal Protective Paints

In our last monthly report we gave results of a brief zinc chromate binder series. Included with that series were two paints in which iron oxide replaced portions of the 20 L asbestine extender used.

We have in preparation at this time a series of primer tests using a "Kromik" type vehicle in which the pigment composition of zinc chromate, asbestine, and iron oxide has been varied in steps of 20% by volume so that we may establish definitely the optimum pigment composition at the lowest raw material cost. We have included also exploratory paints in which normal and basic lead chromate have been substituted for the iron oxide content. This series of panels will be exposed in the salt spray cabinet at Chicago and outside at 45° south at two locations.

A review was made of the metal protective paint panels placed on exposure at Chicago by Mr. Van Nordstrand and Mr. West, in order to bring the information available up to date. The results may be summarized as follows:

1. One series of panels covered comparisons of a number of S-W industrial and trade sales metal primers, including the oleoresinous Kromik primer, the alkyd Kem Kromik, the phenolic-cumar Kem A and A, the phenolic-alkyd primer Rex 46514, the chlorinated rubber Anti-Corrosive Bottom Paint Rex 63227 and the chlorinated rubber primer Rex 64043, the alkyd Kem Red Lead, and blends of Kromik and Kem Kromik. Metalastic Black was used as the top coat.

A study of the panels after 16 months' exposure indicates that all of the regular exterior metal primers afford a good under-surface for the regular top coats. The chlorinated rubber primers are bad for control of

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their chalk. The Cryptone MS-130 - Leaded Zinc-paints and the leaded zinc-O_2 paints showed much less mildew. The latter paints also were best in all round performance with #3 best as to self-cleaning and general appearance, and #2 showing better resistance to checking, cracking, and erosion.

The general evidence is that rutile titanium calcium pigment Titanox improves the performance of the lower lithopone formulations but is not as good as zinc sulphide in the higher lithopone formulas. With this exception all the test formulations appear to be better than the regulars.

Considerable time has been spent during the month on making routine readings of all panels at the Chicago Exposure Farm. About 75% of the panels have been read, and a summary of the most important and interesting observations will be made soon. The construction of two new vertical fences was completed.

Paints were made up for exposure at Chicago on cedar and yellow pine of experimental barn paints using portions of Petropon #2138 in the vehicle binder. Petropon #2138 is described by the Pure Oil Company as an unsaturated viscous liquid of petroleum origin, possessing drying properties similar to vegetable drying oils. Its iodine number is 200 minimum. Regular Barn Paint Red - Rex 54 will be used as the guide. The special formulas include a barn red similar to Cleveland's suggestion using TR-5044 Cottonseed Pitch in the binder, but replacing this vegetable pitch with Petropon #2138, also one using the regular Rex 54 pigmentation and the special vehicle just described. The original drying is slow but eventually the films become very hard and must be watched for embrittlement.

12 - Exterior Primers

To study the effects on durability of varying periods of drying between coats of Rex 450 SWP Undercoater and SWP Gloss White, panels have been prepared for exposure at Chicago and Florida on which the Undercoater has been allowed to dry 1, 2, 7, 15, and 30 days. One uniform 9 foot panel was used for each set.

162 - Studies of Flat Wall Paint Formulation

Flat Wall Paints

Due to the shortage of (5071) Zinol, several products were investigated as possible substitutes for use in Flat Wall Paints. Cook Paint and Varnish Company submitted a limed rosin C-86 which was cut in (348) mineral spirits. The resin was difficult to dissolve and it was not possible to put in the same percentage of solids as in Zinol. However, a replacement on the basis of equal resin content gave Flat-Tone of high body and poor color.

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The Flint Chemical Company has a stock of Zikol which they are offering for sale. Zikol is a zinc resinate solution also made by Newport Industries, Inc., similar in all respects to Zinol except having a slower solvent. Flat-Tone was made using Zikol to replace Zinol and adjusting the (3020) Enamel Solvent #3 accordingly. The batch was satisfactory in all respects, and the purchase was recommended.

Previous batches of Flat-Tone made with (148) Gloss Oil, and # 18459 Zinar solution were too dirty in color to be considered for general production. The factory was given permission to use Zinar in the tints when necessary, but it should be used in the white only when it is absolutely necessary.

Some work is being done on the replacement of at least part of the (2894) bodied linseed oil in Flat-Tone by Tallol T 624. The Tallol produced very thin bodied paint having poor flow and slow drying characteristics. The film did dry very hard in 48 hours. Further work will be done to improve body, flow, and initial drying, and to determine the effect of reducing oil length.

The proposed formula for Paintercraft Flat #10, Rex 65510 mentioned in the last report, which represented a revision to reduce the oil content to 1.2 pounds per gallon, has been examined by Cleveland and approved. The washability has been maintained by increasing the V/P ratio from 0.75 to 0.81 with the use of more zinc resinate.

Semi-Lustre

Work was continued on the formulation of Semi-Lustre White and Tint Base using (4850)N Piccolyte-Polypale varnish for the white, and (3850)N Velsicol-Polypale varnish for the tints. Formulas have been developed using the above vehicles which cost approximately 5¢ less per gallon and contain approximately 1.73 pounds of oil per gallon. The drying is slightly slower than the current production and the film retains slightly more surface tack after over night drying.

Cleveland is distributing formulas for factory production of Semi-Lustre White based on the above with certain modifications to adjust the sheen. They report that on large scale paint-outs the new material shows improved brushing and longer wet edge, with good leveling. Opacity was increased slightly because of the necessity of staying within the O.P.A. requirements for cost reductions. The drying was slightly slower but sufficient to permit recoating in 24 hours. The oil content is 1.715 pounds of oil per gallon.

Due to the slower drying characteristics of the (4850)N Piccolyte-Polypale and (3850)N Velsicol-Polypale varnish mixtures with oil it was decided that possibly a longer oil length varnish would show less residual tack than blends of the shorter varnishes plus oil, as used in Semi-Lustre.

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(40 gallon varnish, ARV 3084, was made using Piccolyte-Polypale having the same solids and oil length as (6173) P. E. maleic-rosin linseed varnish. When ARV 3084 was substituted for (6173) in the regular formula for Semi-Lustre of 6-2-43 the initial viscosity was 51 seconds as compared with 28-30 seconds for the standard. The set-to-touch and over night drying characteristics were not as good as the shorter Piccolyte-Polypale varnish (4850)N. Further work will be done.

Enameloid

A meeting was held in Cleveland during the month to examine the various trade sales formulations which have been developed recently. In the Enameloid White series it was agreed that formula BC 80 made with (4850)N Polypale-Piccolyte varnish showed the best drying. Dry-to-touch and over night hardness were better than the previous standard material made with (3849)E, the P. E. rosin linseed varnish. The gloss of the Polypale-Piccolyte enamel was equal to the standard, and leveling was very good, although the opinion was expressed that it does not have the margin of safety of the previous production, which showed a slight tendency to brush mark. BC 80 is identical to the Emergency formula on Rex 710 now in effect. This formula has an oil content of approximately 2.15 pounds per gallon, and meets the W.P.B. M-332 and C.P.A. 465 requirements as to oil content, non-volatile, cost, etc.

For the Enameloid tints it was decided to adopt a formula corresponding to BC 204, which is pigmented with low oil absorption lithopone and rutile TiO_2, 2173 dry, and which has (3850)N Velsicol varnish as the principal component of the vehicle. Drying was satisfactory with through dry harder than the (2843)G modified phenolic formula. Gloss was equal to standard, and flow equivalent to the previous production. This formula is of the conservation type, carrying approximately 1.95 pounds of oil per gallon, and therefore differs from the Emergency Formula for Enameloid tints which was distributed from Cleveland. Non-volatile and cost features are satisfactory. Where necessary opacity will be reduced by using less TiO_2 and more lithopone. Deep colors made with Velsicol varnish are to carry 3 pounds of aluminum stearate to ensure suspension.

In considering the various Enameloid tint formulas, one formula, BC 81 showed the best surface and through drying. However, it was not adopted since the vehicle was an 18 gallon Velsicol varnish, and there was apprehension that the film would embrittle on aging. Two other conservation type tint formulas showed better drying than the previous production but were not adopted. BC 177 made with (3850)N Velsicol varnish and (2851)R rosin linseed varnish was not adopted because the (2851)R reduced the water resistance. BC 180 with straight Velsicol vehicle was pigmented with anatase titanium calcium 1271 dry and anatase TiO_2 1403 dry, and the water resistance was again lower, in this case because of the calcium sulphate extended titanium.

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Tests were made of BC 178, the vehicle of which was based on [illegible] 3055 a 25 gallon Velsicol-Polypale air blown varnish which requires no [illegible] or carbon dioxide in its manufacture. Drying tests were poor. Further [illegible] is contemplated since this type of varnish could be made at all plants.

182 - Fire Retardant Paints

We have recently received from the Forest Products Laboratory their results on fire retardant tests. Materials which were included in the test were: CH 3869 - Flat Wall Paint (fire retardant type), CH 3870 - Semi-Gloss Wall Paint (fire retardant type), CH 3265 - Oil Paint (fire retardant type) and the 52-P-22 specification fire retardant semi-gloss white.

The results indicate decreasing effectiveness in the order: CH 3870, CH 3265, CH 3869 and 52-P-22, as determined by fire tube tests. According to the standards which the Forest Products Laboratory has set down CH 3270 and CH 3265 give moderate protection at spreading rates of from 100 - 175 sq. ft. per gallon. CH 3869 requires at least four coats to give a protection corresponding to two coats of CH 3870 and CH 3265. The 52-P-22 specification at spreading rates as high as 100 sq. ft. per gal. did not give protection comparable to the other formulations tested.

The Schlyter tests which they performed are difficult to interpret. The significant fact seems to be that CH 3870, CH 3869, and CH 3265 are superior to the 52-P-22 specification paint as measured in terms of flame spread. It is evident, however, that none of the paints are as good in fire-retardance as borax-basic carbonate white lead compositions, sodium alginate-monoammonium phosphate compositions, and special dicyandiamide urea formaldehyde, ethylidene urea formaldehyde resin compositions fortified with phosphoric acid or monoammonium phosphate.

In Schlyter tests which we performed on these same paints we were unable to get flame spread comparable to that which the Forest Products Laboratory obtained. This we believe is due to the fact that Forest Products Laboratory used 3/4" phenolic resin bonded plywood in contrast to our using 3/4" Ponderosa white pine boards. Their procedure says either can be used, but it is evident that phenolic resin plus the higher resin content of Douglas fir which is ordinarily used in plywood makes it more flammable than white pine with its low resin content.

We recently examined, after exposure for 9 months at 45° south, Chicago, a series of fire retardant paints previously reported. These paints were applied as one and two coats over Rex 4F0 Undercoater on redwood. The series and results follow:

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In our test of $CaCrO_4$ previously which was in the airplane primer 5806 L, $CaCrO_4$ was similar to $ZnCrO_4$ in performance. Here it definitely falls down on the basis of salt spray tests. Zinc Tetroxy Chromate is definitely poorer than regular $ZnCrO_4$. Strontium and calcium chromate were rated about equal here, being superior to barium chromate. The special basic chromates gave very high consistencies, which may be related to their poor performance.

Two Wool Grease Emulsion paints were exposed at Chicago and Florida, using steel panels, one coat application, using one coat of Kem Kromik Primer and one coat of Metalastic Black for comparison. The formulas were based on work described in the Berger research reports, and used Thompson-Hayward's Wool Grease #3, Paint Parolite for the bituminous material, rosin, water, and ammonia.

2177 - Pigment Studies

1538 N Zinc Sulphide

At some time in the past the New Jersey Zinc Company gained approval on their ZS-800 Zinc Sulphide to be supplied as our 1538 N dry. We were informed that ZS-800 is becoming short and it will be necessary that a shift be made to ZS-20 Zinc Sulphide. The question was raised as to how much this change would affect our products, since ZS-800 is supposed to have 10 - 15% greater opacity than the ZS-20 which would be available.

We found that testing in Rex 15185 Flat-Tone no change in opacity was detectable when a shift was made from the ZS-800 to the ZS-20. In checking the other properties it was noted also that color and sheen were equal, while the cup viscosity was 20% lower on the paint made with ZS-20 than that made using ZS-800. After allowing a painted panel three weeks for thorough drying we made wash tests of the two materials. These tests showed ZS-20 to be greatly superior to ZS-800 for washability both as to the ease of removal of the stains and as to wear or abrasion resistance in the washing procedure. ZS-800 rendered a porous film while that using ZS-20 was quite water resistant. This bears out an early objection to ZS-800 as expressed by Dr. Holley some years ago.

TiO_2

As substitutions for 2173 dry Ti Pure R 200 both the Titanium Pigment Corporation and the United Color and Pigment Company have introduced grades which were announced as equivalent to R 200. In the last monthly report and the chalking study on TiO_2 pigments reported separately early in June, it was shown that these new materials were more chalk resistant than R 200. This was especially true of the Unitane OR-250 rutile TiO_2.

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Since then United have claimed that their product has greater opacity than R 200 and that by using it a blend with anatase TiO_2 could be made, thus obtaining equivalent opacity at lower cost and at the same time freeing the chalking somewhat. Although we have not had opportunity to check the effect on chalking of a blend of anatase and rutile titaniums we have studied the opacity results.

Using the normal Rex 471 SWP Gloss White conservation formula we have made paints in which TiO_2 and asbestine represented the entire pigment portion. Using these materials we found that at 93% contrast ratio over the black and white Morest sheets, Unitane OR-250 TiO_2 has 10 - 15% greater hiding than Ti Pure R 200. The brightness of the OR-250 is equal to that of the R 200. By blending Unitane OR-250 with 1403 dry, anatase TiO_2, we found that as much as a 1-1 mixture could be made without dropping the hiding power below that of the R 200. This move should be made cautiously, however, as little is known of the chalking rate of the mixture. Some months ago we found that a 1-1 blend of Titanox RA and anatase TiO_2 chalked more like the chalk resistant RA than the freely chalking 1403 dry. Normally the tendency is to favor the more freely chalking component of the blend.

Titanox RA 10 MO at this time appears to be the most logical choice as a substitute for Ti Pure R 200. It has slightly higher opacity than the R 200 and is a slightly more chalk resistant material.

#177 - Mildew Inhibitors

In connection with discoloration of the Rex 63057 - Mildew Resistant Gloss White, batches were made up of formula dates 11-25-41 and 4-5-43, using a wide variety of S-W cooked lead-manganese driers, also both lead and manganese soluble driers of the naphthenate and oilsolate types, used individually and in lead-manganese combinations. Paint-outs reveal very little differences in color between individual paints in the lead series and in the manganese series. The manganese series was, of course, colored more than the lead series. It is interesting to note that when even a colorless solution of manganese oilsolate, for example, is dropped on the surface of the Dowicide 6 containing paint, a characteristic brownish-red coloration appears.

This series of paints has been put into hot storage to check granulation tendencies as a function of the driers used.

Special Studies

Payne Cup Permeability Tests

Work on the determination of moisture permeability of paint films has been continued along the lines reported in May. Variations of Zinc Chr... Primer SP-P-18, NH 788, with inert substitutions which showed consid...

Emulsion Research Department

161 - Emulsion Binder Paints

A. Wetting and Emulsifying Agents

The following table gives the results of laboratory evaluation of wetting agents tested during the past month.

Wetting Agent	Brushing	Emulsion Stability	Settling	Washability
Control	Very good	Excellent	Slight	Excellent
Alkanol WXN	Very good	Good	Slight	Good
Nacconol NRSF + Advawet 60	Very good	Excellent	Slight	Good
" " + " 50	Very good	Excellent	Slight	Good
Advawet 60	Very good	Excellent	Slight	Very good
Advawet 50	Very good	Excellent	Slight	Good
B 33 A	Very good	Excellent	Slight	Fair
B 34 A	Fair	Good	Slight	Fair
B 35 A	Good	Good	Hard	Fair
B 36 A	Good	Good	Hard	Fair
B 37 A	Fair	Good	Hard	Fair
B 39 A	Good	Good	Definite	Good
B 40 A	Good	Poor	Slight	Good
Santomerse #3	Very good	Excellent	Very slt	Good
Santomerse D	Very good	Excellent	Very slt	Good
Santomerse S	Very good	Excellent	Slight	Good
Advawet 30 Special	Very good	Excellent	Slight	Good
Nacconol NRSF + Adv. 30 Sp.	Very good	Excellent	Slight	Good
Advawet 35	Very good	Excellent	Slight	Good
Nacconol NRSF + Advawet 35	Very good	Excellent	Slight	Good
Tret-O-Lite #1	Good	Very good	Slight	Very good
" #2	Good	Very good	Slight	Good
" #3	Good	Good	Slight	Very good
" #4	Good	Very good	Slight	Very good
" S-29	Good	Good	Slight	Good
Dawan #1	Fair	Fair	Slight	Good
Dawan #2	Very good	Very good	Slight	Very good

Nekal BX Salt-Free, General Dyestuff, has been tested in factory production Kem-Tone and was found satisfactory as a substitute for Nacconol NRSF. A ton of this material has been ordered for use in Kem-Tone.

Advawet #30 and Advawet #35 have been tested in factory production and were found to be satisfactory substitutes for Advawet #30. 15,000 pounds of Advawet #35 have been ordered from Advance Solvents to be used in Kem-Tone as a substitute for CW (1734) Advawet #30 as the Advawet #30 is temporarily unavailable.

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Enough of the following wetting agents have been ordered for production tests in Kem-Tone.

Santomerse 3	Monsanto
Santomerse D	"
Dawan #2	R. T. Vanderbilt

Wetting Agent B 39 A produced by the Dry Color Department is a barium naphthalene sulphonate; looks very promising. Work is being continued on combination sodium-barium salts of this type of wetting agents. The raw material cost of this type of wetting agent is very low and would result in a substantial decrease in the cost of Kem-Tone.

B - Casein Substitutes

Four protein solutions received from Swift and Company have been evaluated as casein extenders. Of these samples, Extender #1 shows the most promise.

50% of the casein in the present Kem-Tone formulas was replaced with the Swift extenders, bringing the total casein content to 17-1/2 pounds per 100 gallons. All gave lower viscosities than standard. The emulsion stability on all but one of these paints was poor. The paint in which extender #1 was used had fair stability but was not as good as standard.

Work is to be continued in cooperation with Swift and Company.

A sample of spray dried wheat gluten from Pillsbury has been examined. This material gave a poor dispersion, but was slightly better than a similar material submitted by General Mills.

A sample of ortho protein produced by Drackett was evaluated. The dispersion obtained with this material was poor.

Dispersions of corn protein have been tested in which part of the ammonia-rosin soap was replaced with sodium rosin soap. A slightly improved dispersion resulted. No evidence of decreased washability was noticed.

C - Evaluation of Vehicles and Oil Conservation

A Tall Oil Kem-Tone formulation has been put into production at Chicago in which the vehicle consists of 0.48 pounds of Linseed oil and 0.84 pounds of Tall Oil per gallon of paint. The casein content has been cut to 0.2 pounds per gallon. The resulting paint has excellent emulsion stability and brushing qualities. Washability is equal to standard.

The following vehicles and vehicle combinations have been evaluated in laboratory size batches of Kem-Tone.

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Vehicle	Viscosity	pH	Brushing	Emulsion Stability	Washability
V 17093	49"	8.60	Good	Excellent	Good
V 10870 MM	48"	8.60	Good	Excellent	Very good
V 10870 HH	105"	8.85	Good	Excellent	Fair
V 10870 YY	41"	9.35	Good	Excellent	Very good
V 10870 II	93"	8.65	Good	Excellent	Good
V 17093	Over 120	8.3	Excellent	Excellent	Very good
40% (320) 60% V 17070	" "	8.4	Excellent	Excellent	Very good
40% (320) 60% RR 9623	" "	8.2	Excellent	Excellent	Excellent
40% (320) 60% Rosin Oil	21"	8.5	Good	Excellent	Excellent
40% (320) 60% SandW #1	20"	8.75	Good	Excellent	Very good
40% (320) 60% " #202	21"	9.00	Good	Excellent	Very good

(320) is bodied linseed oil.
V 17070 is Sherwin-Williams soap stock.
RR 9623 is competitive soap stock.
S and W #1 is Stroock and Wittenberg Pine Gum #1.
S and W #202 is " " " #202.

The Stroock and Wittenberg vehicles are treated Tall Oil products having very low acid values. They are recommended as linseed oil extenders.

V 17093 is the Tall Oil vehicle now being used in Kem-Tone consisting of 40% (320) and 60% 3 minute Tall Oil.

Other vehicles are experimental Tall Oil vehicles submitted by the Rosin Research Department.

Washability and flexibility tests on the above vehicles have not been completed.

The amount of linseed oil used with the above vehicles can be further reduced. The only property affected by reduction in linseed oil seems to be flexibility. Work is being continued on the plasticizing of Tall Oil and rosin oil films.

D - Mycological Work

A number of species of mold isolated from a stock corn protein can was added to Kem-Tone 65400 to determine whether such a contaminated protein stock (C 1363 X) could be used safely in the manufacture of Kem-Tone. A control and inoculated cartons were observed for 33 days. An odor not stronger than a slight garbage one prevailed the greater part of the test period. In 33 days each carton showed three mold colonies. Thus, it might be concluded that the preservatives present in the Kem-Tone were effective against mold contaminating the protein stock.

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Bacteriological Work

Examination of constituents in new Kem-Tone formula.

Weights of the following in proportion to that of casein in the new formula were used in casein solution to determine their effect, if any on bacteria. Solutions were incubated 48 hours at room temperature before plating.

1. Casein control
2. (152) - cobalt drier
3. W .2126 - Lecithin
4. V 17093 - Tall Oil Formula
5. Borax
6. Borax and oleic acid (equivalent weight)
7. Borax in special Kem-Tone (no preservatives)
8. Borax and oleic acid in special Kem-Tone

	Control	Bacteriostatic Effect	Inoculated	Bacteriostatic Effect
1.	1920/cc		300,000/cc	
2.	90/cc	95.3%	30,000/cc	90%
3.	8400/cc	Stimulates growth	200,000/cc	33%
4.	300/cc	84.4%	1600/cc	99.5%
5.	120/cc	93.8%	64,400/cc	78.5%
6.	30/cc	98.4%	1200/cc	99.6%
7.	0/cc	100%	0/cc	100%
8.	300/cc	84.4%	0/cc	100%

The effect of hydrogen ion concentration and heat on bacteria attacking Kem-Tone:

Method: Portions of 5% inoculated (2,000,000 bact./cc) casein solution regulated to different pH's were heated to various temperatures and held there for 15 minutes. Plates were immediately made to determine the effect of the pH and heat on the bacteria.

1. Regulation of pH with ammonia (volatile base).

Temp.	pH 7.9	pH 9	pH 9.3	pH 9.75	
70°	300 +	300 +	300 +	300 +	Bact. per 1/40 cc
140°	300 +	300 +	300 +	300 +	
170°	300 +	300 +	300 +	300 +	

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Comments

Bacterial growth was larger in the plate (70° - pH 7.9) than in plate (70° - pH 9.75) which were mere pin points. Plate (170° - 9.75) showed a slight decrease in bacterial number, but abundant growth of those present. This may indicate that the original pH and the heating may have killed a few organisms, at the same time the ammonia gradually boiling out leaving in the end a more favorable growing environment for the thriving bacteria.

2. Regulation of pH with sodium hydroxide (fixed base)

Temp.	pH 10.6	pH 11	
81°	100 +	100 +	Bact. per 1/40 cc
140°	100 +	80	
170	80	50	

Although not conclusive, the results show that heat and pH do have some effect on bacteria. .5 gm NaoH was required to prepare 100 cc of 5% casein solution resulting in the pH 10.6.

3. Regulation of pH with the mixture of ammonia and sodium hydroxide.

The amount of ammonia in the casein solution was fixed. The amount of hydroxide varying to regulate the pH.

Temp.	pH 8.3	pH 8.7	pH 9.3	pH 10.5
				Bact. per 1/40 cc
83°	200 +	200 +	150	150
140°	30	25	15	6
180°	15	10	9	4

In all cases the solutions of higher pH turned darker in color on heating than those of lower alkalinity at the same temperature. Heated samples developed the slaughter house odor due to the hydrolysis of casein.

Evaluation of Preservatives

Evaluation of various preservatives:

Method: To 15 cc of 10% casein solution to which 10 cc of spoiled casein (6,000,000 bact./cc) had previously been added, 10 cc of .3% preservative solution and 5 cc of distilled water were added, the resulting concentration of preservative being .1% in 5% casein solution. The solutions were the

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incubated at room temperature for 48 hours in a closed jar. One drop (special dropper 40 gtt/cc) was plated out in nutrient agar. The second plates were made following another 48 hour period.

The preservative solutions were prepared by dissolving .1 gm preservative in 30 cc distilled water or a suitable mixture of acetone and water. In the case of the latter, the acetone was allowed to evaporate from the final test solution above by leaving the jar open the first 24 hours of the incubation period, and the lost volume replaced with distilled water.

Results:

Preservative	1st Plate pH	1st Plate Count	2nd Plate pH	2nd Plate Count	Final odor and comments	Solubility
1. Sulfanilamide	7.3	4800	6.95	-	Spoiled	Water
2. Silver Nitrate	7.6	13	7.8	C	Slt., dark amber	"
3. di-nitro-o-cresol	7.2	2500	6.8	-	Slt., sol. amber	Acetone-water
4. Dowicide 6	6.9	4500	6.9	-	Slight	" "
5. Preventol	8.1	80	7.9	15,000	Slight	Water
6. a-Naphthylamine	7.7	2	7.45	4,000	Slight	Acetone-water
7. Steri-chlor	7.2	25,000	6.8	-	Spoiled	Water
8. Benzoic Acid	7.2	30,000	6.5	-	Spoiled	Acetone-water
9. Sod. Perborate	8.7	240	8.7	0	Slight	Water
10 National Aniline) Antimycotic 40879)	7.6	8	7.7	200	Slight	Acetone-water
11. N.A. Antimyc.40880	7.3	62	7	20,000	Slight	" "
12. Santophen 20	7.5	0	7.8	0	Slt., dark amber	" "
13. Collatone	8.6	60	8.4	0	Slight	Water
14. Dowicide 7	6.95	50	6.7	25,000	Slight	Acetone-water
15. " S	8.4	0	7.3	10,000	Slight	Water
16. " A	8.5	1	8.5	2,000	Slight	"
17. " G	8	2,000	7.1	-	Spoiled	"
18. " F	7.9	2,000	7.1	-	Slight	"
19. P-dimethylamino benzaldehyde	7.8	0	6.7	10,000	Slight	Acetone-water
20. (1767) Guaiacol	7.6	25,000		-	Slight	" "
21. Hercules Sample A	7.8	2,000		-	Slight	" "
22. Hercules Sample C	7.8	0	7.2	400	Slight	" "
23. Roccal	8.4	10,000	7.25	10,000	Spoiled	Water
24. Santophen 7	7.9	0	7.3	2,000	Slight	Acetone-water
25. Phenol S	7.85	15,000		-	Slight	" "
26. " XT	7.9	2,000	7.2	2,000	Slight	" "
27. Trimethyl phenzyl ammon. chloride	7.8	15,000		-	Slight	Water

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Test - Cont.

Preservative	1st Plate pH	1st Plate Count	2nd Plate pH	2nd Plate Count	Final odor, comments	Solubility
Formaldehyde	7.2	0	6.9	400	Slight	Water
Phenol	8.1	20,000		-	Spoiled	"
Sod. Nitrite	7.4	30,000	7.2	-	Spoiled	"
GD-C-Dip	7.8	25,000		-	Slight	Acetone-wa e
GD-9 A Dip	7.8	0 -	7.4	10,000	Slight	"
Furfural	7.	10,000		-	Slight	" "
Blank	6.9	32,000		-	Spoiled	

Comments:

Only a few samples showed good results. We believe, however, that ore of the tested preservatives are actively bacteriostatic than the results indicate. Silver nitrate, sodium perborate, Santophen 20. and Collatone showed perfect results. Several showed reverse results with low first plate counts and then a sudden jump in the second. This may indicate the possible deterioration of the preservative or a fault in technique. We were not thoroughly satisfied with the results of those preservatives dissolved in acetone-water. The majority showed poor results. This is probably due to the poor dispersal of the preservative in the casein solution.

Second evaluation of various preservatives using Kem-Tone as base.

A special batch of Kem-Tone was prepared leaving out the usual preservative. Solutions of preservatives dissolved in water or acetone-water as in the preceding test were added to portions of Kem-Tone so that the final 50% reduced Kem-Tone contained a .1% preservative concentration.

Preservative	1st Plate pH	1st Plate Count	2nd Plate pH	2nd Plate Count	Final odor and color	Solubility
1. Mersolite 8	8.9	5	8.7	0	Slt casein, dark tan	Acetone-water
2. Dowicide 6	8.9	6	8.7	3	Sl. animal, " "	" "
3. a. Naphthylamine	8.9	3	8.8	10	" " " "	" "
4. Antimycotic 40879	9.2	1	8.8	0	" " " "	" "
5. " 40880	8.8	7	8.6	10	Normal, white	" "
6. Preventol	9.1	2	8.8	5	Sl. animal, dark tan	" "
7. Sod. Perborate	9.1	2	8.7	400	Casein, buff	Water
8. Santophen 7	7.5	600	7.1	340	Sl. casein, white	Acetone-water
9. Dowicide 7	7.7	3	7.5	2	Normal, white	" "
10. " S	9.0	7	9.0	10	Ammonia, sl. animal, buff	Water
11. " A	9.4	0	9.1	3	" " " dk. tan	"
12. " G	7.8	800	7.4	620	Normal, white	"
13. " F	7.8	1000	7.4	500	Cardboard and glue, white	"
14. Roccal	9.4	25	9.3	11	Ammonia, sl. animal, buff	"

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Preservative	1st Plate pH	Count	2nd Plate pH	Count	Final odor and color	Solubility
15. Phenol S	8.9	0	8.7	5	Sl. animal, buff	Acetone-water
16. " XT	9.2	4	8.9	3	Sl. casein, "	" "
17. GD-C-Dip	9.1	3	9.0	20	" " "	" "
18. GD-9 A-Dip	9.2	3	8.9	1	Animal, buff	" "
19. Furfural	8.9	3	8.9	18	Ammonia, animal, buff.	" "
20. Mercury chloride	9.1	1	9.0	0	Casein, buff	Water
21. Blank	8.5	48	8.2	30	Sl. garbage, white	

The results obtained here are quite similar in ratio to those obtained in the previous evaluation. Those giving counts up to three may be considered good. A number of samples showed an increase of bacteria over that of the blank. This may be due to the lack of an effective concentration of the preservative in active physical form in the media. In small concentrations, preservatives oftentimes stimulate the multiplication of bacteria.

The effect of heating on preservatives used in Kem-Tone:

.6% aqueous preservative solutions were heated to various temperatures, held there for 15 minutes, then stood at room temperature for 24 hours. The lost volume of water being replaced, a portion was taken and added to 20 cc of 10% inoculated casein solution (100,000 bact./cc) so that the resulting concentration of preservative was .2%; casein 5%. Plates were made after 72 hours incubation at room temperature.

A. Dowicide G		3rd Day		5th Day
Temp./Time	pH	1st Plate	pH	2nd Plate
0° F./0	8.5	200/cc	8.25	0/cc
100° F./15'	8.4	32,000/cc	8.1	600,000/cc
135° F./15'	8.3	0/cc	8.3	400,000/cc
160° F./15'	8.5	16,000/cc	7.7	1,200,000/cc
185° F./15'	8.4	0/cc	8.2	400,000/cc
185° F./30'	8.55	0/cc	8.3	160,000/cc
Casein control	6.9	640,000/cc		

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B. - Dowicide S

Temp./Time	pH	Plate
0/0	8.7	0/cc
100° F./15'	8.7	40,000/cc
135° F./15'	8.8	40,000/cc
160° F./15'	8.7	80,000/cc
180° F./15'	8.7	40,000/cc
180° F./30'	8.8	40,000/cc
Casein cont.	8.4	200,000/cc

C. Sodium Perborate

Temp./Time	pH	Plate
0/0	8.9	64,000/cc
100° F./15'	8.8	560/cc
135° F./15'	8.7	300/cc
160° F./15'	8.9	300/cc
180° F./15'	8.9	8,000/cc
180° F./30'	8.8	80,000/cc
Casein cont.	8.4	200,000/cc

D. - Dowicide A

Temp/Time	pH	1st plate	2nd Plate
0/0	8.5	800/cc	2400/cc
100° F./15'	8.4	400/cc	3200/cc
135° F./15'	8.5	4000/cc	8000/cc
160° F./15'	8.5	4400/cc	8000/cc
180° F./15'	8.5	6000/cc	4800/cc
180° F./30'	8.5	12,000/cc	9600/cc
Casein cont.	6.4	400,000/cc	

Odor Tests

Report on Kem-Tone Formula 65402 - C 263 E

Due to an odor complaint received on the Kem-Tone formula 65402 - C 263 E, the following observations and tests were made:

1. The original Kem-Tone in the sample bottle:

   a. Odor: moldy, flat, similar to damp wallpaper.
   b. Odor of unexposed surface: sl. pungent, pine oil, pleasant.
   c. Appearance: abundant mold growth on surface of sample.

2. 50% reduced sample:

   a. Odor: O. K., not strong.
   b. pH: 7.9
   c. Appearance: sl. lumpy as if broken, numerous small bubbles.
      After 24 hours: solids settled, leaving clear supernatant liquid.

3. Test for presence of borax

   a. The clear liquid obtained from the 24 hour reduced sample above was acidified and tested for borax using the Turmeric test. A control was run at the same time. Results for the sample in question were

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4. Bacteriology

a. Plate count showed the presence of 800,000 bact./cc in the original sample.

5. Odor test by the usual cardboard carton method using three cartons: 1, wet; 2, dry; 3, inoculated. The odors in all three were identical, being in one day, moldy and slightly of garbage. In 4 days, the odor became very offensive, resembling that of spoiled shellfish. At this time the entire film surface lining each carton was covered with a uniform growth of white mold hyphae. This indicates that the Kem-Tone is grossly contaminated with specific mold hyphae or spores.

Odor test on Kem-Tone test batches:

WP 1018 Kem-Tone: control
WP 1019 " " : 2/3 weight of casein substituted with egg protein
WP 1022

Method: cardboard carton test.

Batch	Carton: wet	Carton: dry	Carton: inoculated
WP 1018	1st day odor: sl. pungent and of drying oil	Sl. musty	Garbage
	30th day odor: faintly musty	Slightly musty	Sl. garbage
	Growth: none	None	2 mold
	Spoilage: none	None	10th: spoiled shellfish 16th: Garbage
WP 1019	1st day: musty	Sl. pine oil, pleasant	Garbage
	30th day: Sp. shellfish	Flat, odor slight	Garbage
	Growth: Numerous brown colonies	None	3 mold
	Spoilage: 16th day	None	
WP 1022	1st day odor: Sl. spoiled shellfish	Slight garbage	Sl. garbage
	30th day: musty, garbage	Cardboard odor, musty	Sl. garbage
	Growth: numerous mold	Numerous mold	Very numerous mold.
	Spoilage: none	None	

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E - Semi-Gloss Kem-Tone

Development work on gloss type emulsion paints requires some re-orientation of thought as compared with lustreless type formulation development.

Gloss is due to specular reflection from the surface of the object, and any point or points on the surface which give rise to diffuse reflection of the light subtract from the gloss, and the extent of these points need not be great in order to lower that characteristic appreciably.

In Kem-Tone the pigment is preferentially wetted by the water phase - and as long as the water coating does not evaporate it appears glossy. But upon evaporation of the water phase the varnish and protein binder act only as a cementitious material, holding the uneven surfaced pigment particles to the area coated and to each other. As light strikes that uneven surface it is diffused to give the soft reflectance of Kem-Tone.

To produce a glossy resin-emulsion paint, it is believed necessary that the pigment be effectively coated with a compound of such nature that the pigment will be preferentially wetted by the varnish binder - and if not originally incorporated therein - will, upon application of the film, undergo a complete phase reversal and become entirely wetted by the initially internal phase. (This latter condition seems to be more of a theoretical concept than practical.)

Further, because water must be the initial external phase (in order to thin with water, and to have good brushing) and the pigment must be within the particles of emulsified binder, the pigment itself must be capable of extremely fine subdivision.

Also, the ratio of pigment to binder must be considerably smaller than in Kem-Tone, for there must be sufficient to completely wet the pigment and allow for handling, and to dissolve those addition agents found necessary to emulsify and stabilize the final product.

It follows from the above that the pigment should have the highest hiding power per unit of volume obtainable.

If the product is designed to have the pigment initially in the varnish phase, it must be made to stay there - must be prevented from migrating to the interface of the phases.

Initial experience with attempted gloss emulsions showed that the pigment, untreated, would migrate into the interface with time, and although glossy upon fresh manufacture, would deteriorate in this quality with age.

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It was theoretically reasoned and later demonstrated that this aging factor can be considerably reduced by a pre-treatment of the selected pigment with a surface coating of a lyophylic nature. A number of metallo-organic compounds were tested with the most practical promise obtained with aluminum resinate applied to a rutile type titanium dioxide pigment.

The theoretical reasoning for the success of aluminum resinate as a coating for the titanium dioxide may be of interest and follows.

It has been known that titanium dioxide has an affinity for adsorption of metallic driers from conventional paint formulations, and as there are indications that such adsorption is oriented - i.e., the metallic portion of the drier adjacent to the pigment, and the organic end of the molecule directed outward, titanium pigments were selected for this study.

In initial work on this phase of the problem a selected group of metallo-organic compounds covering a wide range of metals in the periodic table and some variations of organic acids were dissolved in low boiling petroleum solvent. Samples of treated pigment were then made by first ball-milling an aging titanium dioxide pigment in these solutions. The pigment was centrifuged and washed from the excess of metal-organic test compounds, air dried, and ground into a 25 gallon length oleoresinous vehicle. The pastes were then incorporated into resin-emulsion paints so that the pigment and varnish were the dispersed phase. Results from this series of tests indicated best results with aluminum naphthenate.

As the naphthenates were unavailable, aluminum resinate was used with favorable results.

According to Harkins "oriented wedge" theory - if the trivalent aluminum is oriented so that the metallic end is adsorbed by the titanium dioxide there is a protective "wedge" of the three resinate molecules which are hydrophobic - and prevent the pigment from entering the interface, which should prevent loss of gloss.

Work is under way, in conjunction with Gloucester on the preparation of surface coated rutile titanium dioxide.

The final physical state sought for in the dried film should be as close to that of the conventional enamel film as it is possible to produce. With such specification it is apparently necessary to keep all oil or resin insoluble agents at a minimum.

This requirement introduces the problem of maintaining emulsion stability, as there is considerable tendency for these materials to "break" in the brush upon washing out with water and soap.

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F - Kem-Tone Production Inspection

During the month Kem-Tone production was inaugurated at the John Lucas plant in Gibbsboro and also in the Cleveland plant. At the same time, the Newark plant was placed on production with the corn protein formula, as they had previously used the all casein formula. The set-up in each plant is outlined below:

Cleveland

Kem-Tone production equipment in the Cleveland plant consists of three small mixers, of approximately 75 gallons working capacity each, located on the third floor of B Dept. The mill is a new Morehouse High R Speed Colloid Mill, mounted on a narrow gauge track at the rear of the thin-down tanks, and capable of being moved from one tank to another for each batch ground. There are three thin-down tanks of 400 gallons capacity each. With this equipment, a production rate of 1200 gallons per eight hour shift should be easily attainable. The corn protein solution is made in a separate jacketed agitator tank, located on the mixer floor.

Equipment Needed

Perhaps the piece of equipment most urgently needed in Cleveland is a suitable water meter installed in the line to the thin-down tanks. The present meter is entirely unsatisfactory, and water is being added by measuring in 5 gallon pails at this time. We are using Imperial meters in Chicago, while Newark and Gibbsboro are using Neptune equipment. Both types have proven satisfactory for this purpose.

It is also essential that provisions be made to strain the (2898)R before it is added to the batch. As received, this varnish contains numerous skins and seeds which are not efficiently removed from the finished Kem-Tone by the Roto-Spray strainer at the time of filling. Unless the varnish is strained before using, it is almost impossible to fill clean, uncontaminated Kem-Tone.

Gibbsboro

Gibbsboro's equipment consists of two mixers of approximately 100 gallons capacity each, one Micro Pulverizer mill, and three thin-down tanks of 400 gallons capacity each. Inasmuch as there is no tank available in which to make up the corn protein solution, one of the thin-down tanks is used for this purpose. As a consequence, there are only two tanks available for Kem-Tone production most of the time. On this basis, production should average two tanks or 800 gallons each eight hour shift, with a third tank produced every second or third day, for a 6 day - 48 hour week production of a minimum of 5600 gallons.

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Equipment Needed

Installation of a 250 gallon steam jacketed agitator tank equipped with a dial thermometer, to be used as a corn protein tank, would enable Gibbstown to increase production to an average of 7200 gallons weekly, and would greatly reduce time and labor needed to make the protein solution in the thin-down tank on the second floor, fill in drums on the first floor, and truck up the elevator to the third floor mixers as is being done at present. A second tank, identical with the first one, to be used to make up casein solutions would also be more efficient and would result in a higher weekly production rate.

Newark

The installation of a 250 gallon jacketed agitator tank adjacent to the present casein tank enabled Newark to start production on the new corn protein formula.

Equipment Needed

Another casein tank and another corn protein tank would provide more flexible uninterrupted production. Additional mixers and thin-down tanks would greatly increase weekly output at this plant. Dial thermometers installed in the casein and protein tanks, mixers and thin-down tanks are absolutely essential. It is also strongly recommended that the casein and corn protein solutions be added to the batches on a weight basis instead of volumetrically as at present.

Maximum potential production from the Newark plant could not be realized unless labeling, filling and conveying equipment were considerably enlarged.

Due to an inadequate supply of 2185 dry lithopone, a conservation formula, identified as Alternate "C" has been developed and submitted to all plants to be used whenever the lithopone situation becomes acute.

Kem-Tone Production Control

Facilities have been established in Chicago to maintain a close check on the quality of the Kem-Tone being produced by all of the plants engaged in its manufacture. A representative sample of every fourth batch manufactured is sent to this laboratory where examined for weight per gallon, viscosity, pH, color, odor, washability, brushability and brush clean-out. A report on these tests is sent to the plant submitting the samples.

A standardized inventory and production report form has been established, with all plants submitting this report weekly. It is hoped that a report of this type will correlate all raw material information in a central [illegible] of critical and allocated items.

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Kem-Tone Fibre Package

Filling, handling, shipping, heat, and freeze tests have been made on the #105 gallon Kem-Tone fibre package. Results of the tests are promising and indicate package will be satisfactory for Kem-Tone usage.

Based on the results of the shipping tests it is necessary to use dividers, top and bottom pads in the cartons, or boxes used for packaging the fibre containers.

#175 - Blackout and Camouflage Paints

This laboratory is continuing to cooperate with the factory in re-working rejected batches of T-1279 #2 Dark Green.

#155 - Wallpaper Evaluation

Samples of Style Perfect wallpaper submitted by the United Wallpaper Company have been checked for washability, fade resistance, adhesion, and brittleness.

Kem-Tone trims are also being checked for quality. Tests on recent samples indicate that washability and fade resistance of the trims has fallen below standard. The United Wallpaper Company has been informed of the results of our tests and have been requested to improve the quality of trims with respect to washability and fade resistance.

The adhesion of the trims has been improved and is up to standard.

#170 - Army-Navy Specification Work

See #175.

#174 - Oleoresinous Wrinkle Varnishes

No work done.

Specialties

Work is being continued on the development of a super paint cleaner, particularly for use in cleaning Kem-Tone.

Several spachtling compounds are being evaluated as the sales department desires to offer a product of this type under our own label. Of the samples examined, Savogran Crack Filler showed up best, with respect to non-shrinking qualities and smoothness of finish.

M. VAN LOO

A series of paints based on SWP are being prepared for exposure using various types of extenders to study the effects on (1) durability, (2) dirt collection and general appearance, and (3) color retention in tints. Two types of formulations are being used,- (a) a conventional high oil medium p.v.c. paint similar to 1942 SWP, and (b) an oil conservation type similar to the 1943 SWP. The extenders being studied include 201 magnesium silicate, 2188 dry Micro Velva, 8 dry China Clay, 2077 dry Celite #281, 213 dry Blano Fixe, 306 dry Barytes, 566 dry Mineral Whiting, 2500 dry Suspenso Whiting, 2247 dry Atomite, 1817 dry Surfex, 3 dry Silica, and 1779 dry Mica. Exposures will be over 450 Undercoater, tinted gray under the white paints and left white under the tints, to emphasize erosion. All will be exposed south at Coffeyville, and at Chicago the whites and Colonial Yellow tints will be exposed south and north, and the Slate tints south only.

Panels 4483-98 F were examined after 24 months Florida exposure. These consisted of SWP Canary Yellow, Cream, Gray, and Pea Green tints, two coat 450 primed cedar panels. The regular tint base of 1/5/40 (58 pounds 2031 T and 80 pounds 1895 dry) was compared with a special pigmentation carrying 25% lead titanate in conjunction with leaded zinc and asbestine. In this set, the special high lead titanate pigmentation shows slower chalking with better tint retention than the regular, and a rather surprising advantage in durability and freedom from dirt collection, which has not always been true in parallel comparisons. 40/60 leaded zinc, 1526 dry, shows less checking than 35/65 leaded zinc, 412 dry, in the regular.

Panels 4418-38 F were examined after 36 months exposure at Florida, 2 coat, 450 primed on cedar. Various blends of castor and soya oils are compared with the regular Rx 471 SWP Gloss White formulas of 1/4/40 and 4/4/40, in which the latter carried Dehydrol and soya. The castor-soya combinations involved up to one third substitutions of the total oil and used (a) (3017) Light Bodied Dehydrol (11 seconds) - (1273) Refined Soya, (b) (2325) Dehydrol (50 seconds) - (418) raw soya, (c) special ester interchange oils M 321 a 2/1 castor linseed, M 309 a 3/1 soya castor, M 311 a 2/1 soya-castor, and (d) ARV-1955 soya-castor "kangaroo oil." These panels are remarkable for their fine condition after 36 months exposure south in Florida, and practically no evidence of inferiority due to the use of the above oils could be found.

#162 - Studies of Flat Wall Paint Formulation

Flat Wall Paints

Work is under way to develop flat wall paints based on non-penetrating highly bodied "neutralized" oil vehicles. The same theories apply here that were previously described under house paints, i.e., the neutralization of the free fatty acids reduces the penetration of oil into the substrate.

M. VAN LOO

The neutralizing agents used have been sodium hydroxide, lime, magnesia, etc. Because reactive pigments such as zinc oxide are rarely used in flat wall paints, the neutralization with sodium hydroxide may be done after the paint has been ground and thinned. However, lime treated oils so far have proven more practical. Lowe Brothers have an excellent oil of this type in their V-792, which is a linseed oil carried to a high body with an acid value of about 18, in which the acidity is then reduced to 1.5 at 34% solids with hydrated lime. This oil shows an excellent control of penetration on the usual filter paper tests, and permits formulation using Titanox RCHT with a minimum of "ghosting." We are working to adapt this type of formula to our plants.

Due to the shortage of R 200 TiO_2 2173 dry, an alternate formula was developed using the anatase 1403 dry. The alternate formula is a satisfactory duplication of the regular. (Paintercraft Flat #10).

Semi-Lustre

As an approach to the formulation of an improved semi-gloss wall paint for post-war usage, a review was made of Semi-Lustre formulas back to 1925. Batches were prepared on every important revision to check on the effects on performance and quality, and to find any unusual and desirable qualities which should be incorporated into the post-war formulation.

The various physical characteristics such as weight, viscosity, brushing qualities, drying, gloss, and hardness were checked and washability will be determined after the films have been allowed to dry for two weeks. Due to the multiplicity of batches and tests, the data will not be included here but is available to anyone interested.

Floor Enamel

ARV-3120, a 25 gallon East India-linseed varnish with 50% solids, was supplied by the Varnish Research Division for evaluation in Floor Enamel. Special Rx 468 Floor Enamel Slate was prepared and tested against three standard formulations using (2843)G, (3848)E, and (3850)N respectively. The results were as follows:

Varnish	Viscosity #3 orifice	Drying 17 hrs.	Sward Hardness (17 hrs)	Sword Hardness (96 hrs.)	Abrasion Resistance (96 hrs.)
(3850)N	21.2 sec.	T F	10	24	3300 gms.
(3848)E	28.2 "	VVST	8	20	9600 "
(2843)G	22 "	Tacky	3-4	12	4800 "
ARV-3120	22.6 "	VVST	10	22	2350 "

Varnish	Cold H_2O Resistance 24 hr. spot test	Soap Resistance 1% Ivory-3 hrs.	Print Resistance 2 lbs./sq. in.(24 hrs.)
(3850)N	Turned white-did not recover	Discolored and dulled	Slight Print
(3848)E	Turned milky-almost complete recovery	"	"
(2843)G	Turned milky-almost complete recovery	Discolored and Dulled-trifle less than others	"
ARV-3120	Turned white-did not recover	Discolored and dulled	"

It is not intended in the above that the sand abrasion tests are to be construed as indicative of the traffic resistance. Since the cold water tests on the (3850)N did not appear to equal previous performance of laboratory cooked batches, checks are being made on production.

Based on the above, the East India varnish does not appear to offer any advantages from the quality standpoint over the Velsicol-Polypale combination used in (3850)N.

#148 - Examination of White Lead

Panels 7186 to 7189 C & F were prepared for exposure to compare the durability of our white lead with competitive products. The samples include SW Q.P. lead of high tinting strength, Dutch Boy (3/4 Carter - 1/4 Old Dutch), and Eagle Picher (all Old Dutch). The paints were applied in three coats each, using the regular recommendations for reduction of lead-in-oil for first, second, and third coats.

#86 - Durability of Pigments with Special Reference to Leaded Zinc and White Lead

Panels 7173 and 7177 C were prepared for exposure to compare the relative durability of co-fumed versus mechanically mixed leaded zincs in the oil conservation type house paint formula. This was to review possibilities in case replacements were needed for 412 dry. 9 dry, basic sulfate white lead, was blended with the large particle size non-acicular New Jersey Zinc Oxide XX-50 (1707 dry), and the two aciculars ZZZ-22 and ZZZ-33 to give the same composition as 35/65 leaded zinc.

#112 - Fire Retardant Paints

After 1600 hours in the salt spray machine, the series

M. VAN LOO

In the May report we mentioned that a pigment study was under way in which various blends of iron oxide, zinc chromate, and magnesium silicate would be evaluated for use in a post-war trade sales metal primer. Panels 7128-7154 C & G have been prepared for exposure at Chicago and Gloucester City, N. J., 45° south. These are 9" x 12" hot rolled steel panels, and 3" x 9" panels have been prepared for salt spray tests.

The paints were made on a modified "Kromik" vehicle in which (48) is substituted for the grinding varnish binder content. The p.v.c. was held at 28.7%. Pigment proportions using the three constituents were varied in steps of 20% by volume over the range of 0% - 100% for each variable. A brief test using normal and basic types of lead chromate (12092 dry and 12082 dry) was included to give a comparison with zinc chromate.

Because of the success obtained through the use of calcium carbonate extenders in 52-P-18 primer in fire retardant tests, a similar series is being tested in an oleoresinous primer of the Kromik type.

Panels 7209-10 C were prepared for exposure to evaluate Dutrex Resins A & B from the Shell Petroleum Company as rust inhibitive coatings for steel. The Dutrex resins are long chain aromatic residues from lube oil. The Dutrex resins were cut in mineral spirits and applied by brush to steel panels. Kem Kromik and Metalastic Black were used as the guide system.

Some work has been done on pure red lead ready mixed paints to determine whether it is possible to hold the oil content below 3.75# per gallon. To date, the use of bodied oil has caused considerable after-body.

#177 - Pigment Studies

Leaded Zinc

We were informed during the month that there was some question whether 1526 dry 60/40 Leaded Zinc Oxide could be produced without encountering a serious drop in quality, due to the grades of ores available for that production. It was suggested that 413 dry be tried as a substitute for 1526 in a representative formula.

The greatest quantity usage of 1526 dry is in SWP tints and therefore Rx 496, SWP Ivory, was selected as the cleanest tint in the line. First, it should be reported that recent shipments of 1526 dry have been rather dark in color so that in relation to 1526 the 413 dry samples are whiter and brighter than the comparison material.

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The samples of 413 dry which we studied are described as follows:

1. 413 dry, 943 D - Standard plus color
2. 413 dry, 3472 B - Standard color
3. 413 dry, 1442 C - Standard minus color

These three samples represent about the medium in color and the two extremes in color. However, the quantity of material rated below standard was said to be only about 10-15% or less, so that the average color of a car would normally run standard or above.

If these samples are representative of the proposed 413 dry regular production, there would appear to be no objection to its use in SWP tints and similar formulations where 1526 dry is used. Substitution for 1526 should be made on the basis of equivalent chemical composition. The difference in lead content may be made up by using additional lead carbonate.

Test Comparisons: Tint bases made on Rx 496, SWP Ivory formula, card 27, date 3/5/43.

Paint No.	Leaded Zinc Pigment	Wt./Gal. T	Wt./Gal. A	1 day age, Visc. 75°F. #3 Cup	Color	Opacity	Texture
227	1526	14.90	14.98	21.6"	4	Std.	3M - 4½
228	413 dry 943D plus color	14.90	14.98	21"	1	Equal std.	2P-4
229	413 dry, 3472 B, Std. Color	14.90	15.02	22"	2	Equal std.	2P-4
230	413 dry, 1442 C, minus color	14.90	14.98	20"	3	" "	2P-3½

Color

Rated visually on paint out; recorded in the order of whiteness.

Opacity

Rated by visual comparison of .005" gauge clearance draw downs on Morest black and white contrast sheets. It is felt that any slight error in this rating would be nullified by the tinting of these paints to equivalent color.

M. VAN LOO

Texture

Paints were all ground on a laboratory 3 roll mill at a fixed setting. Texture is reported on the S-W and Lowe Bros. systems as shown on the S-W grind gauge.

Although 413 dry is very slightly poorer in texture than 1526, we would say that if our samples are representative, the shift from 1526 dry to 413 dry could be accomplished with ease in most formulas.

In the last monthly report, we described tests in which we compared the opacity of TiPure R 200, Titanox RA 10 MO, and Unitane OR 250. Panels 7101-7105 and 7127 C have now been prepared for the observation of dirt collection and chalking resistance of the TiO_2 pigment blends using RA 10 MO and the OR 250 with a normal anatase TiO_2. The results of this test will be reported just as soon as significant differences have developed.

A second TiO_2 comparison has been put on exposure. In panels 7155-7172 CN and CS, we are evaluating by both south and north exposures for tint retention and dirt collection, the following pigments:

2173	dry	- TiPure R 200
2259	"	- TiPure R 510
2174	"	- TiPure R 610
1895	"	- Titanox L, Lead Titanate
2269	"	- Titanox RA 10 MO
		Titanox RA 10 LO
		Titanox RA
		Unitane OR 250

These pigments were made up in the Rx 471 formula, card 35. The paints were tinted to Rx 363 Slate and Rx 375 Colonial Yellow.

#77 - Mildew Inhibitors

Panels 7218-7223 F were prepared for exposure in Florida under conditions conducive to mildew. This series compares the calomel Mildew Resistant Paste Rx 203 with a special paste carrying phenyl mercuric oleate. The paints include the SWP Gloss White of 1942 and the current formula, with 1 and 2 parts phenyl mercuric oleate per 1000 parts paint, 3% tetrachlorphenol, and the usual treatment with Rx 203.

Panels 7237-7240 C & F were prepared for exposure as repeats of a previous series where S-W Mildew Resistant Treated Undercoater and Gloss White were compared with Cook's Mildew Resistant House Paint (Panels 6245-48). The earlier set showed a severe yellowish discoloration in the S-W paints.

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#161 - Emulsion Binder Paints

A. Wetting and Emulsifying Agents

The following table summarizes the results of tests made on wetting agents during the month of July:

Wetting Agent	Brushing	Emulsion Stability	Settling	Washability
Control	Good	Excellent	Slight	Good
B-3-D	Good	Fair	Definite	Good
B-4-D	Fair	Good	Definite	Good
Darvan #2 & CW (1734)	Good	Excellent	Slight	Good
Leukanol Type 41	Good	Good	Slight	Good
Leukanol Type 42	Good	Good	Slight	Good
Leukanol Type 43	Good	Good	Slight	Good
Aresket 300	Fair +	Good	Slight	Fair
CPX 454	V. Good	Excellent	Slight	Good
CPX 454 & CW (1734)	V. Good	Excellent	Slight	Good
Tret-O-Lite L13693	Good	Fair	Definite	Good

1. Analysis of casein for amino acids

The casein was mixed with distilled water, heated to 160° F. for several hours and shaken periodically. The filtrate was then analyzed for free amino acids or any of their putrefaction compounds produced by the action of bacteria or enzymes.

The putrefaction substances are formed by decarboxylation (removal of a carboxyl group), deaminization (removal of an amino group), reduction, hydrolysis, or oxidation. Briefly, some of the reactions involved, in which we are most interested, are:

arginine ⟶ ornithine ⟶ putrescine

tyrosine ⟶ tyramine ⟶ p cresol phenol

tryptophane ⟶ indole ethyl amine ⟶ skatole ⟶ indole

histidine ⟶ histamine

indole ⟶ indoxyl

cystine ⟶ cysteine

Some of these reactions probably account for the odor of casein.

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The results of the tests thus far definitely indicate the presence of tryptophane, indole, skatole, tyrosine either or both phenol and the cresols, histidine, arginine and possibly a small amount of cystine and phenyl alanine. The presence of these amino acids and decomposition products was detected by the following positive tests: Tryptophane, indole, and skatole.

1. Adamkiewicz reaction - Addition of glacial acetic acid and concentrated sulfuric acid gives violet ring.

2. Xanthoproteic reaction - heating with nitric acid and addition of ammonia after cooling gives lemon yellow to orange color.

3. p-dimethyl amino benzaldehyde dissolving reagent in sulfuric acid and running beneath filtrate from protein gives red-violet ring.

4. Nitroso-indole reaction - acidifying with nitric acid and addition of potassium nitrite gives a white turbidity showing skatole.

5. Ehrlich's p-dimethyl aminobenzaldehyde reaction - addition of 5% alcoholic p-dimethylaminobenzaldehyde and concentrated hydrochloric acid gives red color

Cystine and Cysteine

Reduced sulfur test - addition of NaOH and heat and then lead acetate gives black color. This solution turned faintly black, probably because the amount of cystine in casein is very small. More tests will be applied.

Tyrosine, hydroxy phenyl group, phenol, o-m-p-cresol

Since tyrosine is the only amino acid with a hydroxy phenyl group, these tests show both its presence and the presence of its decomposition products, namely phenol and p -cresol.

1. p-diazobenzenesulphonic reaction - diazotization of sulphanilic acid with hydrochloric acid and sodium nitrite and addition of sodium carbonate and filtrate from protein gives yellow showing phenol and oresols.

2. Millon's reaction - addition of Millon's reagent, made with mercury and nitric acid gives red color showing hydroxy phenyl group.

3. Bromine test - addition of bromine water gives a white precipitate indicating oresols, phenol, and hydroxy aromatic acids.

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4. Xanthoproteic reaction - heating with nitric acid and addition of ammonia after cooling gives lemon yellow to orange color indicating tyrosine as well as tryptophane.

Since the positive Xanthoproteic reaction shows tyrosine, tryptophane, and phenyl alanine, it cannot definitely be stated that phenylalanine is present. However, further tests are being performed on this amino acid.

Further tests are also being performed to prove the presence of free bistidine, arginine, and lysine. The Vickery and Block method for determining these was used. Excess of silver nitrate was added to a sulfuric acid hydrolysate of the casein which had previously been adjusted to pH 3 - 6 with barium hydroxide. The acidity was further reduced by the gradual addition of more barium hydroxide. At pH 7 - 7.4 bistidine and at pH 13 - 14 arginine precipitated as their silver derivatives. Lysine, which remains in the filtrate, should be subsequently thrown down as its phosphotungstate and finally converted into the picrate. This, however, was not observed.

When the filtrate from the casein was neutralized and allowed to stand several days, a small amount of white flocculent solid precipitated. One theory is that this may be a salt of lysine. Although lysine is extremely soluble in water, it tends to separate from a neutralized casein hydrolysate in associatinn with the sparingly soluble tyrosine with which it appears to form a double salt.

Work is being continued on this problem and also stopping the enzyme action on the amino acids to do away with the odor.

2. Protein Dispersions

No.	Purpose	Results
WP 1115	V-17071 replacing 637 in BX 606	Poor
WP 1116	V-7739 replacing 637 in BX 606	Poor
WP 1117	Dresinate "90" replacing sodium resinate in BX 665	Good
WP 1153	Make linseed meal protein dispersion on BX 619 formula. Water added until the protein content was 9.4% and solid content 12%	Good
WP 1154	Make linseed meal protein dispersion on BX 664 formula. Water added until the protein content was 8.7%	Good

Dispersions of linseed meal protein were made on the BX 606, BX 664, and BX 619 formulas. OR-P3 contains 12% protein and

less than 1% Dowicide G. On the BX 619 and the BX 664 formulas, additional water had to be added to obtain a good dispersion. The protein content of the former was 9.4% and of the latter 8.7%. Results were very poor with the BX 606 formula.

Experimental Kem-Tone batches were made using linseed meal protein as both a replacement and an extender for casein. The linseed protein produced a poor emulsion when used as a complete replacement for casein. A satisfactory emulsion was obtained when the corn protein portion of the formula was replaced with linseed protein, leaving the casein content unchanged. The use of linseed protein resulted in some decrease in washability.

3. Literature Survey on Proteins

Denaturation

A. Denaturation is brought about by the following factors:

1. Heat - e. g. casein loses phosphorous between 90° and 120° C. and the dephosphorised protein is simultaneously denatured.
2. Strong acids and alkalis and the salts of heavy metals.
3. Sunlight and ultra-violet radiations
4. Alcohol and acetones
5. Lecithin and ether
6. Urea
7. Mechanical means such as shaking
8. Freezing
9. Pressure
10. Salicylate
11. All synthetic detergents denature ordinary proteins at the iso-electric point and keep them in solution

B. Denaturation results in

1. Loss of chemical structure
2. Elimination of solvent
3. Decrease in solubility at iso-electric point

4. Formation of colloidal solutions with dilute acids and alkalis.

Solubility and precipitation

Dilute solutions of neutral salts of the alkalis increase the solubility of proteins in water, e.g., globulin dissolved by salts is electrically neutral.

Proteins in acid solutions are precipitated by phosphotungstic acid, hydroferrocyanic acid, meta phosphoric acid. Proteins in neutral or weakly alkaline solutions are precipitated by salts of heavy metals and by simple salts such as Na_2SO_4 only in high concentration.

All complex ionized salts precipitate proteins from solution. Salts which possess a complex anion precipitate proteins only when the latter are in a Kationic state(at a pH more acid than the isoelectric point of the protein). Those reagents which specifically precipitate proteins:

1. Mineral acids (HNO_3, metaphosphoric)
2. Potassium ferrocyanide and acetic acid
3. Salts of heavy metals
4. Alkaloidal reagents, phosphotungstic acid, phosphemolybdic acid, K-HG-Iodide, K-Bi-Iodide, Tannic acid, picric acid
5. Trichloracetic and sulphonyl salicylic acids
6. Uranyl acetates
7. Nucleic acid and protamines
8. Copper, mercury and lead salts

Dispersions of proteins in formaldehyde

Proteins may be dispersed in certain aqueous formaldehyde solutions. The procedures used were:

A. Formaldehyde added to protein followed by acid or base
B. Acid or base added to protein followed by formaldehyde
C. Acid or base added to protein without formaldehyde as a comparison

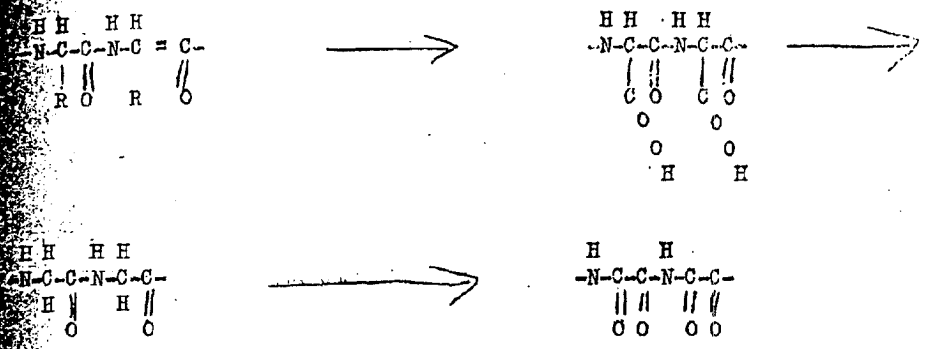
Procedure A gave very low nitrogen dispersion between pH's of 1-10, but B dispersed as much and more nitrogen in some points of the alkaline range as did C. Formaddehyde gives an increased water resistance and can easily be used with soybean protein dispersions but unless caution is used will cause flocculation or gelation with casein.

Oxidation

Oxidizing agents such as Cl_2 and hypochlorite in an

alkaline medium cause a severe darkening of the protein while reducing agents such as SO_2 give a slightly lighter colored product.

Proteins are oxidized by potassium permanganate in the cold, 1 part casein plus 4 parts $KMnO_4$ at room temperature for several weeks:



Ozone likewise oxidized casein.

Selenium in cereal grain proteins can be converted by oxidizing agents to a form easily cleaned. Some selenium is alkalilabile as shown by electrodialyzing a seleniferous gluten peptized in dilute alkali. Selenium can be removed by hydrolysis in alkaline plumbite (PbS).

Specific Proteins

A. Soybean Protein

The adhesive strength, hydrolytic cleavage with NaOH and dispersion characteristic of soybean protein are interrelated. Undenatured protein gives low adhesive values when dispersed in alkaline salts but high values when in NaOH. A mild hydrolytic treatment of soybean protein with NaOH will change the dispersibility so that it will have good adhesive strength when dispersed in alkaline salts but not so good as the undenatured protein dispersed in NaOH.

$Na_2S_2O_4$ and ZnS_2O_4 are the best agents so far discovered for bleaching soybean protein. Soybean meal is known to contain lecithin, cephalin, soluble and insoluble carbohydrates, saporins, plant pigments, lignin, tannin and other substances, one of which or a combination of which is responsible for the color, through the processes of coacervation, absorption, oxidation or even chemical combination.

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Soybean alpha protein should be dispersed in borax and ammonia by warming to 50° C. for a few minutes. 150 cc H_2O, 25 g. of alpha protein, 2.5 g. $Ba_2B_4O \cdot 10\ H_2O$, and approximately 8 cc 28% NH_3 (just enough to give a clear dispersion) was tested to 50° C. After cooling to room temperature, enough formaldehyde was added with vigorous stirring to react with the NH_3 forming hexamethylenetetramine and also to react with and harden the protein (25 cc of 40% formaldehyde). The pH is thus lowered to 5.7 - 7.0 without precipitation of the protein. This lower pH is more desirable because the nearer the pH is to the iso-electric point of the protein, the lower its H_2O absorption. Alpha protein gells if borax is omitted. Tri-sodium phosphate may be used, 2.5% of phosphate is approximately equivalent to 5% borax. Na acetate, Na salicylate, Na thiocyanate, Na silicate, Na carbonate and Na sulfate are less effective than borax.

B. Gluten

Sodium salicylate is the best dispersing agent for gluten. Dispersing power is directly proportional to concentration up to 8%.

C. Zein

Zein is compatible with some highly acidic and alcoholic-soluble resins. It tends to become denatured when in solvents; denaturation is accelerated by agitation the more nearly the solvent becomes anhydrous, while still remaining a satisfactory solvent for Zein, the more stable will be the solution. Highly acid resins, like rosin, improve stability. A non-aqueous solution of one part by weight Zein and two parts of ethylene glycol with not in excess of 5% water added makes a very stable solution.

Aliphatic alcohols are best solvents. Zein is soluble without water in ethylene glycol, diethylene glycol ethyl ether of ethylene glycol, furfuryl alcohol and tetra-hydrofurfuryl alcohol. It is soluble also in the following: acetic acid, lactic acid, phenol and alcohol or water, aromatic amines and alcohol, methyl and ethyl lactates, ketones and water, acetone (60-80%) and water, aromatic hydrocarbons (benzene, toluene) and anhydrous alcohol, esters of hydroxy acids (lactates) and anhydrous alcohol, chlorinated hydrocarbons and alcohol, ethylene dichloride, aliphatic nitro-compounds, 10% ethylene glycol and anhydrous alcohol, aqueous solutions of alkaline materials (pH at least 11.5) dispersed in water solution of fatty acids and rosin.

Zein cures with formaldehyde and acid, acetic or lactic acid, hydrochloric acid and primary amines or NH_3, formamide.

Zein is compatible with rosin, Manila resin, or shellac, alcohol ester gum.

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C. Evaluation of Vehicles and Oil Conservation

The following experimental Tall Oil vehicles were evaluated in the Tall Oil Kem-Tone formula as substitutes for V-17093:

Vehicle	Comments	Visc.	pH	Settling	Brushing	Emulsion Stability	Washability
V-17093	Control	45	8.4	None	Excellent	Excellent	Good
[illegible]10916C	BaO-35% (320)	46 (12-8)	8.8	"	V. Good	"	Fair
[illegible]10932F1	2½% RA 32	68	8.3	V.Slight	Good	"	Good
[illegible]10932F2	5% RA 32	75	8.1	None	V. Good	"	Fair
[illegible]10932F3	7% RA 32	105	8.0	V.Slight	V. Good	"	Fair+
[illegible]10932F4	10% RA 32	38	8.2	Def.	V. Good	"	Fair +
[illegible]10932F5	15% RA 32	34	8.1	Def.	V. Good	"	Fair +
[illegible]10932F6	5% RA 32 47% London Oil	39	8.4	Def.	Good	Good	Good
[illegible]10932F7	10% RA 32 45% London Oil	35	8.4	Slight	V. Good	Excellent	Fair +
[illegible]10932F8	15% RA 32 42% London Oil	33	8.3	Def.	V. Good	"	Fair +
[illegible]10932F9	20% RA 32 London Oil 40%	34	8.4	Slight	V. Good	"	Good
[illegible]10932F10	100% T 624	60	8.1	None	V. Good	"	Good
[illegible]10932F10	35% (320)	75	8.2	None	V. Good	"	Good

Wash tests on the above vehicles are incomplete and brittleness of film has not been evaluated.

The following Tall Oil vehicles were also evaluated in Kem-Tone:

Vehicle	Comments	Visc.	pH	Settling	Brushing	Emulsion Stability	Washability
V-17093	Control	45	8.4	None	Excellent	Excellent	Good
T-624	35% RA0324	38	8.4	None	"	V. Good	V.Good
[illegible]10931A	35% (320)	45	8.3	None	V. Good	V. Good	Fair
[illegible]10931B	35% (320)	180	7.9	Slight	V. Good	V. Good	Good
[illegible]10931C	35% (320)	68"	7.9	Slight	V. Good	V. Good	V.Good
[illegible]10931E	35% (320)	180	8.0	Slight	V. Good	V. Good	Good
RV 31	Rosin Ester	36½	9.25	None	V. Good	Excellent	Good

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Wash tests on the above vehicles are incomplete. Brittleness has not yet been evaluated.

Flexibility tests on the Stroock and Wittenberg Pine Gum #1 and #202 showed this material to be definitely more brittle than #624.

D. Bacteriological Work

1. Survey on odor and appearance of Kem-Tone test batches

388 different batches of test Kem-Tone were observed on odor and appearance. The manufacturing dates ranged from 6-23-42 to 7-9-43, there being 2 or 3 containers of the same test batch for the later dates. 244 were classed as being good; those giving a faint slight, preservative, pine oil, ammonia, or slight drying oil odors were placed in this category. 127 were fair; those having strong preservative, oxidized oil, and slight garbage odor. 17 were definitely bad, smelling of garbage or sewer.

Those prepared after February 1st were good with a few exceptions. Of the 17 definitely spoiled, 11 constituted a series of test batches prepared in March from a specific batch of casein solution. Of the series, only one container did not show signs of putrefaction; others ranged from a strong garbage odor to a sewer one; the latter odor was accompanied by generous gas formation in the cans in all cases. Within that series, 6 gave the sewer odor. These 6 and one other showed extremely low initial pH value (7.68 - 7.8), the odd one giving a garbage odor. The remaining 3 gave only garbage odors. Their initial pH was 8.4 - 8.5. The six batches not in the series gave garbage odors only.

The majority of batches were stored in metal cans, some in bottles and a few in cardboard cartons. The odor of the Kem-Tone stored in bottles appeared to be most favorable, the metal cans second. Kem-Tone in the latter frequently gave a slight metallic odor. The cardboard containers appeared to be least desirable for storage as all batches thus kept showed a thick dried film on the surface and along the cardboard interior.

2. Mycological Study of Kem-Tone film on 3 types of carton linings

Kem-Tone Batches: 1. 65402 - C 263 E (report on odor complaint in June report; grossly contaminated with mold)

2. Sample #6 containing .07% Dowicide F
.035% Roccal

3. Samplo #3 containing .15% Dowicide F
.07% Dowicide A
.09% Sodium Perborate

(Previous reports of Samples #6 & #3 in May Report)

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Carton Types tested: A. plain, no lining, cardboard carton
B. parchment lined cardboard carton
C. metallic foil cardboard carton (lined)

The foil lined carton in all cases fostered no mold growth due to the inability of Kem-Tone to adhere to the foil surface. The plain carton was next showing no mold growth in Sample #3, one in Sample #6, and an almost grown over appearance in 30 days of batch C 263 E. The parchment lining showed up the poorest, being in batch C 263 E almost grown over in 15 days, showing 8 mold growths in sample #6, and none again in sample #3.

An evaluation of the preservatives contained in the two samples (we believe batch C 263 E contains no preservatives) can also be made here. Sample #3 inhibited mold growth completely; sample #6 but little.

3. Evaluation of preservatives

A. First Series

	pH	count x 1000 = bact./cc.
.1% Toluene	9.6	11
.05% toluene & .05% Dowicide F	9.6	4
.1% fusel oil	9.6	3
.05% " " & .05% Dowicide F	9.6	10
.1% Dowicide F	9.5	3
Casein Blank	9.6	48

Primary amyl alcohol has been proven to have the greatest toxicity on bacteria of any of those alcohols in that aliphatic series. Primary amyl is more active than iso-amyl, secondary, or tertiary forms. Fusel oil contains amyl alcohol in mostly the iso form. As we didn't have any primary amyl alcohol on hand, we experimented with fusel oil to note its effect on bacteria attacking Kem-Tone. The results above compare with that of Dowicide F. The odor of fusel oil is quite penetrating resembling whiskey or wine and may or may not be desirable in Kem-Tone depending on individual taste.

B. Further tests on toluene-Dowicide F combination

C. Second Series

			pH	Count x 1000= bact./cc	Odor on Discarding
1.	Guanidene Sulfate	.1%	7.7	1200	Sewer
2.	Mercury Bromide	.1%	7.8	0	Sl. Acrid
3.	Alkated Cresol	.1%	7.7	130	Sewer
4.	Puratized B_2 Solid (Gen. Dyestuff)	.1%	9.8	0	Good-Faint
5.	" " "	.004%	8.0	0	" "
6.	Sodium Perborate	.1%	7.5	0	Sl. Casein
7.	Casein Blank		6.4	1500	Sewer

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D. Further tests on Puratized B_2 Solid (G. D.)

About .03% B_2 solid costs the equivalent of .167% Dowicides used in Kem-Tone. B_2 solid was tested for its effectiveness in the following percents in 5% casein solution:

		pH	Count
1.	.03%	8.6	0
2.	.015%	8.6	0
3.	.0075%	8.6	0
4.	.0038%	8.6	0
5.	.0019%	8.6	0
6.	.00095%	8.6	0
7.	.00047%	8.6	0
8.	.00024%	8.6	0

E. Evaluation of S-W Exp. No. C-4

		pH-24 hrs.	Count x 40 = bact/cc
1.	.1% in 5% casein soln. (orig. pH-8.6)	7.7	10,000 +
2.	.05%	7.8	"
3.	.025%	7.8	"
4.	.012%	7.8	"
5.	.006%	7.7	"
6.	.003%	7.7	"
7.	.0015%	7.6	"
8.	.0008%	7.5	"
9.	.0004%	7.7	"
10.	Casein Blank	7.7	"

F. Evaluation of Roccal for use in Kem-Tone

1. Minimum effect in 5% casein solution

Concentration Tested Wt. Roccal/Wt. Casein	pH	Results - plate count x 1000 = Bact/cc (blank = 100,000/cc
1/5000	9.4	92
1/2500	9.45	19
1/1000	9.8	17
1/500	9.7	27
1/250	9.9	2
1/100	9.8	4
1/50	9.8	4
1/25	9.8	4
1/10	9.7	0

Concentrations from Roccal 1/250 may be considered good.

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2. Roccal Threshold

Percents of Roccal were based on the peptone content of nutrient agar. Amounts of Roccal solution as to give desired concentrations were added to petri dishes prior to the addition of 10 cc nutrient agar. When hardened, streaks using a spoiled casein solution were made on the surface. The plates were observed for growth in 48 hours.

Conc. Roccal	Results
.001%	Large growth
.005	" "
.01	Less than half of .005% plate
.02	Some growth
.04	Slight growth (also presence of 2 mold colonies)
.06	No growth
.08	" "
.1	" "
.2	" "
.3	" "
.4	" "
.5	" "
1.0	" "

The concentration of Roccal at .06% of the weight of peptone prevented entirely the growth of bacteria in this test. .06% is equivalent to about 1:1700 protein. The method used above for the evaluation of Roccal is expected to show better results than in the previous test in which inoculated Roccal preserved casein solutions were incubated for 48 hours and a count made of the surviving bacteria.

3. Another experiment showed that the action of Roccal was not effected by the pH of different media regulated with ammonia from 6.3 to 10.1.

G. Second evaluation of Kem-Tone batches containing different preservatives

Previous tests on the following batches were made in April and the results shown in the May report.

	Preservatives
Sample 1	.15% Dowicide F
	.07% Dowicide A
Sample 2	.07% Dowicide F
	.07% Dowicide A
	.07% Phenol S

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	Preservatives
Sample 3	.15% Dowicide F .07% Dowicide A .09% Sodium Perborate
Sample 4	.07% Dowicide F .01% Roccal
Sample 5	.07% Dowicide F .02% Roccal
Sample 6	.07% Dowicide F .035% Roccal
Sample 7	.07% Dowicide F .055% Roccal
Sample 8	.07% Dowicide F .07% Roccal
Sample 9	.07% Dowicide F .10% Roccal

Procedure

Each sample was reduced 100% and inoculated with .5 cc of spoiled casein solution (5,000,000 bact./cc). In addition to these, Sample 4 was reduced 200 (4b) and 300% (4c) to test the effect of Roccal in lesser concentrations. The first plate was made after 24 hrs. incubation at room temperature; the second 48 hrs. later. The samples were discarded on the fifth day.

	24 hr. pH	Count	76 hr. pH	Count	pH	Odor on discarding
Sample 1	8.2	100	7.9	800	7.8	Sl. sewer gas
2	8.2	160	7.8	500	7.7	Sl. garbage
3	8.5	3	8.2	9	8.0	Not spoiled
4	8.4	72	8.1	600	7.8	Sl. shellfish
5	8.4	71	8.0	360	7.8	" "
6	8.4	240	8.0	560	7.8	V.Sl. "
7	8.5	1	8.2	700	8.0	Flat Garbage
8	8.5	1	8.2	700	8.0	Sl. oxid. oil.
9	8.3	50	8.0	520	7.8	Sl. shellfish
4b	8.2	0	7.9	360	7.7	" "
4c	8.3	800	7.9	900	7.7	Sl. sewer gas

The results in comparison with those of the previous tests indicate that with the exception of Sample 3 containing sodium perborate the preservatives in the other sample are deteriorating. The amount of inoculating material was less than previously and the samples spoiled sooner.

Sodium perborate again showed excellent results.

Additional Heat Tests on bacteria attacking Kem-Tone

200 cc of (1) 5% casein solution, (2) 5% casein solution containing .1% Dowicide F based on the casein content; (3) water, were all inoculated. After 48 hrs. all were heated to 160° F. and plates made from the samples at certain time intervals.

Count x 60 = bact./cc

Temp./Time	pH - 9.6 (1)	pH - 9.6 (2)	ph - 8.6 (3)
Room Temp.	200	128	10,000
160° F/5'	8	9	140
160° F./10'	54	18	60
160° F./20'	43	15	125
160° F./35'	34	7	1
160° F./60'	24	10	200

On the following day solutions, (1) and (2) were prepared again and for (3), 100% reduced BX 619, casein solution, containing Dowicides A and G, and inoculated.

Temp./Time	pH - 8.7 (1)	pH - 8.8 (2)	pH - 9.0 (3)
Room Temp.	200	23	53
160° F./60'	6	3	11
160° F./90'	1	0	1
160° F./120'	1	0	1

E. Kem-Tone Quality Control

The function of this quality control unit is to maintain a constant check on the quality of the Kem-Tone produced by the respective plants.

Test data is referred to Kem-Tone development group and in this way, development group is kept up to date on production problems.

For the quality control group to function and be of service to the respective manufacturing units, it is necessary that production samples be sent through every day. At the present time, it has been established that twenty five percent of the Kem-Tone production should be quality tested.

Kem-Tone samples are checked for application characteristics, emulsion stability, wt./gal., pH, viscosity and shade.

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170 - Army-Navy Specification Work

The Chicago formula for #2 Dark Green Camouflage Paint, Specification T-1279, H 6793, was investigated to determine its degree of conformity to the revised specification, T 1279 B. Preliminary work indicates that although the present formula will not fully meet this specification, comparatively minor changes will result in complete conformity. Some work is also being done with the Cleveland Camouflage Vehicle, V-19038, with the purpose of having the most satisfactory available formulation ready for manufacture on any future orders received for this type of material.

Considerable work has been done on suitable emulsifying agents for use in the zinc chromate primer used in some of the West Coast aircraft plants, particularly Lockheed. The present status of this investigation shows some promise and work is to be continued.

Specialties

Primarily the problem assigned was a development of a compound based on a resin-emulsion type of material, which would be a prepared paste purchased by the consumer, ready for use.

Experimental scouting with formulations involving inert pigments and protein-ester gum emulsion binders showed that because of the high volatile shrinkage of the dried compounds was serious, and that drying itself took excessively long (several days). As those commercial preparations presently available dry in at most four hours, have little shrinkage, and cost in the neighborhood of 25 cents per pound, they offer very stiff competition in the light of present knowledge of resin-emulsion pastes for spachtling use.

The base material of most patching compounds is calcium sulfate $\left[(CaSO_4)_2H_2O\right]$ made by calcining gypsum until 3/4 of the water of hydration is lost.

They harden by again forming the hydrated calcium sulfate, a reaction which liberates heat and can be either accelerated or retarded by certain addition compounds. Speeding of set can be accomplished by the addition of small amounts of soda ash, common salt, or sodium sulfate. Retarding can be obtained through small inclusions of glue, albumen, tankage, wheat paste, hair solubilized with caustic soda, vinegar and dextrine. We have found in addition that casein, methyl cellulose, $(NH_4)_2CO_3$, $(NH_4)\,C_2H_3O_2$, sodium cellulose glycolate and cement affect the time of set. We have good evidence to believe that any water soluble protective colloid such as starch, Keltex, soap, etc. will cause a retarding action.

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Calcium sulfate will set by itself in from 5 to 7 minutes to form a hard, stony, unworkable material, but by inclusion of the above variety of materials, set can be postponed almost indefinitely, due in some cases to protective colloidal action.

However, if very much more than 1% of many of the above materials are added, shrinkage becomes increasingly great and the patching compound becomes worthless because of crack development upon drying.

It has been suggested that a form of "Swedish Putty" might be made by the admixture of reduced Kem-Tone and a patching plaster whose main constituent might be plaster-of-paris. Two difficulties ensue from the above course. One, the set is postponed for at least twenty four hours, and two, the shrinkage of the dried material is so great that there is danger of the patch falling out of the repaired crevice after through drying.

The original problem of a resin emulsion plastic patching putty is not to be considered abandoned, but that at present a formulation based upon plaster-of-paris is both more economical to produce and more satisfactory for use.

Accordingly, tests were conducted on a number of commercially available spachtling compounds to evaluate those materials in relation to one another and select one or two having the greatest number of desirable characteristics.

Among those tested were United States Gypsums' K Cemo Primer, Reardon's Resurfo, Anderson's Crack Filler, Acmo's Spachtling Compound, and Plastic Patch.

Shrinkage of the compounds was tested by filling small brass rings about one inch in diameter, and noting after thorough drying the "fit" of the compound within the ring.

Test No.	Material	Shrinkage Condition
1	Savogran	Very Slight
2	Anderson's	None
3	Acme	Slight
4	Reardon	Very Slight
5	Plaster of Paris	None
6	Plastic Patch	Slight
7	Corfex	Slight

From practical application tests, Savogran and Anderson's were considered to be the best from outside sources, with Savogran having slight preferance. Savogran and Anderson's material show a fairly short period of workability of from 10 to 12 minutes before set. Corfex and

Plastic Patch showed the longest period of workability, which was in excess of one hour. Directions on the label show that the working time of Savogran can be extended to one hour by adding a teaspoon of vinegar to a pound of spachtle.

Employing plaster-of-paris as a base constituent, a considerable number of formulations were made. As was previously stated, it was found that many materials other than those commonly used would appreciably alter the speed of the setting, and of these, most attention was given to hide glue and Ammonium Acetate. Samples were made by micro-pulverizing methyl cellulose and calcium sulfate and also hide glue and calcium sulfate. Samples with only two materials, as shown, evidenced objectionable shrinkage. By carrying the percent of hide glue to 4%, equivalent time of set to Plastic Patch can be obtained, but shrinkage then becomes excessive.

Later experimental batches showed that with 1% of glue, 1% of Ammonium Acetate, and 2% of Bentonite Clay with the remainder plaster-of paris that we could actually show a swelling of the hardened product and a working time of one hour. If the clay was omitted, there was a slight shrinkage in volume upon setting.

Cement and calcium hydroxide were also included as possible agents for improvement of adhesion and setting time with the results not decisive on adhesion increase but definite on retardation of set and increased shrinkage.

There are indications that all present formulations may be too hard with consequent brittleness and improvement possible with the inclusion of a substance having some reinforcing characteristics. Wood flour was a possibility and additions from 10% on down were made with 10% found to be greatly in excess, (no hardness at all in the set material). The following formula looked good and was compared in a number of tests with commercial compounds:

100	-	Plaster-of-Paris	377
2	-	Wood Filler	SW-32
2	-	Bentonite Clay	1441-D
1	-	Ammonium Acetate	
1	-	Hide Glue	

It failed only on adhesion to glossy painted surfaces and was lacking in cohesive power. It is a point from which progress may be made.

No work was done on the following:

#175 - Blackout and Camouflage Paints
#155 - Wallpaper Evaluation
#174 - Oleoresinous Wrinkle Varnishes

160 - Durability Studies of Zinc Sulphide Pigment Combinations

Panels 7334-6 C and Cof. were prepared to repeat previous exposures [illegible] Cryptone MS-150/lead titanate/magnesium silicate paint in the 1942 tint [illegible]tention series study, which showed extremely bad fading in Coffeyville and [illegible]icago after only a few months' exposure. The pigmentation showing this [illegible]malous fading was approximately 75% Cryptone MS-150/10% lead titanate/ [illegible]Magnesium silicate. This repeat test should determine whether any errors [illegible]e made in the original grind.

178 - Studies of Dark Colored House Paints

Drying tests were made at 10-1/2 months on storage samples of the [illegible]llowing dark colored house paints, mentioned in previous monthly reports.

	Drying set-to-touch at one week	At 10-1/2 months
[illegible]SWP Modern Brown [illegible]ZnO - as 25# 414 W	3 hours 40 minutes	6 hours
[illegible]SWP Modern Brown [illegible]No ZnO	4 " 50 "	6 "
[illegible]SWP French Green [illegible]ZnO as 25# 414 W	5 " 30 "	8 "
[illegible]SWP French Green [illegible]No ZnO	7 " 30 "	45 "

Acetone insoluble determinations were run on films exposed six [illegible]ths. Results were:

	At 6 Weeks	At 6 Months
1. above	- 29.6% loss in weight	25.3% loss in weight
2. "	- 30.5% " " "	22.2% " " "
3. "	- 32.4% " " "	29.1% " " "
4. "	- 36.4% " " "	28.3% " " "

The value of ZnO in French Green in preventing loss of drying is [illegible]ery evident. Its effect is not noticeable, however, in SWP Modern Brown.

With respect to acetone soluble determinations, we are at loss to [illegible]plain divergencies in determinations at 6 weeks and 6 months, except on the [illegible]ossible basis of zinc soap formation. If this is the case, acetone soluble [illegible]determinations on the film will be valueless as a check on sol-gel ratios as [illegible]function of exposure time, since the solubility of the zinc soaps will [illegible]row off the determination.

M. VAN LOO
Cont.

Exterior Primers

An extensive series of panels (5800-50 C) testing various substitutes for shellac for sealing knots were examined after 21 months' exposure at Chicago. One series consists of 8" x 12" x 3/4" panels exposed 60° south, with more extensive series on beveled siding vertical south. The wood used was third grade "green" yellow pine such as was used on some cantonment buildings. The purpose of the exposure was to find a substitute for shellac to prevent staining, blistering, cracking, and peeling of paint around knots.

The test materials included (a) White Shellac 02739, (b) aluminum primer with Lowe Brothers' vehicle L 2910, (c) Marvelac, 2-1/2# cut, (d) Metalead primer using both (2985) A 100%phenolic 2600 dry tung-linseed varnish and ARV 2248 modified phenolic V 13130 Dehydrol varnish as vehicles. The top coat in most cases was Rex 47809 Lead-zinc paint TT-P-36a Type II Class B, with a few tests using SWP Gloss White, Rex 63402 Exterior Paint Type 2 Cream for the Quartermaster Corps, specification 8000-E, and a special cream cantonment paint FN 22-3 pigmented with 20% zinc oxide, 13.5% lead sulphate, 16.5% lead carbonate, 25% lead titanate, and 25% magnesium silicate. A special pine primer prepared for the Southern States Federation was also used.

A feature of the tests were special exposures on the beveled pine siding in which saw cuts were made vertically across the center of the face of each test section and guide, for the purpose of allowing moisture to enter, thus speeding up the weathering process.

Shellac proved to be best, aluminum primer and the Metalead primers next, and Marvelac definitely poorest. The failures ranged from almost complete flaking away of the paint on the unsealed controls and some of the Marvelac panels to almost perfect protection with shellac. In a few cases, aluminum primer shows no failures. The Federation Primer showed up well in incidental tests.

Several samples of sulphur chloride treated oils similar to Bilinco 101 were submitted by the Varnish Reseach Division. The samples varied in the amounts of (319) added and in the agent used to arrest the action of the sulphur chloride. The sample of Bilinco 101 used appeared to be slower in drying than previous receipts. One of the experimental samples, 10-C, equalled Bilinco 101 on set-to-touch, was slightly more tacky during the drying period, but was harder over night. The other experimental samples were slower to set. Additional drying tests will be run using other samples of Bilinco 101.

162 - Studies of Flat Wall Paint Formulation

Flat Wall Paints

Considerable time has been spent on the development of a Flat-Tone White and a tint base formula using rutile titanium calcium and a non-penetrating highly bodied "neutralized" oil vehicle patterned after Lowe Brothers' V-792. V 11152 has been assigned to this vehicle, although the final formula may still be subject to some revision to correct some deficiencies in the paints.

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Because of the high poundage of anatase titanium calcium pigment required to introduce the necessary bodying, excessive consistencies result. The use of the higher opacity rutile titanium calcium pigment permits somewhat of an increase in opacity with satisfactory body, and effects a saving of approximately 4-1/2¢ per gallon. If present opacity is satisfactory, further reductions in cost are possible. If present difficulties with bodying in the package and excessive pull under the brush can be solved there is a prospect of being able to operate with a rutile titanium calcium pigmentation with bodying tendencies equal to or less than lithopone-zinc sulphide.

Several Tall Oil samples were submitted by the Resin Research Department under the numbers RA 589, 591, and 592, for evaluation as flat wall paint vehicles. In general the tall oil vehicles did not dry well over night but were quite hard in 48 hours. RA 589 was best from the standpoint of drying, but all produced thin body and lacked flow and "feel" under the brush. RA 609, a 4% calcium soap of refined tall oil, also produced a paint which brushed too freely, lacked flow, and was deficient in color. The washability was poor.

Semi-Lustre

Work on this project during the month consisted of the completion of wash tests on the Semi-Lustre formulations back to 1935. It was felt that in general the post-war Semi-Lustre should possess a higher degree of washability. For the whites the formula of 12-2-41 employing (6138), long oil maleic alkyd, gave the best wash test, while in the tints, the formula of 5-27-42 based on the modified phenolic varnishes (2841)G and (2843)G showed the best performance in this respect. Work continues particularly along the lines of an alkyd formulation for post-war usage.

103 -Metal Protective Paints

We have received a sample of Ferrous Ammonium Phosphate for evaluation as to rust inhibitive properties. A report will be made as soon as results are available.

The panels in the zinc chromate-iron oxide-magnesium silicate series, which were described briefly in the May report, have been withdrawn after 910 hours in 3% salt spray. It will be recalled that each component was studied in 20% increments in all combinations in the three component diagram. The vehicle is oleoresinous, similar to Kromik, since the work is directed toward the evolution of a post-war trade sales zinc chromate primer.

It is evident that in such detailed studies extreme care must be taken to suspend every panel precisely vertical to avoid uneven condensation or attack by the spray. While there are a very few anomalies in the present series due to this cause, in general rather consistent results indicate certain conclusions:

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161 - Emulsion Binder Paints

A. Wetting and Emulsifying Agents

The following wetting agents were evaluated in the (2898)K - corn protein formula.

Wetting Agent	Brushing	Emulsion Stability	Settling
Control	Good	Excellent	Definite
CPX 454	Very good	Very good	Definite
B-5-D	Good	Excellent	Definite
B-7-D	Good	Very good	Slight

The above wetting agents were also evaluated in the Tall Oil formula. Results are given below.

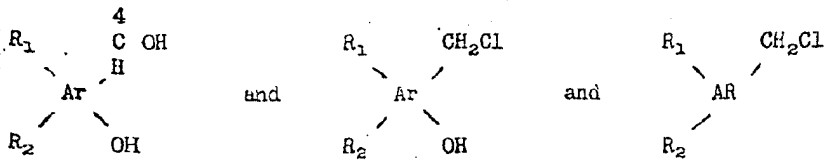
Wetting Agent	Brushing	Emulsion Stability	Settling
Control	Very good	Excellent	Definite
CPX 454	Excellent	Very good	Definite
B-5-D	Good	Very good	Definite
B-7-D	Very good	Excellent	Slight

Literature Survey on Wetting Agents

Condensation products of p-hydroxy benzoic acid - 2,264,358. A compound selected from the group consisting of 4-hydroxy-benzoic acid and its esters in which at least one of the H atoms ortho to the phenolic hydroxyl groups is replaced by a non-aromatic tertiary amino methyl group.

Alkylated aromatic sulphonic acids - 2,268,140. A mixture of alkylated sulphonic acids containing in the molecule at least one alkyl radical selected from the class consisting of propyl, butyl and amyl radicals and at least one alkyl radical selected from the class consisting of isohexyl, isoheptyl and iso-octyl radicals.

Condensation products and process of preparing them - 2,268,126. Process which comprises condensing a comp. selected from the group cons. of comps. having one of the gen. formulae:



wherein Ar is a member of the group cons. of aromatic hydrocarbon radicals and substituted aromatic hydrocarbon radicals, R_1 is an alkyl radical of at least 3 carbons and aralkyl radicals and cycloaliphatic hydrocarbon radicals,

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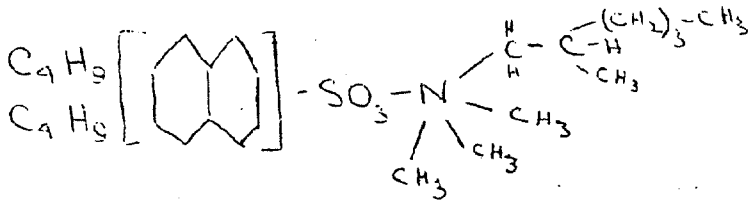
...a member of the group cons. of H, alkyl radicals of at least 3 C atoms, ...lkyl radicals, and cycloaliphatic hydrocarbon radicals with an aliphatic ...hydroxyl comp. containing at least 3 hydroxyl groups. Process which ...prises reacting the condensation comp. containing aliphatic radicals sub-...tuted by hydroxyl groups with a sulfonating agent.

... Wetting agent - 2,271,707. Water soluble salt of formula:

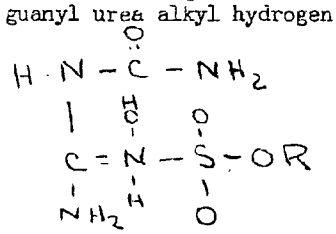


... Terpene Esters - 2,272,400. New terpene comp. having the type ...rmula R (OOCR'Zw)y in which R is a radical of the terpene polyhydric alcohol, ...is a hydrocarbon radical, in which Z is a negative group and w and y are ...all whole nos. (A terpin di thiocyanoacylate.)

... Substituted aromatic aliphatic ether chlorides and process - ...273,622. Reacting by heating in the presence of a surface active siliceous ...lay an ether chloride of formula R'(O-A)n Cl. R' is an aryl nucleus. ...is a group sel. from the class of alkylene rad. having a chain of at least ...C atoms and polyalkylene ether rad. having at least 2 C atoms in each alkyl-...group and n is less than 8 and a member of the group cons. of unsat. and ...droxy substituted higher carboxylic acids and esters sel. from aliphatic, ...rylaliphatic and hydroarylaliphatic series.

... Sulphonated organic compounds as capillary active media - 2,283,437. ...lphonation product of a saturated organic compound containing at least 12 ...atoms, 2 carbon rings and 1 free hydroxyl group joined to one of the rings.

... Guanyl urea salts of monoalkyl esters of sulphuric acid - 2,286,364. ...acting together dicyandiamide, H_2SO_4 and a mem. of the grp. cons. of prim. ...nd sec. alcohols. A guanyl urea alkyl hydrogen sulphate of the formula:



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ere R is an aliphatic hydrocarbon radical.

Wetting agent - 2,214,051. Comp. of matter cons. of a salt of a sulated condensation product of a petroleum solvent extract obtained by treating petroleum hydrocarbons with a preferential solvent having a selectivity for drocarbons of the nature of that exhibited by liquid SO_2 and an olefenic drocarbon.

Acid amides as wetting agents - 2,213,984. Reacting a compound lected from the grp. cons. of comps. having one of the general formulae:

$$\text{A. O. R. CO} \\ \text{A. O. R}_1\text{. CO} \Big> \text{O and A. O. R}_1\text{. CO Cl}$$

A = member of group cons. of aromatic and hydroaromatic hydrocarbon adicals subs. in the nucleus at least once by a hydrocarbon radical of at east 4 C atoms.

R_1 = member of group cons. of aliphatic hydrocarbon radicals whose arbon chain is interrupted by O, with a comp. of the general formula:

$$\begin{matrix} R_3 \\ > \\ H \end{matrix} \text{N} - R_2Y$$

here R_2 is a member of a group consisting of aliphatic hydrocarbon radicals, hose C chain is interrupted by O, cycloaliphatic, aliphatic aromatic and romatic hydrocarbon radicals, R_3 is a member of a group consisting of hydrogen, liphatic, cycloaliphatic, aliphatic aromatic and aromatic hydrocarbon radicals. Y is a member of a group consisting of OSO_3Me and SO_3Me, Me being a member of a roup consisting of alkali metals, NH_4 and the radical NH_4 in which at least Hydrogen, at most 3 Hydrogens are substituted.

Aminohydroxy compounds - 2,215,038. A process which comprises reacting 2-amino-2-methyl-1,3-propanediol with diethyl carbonate to form a urethane.

Products of high wetting power from aliphatic ketones - 2,218,660. Introducing at least one of the groups selected from the class cons. of SO_3H and - S - SO_3 H groups into an aliphatic ketone having 11 - 17 C atoms in the molecule, the alkyl groups of which contain at least 5 C atoms.

Sulphonated high molecular alcohol - 2,227,659. Water soluble product intended as wetting, cleansing and emulsifying agent comprising a sulphonation product of a mixture of alcohols obtainable by hydrogenating products from the destructive oxidation of difficultly volatile aliphatic hydrocarbons in the liquid phase by means of a gaseous oxidizing agent containing free oxygen.

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Alkyl substituted benzene sulphonates - 2,232,117. Mixture of water ble salts of mono-sulphonated alkylated benzene comps. obtained by alkylat- in excess of a hydrocarbon of the ⬡ series boiling within a range of 184° C. with a mixture of hydrocarbon polymers distilling within the of approximately 145 - 225° C. and comprising mostly aliphatic mono- ins and small amounts of depolymerizable polymer olefins separating from lkylated products a mixture of alkylated benzene hydrocarbons having lkyl group with the same number of C as that contained in an olefin boiling in range of 145 - 225° C. monosulphonating the said separated mixture of lated benzene hydrocarbons and converting the mixture of sulphonic acid e water-soluble salts.

Wetting and dispersing agent - 2,236,296. A modifying composition ints, varnishes, etc. consisting of a non-aqueous homogeneous solution least one substantially water-insoluble neutralization product being d by the interaction of at least one acid selected from the group con- ing of naphthenic acid, linseic acid, oleic acid, abietic acid, benzoic furoic acid, salicylic acid, isopropyl-methyl-endoethylene-tetrahydro lic acid, with at least one acid neutralizing agent selected from the consisting of cobalt, Zn, Ba, cadmium, Ca, Cr, cerium, Mg, strontium and and the water-soluble neutralization product being formed by the inter- on of at least one acid selected from the group consisting of naphthenic linoleic acid, oleic acid, and abietic acid, with at least one acid neu- izing agent selected from the group consisting of Na, K, lithium and ium.

Condensation products of hydrolized protein material and their dcture - 2,183,856. The products essentially comprising a mixture of amino oxylic acids obtainable by totally hydrolyzing protein materials, said amino oxylic being acylated with high molecular aliphatic sulfo-acid radicals ted from the group consisting of sulfonic acid radicals and sulfaminic radicals.

Sulfonic derivatives - 2,184,770. Chemical compounds corresponding e general formula RO - (alk - NY)m - CO - Z (X) w wherein R is an lo radical containing at least 4 carbon atoms, - alk and Z are each members ted from the class cons. of hydrocarbon radicals and substitution products eof; Y is a member of the group cons. of hydrogen, alkyl, cycloalkyl, yl, aralkyl, aryl and alkylol, m and w are whole numbers and X is a sul- ic radical.

Sulphonated aliphatic compounds - 2,127,567. Reacting a fatty material e cls. cons. of fatty oils and fatty acids w. a derivative of isobutylene e class cons. of beta-methyl glycerine and beta methyl glycidol and reafter treating the prod. with fuming H_2SO_4.

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Sulphonating and sulphating olefins - 2,135,358. Sulfuric reaction products by treating an olefin with the reaction product of SO_3 with dioxane.

Wetting agent - 2,136,379. A sulphuric acid derivative of a fatty acid diester of a glycol.

Sulphonated alkylated diphenyl compounds and salts thereof - 2,135,978. A polyalkylated, polysulphonated diphenyl compound which comprises treating substantially one molecular proportion of an aromatic compound containing a diphenyl nucleus, the nuclear H atoms of which where substituted are replaced by a member of the group consisting of the hydroxyl group and halogen atoms, with an excess over two molecular proportions of an aliphatic alcohol and an excess of fuming sulphuric acid over that required to theoretically produce two sulphonic acid groups at a temperature below 20° C. raising the temp. to complete the sulphonation and isolating the polyalkylated polysulphonated diphenyl compound.

Sulphation of chlorhydrins - 2,139,669. Reaction product of at least 8 C atoms comprising essentially a neutralized chlorhydrin ester, said ester being formed by sulphating at a temperature not over about 25° C. a chlorhydrin secured from olefins having at least 6 C atoms per molecule.

Sulphuric acid derivatives of organic acid amines - 2,139,037. Treating with sulphonating agents, amides having at least one group capable of being sulphonated, of the general formula ZX.R.NY, where R is selected from the group consisting of aliphatic carbonyl groups cont. not more than 3 C atoms and aliphatic sulphonyl groups cont. not more than 3 C atoms; X is a non-metallic, polyvalent atom of the group consisting of oxygen, sulphur, and nitrogen, combined with at least one hydrocarbon. Group Z cont. not more than 10 C atoms and NY is an amido group substituted by at least one higher non-aromatic hydrocarbon radical Y containing at least 6 C atoms.

High molecular glycols and esters thereof - 2,138,917. Oxidizing a higher molecular olefin-1 having 8 or more C atoms in the molecule into a higher molecular glycol-1, 2 while the former is in solution in a low aliphatic acid with the aid of heat for a period necessary to complete the glycol formation and saponifying to produce free glycol.

Petroleum sulphonyl chlorides - 2,142,934. Mixture of sulphonyl chlorides of the aliphatic and cycloaliphatic hydrocarbons contained in a petroleum fraction composed primarily of molecules having not less than 12 C atoms.

Secondary alkyl monosulphonates - 2,142,162. Secondary alkyl monosulphonates containing less than 17 C atoms in which at least 10 C atoms are in a straight chain having the general formula: $R-\overset{H}{\underset{X}{C}}-R'$ in which R and R' are saturated aliphatic hydrocarbon radicals containing at least 2 carbon atoms and X represents a sulphonate group.

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(a) - Cont.

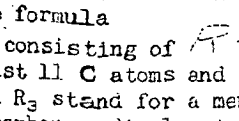
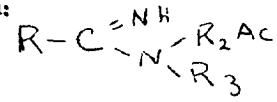
Tertiary alkylaryloxy alkyl sulphates - 2,143,759. A comp. of the ... form. A-R-O-R' in which A represents a tertiary alkyl group of at least 8 ...toms. R is an aromatic nucleus; R' is an aliphatic radical containing an ...O_3M group wherein M is a mem. of the grp. cons. of H, the alkali metals and ...ammonium radical.

Condensation product of Halogenated Aromatic Hydrocarbons with ...riglycerides - 2,144,524. Condensation product of a triglyceride of an ali...atic carboxylic acid cont. at least 10 C atoms in the molecule with a compound ...lected from the group consisting of mono-, di-, and tri-halogen substituted ...matic hydrocarbons.

Aliphatic aminomethane sulphinic acids and their salts - 2,146,280. ...liphatic aminomethane sulphinates of the formula $RR'NCH_2SO_2M$ in which R is an ...liphatic radical of 4 or more C atoms, R' represents a member of the group con...sting of hydrogen and lower alkyl radicals and M stands for a member of the ...roup consisting of H and a salt forming group from the group consisting of ammon...m, alkali metals, alkaline earth metals, zinc, sat. aliphatic amines, aniline ...d pyridine.

Water-soluble, capillary active sulphonates - 2,148,432. Water soluble ...lphonates which in the acidic form have the general formula $R-R'-O-A-SO_3H$ in ...ich R is a cycloaliphatic hydrocarbon radical, R' is a radical selected from ...e benzene and naphthalene and A is a polyalkylene ether radical in which each ...lkylene group contains at least 2 C atoms.

Sulphonated terpene products and methods - 2,148,087. A sulphonated ...oduct which includes reacting with a sulphonating agent a mixture of a polymer...ed terpene and an aromatic compound selected from the group consisting of ...nthols, cresols and phenols.

Water soluble salts of amidines and derivatives thereof - 2,147,401. ...ixtures of acid addition salts of amidines containing at least 1 addition salt ...f the formula  wherein R means a member of the ...roup consisting of aliphatic hydrocarbon radicals of ...least 11 C atoms and cycloaliphatic hydrocarbon radicals; ... and R_3 stand for a member of the group consisting of H and aliphatic ...ydrocarbon radicals; Ac means an acid and at least one addition salt of the ...ormula:  wherein R means a member of the group consisting of aliphatic hydrocarbon radicals; R_2 and R_3 stand for a member of the group consisting of H and aliphatic hydrocarbon radicals, Ac means an acid.

Preparation of isophorones - 2,148,103. A process for preparing ...sophorones containing at least 15 C atoms which comprises heating and sat. ...lkyl mono-ketone having a methyl group directly attached to the carbonyl group ...nd at least 1 H atom attached to the α C atom of the other alkyl group and

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taining at least 5 C atoms in the molecule w a member of the group consisting oxide, hydroxide, amide and alkoxide of an alkali metal at a temperature ve 100° C. so as to split out water.

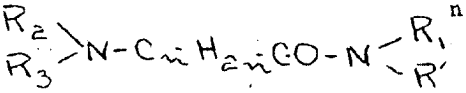
Mineral oil sulphonates - 2,149,661. Composition of matter character- by its ability to act as a detergent and as a wetting agent in aqueous lutions by a substantial absence of color and odor both in its dry form and aqueous solutions - preparable by fractionally distilling and solvent extract- mineral oil so as to produce a material boiling around 210 - 250° C. at 5 mm bsure, said solvent extraction being performed by the use of a preferential lvent which tends to dissolve certain constituents of the oil of an unsaturated ture, including those of aromatic nature and thereafter treating the material, le in solution in liquid SO_2, with a sulphonating agent.

Basic Derivatives of fatty acids - 2,149,527. Process for new basic ivatives of fatty acids, comprising the steps of condensing a hydroxyalkylamine th a body selected from the group consisting of , glycerinedichlorhydrine epichlorhydrine, heating the hydroxylated polyamines thus obtained with a y selected from the group consisting of fatty acids containing at least 8 C and and of their esters, to a temperature of 100 - 250° C. and transforming basic compounds thus obtained into their acid addition salts.

Process for preparing wetting agents - 2,153,286. Cracking a paraffinic troleum fraction selected from the group consisting of petrolatum and paraffin to provide a cracked fraction containing a mixture of olefins having more n 6 C atoms per molecule, reacting the said mixture of olefins with a strong rganic polybasic acid and neutralizing the resulting mixture of alkyl acid ivatives of said acid.

Sulphonated organic compounds - 2,154,922. Producing an imidazoline bstituted in the imino group which comprises causing an imidazoline having 2-position an aliphatic radical of at least 7 C atoms to react with a member the group consisting of aliphatic halogen-hydroxy-sulphonic acids and logen-hydroxy-sulphuric acid esters, hydrogen halide being eliminated.

Amino acid derivatives - 2,155,707. As new products, the amino-acid ides of the general formula



n = 1, 2, 3;

which R_1 represents a rad. sel. fr. the grp. cons. of sat. and unsat. kyl radicals of high mol. wt. cont. more than 6 C atoms; R' represents a d. sel. fr. the grp. cons. of cycloalkyl, aralkyl and aryl; R_2 repres. a rad. fr. the grp. cons. of H_1 aliphatic, araliphatic, hydroaromatic, radicals, R_3 represents a rad. sel. fr. the grp. cons. of aliphatic, araliphatic, roaromatic and aromatic radicals and the salts and quaternary ammonium ps. of the said amino acid amides.

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Sulphated aliphatic ethers - 2,155,899. A stable chem. substance [illegible]res. by the gen. form: $R\text{-}O\text{-}X\left[\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}O\text{-}\right]_w Y_v$ wherein R is an alkyl grp, X [illegible]res. the residue of an aliphatic polyhydroxy, subst. of [illegible]class cons. of glycerol, polyglycerols, glycols, poly-[illegible]ycols, hydroxy-carboxylic acids, sugars, sugar alcohols, and acid derivatives [illegible]sugars, which links together the alkyl radical with the sulphate group; Y is [illegible]ation and w and v are small whole numbers, at least one.

Detergent and wetting compositions - 2,156,996. A wetting agent com-[illegible]rising a mixture of a water soluble alkyl sulfate having 8-18 C atoms in the [illegible]kyl rad. and a water-sol. salt of a true sulfonic acid corresponding to the [illegible]n form: $R\text{-}CO\text{-}X\text{-}R_1\text{-}SO_2\text{-}OH$ in which R denotes an aliphatic rad. having 8-18 C [illegible]oms, and $-X-R_1-$ denotes an oxyalkylene or an amino alkylene rad. the ratio [illegible]true sulfonate to alkyl sulfate being not greater than 3 to 2 but such that [illegible]ter solutions of said mixture are characterized by greater wetting power than [illegible]t predictable from the corresponding characteristics of the respective ingre-[illegible]dients.

Oxides of amino acids - 2,159,967. New products of the formula wherein R_1 and R_2 represent a rad. sel. fr. the grp. cons. of $N\text{-}R_3$ aliphatic and cycloaliphatic rads and R_3 is an aliphatic hydrocarbon $\|$ radical cont. an acidic grp. and at least 1 of the radicals rep. by O R_1, R_2, and R_3 has a chain length of at least 8 carbon atoms.

C-aliphatic isocyclic amines n-substituted by oxyaliphatic radicals - [illegible]151,322. Containing essentially at least once the grp. of the gen. formula: [illegible]R_1 R_1 stands for a mem. of the grp. cons. of H, alkyl, cycloalkyl, aryl, [illegible]aralkyl, oxyalkyl, polyoxyalkyl and polyglycoether radicals. [illegible]R_2 R_2 is a mem. of the grp. cons. of oxyalkyl, polyoxyalkyl, and poly-glycolether radicals, the N atom being directly linked to an isocyclic [illegible]ydrocarbon radical of the grp. cons. of a phenyl, naphthyl, cyclohexyl, and [illegible]trahydronaphthyl rad. substituted at least once by an aliphatic radical [illegible]ntaining a saturated chain with at least 4 C atoms.

Sulfuric acid derivatives of alkyl phenols - 2,162,269. Reacting [illegible]ogether di-isobutylene or other polymers having a mol. wt. above 100 and pro-[illegible]uced from gaseous olefins, with phenols or triphenols in the presence of a [illegible]trong polybasic inorg. acid such as H_2SO_4 sufficient to form acid derivatives [illegible]of the resulting alkyl phenols.

Sulfuric acid derivatives of polyisobutylene - 2,160,343. To produce [illegible]products such as a mixture of tetraisobutane sulfates and tetraisobutane hydroxy [illegible]sulfonates, tetraisobutylene is treated with SO_3 or H_2SO_4 (suitably at - 10°). [illegible]Pentaisobutylene may be similarly sulfated and the products obtained are suit-[illegible]able for use as wetting agents.

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(a) - Cont.

Alkyl-substituted aromatic sulfonic acids - 2,161,175. Wetting agents clude essentially a mixture of monosulfonated alkylated benzene compds. tained by introducing Cl into an excess of a Kerosene fraction cons. of para-finic hydrocarbons, the major proportion of which is decane, undecane, decane, and tridecane and having a distg. range of 160 - 245°, so as to duct a preponderent proportion of alkyl monochlorides, employing the alkyl halides as an alkylation medium by condensing therewith an aromatic hydro-bon of the benzene series and sulfonating the alkylated benzene compounds.

- - -

The primary factors influencing the selection of the proper wetting t are:

1. Type of wetting required.
2. Rate of wetting required.
3. Temperature used.
4. Economical concentration.
5. Hardness of water.
6. Presence of other chemicals.
7. pH of agent or bath.

"Spreading" wetting depends upon lowering the interfacial tension ween the surface to be wet and water, while penetration wetting depends mewhat upon this and also upon other factors, which govern the rate of pene-tion of a porous material.

The effect of temperature upon wetting is one of the most important tors in the selection of the proper wetting agent or penetrant. With many ting agents, the temperature of maximum efficienty is frequently just above cloud point. The selection of an economical wetting agent depends mainly the fact that various wetting agents are affected differently by dilution. erally speaking, a small change in the concentration of a fairly concentrated tion of wetting agent makes very little difference. With increasing dilu-, small reduction in concentration greatly affects the wetting power until int is reached beyond which the wetting agent is of little or no value. water greatly affects the activity of soap and other wetting agents which l contain free - COOH groups. Extreme cloudiness or slight precipitation, to hard water usually results in the deposition of insoluble materials on fiber.

The Draves test is considered the best for lab evaluation of wetting nts. The method consists essentially of finding the concentration of wetting nt that is required to cause the sinking of a 5 g. skein of unboiled, gray, ply cotton yarn in a standard period of time when the skein carrying a hook of ndard weight is held beneath the surface of the wetting solution by a heavier ght called the anchor. The value of the concentration to cause sinking in

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tandard time is obtained by interpolation from a curve plotted from aver-alues of sinking times determined with known concentrations of wetting

. Wetting, dispersing, foaming, and cleansing agent - German 692,925. molecular alicyclic amines are converted with halogenated carboxylic acids, ng one or more exchangeable halogens, or their anhydrides, into a halogen-acid amide. The latter is sulfonated and may or may not be oxidized. The product corresponds to the general formula: $RR'NCO.R''(SO_3H)x$ where R is a molecular hydrocarbon radical of the alicyclic series. R' is H or like R" igh or low molecular hydrocarbon radical. These may contain also hydroxyl ps. X is the number of sulfonic acid radicals and is usually 1 or 2, nding on the number of exchanged halogens.

Water-soluble polyalkylated phenolic sulfonic acid derivatives. 2,237,066. In the process of preparing water soluble poly-alkylated lic sulfonic acid derivatives, the step of reacting an alkylating compound the group consisting of olefines and alcohols containing 7 to 20 carbon with mono-alkyl phenols containing a side chain of 4 - 6 carbon atoms and he presence of concentrated sulfuric acid which is employed in greater than lytic proportions whereby sulfonation results.

Derivatives of amino alcohols - U. S. 2,236,528. Chemical compounds ng the formula $C_{11}H_{23}-\overset{\overset{O}{\|}}{C}-NH-CH_2-CH_2-O-\overset{\overset{O}{\|}}{C}-CH_2-\underset{\underset{SO_3\ Y}{|}}{CH}-COOY$ wherein Y is a cation

ted from the group consisting of alkali metals, ammonia, and ethanolamines.

Sulfonic compounds for use as detergents, etc. - U. S. 2,236,541. rocess of preparing chemical compounds which comprises reacting the methyl of chloracetic acid with monoethanolamine, in a substantially non-aqueous m, at temperatures of about -10 degrees C. to about + 10 degrees C. to ce essentially N-beta-hydroxy-ethyl, chloracetamide, then reacting said with lauroyl-chloride to produce the lauric acid ester of said amide, and reacting said compound with an alkali metal sulphite whereby the chlorine of the lauric acid ester of the N-beta-hydroxyethyl, chloracetamide is ced by a sulphonic group.

Esters of hydroxy polycarboxylic acid derivatives - U. S. 2,236,516. ocess of preparing new chemical compounds which comprises reacting an alcohol ining at least four carbon atoms with a carboxylic acid ester of an alpha-ydroxy polycarboxylic acid anhydride.

From water soluble to water-dispersible chemical compounds comprising tion products of carboxylic acid esters of aliphatic hydroxy polycarboxylic anhydrides and a member selected from the group consisting of higher lar weight aliphatic partial ethers and partial esters of aliphatic

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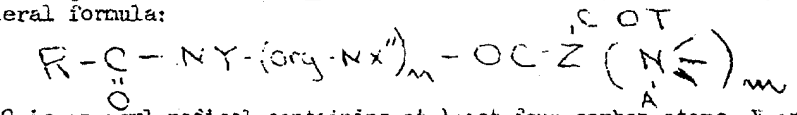
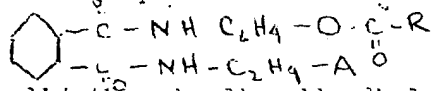
[illegible]hydroxy substances, the higher molecular weight aliphatic radical containing [illegible] least 8 carbon atoms.

Nitrogenous compounds - 2,239,706. Chemical compounds corresponding [illegible]he general formula:



[illegible]erein R-C(=O)- is an acyl radical containing at least four carbon atoms, Y and Y" [illegible]the same or dissimilar members selected from the group consisting of hydro-[illegible], alkyl, cycloalkyl, and alkylol, or, is an organic residue containing at [illegible]st two carbon atoms, Z is the residue of a polycarboxylic acid, A is an anion, [illegible]s (1) a member selected from the group consisting of NHR' where R' is hydro-[illegible], lower alkyl hydroxy-alkyl or cyclo alkyl or (2) OY where Y is a cation, [illegible]er alkyl cycloalkyl or an aliphatic polyhydric alcohol radical, m and n are [illegible]ll whole numbers, and at least one of the three indicated valence bonds [illegible]tached to nitrogen is satisfied by a radical of the class consisting of [illegible]tyls, cyclo alkyls, alkylols, aralkyls, aryls, aralkylols, and the radical of [illegible]eterocyclic ring of which nitrogen is a member.

Surface modifying derivatives of amides of polycarboxylic acids - [illegible]S. 2,238,901. Chemical compounds in accordance with the general formula:



[illegible]erein R-C(=O)- is an aliphatic carboxylic acid radical containing from ten to [illegible]ighteen carbon atoms, and A is a water solubilizing polar group.

Sulfonation products - German 694,945. High-molecular aliphatic or [illegible]cloaliphatic alcohols containing aromatic or hydro-aromatic radicals are [illegible]lfonated in the presence of aldehydes. Suitable aldehydes are CH_2O, AcH, [illegible]opionaldehyde, as well as compounds acting like aldehydes, e.g., acetal, [illegible]dehyde bisulfite, and aldehyde ammonia compounds. Suitable sulfonating agents [illegible]H_2SO_4, fuming H_2SO_4, and $HClSO_3$. Promoters, e.g., anhyd. AcOH, $POCl_3$, or [illegible]s may be added. These compounds are soluble in H_2O and in acid and alkaline [illegible]lutions.

Sulphonic compound - U. S. 2,243,332. A sodium salt of a secondary [illegible]liphatic monosulphonic acid containing at least eight and less than 21 carbon [illegible]oms in a straight hydrocarbon chain having the sulphur atom of the sulphonate [illegible]oup directly attached to a carbonation to which a double bond at least once [illegible]moved from the terminal carbon atom is also attached.

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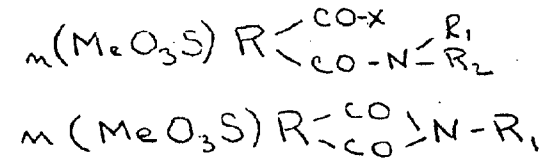
A process for producing a sulphonate which comprises reacting a dcinal dihalide having at least four carbon atoms in an aliphatic chain with an lkali sulphite at a temperature between about 100° C. and the decomposition mperature of said dihalide.

Sulfonamides - U. S. 2,245,437. The process which comprises causing ulphonic acid amides containing an organic radical having at least 4 carbon toms in a chain prepared by condensing ammonia with a product obtained by imultaneous action of chlorine and sulfur dioxide upon saturated aliphatic ydrocarbons to react with a member of the group of formaldehyde and compounds elding formaldehyde and with a salt of the group consisting of amino-carboxylic nd amino-sulphonic acid salts.

Wetting agents - U. S. 2,245,645. The process of preparing sulfonic cids of high wetting, cleansing and emulsifying properties which includes the tep of condensing an oxygenated terpene with an ether containing an aryl group uch as methyl phenyl ether and the step of sulfonating the said aryl group.

Analysis of "Igepon AP extra." A com. sample of "Igepon AP extra" ontained $C_{17}H_{33}COOCH_2CH_2SO_3NA$ 53.557, Na_2SO_4 3.977, $NaHSO_4$ 5.257, $(NH_4)_2SO_4$ 33.400, NaCl 1.967, Na_3PO_4 0.977%.

Amine derivatives of sulphodicarboxylic acids - U. S. 2,252.401. mine derivatives of aliphatic sulphodicarboxylic acids, said derivatives con- isting of those having the formula of the group consisting of:



herein R is the residue of an aliphatic dicarboxylic acid, R_1 and R_2 are embers of the group consisting of hydrogen and monovalent amine forming adicals, and -CO-X is a radical taken from the group consisting of carboxyl nd salts and esters thereof, and in which n is an integer not greater than 2, nd Me is a member of the group consisting of hydrogen and salt forming radicals.

B - Proteins

(1) Chlorination of Casein

urpose

Attempts were made to chlorinate casein in order to stop the action of putrefactive bacteria and enzymes. Apparently the halogen enters by substi- tion in the aromatic nuclei of the protein molecule, since Millon's reaction or tyrosine and Adamkiewicz' reaction for tryptophane are negative when the

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logenated product is tested. If the tryptophane is altered no indol or skatole ation would be possible when the casein were acted on by indol-producing teria. Altering the tyrosine would get rid of the tyramine which produces foul odor in cheeses. Literature shows the chlorinated product to have ing degrees of solubility in hot water.

thods Used:

(1) 450 grams of potassium chlorate were added to a mixture of 1000 of casein suspended in 4,000 grams of 20% hydrochloric acid. The mixture came very warm and increased its volume about 100% with foaming. After cooling the mixture was greatly diluted with water and the insoluble portion washed distilled water until free from chlorides.

(2) 50 grams of casein were heated on a water bath with 241 cc of 6 grams of 50% NH_4OH were added at 160° F. to dissolve the casein and solution was heated to 190° F. 50 grams of clorox were added and the ction was allowed to go on at this temperature for several hours with agitation. After cooling, the mixture was greatly diluted and the soluble portion reprecipitated with HCl.

(3) Same as method (2) without NH_4OH, casein suspended in H_2O instead dissolved.

sults:

Apparently the difficulty encountered in all these methods is in not chlorinating the casein uniformly. Only part of the molecule seems to be getting chlorine.

With method one, tests for tyrosine by the Millon reaction and the diazo-benzenesulphonic acid reaction were negative, but with methods two and ree Millon's reaction was positive. Tests for tryptophane by the Adamkiewicz ction and the p-dimethylaminobenzaldehyde reaction were negative with method but positive with methods two and three.

With method one, the product was neither soluble in hot water nor in lkalies. However, when ammonia, borax, and sodium hydroxide were added the lution turned a dark reddish brown and the protein was suspended in it.

With method two, there was some insoluble portion after the reaction completed. The soluble portion was reprecipitated. This difference in lubility would indicate that not all the casein had been chlorinated or to the me degree. The insoluble portion, which was probably the chlorinated portion, uld not be put into solution and was discarded. The tests were applied to the luble portion but apparently this portion had little chlorine since tests for rosine and tryptophane were positive. The casein was soluble in alkalies and cast soluble at pH of 4.4 - 4.6, the isoelectric point of ordinary casein. low this pH a gel was formed that was not filterable.

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With method three, there was some insoluble portion and some soluble, same as method (2). The mixture was discarded since undoubtedly chlorination was not uniform.

The bacteria count with method (1) was very small which shows that chlorinated casein is advantageous. The yield was small in this method, ever, and quite impractical on an industrial scale. The problem is to obtain inexpensive method of chlorinating uniformly.

Further work is under way to attempt chlorinating casein to a limited ree to achieve its own bacteriostatic effect and still preserve solubility protective value.

Dispersing Triticote #111

mary:

This protein was not successfully dispersed. The factors that affect denaturation seem to be degree of alkalinity, agitation and heat.

Various batches were made up with pH ranging from 6.8 to 9.4 on different formulas. The formulas were essentially BX 619, BX 606 and BX 664 with ifferent amounts of solvents. The solvents used were borax, ammonium hydroxide, ethylamine, and monoethanolamine. Some of these batches looked fairly good, ough none were completely dispersed. The best batches were between a pH of and 8.6.

The proteins did not seem to denature immediately upon addition of alkali but usually several minutes of stirring elapsed. Those batches, hat were fairly well dispersed, were allowed to stir cold. Most of them came denatured after a few minutes but the thinner ones, to which more water been added, did not denature. When these latter batches were reheated and irred they broke at approximately 160° F.

Attempts were made to disperse the protein by holding the temperature 150° F. but none of these batches were good. The protein seems to wet easily ith water so that it would not appear that the addition of wetting agents ould be beneficial. However, one batch was made up with 6% of the weight of e protein of Nacconol, with no more success than the others.

It does not appear possible to disperse this protein since heat and gitation hasten its denaturation to such a degree.

Sodium salicylate is the best dispersing agent for wheat gluten, the spersing power being directly proportional to the concentration up to 8%. ttempts were made to disperse the gluten, first with sodium salicylate alone nd then combined with ammonia, but with little more success.

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...rimental Work

	Method	pH	Results
...1197	Triticote #111 subst. for casein in BX 619 formula.	8.9	Protein denatured after addition of (443).
...1199	BX 619 formula omitting (443).	8.0	Protein not dispersed. Results were fair.
...1200	Triticote #111 subst. for corn protein in BX 606 formula.	8.4	Very poor results.
...1201	BX 606 formula and borax.	8.6	Results were poor. When extra water was added, results were better - almost dispersed. On re-heating with agitation, batch broke. Stirring alone had no effect.
...1215	BX 606 formula with extra (443) and twice as much borax.	9.1	Very poor. The (443) was added gradually but the protein was not denatured for 4 or 5 minutes of agitation.
...1216	BX 664 formula.	8.65	Poor - batch very rubbery.
...1217	W 2125 replaced (443) in BX 664 formula.	9.4	Very poor - too much W 2125 used.
...1218	W 2125 replaced (443) in BX 619 formula (1/2 as much 58% W 2125 used	8.7	Very bad - heating and agitation seemed to cause denaturation.
...1219	Same as WP 1217 but 1/4 as much W 2125 - heated to 150° F. and allowed to mix 10 minutes after addition of W 2125.	6.8	Poor - not alkaline enough to disperse the protein.
...1220	Same as WP 1219 plus 10 g. of 41. Heat kept at 150° F.	7.9	Poor
	8 g. more of 41 added. Heat kept at 150° F.	8.3	Very poor
...1229	Sodium salicylate used to disperse the protein in the BX 606 formula.	5.9	Odor and color poor but batch looks fair.
	10 g. more of sodium salicylate added.	6.1	Results improved

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Method	pH	Results
Same as WP 1229 plus (443).	8.6	Almost dispersed - best batch.
6% of the weight of the protein of CW 1495 and BX 606 formula used.	8.8	Poor

Dispersing Gliadin

This protein was not successfully dispersed. Little work was done of material. The protein wets poorly so that additional water is re- The batches made up were on the BX 619, and BX 606 formulas with It appears to be impossible to disperse this protein.

mental Work:

Method	pH	Results
Gliadin substituted for casein in BX 619 formula.	8.7	Very poor.
Gliadin substituted for corn protein in BX 606.	8.8	Very poor.
Same as WP 1229 plus 6% wt. of protein of CW 1495.	8.9	Very poor

Casein and Corn Protein

A batch of BX 664 was made up substituting casein for the corn protein. spersion was excellent but it seemed to take the ammonia a few minutes to dissolve the casein than it does the corn protein. Since there was and little Dowicide the bacteria count was high.

Batches were made up mixing the casein and corn protein together in portions used in Kem-Tone - 30% of corn protein to 20% of casein. These were not successful because the corn protein molecule seems to form a around the casein molecules, preventing its dispersion.

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Experimental Work:

No.	Method	Results
WP 1244	Casein on BX 664 formula	Excellent
WP 1245	Casein and corn protein on BX 664.	Appears dispersed but the draw-down shows it isn't.
WP 1245A	Casein and corn protein wet longer with CW 1495.	No improvement.

Linseed Meal Protein - OR-P3

The first dispersions, WP 1153 and WP 1154, made up on the BX 619 and 664 formulas were good. However, the second and third batches of the linseed meal protein, when made up on the same formula, proved unsuccessful. The protein must have been purified in a different manner. The pH of the protein was 6.4 but it required a much greater amount of ammonia to bring the pH up to the regular pH of BX 664.

C - Evaluation of Vehicles and Oil Conservation

The following vehicles produced by the Resin Research Department were evaluated in the Tall Oil Kem-Tone formula:

Vehicle	Comments	Visc.	pH	Brushing	Emulsion Stability	Washability
576 A	10% SN 176	70	8.2	Good	Excellent	Fair
576 A	25% SN 176	55	8.3	Excellent	Fair	Fair +
576 A	33% SN 176	55	8.2	Good	Fair	Fair
576 A	50% SN 176	64	8.3	Good	Fair -	Fair
577 A	25% SN 176	135	8.3	Excellent	Fair	Fair +
577 B	33% SN 176	75	8.3	Excellent	Good	Fair +
577 C	50% SN 176	145	8.4	Good	Fair -	Fair +
585 A	20% SN 176	240	8.4	Good	Good	Fair
585 B	33% SN 176	210	8.4	Good	Fair	Fair
587 H1	2-1/2% (113)	40	8.05	Excellent	V. good	Good
587 H2	5% (113)	58	8.01	Excellent	V. good	Fair
587 H3	10% (113)	115	8.1	Excellent	V. good	Fair
587 H4	15% (113)	40	8.3	Excellent	V. good	Fair +
587 H5	20% (113)	45	8.2	Excellent	V. good	Fair +
587 H6	5% (113), 47% Rosin Oil	23	8.4	Excellent	V. good	Good
587 H7	10% (113), 45% Rosin Oil	20	8.4	Excellent	Good	Good
587 H8	15% (113), 42% Rosin Oil	19	8.5	Excellent	V. good	Good +
587 H9	20% (113), 40% Rosin Oil	29	8.7	V. good	V. good	Fair

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Vehicle	Comments	Visc.	pH	Brushing	Emulsion Stability	Wash-ability
RA 587 H10	25% (113), 37% Rosin Oil	27	8.7	V. good	V. good	Fair
RA 587 H11	35% (113), 35% Rosin Oil	21	8.6	V. good	Good	Fair
RA 587 H12	100% T 624	40	8.1	Excellent	V. good	Fair +
RA 587 H13	33% (320)	75	8.5	Excellent	V. good	Fair
RA 614	Chesapeake Camp.	55	8.2	V. good	V. good	Poor
RA 615	33% (113)	26	8.5	V. good	V. good	Fair
RA 616	26% (113)	37	8.5	V. good	V. good	Fair
RA 617	33% (113)	27	8.2	Excellent	Good	Fair
RA 618	26% (113)	79	8.3	Excellent	Good	Fair
RA 601	Control	47	8.2	Good	V. good	Fair +
RA 601 J4	33% SN 206	50	8.2	V. good	V. good	Good
RA 601 J5	67% SN 206, 33% (320)	24	8.5	Good -	V. good	Good
RA 601 J6	33% SN 206, 33% (320)	54	8.5	V. g	Good	Good
RA 601 J7	40% SN 206, 20% (113)	35	8.4	Good		Fair +
V17093	Control for RA 632 A	75	8.5	V. g		
RA 632 A	Special T 624	61	8.5	V.		

The following vehicles were also tested:

5414

Vehicle	Comments	Visc.	pH	Br
SV 54	Tall Oil Pitch	38	8.5	G
SV 55	Linseed Pitch	22	8.8	P

D - Bacteriological Work

A. Tests on chlorine-treated casein

I. First series

1. Chlorinated casein (use of pyridine HCl)
2. Reprecipitated casein prior to chlorination
3. Untreated stock casein

Results	pH 24 Hrs.	pH 120 Hrs.
1. Blank	8.8	7.42
2. "	8.9	8.55
3. "	8.95	7.0
1. Inoc.	6.86	8.08
2. "	8.9	7.7
3. "	9.0	- 7.0

The purpose in chlorinating casein prior to its use was to produce a casein having an inherent bactericidal property. Results above show some

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of improvement in the treated casein. The solubility of casein, however, ltered by chlorination to a greater or lesser degree depending, we believe, he extent of chlorination. Available literature shows some controversy over subject. In our case, 1st and 2nd series tests, we found the treated casein soluble than the original stock product. More work should be devoted to question.

Second series

1. Chlorinated casein (use of $KClO_3$-HCl)
2. Untreated stock protein

Results	pH 48 Hrs	Count x 40 = bact./cc
1. Blank	8.7	60
2. "	8.55	+ 20,000
1. Inoc.	8.8	7000
2. "	8.5	+ 25,000

Results are rather promising. We estimate about 7-8% chlorine was ained in the treated product. Solubility in alkaline water was decreased, ver. In both cases the finished product was devoid of any odor.

Bactericidal properties of a new casein solution formula as compared with the stock formula.

New formula WP 1244	14.1% casein Tall Oil .5% Dowicide G Pine Oil
Stock formula BX 646	16% casein Dowicide A) 1.1% Dowicide G) Borax 1.1% Keltex .25%

Results	pH 24 Hrs.	72 Hrs.	Count x 80 = bact./cc
1244	8.56	8.5	0
646	8.46	8.5	10

The new formula showed more active bactericidal properties than stock formula which contains twice as much preservative and also borax. action may be due to the possible soap formation between components of oil and the alkali present.

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Evaluation of Preservatives

A. Givaudan-Delawanna Stabilizers

I. 9-A-DIP in 5% casein solution, 20 cc inoculated with 1/4 cc of spoiled casein solution (8,000,000 bact./cc).

		pH	Count x 200 = bact./cc
1.	.1% of solution	8.8	800
2.	.05%	8.65	560
3.	.025%	8.7	28
4.	.012%	8.8	18
5.	.006%	8.8	8000
6.	.003%	8.4	8000
7.	.0015%	7.9	Discarded
8.	.0008%	7.9	"
9.	.0004%	7.9	"

II. C-DIP as above

1.	.1%	8.9	195
2.	.05%	8.9	200
3.	.025%	8.8	320
4.	.012%	8.8	840
5.	.006%	8.7	6000
6.	.003%	8.2	10,000
7.	.0015%	7.95	Discarded
8.	.0008%	8.15	"
9.	.0004%	7.8	"

B. Sodium perborate

Stability test of 5% casein solution containing perborate as preservative; inoculated with 1/2 cc of spoiled casein solution (6,000,000 bact/cc). The .1% solution from which all other concentrations were prepared was heated to 145° F. for 10 minutes prior to use to activate the perborate.

	Soln #1	pH 24 hrs.	72 hrs.	Soln #2	pH 24 hrs.	72 hrs.
1.	.1% of soln	8.7	8.7		8.4	8.3
2.	.05%	8.7	8.45		8.4	7.7
3.	.025%	8.65	8.3		8.4	8.1
4.	.012%	8.7	8.2		8.4	8.1
5.	.006%	8.5	8.0		8.4	7.6
6.	.003%	8.5	7.5		8.4	7.9
7.	.0015%	8.6	7.6		8.4	7.9
8.	.0008%	8.6	7.6		8.4	7.8
9.	.0004%	8.5	-		8.4	7.4

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Sodium perborate seems effective in all concentrations in a 24 hour period, however shows that deterioration takes place with time so that in 72 hours only the .1% concentration was still effective.

C. Antiseptic-astringent combination

Reports have shown that the above combination is more active against bacteria than antiseptic alone. A test using equal parts of a phenol compound and tannic acid to preserve a 5% casein solution was made. It showed the combination to be impractical as the tannin acted on the casein, producing discoloration.

D. Stabilizing power of S-W C-4 in Kem-Tone.

1. .1% S-W C-4 in special Kem-Tone containing no preservatives
2. .1% Sod. perborate " " " " "
3. Special Kem-Tone containing no preservatives

	pH 24 hrs.	48 hrs.	72 hrs.	120 hrs.
1.	7.52	7.55	7.78	7.05
2.	7.64	7.68	7.85	7.18
3.	7.51	7.54	7.78	7.05

The pH meter at 48 and 72 hour readings was faulty, the results being higher than at 24 hours. The results were tabulated nevertheless as we are not so much interested in the change of alkalinity per every period reading as we are in the results as compared with other samples of the same period. In 24 hours S-W C-4 was already approaching the reading of #3 blank. In 72 hours S-W C-4 and the blank gave identical results, while perborate in every case showed superiority. This brief test shows the value of S-W C-4 as relatively ineffective for use in Kem-Tone.

Odor Tests

A. Tall oil batch 65406 - C 1863 F (Miller case)

Following a complaint made on the odor of the drying film of the above Kem-Tone batch (pH 8.6), laboratory tests using the cardboard carton method were made. Control batch 65405 - C 1953 E (pH 9.0) was run at the same time. The odor of C 1863 F batch was not at any time unpleasant; 1st day giving a pine oil and slight flat oily odor, on the 12th day a slightly oxidized oil odor and finally on the 36th day a slightly rancid butter to a faint, very slightly moldy odor. The control followed the same pattern with a slighter degree of odor.

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B. Batches 65401 - C 1953 (pH 8.1), 65402 - C 1965 F (pH 8.2), 65407 - C 1963 B (pH 8.2)

Complaint of odor. The usual cardboard carton test was run; results showed no spoilage in any case. All batches gave a slight pine oil and slight tall oil odor on the 1st day. On the 12th day the odor was the strongest and relatively undesirable, that of slight moldy (C 1953), slight oily (1963 F) and slight shellfish (1963 B). The 33rd day showed a slight oxidized oil in all batches.

C. Batches prepared C 1223 F (pH 8.8) and C 1225 E (pH 8.8)

Complaint of slight acetic odor in the original package. With the cardboard carton test there was no sign of the slight acetic odor at any time during the test period. Both samples gave good showings, being on the first day slightly musty and of slight tall oil. In the remaining period a slightly moldy to a slightly oxidized oil odor prevailed.

D. Test batches prepared with various tall oils:

Batch 1129	Control containing V 17093 prod. tall oil formula								
1130	Tall oil	F-1,	10%	(348)	(mineral spts),	5%	(293)	(pine	
1131	"	"	F-2	"	"		"	"	oil)
1132	"	"	F-3	"	"		"	"	
1133	"	"	F-4	"	"		"	"	
1134	"	"	F-5	"	"		"	"	
1135	"	"	F-6	"	"		"	"	
1136	"	"	F-7	"	"		"	"	
1137	"	"	F-8	"	"		"	"	
1138	"	"	F-9	"	"		"	"	
1139	"	"	F-10	"	"		"	"	
1140	"	"	F-10, 35% polymerized linseed, 10% (348), 5%						
1143	"	"	T-624, RA 0324, 10% (348), 5% (293)						(293)
1144	"	"	50% RR 10931-A, 35% (320), 10% (348), 5% (293)						
1145	"	"	50% RR 10931-B,	"	"	"	"	"	"
1146	"	"	50% RR 10931-C,	"	"	"	"	"	"
1147	"	"	50% RR 10931-E	"	"	"	"	"	"

Samples 1130, 1131, 1133, 1134, 1135, 1136, 1137, 1138, 1140, 1144, 1145, 1146, and 1147 were discarded in a 7-14 day period due to unpleasant odor. 1130 was retained for the entire test period to note the change, if any, of the paint film with time. There was no change. The odor being of an extremely penetrating smoky type. The control 1129 ranged from the 1st day oxidized oil odor to the final faint moldy to no odor showing. 1132 was slightly smoky and slightly fruity. 1139 ranged from a slightly fish to a slightly oxidized oil. 1143 was slightly smoky.

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B. Test batches containing sodium perborate.

	Manufactured	pH	Orig. Data	Plate count x 2000 = bact./cc
WP 608	11-10-42	8.4	-	6
WP 609	"	8.1	-	320
WP 610	"	8.4	-	36
WP 611	11-11-42	8.2	-	92
WP 612	"	8.1	-	3
WP 721	1-14-43	8.0	pH 8.4	2
WP 722	"	8.0	8.3	12
WP 723	"	7.9	8.3	13

All batches gave good odor tests, the majority being of slightly pungent and ammoniacal nature, also of slightly oxidized oil. WP 610 and 611 were more strongly ammoniacal; 608, 721, 723 having a slightly off-odor.

Semi-Gloss Kem-Tone

A series of base pastes have been prepared in a 25 gallon length high acid value ester gum - heat bodied linseed oil (320) of about 95% solids as a test vehicle.

This series of bases are to be used to determine the relative values of both methods of treating pigments and the treating agents. We are working in cooperation with Gloucester on some samples of treated pigments furnished by them, and a considerable number prepared at Chicago.

The factor of aging upon both the bases and the resulting emulsion paste paint are being studied, and may reveal some information pertinent to the development of a suitable gloss emulsion paste paint.

Gloss measurements are being made on the Gardner glossimeter to evaluate the results obtained from the bases used.

There are many problems that must yet be overcome before a successful glossy emulsion paste paint is forthcoming, but initial work indicates that such a material is on its way.

Kem-Tone Quality Control

A - Production bulletins

During the past month Kem-Tone Production Control Bulletin #9 was issued to the respective manufacturing units. Bulletin #9 covers tall oil Kem-Tone formulation with eight different hiding power pigment combinations for the respective Kem-Tone colors.

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B - Quality Control

Listed below are the number of Kem-Tone batch samples from the different Kem-Tone manufacturing units tested by the quality control group.

Plant	Number of Batch Samples Tested
Chicago	323
Detroit	63
Oakland	40
Cleveland	28
Newark	15

Batch samples are checked for weight per gallon, pH, viscosity, color match, brushing characteristics, emulsion stability (brush washing characteristics). Samples are sent from the respective plants every day, and represent 25% of the daily production.

In addition to the above laboratory tests, 14 room tests have been made to determine application, hiding, odor, and other Kem-Tone performance characteristics. This practical work supplements Kem-Tone laboratory control work.

#155 - Wall Paper Evaluation

Samples of Style Perfect wall paper submitted by the United Wall Paper Company have been checked for washability, fade resistance, adhesion, and brittleness.

Kem-Tone trims are being periodically checked for quality. Recent tests on samples indicate that washability resistance and adhesion of the trims has fallen slightly below standard.

The United Wall Paper Company has been informed of the results of our tests and have been requested to improve the quality of trims in respect to the above departure from standard.

#170 - Army-Navy Specification Work

T 1279 - #2 Dark Green Camouflage Paints

Additional work done on this formula produced a material which meets the current T-1279 B specification in all respects. Greatly improved emulsion, reducibility and "take on" have been secured. It was noteworthy that in all cases the 15 day bake at 150° F. improved the emulsion and "take on" over the unbaked material.

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150 - Durability Studies of Zinc Sulphide Pigment Combinations

Panels 1538-45 C were examined after 48 months' exposure in Chicago. The paints represent variations of Family Paint White - Rex 300 and Cream - Rex 317, both as to pigment and vehicle. Included are: (a) increased lead-zinc, and approximately 50% Cryptone MS-130 replacing lithopone and zinc sulphide in the regular Rex 300 formula of 10-12-38 with 30% V 11065 - 50" maleic treated soya in the vehicle, (b) the same pigmentation with raw soya replacing the maleic treated type, (c) a similar pigmentation with 32% V 11065 and 68% linseed, including 51% (798) and (d) a special high Cryptone MS-130 formula with 46% maleic soya. In the tints Rex 317 formula of 11-14-35 was used as the guide.

All the special whites were considerably better than regular Rex 300, which was entirely eroded away at 48 months. The formula with the 51% of (798) has the heaviest film remaining, while the other variations show serious erosion. The best tint as to durability is the high maleic soya - high Cryptone MS-130 formulations, - its color is also good. The tint guide is intact except for bad micro-checking. Those using moderate amounts of soya and Cryptone MS-130 are eroded.

178 - Studies of Dark Colored House Paints

As an elaboration of work previously reported on dark colored house paints, a series of draw-downs of the same batches of paint put out last fall were put out in July for acetone soluble determinations. In this way paints drying under favorable and unfavorable drying conditions could be compared.

Determinations on films exposed for three and six weeks gave the following results for a 32-hour extraction.

		At 3 Weeks	At 6 Weeks
1.	SWP Modern Brown 25% 414 W	23.2% extracted.	19.5% extracted.
2.	SWP Modern Brown No ZnO	22.0% "	18.9% "
3.	SWP French Green 25% 414 W	31.5% "	27.1% "
4.	SWP French Green No ZnO	27.9% "	23.8% "

Qualitative analyses of the acetone soluble residue showed that zinc was present in that from paints 1 and 3, which probably accounts for the differences noted above. At the time the paints were put out they had been in

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orage for about eight months, hence package reactions had a good chance to place. The results given in last month's report indicate that these tions take place in the dried film as well.

If all the ZnO had reacted with residual fatty acids in the vehicle, f all were extracted, it would amount to about four per cent of the film ght. In the French Green evidently a large amount has reacted, which would unt for the drier protective action afforded by the use of ZnO.

In future determinations of acetone soluble a quantitative analysis be made of the ZnO present, in order to determine the amount of acetone mbilized in the form of zinc soap. This in turn will be correlated with a bable average fatty acid radicle of C_6 - C_8, which on the basis of zinc soap tone solubility are most likely to be present. (Higher molecular weight soaps of saturated fatty acids (C_{12} - C_{16}) are insoluble in acetone.

82 - Studies of Flat Wall Paint Formulation

Flat Wall Paints

Work has continued during the month on the development of a new mula for Flat-Tone White and tint base. The formula employs rutile titan- calcium for the pigment and V 11152 reduced limed oil as the principal der ingredient. Factory runs on the vehicle and paint have been made with tisfactory results, but distribution of the formulas is being held up until rovement has been made in controlling the body and stability of the V 11152. Varnish Research Division has communicated with Mr. Fasig on this, as the is based on Lowe Brothers' V-792. So far it appears tha t a formula having washability and good control over "ghosting" can be made from the rutile tium pigment.

Work on Paintercraft One Coat Flat #10 will be continued to replace with V 11152 to keep the formulations uniform.

Work has been extended to the development of a post-war Flat-Tone, nding combinations of V 11152 and various alkyds. To date the best com- tion has been V 11152 and V 15193, a long oil P. E. alkyd. The latest mula, OJ 637 C has a V/P ratio of 0.77, with 21,825 units of hiding using gmentation of half Titanox RC HT and half lithopone.

Vehicles for Enamels and Semi-Gloss Paints

Reports that enamels made with the Velsicol-Polypale varnish, (3850)M, metimes show excessive "bodying" led to an investigation into the factors olved.

Results of this investigation may be summarized as follows:

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3 Pigment reactivity

Large variations were found in different pigments. Calcium Titanox titanium oxide are non-reactive with (3850)N, but lithopones as a class inclined to be reactive, - some grades more so than others. Of three thopones tested, 461 L was very reactive, 461 S modera tely reactive, and Jersey Red Label #14 least reactive.

Varnish viscosity.

(3350)N in three bodies, "E," "F-G," and "H" was used in a series of sts. Results showed that the higher the viscosity of the varnish, the higher original viscosity of the enamel, and (with reactive pigments) the higher rate of viscosity-increase on storage.

Introduction of litharge into varnish during its manufacture.

(3850)N stabilized with lead gave enamels with slightly lower origi- viscosity and a lower rate of viscosity increase when used with pigments lined to be reactive.

The use of aluminum stearate in conjunction with lithopone gave higher iginal viscosities, and a higher rate of viscosity increase than the use of thopone alone.

The use of aluminum stearate with titanium pigments did not cause scosity increases in enamel on aging.

Excessive heat developed during grinding, caused excessive "body- of enamels, particularly where a reactive pigment and/or a high bodied 350)N not stabilized with lead was used.

Enameloid

The revised (3850)N, made with Velsicol, Rosin and linseed oil and abilized with lead was compared with the old (3850)N made from Velsicol, ypale and linseed oil. Two types of pigmentation were used: (a) lithopone titanium oxide and (b) Titanium Calcium Titanox RC HT. The following sults were observed:

The revised (3850)N, in Enameloid formulas, shows only slightly less water and soap resistance than previous material.

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The lithopone - TiO_2 pigmentation gave better water and soap resistance than the Titanium Calcium pigmentation, with both old and revised (3850)N.

The revised (3850)N shows slightly greater flow and more tendency to sag than the old (3850)N.

The relative effectiveness of aluminum stearate and Multifex to control flow was tested in several Enameloid tint formulas. 1 pound and 3 pounds of aluminum stearate per 100 gallons were equally ineffective in producing controlled flow or lack of sagging, but 25 pounds of Multifex, 2209 dry, in the same formulas produced excellent control of flow. Enamels containing the Multifex had very slightly lower gloss, and more "feel" under the brush. This latter feature is desirable in the present-day Enamoloid which has a tendency to be too limpid under the brush. Inspection of enamels at the end of two weeks showed a better package condition where Multifex was used instead of aluminum stearate. Settling tendencies seem to be substantially less.

The varnish RL225N6 made from Cook's Resin R2212 was tested in Enamoloid tints. It proved unsatisfactory because of instability, poor brushing properties, and poor water and soap resistance as compared with (3848)E or (3850)N. Color of varnish was very dark.

ARV 3132 #2 is a "blown type" varnish made from Cook's Resin R2212 and rosin (3 parts to 1 part) and linseed oil. ARV 3186 is similar, but with equal amounts of rosin and R2212. These vehicles were compared with (4850)N and (3848)E in white Enameloid - Rex 710. The following tables summarize results:

Formula	Varnish	Set-to-touch	Condition at 18 Hours	Tack-free
BC 279	(4850)N	2-1/2 hours	V.S.T.	26 hours
BC 277	(3848)E	2-1/2 "	Tacky	"
BC 501	ARV 3132	2-1/2 "	S.T.	"
BC 502	ARV 3186	3 "	S T.	"

Resistance to 1% Solution Ivory Soap Flakes (3 hours)

BC 279 - Slightly affected - some dulling and softening.
BC 277 - Very slightly affected.
BC 501 - Badly affected - very dull - film quite soft.
BC 502 - " " " " " " " "

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Water Resistance (24 Hours)

BC 279 - Slight dulling - "haze." Recovered.
BC 277 - Slight dulling - "haze." Recovered.
BC 501 - Softened, dulled. Incomplete recovery.
BC 502 - " " Did not recover.

Color of 501 is very slightly poorer than that of 279 and 277. 502 is definitely "creamy."

Film embrittlement. At end of two weeks, BC 501 shows more elastic film than enamels made from either (3848)E or (4850)N. BC 502 is about the same as BC 279 or 277.

Semi-Lustre

A portion of our time was devoted to experimental formulas, in an effort to develop materials having greater package stability. Several Piccolyte-Rosin vehicles stabilized with lime or Zitro Resin in varying amounts, were substituted for (4850)N in Rex 16270. BC 533 using ARV 3202, (4850)N stabilized with lime and (48) for the vehicle was chosen as the best of the experimental formulas.

In the work on Semi-Lustre tints, the inert was varied in the pigment portion and a variety of vehicles were tried, including:

1. Congo varnishes (2851)C and (2896)C plus (1752) - Blown Linseed and (3071) Zinol.
2. (2851)R, (785) and a 50% Velsicol Solution.
3. Revised (3850)N and (1752).
4. Revised (3850)N and (48).
5. Revised (3850)N and (785).

The most promising experimental formula was BC 520. This paint is pigmented with Titanox RC HT 2132 dry and Surfex 1817 dry, with revised (3850)N and (1752) for the vehicle.

This material is much more stable than the Semi-Lustre made on the existing formulas. Drying is equal to that of batches made from best lots of Congo and much better than that made from some of our varnishes made from Congo resin.

Some doubt has been expressed as to whether Semi-Lustres formulated with (3850)N will retain drying properties. Samples of BC 520 will be retained for future tests.

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Porch and Deck Paints

Considerable work was done on the reformulation of Porch and Deck due to the reactivity and after-body tendencies of the Congo formulation. A number of formulas were made using ARV 3120 - East India Varnish, ARV 3160 - Rosin-East India Varnish, (1720) and (3850)N in two types of pigmentation. The various vehicles were used in conjunction with leaded zinc and with calcium Titanox.

The leaded zinc formulas all showed considerable reactivity with ARV 3120, 3160 and (3850)N. (1720) produced very thin paint but other properties were quite satisfactory. In the case of the Calcium Titanox pigmentation no reactivity was evident, as would be expected.

The ARV 3120 represents a 100% East India and ARV 3160, 60% Rosin 40% East India Varnish. Based on the limited supply of East India, we decided to select the ARV 3160 as the most desirable varnish for use in Porch and Deck. Subsequently it was found that even this reduction in East India content would soon exhaust our supply, and further work was necessary. Both East India varnishes were found to be superior to the Congo formula for water and soap resistance. The 60% Rosin - 40% East India was slightly below the 100% East India in the above tests but definitely superior to Congo. The paint made from ARV 3160 of G to H body was slightly sticky but the ARV 3160 with F body produced a very satisfactory brushing paint.

A report on the above work was sent to A. B. Holton along with our recommended formulations. Work continues with the introduction of varnishes such as (2841)G, (2843)G and (2843)GS as it is reported that a fairly large supply of the raw materials required for their manufacture are available.

Complete details on the above evaluation are available.

103 - Metal Protective Paints

Examination was made at 1200 hours of the 52-P-18 - T-1602 primer series reported in the August report. The condition of the panels in order follows: (Rated according to general appearance.)

1) Slight rust and blistering.

52-P-18 - Regular.
" - Regular p.v.c., 213 dry Blanc Fixe as inert.
" - " " 1220 " Red Iron Oxide for raw sienna.
" - " " 354 " Black " " " " " "
" - " " 1817 " Surfex as inert.
" - 45% " " " " " "
" - 50% " " " " " "
" - 55% " " " " " "
Special Primer per Van Loo - 40% p.v.c.
" " " " " - 37.5% "

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In the report for August results were [illegible] on the first series of salt spray tests on the zinc chromate-iron oxide, magnesium silicate series first described in the May report. The results of [illegible] water immersion tests can now be reported. In general it may be [illegible] as the zinc chromate proportion is increased the blistering is decreased. At the end of 24 hours' immersion in salt water (3.6% concentration) [illegible] which had no zinc chromate had blistered badly. Those with 20% zinc chromate showed definite blistering while all of those with higher percentages of zinc showed no blistering. After 48 hours' immersion the 20% zinc chromate series showed definite to bad blistering while the 40% zinc chromate [illegible] slight blisters.

At this time a definite superiority for [illegible] resistance was also shown by magnesium silicate over iron oxide. This superiority is not as great, however, as the difference between the 20 and the 40% zinc chromate concentrations.

As the immersion tests have progressed [illegible] 48 hours' time the zinc chromate concentration has continued as the factor controlling blistering although the succeeding steps have not been as definite as those just outlined. At the time of writing this report the panels have now been immersed in the salt water for fifteen days or 360 hours, and all persist show bad blistering, with the exception of those containing 80 and 100% zinc chromate, which show definite blistering.

The salt spray series reported in August is now ready to be repeated so that results may be checked.

177 - Pigment Studies

A sample of 414 W was received from Coffeyville representing a laboratory treatment of certain selected better quality cars of fume received from July 7 to September 14, 1945. The cars from which samples were taken for this composite represent 85% of all cars received in that period.

The sample was not equal in color to 414 W Lot 251, which had a color better than standard. The new sample was somewhat gray in color and somewhat less bright. As compared with the minimum standard for 414 W (Lot 183) the new sample is equal in brightness and somewhat gray in color. Ground in SWP tint base substituted for 1526 dry on equal lead-zinc contents, viscosities are practically equal and quite constant.

112 - Fire Retardant Paints

Panels 7354-8 C and 7373 C were put out on exposure at Chicago only to compare zinc and lead borates versus borax in fire retardant coatings. The zinc borate samples were obtained from New Jersey Zinc and Kentucky Color, and the lead borate from Kentucky. The paints were made up into SWP Gloss white of 9-21-45, substituting 25% of the pigment by weight as zinc or lead borate with correction for volume by reducing the magnesium silicate.

EMULSION RESEARCH DEPARTMENT

161 - Emulsion Binder Paints

A. Wetting and Emulsifying Agents

The following wetting agents were evaluated for use in Kem-Tone:

	Date	Visc.*	pH	Edge	Brushing	Emulsion Stability	Purpose
1254	9-2	41"	8.55	Good	Good	V. good	Control for WP 1255-1256-1259.
1255	9-2	30-1/2"	8.42	Good	Good	V. good	Test B-XLV-A Leucanol Type
1256	9-2	27"	8.42	Good +	Good +	V. good	Test B-XLVI-A Leucanol Type
1281	9-10	25"	8.3	V. good	V. good	Good	Control for WP 1282-1290. CW 1282 dry
1282	9-10	25"	8.3	V. good	V. good	Fair	Control for WP 1282-1290 CW 1792
1283	9-10	27"	8.2	V. good	Excel.	Fair	Test Advawet #75
1284	9-10	35"	8.5	V. good	V. good	Fair	Test Advawet #80
1285	9-10	27"	8.3	V. good	V. good	Good	Test Advawet #90
1286	9-10	22-1/2"	8.4	V. good	V. good	Good	Test Advawet #100
1287	9-10	24"	8.3	V. good	V. good	Good	Test Advawet #110
1288	9-10	22-1/2"	8.25	Excel.	Excel.	Good	Test Advawet #120
1289	9-10	26"	8.3	V. good	V. good	Good -	Test Advawet #130
1290	9-10	28"	8.35	V. good.	V. good	Good -	Test Advawet #230
1301	9-21	71"	8.6	Excel.	Excel.	V. good	Control for WP 1302
1302	9-21	49"	8.6	V. good	V. good	V. good	Test Gloucester TiO_2

*All paints reduced 50% except WP 1301 and 1302, which were reduced 63%.

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Chart continued from previous page:

No.	Wash Test 5 Days	14 Days	30 Days	Settling
WP 1254	200	210	147	Some
WP 1255	135	185	147	Slight
WP 1256	200	185	133	Some
WP 1281				Some
WP 1282				Definite
WP 1283				Very definite
WP 1284				Very definite
WP 1285				Definite
WP 1286				Some
WP 1287				Some
WP 1288				Definite
WP 1289				Definite
WP 1290				Definite
WP 1301	70	180		None
WP 1302	80	127		None

Wetting agents B-XLV-A and B-XLVI-A are modifications of our recently developed wetting agent. This wetting agent is now being produced regularly by the Chemical Products Department for use in Kem-Tone. To date, this material has proven to be very satisfactory in Kem-Tone production.

B. Proteins and Protein Substitutes

I. Use of Methyl Cellulose in Kem-Tone

The use of methyl cellulose in Kem-Tone has been investigated at various times. To date we have been unable to show any particular advantages in the use of this material. In addition, methyl cellulose does not adapt itself very well to our production procedure. However, we have tried to keep up with the latest developments on uses of this material. The following information was condensed from a recent literature survey:

1. In comparison with casein as a pigment adhesive for paper coatings, methyl cellulose exhibited higher binding strength, greater resistance to ink penetration, more flexible coating, reduced gloss, opacity, and brightness. There was no difference in smoothness.

2. Methyl cellulose solutions in water increase in viscosity with increase temperature to a maximum. This is also true with an addition of ether to methyl cellulose solutions increasing to a maximum with equal parts of ether and water.

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Tylose 4S (a derivative of methyl cellulose) is water insoluble, soluble in alkali, gives wash-resistant finishes.

The degradation of methyl cellulose in solution can be judged by decrease in viscosity.

Weakly hydrated ions are strongly adsorbed by methyl cellulose. Comments: A cellulose-substitute for casein would be particularly advantageous in Kem-Tone as it would solve the odor problem; celluloses are not susceptible to bacterial putrefaction.

II. Effect of peptizing agents on pigmented protein films.

In an effort to determine the effect on the film strength of pigmented protein solutions of various peptizing agents, samples of Kem-Tone were produced which contained no resinous or oil type binders. In making up these samples, a water slurry of the pigment was treated with the peptizing agent before the protein solutions were added. The protein solutions used were the regular solutions of corn protein and casein as used in Kem-Tone.

The following materials were used as peptizing agents. The percentages given are based on the weight of pigment.

0.33% CW (1792) - Advawet #35
0.53% CPX 454 (solids basis)
0.10% Borax
0.025% Calgon
0.025% Trisodium phosphate
0.10% 26° Ammonia
0.01% Sodium hydroxide

The above batches of protein paints were reduced with water and drawn down (.005" thickness) on Kraft paper and tested for film strength by the wax pick test after drying 24 hours and one week.

Of the above treatments only the borax and sodium hydroxide showed any increase in film strength over the untreated sample. The improvement in the case of sodium hydroxide was only very slight. The borax proved to be somewhat better.

Further tests are being run using increased amounts of peptizing agent.

C. Evaluation of Vehicles and Oil Conservation

Work is being continued in cooperation with the Resin Research Department on the development of emulsion paint vehicles. Our immediate aim is to decrease the acid value and improve the washability of the present tall oil Kem-Tone vehicle.

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The following vehicles were evaluated over the past month:

Code No.	Date Tested	Visc.*	pH	Edge	Brushing	Emulsion Stability	Purpose
WP 1248	9-1	56"	8.4	E	E	G -	Check tall oil for plant-tank #2
WP 1249	9-1	52-1/2	8.35	VG	VG	G	Ditto - tank #4
WP 1250	9-1	72"	8.4	E	E	G	Ditto - tank #6
WP 1251	9-1	35-1/2	8.3	E	E	G	Ditto - tank #8
WP 1252	9-1	44"	8.4	E	E	VG	Control for WP 1248-51
WP 1259	9-2	30"	8.6	G	G	VG	Check (2898)R Newark production
WP 1269	9-4	63"	8.3	E	E	VG	Control for WP 1270 to 1276. RA 636 K-1
WP 1270	9-4	18-1/2	9.05	E	VG	P	Test RA 636-K-2
WP 1271	9-4	31"	8.9	VG	E	G	Test RA 636-K-3
WP 1272	9-4	18"	8.8	G	G	G -	Test RA 636-K-4
WP 1273	9-4	26-1/2	8.3	G	VG	G	Test RA 636-K-5
WP 1274	9-4	36"	8.5	VG	VG	G	Test RA 636-K-6
WP 1275	9-4	36"	8.5	VG	VG	VG	Test RA 636-K-7
WP 1276	9-4	45"	8.4	E	E	VG	Test RA 636-K-8
WP 1307	9-23	75"	8.6	Too wet sags	Best of series	E	Test SV 69 containing RA 631
WP 1308	9-23	29-1/2	8.7	VG	E	E	Test SV 70 containing RA 631 + (320)
WP 1309	9-23	39"	8.7	VG	E	E	Control for WP 1307-08 using RA 631 control in SV-71
WP 1313	9-30	74"	8.6	VG	E	G -	Test RA 637 L-1
WP 1314	9-30	64"	8.75	G	E	G	Test RA 637 L-2
WP 1315	9-30	28"	8.85	G	VG	P	Test RA 637 L-3

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Code No.	Date Tested	Visc.*	pH	Edge	Brushing	Emulsion Stability	Purpose
WP 1316	9-30	40"	8.8	G	E	G	Test RA 637 L-4
WP 1317	9-30	24"	8.95	G	G	P	Test RA 637 L-5
WP 1318	9-30	36"	8.65	VG	E	G	Test RA 637 L-6
WP 1319	9-30	35"	8.85	G	VG	G	Test RA 637 L-7
WP 1320	9-30	81"	8.45	G	E	G	Test RA 637 L-8 Control for WP 1313-19

*All paints reduced 63% with the exception of WP 1259, which was reduced 50%.

Wash Test

No.	5 Days	14 Days	30 Days	Settling
WP 1248		-		-
WP 1249		-		-
WP 1250		-		-
WP 1251		-		-
WP 1252		-		-
WP 1259	150	225	200	Some +
WP 1269	106	165		None
WP 1270	103	200		Slight
WP 1271	145	180		Definite
WP 1272	215	290		None (Yellow)
WP 1273	154	150		Very definite
WP 1274	85	125		Slight
WP 1275	160	110		Slight
WP 1276	100	96		Some
WP 1307	102			None
WP 1308	105			V. V. slight
WP 1309	110			None
WP 1313	143			Definite
WP 1314	155			Definite
WP 1315	145			Some
WP 1316	127			Slight
WP 1317	105			Definite
WP 1318	120			None
WP 1319	93			None
WP 1320	62			Some

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A description of the experimental vehicles evaluated is given below:

RA 656 Series

Material		K 1	K 2	K 3	K 4	K 5	K 6	K 7	K 8
Neofat D-342	%	0	50	25	85	50	35	34	17
(320)	%	35	35	35	0	0	0	17	17
T 624	%	50	0	25	0	35	50	34	51
(348)	%	10	10	10	10	10	10	10	10
(293)	%	5	5	5	5	5	5	5	5
Acid Value		85	30	58.5	33.5	76	95	73	91.5
Viscosity		23"	1'8"	45"	4'15"	1'5"	41"	50"	33"
WP Pt. Ref. No.		1269	1270	1271	1272	1273	1274	1275	1276

RA 631 Series

Material		SV 69	SV 70	SV 71
RA 631	%	85	50	0
(320)	%	0	35	35
(348)	%	10	10	10
(293)	%	5	5	5
T 624	%	0	0	50
WP Ref. No.		1307	1308	1309

RA 631 is a castor oil, tall oil ester with a 117.5 acid value.

RA 637 Series

All vehicles contain 85% N.V.M. The composition of the N.V.M. is given below:

Material		L 1	L 2	L 3	L 4	L 5	L 6	L 7	L 8
T 624	%	70	60	50	60	60*	40	40	59
(113)	%	20	20	20	15		15	20	0
2197 Dry	%	10	20	10	5	10	5	10	0
(320)		0	0	20	20	30	40	30	41
Acid Value		-	-	50	-	36	59	59	-
WP Ref. No.		1313	1314	1315	1316	1317	1318	1319	1320

*The material indicated here is a castor oil - tall oil ester and not straight T 624.

Emulsion Research Department
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D. Bacteriological Work

I. Tests on production batches containing perborate and deodorant.

1. 65401 - C 1963 containing CW 1745 - sodium perborate, replacing by 2 X the weight of 41 - borax, and CW 1772 Deodorant #5AAA(G-D) 2#/320 gal.

2. 65402 - 1973 D containing CW 1745 - 2 X weight replacing 41 - borax.

3. 65401 - 1963 A control.

The samples containing perborate showed slight improvement over the control being milder in odor during the test period than the latter which smelled strongly of oxidized oil on the 14th day examination. All samples on the 31st day gave faint or flat cardboard odors. The sample containing deodorant was not any improvement over those that didn't. It gave a very faint aroma during the entire period somewhat on the acrid side. In a room test the tall oil and somewhat flat odor prevailed; the deodorant made no difference.

II. Kem-Tone with a vehicle change.

65408 - C 2135 D control
65408 - C 2135 E

Results: The odor trend was similar in both batches, both being mild.

III. Kem-Tone contaminated by action on metallic carton lining.

65401 - C 1293 R pH - 8.7 bacteria count - 0

Unreduced paint in the carton gave a flat, slightly garbage odor; however, the odor test showed no spoilage. The first day odor was slightly flat and slightly of garbage, later slightly rancid, and finally slightly moldy.

IV. Spoilage case 65401 - C 2512 C

Unreduced sample batch odor: pine oil, aromatic.
Reduced " : faint pine, "
Panel odor at 5 minutes: slightly aromatic, slightly off.
1 hour: " " " of garbage, similar to damp cardboard.
24 hours: none.

pH - 8.4

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Bacteria count: 2,400,000 bacteria/cc

Odor test: 1st day: slightly garbage, slightly aromatic.
12th ": sharp shellfish, offensive.
35th ": slight ammonia

In the undried carton at 28 days, the entire paint film lining was overgrown with brown mold. This usually happens in cases where there is little or no preservative present in the paint film to prevent the growth.

Bacterial counts were made on all samples of batches manufactured that day with the following results:

65401 - C 2512 A	pH 8.35	Count: 5
65401 - C 2512 B	8.3	0
65401 - C 2512 D	8.2	0
65401 - C 2512 E	8.1	10
65401 - C 2512 F	8.2	0
65401 - C 2512 G	8.5	0

V. Tests on returned batch 65405 - C 493

The Kem-Tone in the original carton on examination appeared to have separated into two fractions; the lower portion, a pigment paste, the upper, a clear supernatant liquid. The odor of the paint was pleasant and unspoiled, pH 8.5, viscosity (50% red. 75o F.) 17", weight per gallon 13.40 which checked with original records. When painted out, the odor was slightly flat; the emulsion was not broken. Bacteria count was negative. The 30-day odor observation showed a slight oxidized oil to a moldy trend.

VI. Evaluation of preservatives

Further examination of toluene-Dowicide combination:

a. .05% Dowicide A + .375% toluene in 5% casein solution
b. .5% toluene " " " "
c. .1% Dowicide A " " " "
d. .1% " " + .2% toluene " " " "
e. .05% " " + .2% " " " " "
f. .025% " " + .1% " " " " "
g. .5% mineral spirits " " " "
h. .1% " " " " " "

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Results	pH - 24 Hrs.	Bacteria/cc	pH 120 Hrs	Bacteria/cc
a.	8.7	48,000	8.55	500,000
b.	8.65	100,000	8.4	4,000,000
c.	8.7	24,000	7.78	4,000,000
d.	8.7	41,600	8.61	240,000
e.	-	400,000	-	Sample discarded
f.	8.7	800,000	6.86	" "
g.	8.71	800,000	6.72	" "
h.	8.7	400,000	6.8	" "
Blank	8.65	800,000		

The toluene-Dowicide combination is not effective enough for use in Kem-Tone.

VII. General examinations

a. Glidden emulsion paint sample 102-K 4 June 10, 1943 compared with "tall oil" and "casein" Kem-Tone batches.

	pH Orig.	Visc.	pH 24 Hrs	* Bact./cc	Odor on Discarding
1. Glidden	7.95	22" (35% red.)	7.8	256,000	Phenol
2. 65408 C 2123 F (Tall Oil)	8.4	44" (50% red.)	8.35	17,000	Faint tall oil
3. 65400 C 02053 (Casein)	8.55	22" (50% red.)	8.4	63,000	Sl. sewer

*Inoc. 1/2 cc 6,000,000 bacteria/cc in 30 cc paint.

Other properties of Glidden sample:

Hiding power poor.
Brushing poor, drag, set-up too fast.
Brush wash poor.

Odor test:

1. Glidden sample: phenolic throughout 31 day test period.
2. 08-C 2123 F: slight tall oil to sl. moldy odor.
3. 00C-02053: faint odor to sl. oxidized odor.

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b. du Pont Speed-Easy Wedgewood Blue 385 106 7471

pH 8.3
Viscosity - 21" (50% red.)
Odor: sl. garbage, glue size, formaldehyde.
Bacterial count: 70,000 bacteria/cc

E. Gloss Emulsion Paints

A series of 14 formulations of gloss resin emulsion paints have been made with three variations of treatment in the manufacturing process. All formulations are being evaluated. The results of this evaluation, it is believed, will give us valuable information and directional data for further research and development along the way toward better gloss-emulsion paints.

Evidence thus far indicates that we may expect to produce a Semi-lustre with about 30 gloss/mil value on the Gardner Glossimeter.

F. Outside Rem-Tone

A series of nine formulations have been developed utilizing both a high organic binder to pigment ratio and a low organic binder to pigment ratio. There are several variations of pigmentation included, as well as several variations in the type of vehicle such as straight oils and long and medium length alkyd varnishes.

It is proposed to send one gallon of each of these to California for exposure tests on stucco homes, where they may prove to have considerable beautifying and protective value. Exposures have been made on concrete and brick at Chicago for purely comparative results from the formula variations.

Results of California exposure should give us good indications of what way to go on future outside brick and stucco resin emulsion paints.

Specialties

A. Spachtling Compounds

Considerable attention was given to a sample from H and H Laboratories of a ready mixed patching compound which was examined in detail.

Analysis of New Ready Patch

pH	8.2
Total solids	80.64%
Volatile matter	19.36%
Organic matter	7.7%
Water soluble	5.56%
Ash from water soluble residue	.43%

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Qualitative tests

A. Flame

Barium - Neg.
Calcium- Pos.
Sod. - Trace

B. Precipitation

Sulfates - present

C. Spot tests

Dextrine - present in water soluble portion.

From the above data and microscopic examinations, a fairly complete picture was presented and a formula closely matching the M and H material was compounded after several trials as follows:

SC-22

250	pounds	45 dry	Calcium Sulfate $2H_2O$
25	"	2077 dry	Diatomaceous Silica
100	"	2183 dry	Mica
(50	"	523 dry	Dextrine
(150	"	(12)W	
?		Oil of Citronella	

The above formula is not meant as identical to M and H Laboratory material, but is a close match. It is intended to try to improve upon the above - working toward a successful ready-mixed patching compound.

Kem-Tone Quality Control

Examination of Kem-Tone production from the various Kem-Tone plants for weight per gallon, pH, viscosity, shade, washability, odor, brushing properties and emulsion stability is being continued. The number of samples received and tested during the past month is given below:

Plant	Samples Tested
Chicago	260
Newark	44
Detroit	35
Cleveland	22
Oakland	22

In addition to the laboratory tests, 20 room tests were completed. These tests supplement the regular laboratory tests.

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Kem-Tone Rechecks

During the month of September 1361 batches of Kem-Tone manufactured on the (2898)R, corn protein, casein, formula were tested for application properties, package condition, emulsion stability, viscosity, pH, and shade.

In order to correlate results obtained by the Newark and Chicago testing groups, 19 batches which had previously been evaluated at Newark, were rechecked at Chicago. The results obtained at Newark and Chicago were in complete agreement.

#155 - Wall Paper Evaluation

(a) Samples of Style Perfect wall paper submitted by United Wall Paper Company have been tested for washability, fade resistance, adhesion, brittleness, and design flaws. Results of these tests indicate that United are keeping the quality of the paper at a high standard.

(b) Samples of Kem-Tone trims are also being checked periodically for quality. Our most recent tests show some improvement over last month's production samples.

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No work was done during the month on the following projects:

#170 - Army-Navy Specification Work

#174 - Oleoresinous Wrinkle Varnishes

#175 - Blackout and Camouflage Paints

M. VAN LOO
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Panels 5417-20 C, F were examined after 30 months' exposure in Chicago and 24 months in Florida, respectively. The test paint was SWP Gloss White which had been "Hauzerized" by Modern Way Produx of Detroit. No details of the process were disclosed. The special showed no advantage, and possibly had a greater tendency to erode and check.

Panels 4416-58 C were given a final examination after 39 months' exposure at Chicago, vertical south. These paints parallel the Florida series reported in the July report, page 6. The paints were based on the 1-4-40 formula of SWP Gloss White and tested various blends of Dehydrol and soybean oils as well as special ester interchange oils, and a soya-castor "kangaroo" oil, up to one-third substitution. These tests completely confirmed the Florida reports, showing that all the blends were very satisfactory, fully equal to the regular.

148 - Examination of White Lead

Panels 4479-82 F testing special lots of basic carbonate white lead in SWP Ivory, were examined after 36 months' exposure in Florida. Two nearly identical lots of Quick Process white lead, lots #960 and #982, and one lot of U.S. lead, lot #1020, were used in the laboratory batches, with a stock paint carrying a similar amount of 50/50 Old Dutch/Q. P. lead as the guide. The pigmentation carries only 80# basic carbonate white lead, and therefore no great differences would be expected, but a routine check was necessary. All the paints showed uniformly good durability, varying only in that the special lots were definitely ahead of the stock (blend) in tint retention.

150 - Durability Studies of Zinc Sulphide Pigment Combinations

Exposures 2735-41 C testing zinc sulphide-asbestine-mica blends in Lone's "Big Six" Outside White were examined after being out 45 months in Chicago. Coffeyville's zinc sulphides XX-148, XX-157, and XX-165 were compared with New Jersey's ZS-30 in blends corresponding to their Cryptone MS-130 which was used in the guide. All panels were self-primed on cedar. ZS-30 and XX-148 proved to be definitely inferior in general durability to XX-157 and XX-165 which were practically equal to the regular. Most of the panels were clean, with good general appearance. At this time Coffeyville cannot identify the individual lots, so this report is made as a matter of record until the data sheets are located.

164 - Reformulation Studies of House Paints to Reduce Dirt Collection

Panels 7374-9 were prepared for exposure at Chicago south and north vertical, and Florida and Coffeyville south vertical to compare Titanox RC - 2140 dry with Titanox RCHT - 2132 dry, particularly as to chalking rate and dirt collection. By using these materials on an equal hiding power basis in the alternate SWP formula of 8-16-43 (also 50/50 RC/RCHT) together with the regular SWP Gloss White formulas of 4-8-42, 10-15-42 and 1-22-43 it is felt [illegible] SWP white formulations is quite complete, con-

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Cont.

160 - Painting of Bricks

A bulletin, "Final Report on Asbestos Shingle Exposures" supplementary to Bulletin RC-73 was issued during the month. There are no indications after 54 months' exposure which are contrary to the statements as of 21 months' exposure. The best panels are SWP Gloss White over chlorinated rubber type primers.

12 - Exterior Primers

Due to the current interest in one coat house paints it appeared worth while to investigate the relative absorption of oil by the wood or paint surface from conventional oil paint vehicles as compared with "neutralized" oil vehicles. The reduction in acid value is supposed to exercise considerable control over penetration.

It is understood that the low p.v.c. house paints are not recommended for application on new wood, but the general applications of "neutralized" vehicles in house paint undercoaters with controlled penetration appears interesting. Work has been started on determining the relative oil absorptions, and a few preliminary tests have been run using one of the low pigment volume formulas recommended by Titanium Pigment Corporation.

The method is similar to that employed by Floyd Nelson, who worked extensively with Rex 450 Undercoater and published his results in Bulletin 52. Paint is applied on a selected board at a given spreading rate, allowed to dry partially, and scraped off into weighed containers. The oil is removed by Soxhlet extraction and weighed, and by suitable calculation the per cent of oil absorbed into the wood is determined. It appears possible that a rapid percolation type of extraction may be substituted for the time-consuming Soxhlet extraction.

162 - Studies in Flat Wall Paint Formulation

Flat Wall Paints

Due to the shortage of zinc sulphide, work has continued on the formulation of a rutile titanium calcium pigmentation based on a limed oil, V 11152. Distribution of formulas has been held up because further work to stabilize the soaped vehicle continues and because earlier expectations of good washability have not been realized.

The shortage of zinc sulphide and titanium oxide has compelled an approach using straight titanium calcium as the opacifying pigment. Such a pigment is definitely inferior in washability to a zinc sulphide-lithopone combination, and this weakness shows up quickly over glue size. This factor apparently dominates over any effect produced by the soaped vehicle.

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Cont.

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A number of experimental variations of V 11152 have been made in the Varnish Research Division to improve the stability and washability, including variations in lime treatment and the use of different amounts of Dehydrol. Further details are given in the Varnish Research portion of this report.

Preliminary tests were made using Linogel as a flat wall paint vehicle, but results to date do not indicate that this material has any advantage over the regular oils insofar as "ghosting" is concerned. The consistencies obtained were rather low, with flow fair. Further work will be done.

Paintercraft Flat #10 has been reformulated to eliminate the pure TiO_2, replacing with titanium calcium. The new formula has an oil content of 1.2 pounds of oil per gallon, 39.8% vehicle solids, V/P ratio of .74, and hiding power of 21,000 units.

Semi-Lustre, Enameloid, Floor Enamel

The Velsicol-rosin-linseed varnish (3850)N has been used for several months in some trade sales lines. With Dehydrol available for general use, the Varnish Research division has made variations of (3850)N replacing part or all of the linseed with dehydrated castor.

ARV 3237 with half linseed and half Dehydrol and ARV 3240 with straight Dehydrol were evaluated in several Enameloid and Floor Enamel formulas. Results indicate that replacement of linseed by dehydrated castor up to 100% makes very little difference in the performance of the enamels. Drying, water resistance, soap resistance, and package stability are quite similar.

The following is a brief summary of the experimental work:

Formula	Varnish	Viscosity #3 Orifice	Over night Drying	Tack-Free	Cold Water 24 Hrs.	1% Soap Resistance 5 Hrs.
Enameloid Ivory	(5850)N	25"	Tacky	24 Hrs.	Sl. soften-	Discolored
" "	ARV 3237	23"	Sl. tack	"	ing and	and dulled
" "	ARV 3240	31"	Sl. tack	"	milky	
Floor Enamel Gray	(5850)N	18"	V. sl. tack	21 Hrs.	"	"
" " "	ARV 3237	19"	Sl. tack	"	"	"
" " "	ARV 3240	23"	Sl. tack	"	"	"

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Cont.

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Actual factory production of ARV 3240 under the assignment of V 11159 was also checked in Enameloid formulas. Again very little difference was found between the linseed (3850)N and the castor type. The castor varnish appeared to give slightly better water resistance and the linseed somewhat better through drying and sharper gloss.

Formula	Varnish	Visc. #3 Orifice 1 Day	Visc. #3 Orifice 3 Days	Tack-Free	(24 Hrs.) Cold Water Resistance
Enameloid Ivory	V 11159 G Body	28.8"	28.7"	24 Hrs.	Sl. haze; recovers.
" "	V 11159 I-J "	36.4"	36"	"	" " "
" "	(3850)N E-F "	25"	25"	"	Sl. milkiness. Incomplete recovery.

In order to obtain a fair picture of current quality of Enameloid a review is being made of typical production formulas running back to 1938. Samples of competitive enamels will also be included in the evaluation. Exposure tests will be made on whites and ivories. In addition a series of exposure tests are contemplated where a direct comparison will be made of the various individual varnish vehicles used in Enameloid. Non-chalking rutile TiO_2 will be the only pigment, and the pigment-binder ratio will be kept constant. Enamels will be tinted to light gray.

White Enameloid

Lab. No.	Date of Formula	Vehicle Used
BC 592	6-20-38	(1567) Ester gum-C.W.O.-linseed (2946)EA Ester gum-Phenolic-C.W.O.
BC 593	9-27-40	(3111) Linseed alkyd (4100) P. E. alkyd
BC 594	1-23-41	(3110) Linseed alkyd (4100) P. E. alkyd
BC 595	6-12-41	(6158) Maleic rosin linseed alkyd. (4100) P. E. alkyd (6100) Maleic rosin soya alkyd.
BC 596	10-1-42	(2848)N P. E. Polypale Dehydrol
BC 631	12-1-42	(3848)E P. E. Rosin linseed
BC 598	5-21-45	(4850)N Piccolyte Polypale Linseed

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Ivory Enameloid

Lab. No.	Date of Formula	Vehicle Used	
BC 600	8-31-39	(40)	Heat Bodied Linseed
		(2945) EA	Ester gum-Phenolic-CWO-linseed
BC 601	1-30-40	(2841) G	Mod. Phenolic-Dehydrol
		(2843) GS	Mod. Phenolic-maleic linseed
BC 602	5-20-42	(2843) G	Mod. Phenolic-linseed
BC 632	1-17-43	(3848) E	P. E. Rosin linseed
BC 604	7-6-43	(3850) N	Velsicol-Polypale linseed
BC 612	8-21-43	(3850) N	Velsicol-Rosin-Dehydrol

Gray Series

Lab. No.	Varnish	
BC 616	(4100)	P. E. alkyd
BC 617	(2945) EA	Ester gum-phenolic-C.W.O.
BC 618	(2848) N	P. E. Polypale Dehydrol
BC 619	(2847) N	Maleic-castor-linseed
BC 633	(3848) E	P. E. Rosin-linseed
BC 621	(4850) N	Piccolyte-Polypale-linseed
BC 639	(1567)	Ester gum-C.W.O.-linseed
BC 625	(3111)	Linseed alkyd
BC 624	(6100)	Maleic rosin soya alkyd
BC 625	(2945) EA	Ester gum-Phenolic-C.W.O.-linseed
BC 626	(2845) GS	Mod. Phenolic-Maleic linseed
BC 627	(2843) G	Mod. Phenolic-linseed
BC 628	(3850) N	Velsicol-Polypale-linseed
BC 629	(2841) G	Mod. Phenolic-linseed

Porch and Deck Paints

In cooperation with the Varnish Research division a series of Porch and Deck paints were made to further evaluate the exterior exposure value of a series of varnishes paralleling the Enameloid series, and the clear varnish exposures prepared by the Varnish Research division.

The first series included the following formulas:

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Formula	Opaque Pigment	Varnish in Vehicle
OJ 683 G (Regular of 4-7-43)	2174 dry, Non-Chalking Rutile TiO_2	(2831)C and (2896)C Congo Varnishes
OJ 697 G	2140 dry, Titanox RC	(3850)N Velsicol-Polypale linseed
OJ 699 G	"	ARV 3120 East India varnish
OJ 702 G	"	DEV 886 60% Rosin, 40% East India
OJ 722 G	414 W Leaded Zinc	(2845)GS Mod. Phenolic-Maleic linseed
OJ 723 G	2140 dry, Titanox RC	(2841)G Mod. Phenolic-Dehydrol
OJ 724 G	2140 dry, Titanox RC	(2845)G Mod. Phenolic-linseed
OJ 725 G	"	(2843)GS Stock varnish

This series has been put on exposure on 8" x 24" yellow pine panels as two coat work, 45° south in Chicago and Florida under panel numbers 7391 - 7398.

This series was supplemented by a more elaborate series which included several regular Porch and Deck formulas and covered the additional varnishes in the Enameloid and clear exposures. Two series were prepared, one using the regular leaded zinc pigmentation of 5-20-42 and the other using 2140 dry; Titanox RC rutile titanium calcium.

The leaded zinc formulas employed (2841)G (regular formulas of 2-1-40 and 5-20-42), (5848)E, (2946)EA, (2845)GS, (2945)EA, (2845)G, (429) (including regular of 9-20-27), (1567), (2843)N. The titanium calcium formulas include these varnishes plus ARV 3120, ARV 3160, (2847)S maleic rosin-Neofat #19 TG - Dehydrol, (4850)N, (3850)N, (6100), (3111), and (4109). These varnishes have been identified previously. It must be mentioned that all the above do not have practical consistencies, but are included for complete coverage.

The various paints will be exposed in Chicago and Florida, as were the original series.

#103 - Metal Protective Paints

Examination was made at 1900 hours in 5% salt spray of the series of 52-P-18 and special primers on which the condition was reported at 1200 hours in last month's report. The series, evaluated on the basis of general appearance follows:

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1. Slight blistering and rusting

52-P-18 - Regular P.V.C. - 1817 - Surfex as inert
" P.V.C. - 45% " " " "
" " 50% " " " "
Special Primer per Van Loo - P.V.C. 57.5%
" " " " " " 40%

2. Slight rusting - considerable blistering

Regular 52-P-18
" " - but 215 dry - blanc fixe as inert
" " " 1220 " - red iron oxide for raw sienna
" " " 354 " - black iron oxide for raw sienna
- - - " - P.V.C. to 55% by Surfex as inert

Other panels in this series reported last month were removed from exposure at 1200 hours because of poor condition. This total series has now been discontinued. It will be noted that Surfex can be used at a much higher p.v.c. than magnesium silicate without serious rusting.

In connection with the above series fire retardant tests were run on the Surfex series at P.V.C.'s of 40, 45, 50, 55 and 60% versus regular 52-P-18 and the proposed Maritime 52-MC-29 (Tent.) primer. The technique used was that of using 0.005" draw-downs of the primer with a 0.005" draw-down of a top coat of 52-P-22 Fire Retardant Semi-Gloss at right angles. The temperature of the muffle was held at 1850° F. for the test. In these series of tests the two coat system blistered and peeled in all cases. However, there were marked differences in the condition of the primer coat.

52-P-18 - P.V.C. to 60% by Surfex - condition good.
" " 55% " " - fair - good.
" " 50% " " - fair
" " 45% " " - fair.
" - regular - fair.
52-MC-29 (Tent.) - fair.
52-P-18 - P.V.C. to 40% by Surfex - poor.

The results seem to be in fair agreement as to what was to be expected on the basis of the salt spray data. However, the performance of the primers are influenced to some extent by the decomposition of the calcium carbonate, which tends to produce blistering and subsequent peeling. Since porosity of the film detracts from rust inhibition but favors performance on the fire test, these two properties do not reach their maximum in the same formula.

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Special Studies

Examination was conducted on a series of proposed Maritime primers versus 52-P-18 and T-1602 - Engineer's primer. After exposure to 3% salt spray for 1600 hours, the condition of the panels in general were the same as in last month's report. Summarizing the test results briefly: (Pigmentations are given in the August report):

1. Slight rust and considerable blistering

   Base formula using RA 421 - 39.2% P.V.C.
   Special Base Formula #2 using RA 421 - 39.2% P.V.C.
   Base formula using RA 419 - 39.2% P.V.C.
   52-P-18 - regular formula - 40.0% P.V.C.

2. Considerable rust and blistering

   "A" modification of base formula using RA 420 - 37.8% P.V.C.
   "C" " " " " " " - 36.0% "
   "D" " " " " " " - 37.7% "

3. Bad rust and blistering

   "B" modification of Base Formula using RA 420 - 39.6% P.V.C.
   Base Formula using RA 420 - 39.2% P.V.C.
   T-1602 Spec. - 36.2% P.V.C.

4. Very bad rust and blistering

   Sp. Base Formula #1 using RA 421 - P.V.C. 37.2%

As reported in August the vehicle used for the proposed primer was the 52-MC-21 specification, a 23% phthalic anhydride linseed alkyd. RA 419 contained 25% of a V bodied linseed oil in the cook to obtain the required C-E body at 50% solids. RA 420 contained a small amount of maleic cooked at higher temperatures, and RA 421 contained a larger amount cooked at lower temperatures.

The scored side of the panels all seemed to exhibit about the same amount of rust creep. However, when stripped the scored sides exhibit rusting in every case in agreement with the above evaluation. The 52-P-18 panels showed considerable blistering on the scored side of the panel, with much less blistering on the unscored side. However, except for the scores very little rusting had taken place under the blisters. It was very evident that corrosion inherent in the moisture occluded in the blisters had been inhibited by the zinc chromate. The proposed Maritime 52-MC-29 formula showed very much less blistering on the scored side of the panel than the 52-P-18 Bureau of Ships formula. Salt spray exposure of these panels has been discontinued.

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Panels have been prepared for exterior exposure of this series as well as many variations of these which are in the process of being evaluated in the salt spray machine and by immersion tests in distilled and salt water. In this way further data will be obtained with respect to correlation to be expected with salt spray and blistering tests versus exterior exposure.

In the September report, mention was made of the tests of Ferrous Ammonium Phosphate as a rust inhibitive pigment. Similar panels were made with paints on the Bureau of Ships 52-P-18 formula in which 30% of the zinc chromate volume had been displaced by an equivalent volume of Ferrous Ammonium Phosphate. No difference was noted in blistering or recovery when the panels were submerged in either distilled or salt water.

Salt spray tests, after 730 hours, showed some preference for the Ferrous Ammonium Phosphate containing paints. However, the advantage is only very slight and the work is to be repeated and checked.

Panels 7388-90 C were prepared for exposure at 45° south in Chicago, using cold rolled steel panels with an over-all spray coat of the primer, with the upper half of each panel carrying a top coat of Low Visibility Gray 52-MC-6.

Salt spray tests on the Lead Industries Association materials show no differences to date.

#177 - Pigment Studies

We have received from Gloucester a sample of TiO_2, lot G 376, for evaluation in exterior finishes. This material has been made up in a modified exterior formula which includes TiO_2 and Magnesium Silicate as the only pigmentation, and in Rex 710 - Enameloid White. These have been put on accelerated exposure for the study of chalking rate. Thus far no chalking has taken place.

In evaluation of the Gloucester material we can report that the color is not equal to either 1403 dry or 2173 dry, being slightly lower in brightness and slightly dirty in color.

Opacity evaluations have been delayed due to trouble which has been encountered with the reflectometer. However, it can be said from visual observation that the Gloucester material is not equal to 1403 dry in hiding.

EMULSION RESEARCH DEPARTMENT

#161 - Emulsion Binder Paints

A. Kem-Tone Deep Colors

The problem of uniform surface appearance of the deeper colors of Kem-Tone is very complex and has relation to many factors, some of which have not been isolated.

In the last month 45 formulas have been made in the laboratory and shaded to Aqua Blue, a color selected for its troublesomeness in lack of uniformity upon drying. These were reduced and applied over wall paper and previously Kem-Toned surfaces.

Prime pigments used were rutile titanium and some experimentals also contained lead titanate with the purpose of increasing washability. The latter, however, showed some disadvantage in ghosting and streaking and was discontinued for various other reasons.

In a 100 gallon formula rutile was varied from 100 pounds, which was definitely low in covering to 150 pounds, which was adequate in respect to hiding.

Celite was varied from zero quantity to 250 pounds per 100 gallons, and in general it was found that the higher the quantity of Celite, the less trouble was experienced due to streaking. The level in most of the formulas held Celite at 100 pounds, but a higher final quantity is indicated.

Atomite has been used in a considerable number of formulas and varied from 80 pounds to 250 pounds per 100 gallons. So far there has been no correlation between those batches which showed promise and the Atomite content.

Talc has also been used in some formulations ranging from 25 pounds to 250 pounds per 100 gallons. In those formulas with a low talc content there seemed to be no advantages apparent, but in the cases where talc was extremely high and the only other inert in use being Celite, superior uniformity in the dried film was observed.

While mica has never been of any advantage in regard to color uniformity, we have never proven that it does have adverse influence in the quantity normally used.

Many of the experimentals made gave fairly satisfactory results in two coat application, but all showed some undesirable characteristics over some papers in one coat. On the other hand, we also found some papers that gave quite satisfactory one coat results. Moreover, it was found considerably easier to achieve one coat results over Kem-Toned surfaces than over some of the wall papers used.

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It was found in the case of one of the very difficult wall papers, that if the paper was thoroughly washed before Kem-Toning, that streaking was negligible over the washed portion, but most undesirable over the unwashed portion.

It was also observed that the viscosity of application has some part in the complex picture, for in some formulas, if the viscosity of application was low, i.e., 16 - 24 seconds, on standard Ford cup, streaking was much more pronounced than application at 30 - 35 seconds.

From another series of tests it was found that the tall oil soaps were apparently contributing to the delinqu ency of the formulation, and when omitted showed a slight improvement in dry film appearance. Consequently, most of our latest experimentals have been on a tall oil-free base, substituting rosin and ester gum vehicles for the oleoresinous binder.

It was also found that an increase in the percentage of Lecithin and protective colloid proteins employed contributed some improvement in the direction desired.

Clay was shown fairly conclusively to be detrimental, by incorpora - tion in formulas of satisfactory nature without clay, which showed up poorly after incorporation of it.

We have also tried to shade the base with colors dispersed in oil, thinking that by this means the color could be effectively tied down. The formulation did not prove an advantage.

Another set of colors were ground with inerts such as Celite and talc and these seemed to give a slight advantage over the standard shading bases.

A recent trial in plant batches has been room tested with encouraging results in both Aqua and Montrose Coral shades. Its formula is as follows:

150 pounds	2269	Rutile Titanium
150 "	2077	Celite
250 "	2263	Talc
208 "		Rosin-Protein BX 606
204 "		Casein BX 666
6 "	2182	Wetting Agent
162 "		(12)W
100 "		V-17117 Ester Gum Vehicle
2 "		(4090) Pb Drier
2 "		(4092) Co Drier

[illegible] shading colors ground with Celite and talc [illegible] comparative.

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This formula gave some difficulty in plant manufacture because of the water requirements of the pigment used. Further laboratory work is to be done from this formulation to see what can be accomplished in the factory problem.

It is also intended to increase the amount of oleoresinous binder to note the influence upon the final product both as to working properties and dried film characteristics.

Results so far indicate that one coat work will suffice in a majority of cases, with two coats necessary in difficult cases. No one factor investigated seems to bear a sizable relation to the solution of the problem of the deeper colors, but each seems to contribute through its balance to a more desirable end product.

B. Wetting and Emulsifying Agents

Comparative conductivities of various wetting agents.

26 wetting agents were examined thoroughly with the use of a conductivity bridge. Impurities in the form of electrolytes can be detected by a direct reading in ohms. Results are tabulated below of .1% wetting agent in aqueous solution.

1st Series - Competitive Wetting Agents

	pH	Ohms
Nekal Bx salt-free (IT shipment)	6.1	1370
" " " " (100 pound shipment)	6.1	1840
" " " " (10-18-43 shipment)	5.82	2150
" " " " (original sample)	5.8	2800
Nekal Bx High Concentrate	6.0	2030
Duponol ME	7.4	4000
Santomerse D	6.25	4680
Santomerse #3	6.4	5400
Nacconol SFT	6.1	3400
Nacconol NRSF - 2182 Dry	6.15	3570
Aresket 300	6.1	3300

Nekal samples show a presence of more electrolytes than the others. Recent shipments of Nekal Bx salt-free are more comparable to the Nekal Bx High Concentrate sample than the original salt-free sample.

It should be noted that the Santomerses have a higher resistance than Nacconol NRSF or SFT indicating a lower salt content.

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2nd Series - CP935 - Concentration 0.1% of Active Wetting Agent.

Lot	% Active	Total Solids	Gm/100 cc H_2O	pH	Resistance/Ohms
1	30	36	.335	10.3	2000
2	31	38	.322	9.1	2820
7	35.4	43	.282	6.2	3520
8	34.5	42	.290	6.93	3560
9	26.5	34	.377	9.5	2620
10	36.8	40	.272	6.0	3280
11	51.5	58	.194	8.6	4100
12	29.8	38	.336	8.7	2550
13	29.2	38	.342	10.0	2580
14	21.8	31	.458	9.55	2250
16	27.8	35.5	.360	6.3	2680
17	26.6	37.5	.376	8.8	2290
19	23.7	53	.422	5.46	2300
20	24.6	35	.406	9.4	2300
21	36.8	43	.272	6.4	2920
22	16.5	27	.606	5.7	1470
23	35.1	38	.285	6.0	2250

Graphs were plotted, comparing solids, pH, and resistances of the above solutions. It was found that the more neutral the solution the higher the resistance and that the higher the per cent of active ingredients the higher the resistance. The third graph showed that those with higher per cents of active ingredients tended to be more neutral solutions. The amount of impurity seems to be in indirect proportion to the per cent of active ingredients, e.g., lot 11 51.5% active ingredients 4100 ohms to lot 22, 16.5% active ingredients 1470 ohms.

C. Proteins and Protein Substitutes

1. 12% protein solutions were prepared with various proteins using the following formula:

533 gm distilled water)
76 " protein) Soak 10 minutes

4 " Dowicide A)
4 " " G) Add at 140° F.

9.5" Borax) Add at 160° F. and
7 " Ammonia) heat for 10 minutes longer.

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a. 12% casein solution was excellent in every detail. pH - 8.65. Very viscous solution, smooth, cohesive. Dispersion and preparation was very easy. Under microscopic examination, there appeared only small single globules.

b. 12% corn protein required more ammonia and heating at higher temperatures for dispersion. pH 8.6. However, the final product was a very poor one, separating out in two fractions. The solution had little viscosity, was not smooth, no cohesion. Microscopically particles of various sizes were evident, ranging from huge agglomerates to small globules twice the diameter of those of casein.

c. 12% Prosein gave a solution having a consistency similar to that of flour paste. Appearance was slightly more smooth in that the particles were of uniform size, high viscosity, but no cohesion. pH - 9.17. Microscopic examination showed poor dispersion, particles being of fairly large uniform size.

d. 12% alpha-protein, pH 8.77. Appearance smooth, some viscosity, slight cohesion. Microscopically, particles were of various sizes. The solution, all in all, was better than corn protein.

e. 12% Aratein 80, pH 8.82, did not disperse well. Large particles in the final product were still evident to the naked eye. Viscosity fair, cohesion slight. Microscopic examination showed smaller various sized particles.

f. 12% corn protein solution with Tall Oil was prepared from the following formula:

190 gm	distilled water)	soak 10 minutes
76 "	protein)	
4 "	Dowicide A	
4 "	Dowicide G	
100 "	distilled water	
37 "	Tall oil formula	
5 "	borax	
10 "	ammonia	
207 "	distilled water	

The final product was a very much improved solution over the 12% corn protein plain. pH - 8.78, some viscosity, slight cohesion. Microscopic examination showed small globules and particles from the Tall Oil vehicle.

2. Work with Aratine (Wesco)

Solution of Aratine was attempted. It was discovered that soaking of the protein, careful heating and control of the solvent ammonia, were necessary for a satisfactory solution. Soaking in water was carried out over night, followed by heating the next morning up to 100° F. The addition of ammonia was controlled to give a pH of about 8.0 during the solution. Excess ammonia darkens the solution. Considerable agitation was necessary. The temperature during the agitation ranged from 70° F. to 100° F. The final solution had

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some viscosity, little cohesion, was not entirely smooth in texture.

A test batch of Rem-Tone was prepared using the Aratine as protein base. The product gave the following test results: Viscosity 17" (50% reduction), pH - 8.72. Brushing fair, wet edge fair. General appearance, no body, no cohesion. Wet panel odor strong, not too good. Brush wash in water was poor, in soap, good.

3. Further work on peptizing agents on pigmented protein films.

Two additional test batches were prepared containing two and four times as much sodium hydroxide as used in a former test carried out in September. The wax pick test was applied at the same test intervals. Results showed no improvement in film strength with the increase of sodium hydroxide, peptizing agent. This is contrary to claims made by American Maize for this treatment.

4. Further work on chlorination of casein.

25 gms casein were suspended in 500 cc of a number of slight acid solutions in calibrated graduates. The expansion of the particles in the solutions is recorded below.

	Orig. Vol.	30 Min.	1 Hour	3 Hours
Hydrochloric Acid pH 1.8 1 cc in 500 cc dist. water	2-1/2 oz.	5 oz.	7 oz.	9.5 oz.
Phosphoric Acid pH 2.0 1 cc in 500 cc dist. HoH	2 oz.	7 oz.	10 oz.	11 oz.
Acetic Acid pH 3.25 2 cc in 500 cc dist HoH	2-1/4 oz.	5 oz.	4 oz.	4 oz.
Boric Acid pH 4.2 20 gm in 500 cc dist. HoH	2-1/2 oz.	3 oz.	4 oz.	4 oz.

At the end of 3 hours soaking of particles in the solutions a fairly rapid stream of chlorine gas was passed through the solutions for 30 minutes. The chlorinated particles were then washed with water, filtered, and dried at room temperature. In all cases the treated caseins were soluble in dilute alkali, insoluble in water. Solutions were made to be tested for inherent bacteriostatic powers.

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	pH	Degree Darkness of Solution	pH-24 Hrs. After Inoc.	43 Hrs.	Bacteria Count
Untreated casein control	8.8	Light	8.8	8.7	2000
HCl suspended casein	8.8	Dark 1 (most)	8.45	8.3	1
Phosphoric acid sus. cas.	8.8	Dark 4 (least)	8.5	8.4	5
Acetic acid Susp. casein	8.5	Dark 2	8.65	8.6	72
Boric acid " "	8.8	Dark 3	8.55	8.55	100

5. Deodorization of off-grade casein.

Casein batches and subsequent Kem-Tone were prepared from a casein shipment from Cleveland, which had been wetted in shipping and consequently had discolored and giving an acrid unpleasant odor. Discolored lumps were broken up to some extent; however, there were still some lumps in the prepared casein batches; there were none in the final Kem-Tone. The following casein batches were prepared.

	pH of Product	Bact. Count
a. Casein control using stock casein	9.5	0
b. Control using wetted casein	8.9	0
c. Wetted casein with 2 x wt. sodium perborate replacing borax	9.0	0
d. Wetted casein with 3 x wt. sodium perborate replacing borax	9.5	0

Kem-Tone batches were prepared from the casein batches.

Fresh Odor	Visc. (50%)	Visc. (67%)	pH	Bact. Count
a. Sl. ammonia, sl. pine oil	14"		8.84	0
b. Sl. casein, flat, sl. unnatural	22"		8.78	0
c. Slight peroxide	More than 2'	28"	8.88	0
d. Slight peroxide	" " "	28"	8.92	0

The wetted casein can safely be utilized in the manufacture of Kem-Tone. The use 2 x wt. sodium perborate replacing borax is recommended as the final product gives a more pleasant odor. The addition of sodium perborate in a casein formula creates a considerable increase in viscosity. This should be taken into consideration.

Odor tests are now being carried out.

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D. Bacteriological Work

1. Evaluation of Preservatives

Compound G-4 Pure (Givaudan-Delawanna) 5% casein solution containing the following % preservative were prepared, inoculated, observed for changes in pH, and also plate-counted frequently.

	pH 24 Hrs.	48 Hrs.	96 Hrs.	Count at 96 Hrs.	144 Hrs.
1. .1%	8.9	8.8	8.8	-	8.6
2. .05%	8.9	8.8	8.8	20	8.55
3. .025%	8.85	8.7	8.8	400	8.5
4. .012%	8.88	8.85	8.7	400	8.55
5. .006%	8.9	8.8	8.6	-	8.1
6. .003%	8.9	8.8	8.65	-	-
7. .0015%	8.9	8.8	8.6	-	-
8. .0008%	8.84	8.7	8.6	-	-
9. .0004%	8.8	8.65	8.2	-	-

Comment: The solubility of the above preservative in casein solution was less than the technical grade below.

Compound G-4 Technical powder as above.

	pH 24 Hrs.	48 Hrs.	96 Hrs.	Count at 96 Hrs.	144 Hrs.
1. .1%	8.9	8.8	8.8	30	8.6
2. .05%	8.9	8.8	8.8	400	8.6
3. .025%	8.9	8.9	8.7	25	8.6
4. .012%	8.9	8.8	8.7	1600	8.1
5. .006%	8.9	8.8	8.7	250	-
6. .003%	8.9	8.9	8.75	-	-
7. .0015%	8.88	8.85	8.7	-	-
8. .0008%	8.85	8.85	8.7	-	-
9. .0004%	8.8	8.6	8.1	-	-

Somewhat better results were obtained with the Technical grade due to the greater solubility of the latter in the casein solution. Both grades made good showings inasmuch as those of higher concentrations were still stable in 144 hours.

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2. Odor Tests

Check on Swift casein extenders.

WP 1097	Control	Mfd. 6-21-43	Visc. 36" (12 to 5)	pH 8.4
WP 1099	Extender #2	"	25" (12 to 5)	8.4
WP 1101	" #4	"	25" (12 to 5)	8.4

The extenders replaced the casein in the test batches. The odors in all cases were not putrid during the test period. A slight rancid or oxidized oil odor was prevalent the greater portion of the time. Mold growth developed later in all cartons.

E. Evaluation of Vehicles and Oil Conservation

The following three vehicles were evaluated in Kem-Tone as replacements for V-17093.

	Composition				
	T 624	(520)	(348)	(295)	(2231)*
RA 638-M 1	250	175	50	25	-
RA 638-M 2	245	175	30	25	25
RA 638-M 3	237.5	175	0	25	62.5

*(2231) - 20% solution of Dowicide 6.

Results of Tests.

	Brushing	Emulsion Stability	Settling	5	14	30
				Wash Test		
RA 638-M 1	V. good	OK	V. slight	100	86	165
RA 638-M 2	V. good	OK	None	89	87	108
RA 638-M 3	V. good	OK	None	100	100	150

The following vehicles, produced from Tall Oil by the Resin Research Department were evaluated in Kem-Tone.

RA 656-M 21 Contains a Tall Oil amide.
RA 656-M 22 " " Tall Oil-Phosphoric Acid Product
RA 656-M 23 " " Tall Oil amide.
RA 656-M 24 " " Tall Oil amide product.

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Cont.

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Results of Tests.

	Viscosity	Brushing	Emulsion Stability	Settling	Wash Test 5	14	30
V 17093	38"	Good	Good	V. slight	100	86	165
RA 656 M-21	25	Good	V. good	None	115	140	180
RA 656 M-22	45	Excel.	Good	None	77	100	200
RA 656 M-23	74	V. good	V. good	None	110	98	160
RA 656 M-24	16	Fair	Fair	None	155	215	280

The following vehicle, V 17108, is similar to V 17093, except that the tall oil is partially esterified.

	Viscosity	Brushing	Emulsion Stability	Settling	Wash Test 5	14	30
V 17093	94	Excel.	Good	Slight	127	226	180
V 17108	19	Good	Poor	Cons.	195	187	230

F. Resin Emulsion Gloss Paint Developments

Formulative work is progressing on selection of the proper pigments to use for the production of the most full development of gloss in the final film.

One system has been temporarily selected for pigmentation, and a variety of vehicles are now being used to note their influence in combination with the standard pigment.

Drying of the final film after application is now under study, and at present drying is far from satisfactory. There have been some encouraging results in the past in regard to this problem, but a considerable amount of work must be done. Alkyds seem to give better drying characteristics when the emulsion breaks than the ester gum vehicles first used, but the alkyds seem to show poor gloss as compared with ester gum vehicles.

Emulsion characteristics have been improved noticeably with one of a series of commercially available emulsifying agents, and it is planned to test a series of similar materials in varying concentrations to note the effect upon brushing, washing of the dry film, and stability upon aging.

In a recent test a laboratory formulation was applied with a five inch brush without undue hardship in application. It is decidedly easier to apply as to pull on the brush than conventional enamels, but not as free as Kem-Tone.

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Inasmuch as there are other approaches to the problem of a semi-gloss water thinned paint than the one above, work has been started on other means to the end in view.

G. Kem-Tone High Dry Hiding Developments

Development work is under way on the formulation of a Kem-Tone which will have a lower amount of prime pigment per gallon than standard, yet when dry, the film will have approximately the same covering power as the standard.

The following chart is a comparison of the two types of formulations:

Standard Kem-Tone	Base A		Base B	
	Pounds	Hiding Units	Pounds	Hiding Units
Lithopone	400	10,800	400	10,800
Titanium	110	13,770	100	12,500
		24,570		24,300
High Hiding Type				
Lithopone	400	10,800	400	10,800
Titanium	55	6,880	45	5,630
		17,680		16,430

These formulas actually will show very close to the same degree of dry hiding when tested over Morest sheets. This saving in titanium dioxide is accomplished by increasing the pigment volume from 20 gallons - now standard - to 25 gallons proposed. This is an increase of 25% over the standard product. By such alteration a titanium savings will vary between 10 and 30%.

The vehicle used will be appreciably lowered in tall oil content and increased in the amount of bodied oils present. This will compensate for the increased amount of pigment to some extent. Further work is under way on these formulations.

H. Kem-Tone Quality Control

Examination of Kem-Tone production from the various Kem-Tone plants continues.

Batch samples received are tested for weight per gallon, pH, viscosity, shade, washability, odor, brushing properties, and emulsion stability.

Following are the number of samples received and tested during the past month:

Emulsion Research Department
Cont.

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Plant	Samples Tested
Chicago	306
Cleveland	53
Newark	50
Detroit	26
Oakland	17

Supplementary to the laboratory tests, 8 room tests were completed.

#155 - Wall Paper Evaluation

(a) Samples of Style Perfect wall paper submitted by United Wall Paper Company are being received daily.

The wall paper is tested for washability, fade resistance, adhesion, brittleness and design flaws.

Results indicate that United are continuing to maintain the quality of the wall paper at a high standard.

(b) Samples of Kem-Tone Trims are also being checked quite frequently. The latest shipments of samples show considerable improvement over last month's production.

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No work was done during the month on the following projects:

#170 - Army-Navy Specification Work

#174 - Oleorosinous Wrinkle Varnishes

#175 - Blackout and Camouflage Paints

M. VAN LOO
Cont.

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1. At a 2 to 4-hour drying time of the film before testing, and with petroleum ether as a solvent, a rapid percolation-reflux method will give fully as dependable results as the time-consuming Soxhlet extraction.

2. A rough average of all compatible results shows that somewhat less oil is absorbed by fine-grain cedar siding from "neutralized" oil paint than from Box 450.

3. Two of the most stubborn problems have been:

   (a) Error due to incomplete loss of solvent from the semi-dried film.

   (b) Error due to the taking up of colloidalized "fines" from the pigment (also possibly lead and zinc soaps) by the solvent.

4. Current trials should show whether or not these sources of error can be eliminated within the practical limits of importance of the problem.

7177 - Pigment Studies

Panels 7380-7 Cof. and F were placed on exposure during the month covering the special lots of treated Canadian fume leaded zinc described in the September report. The paints were made on the SWP tint base formula, card #25 which calls for 1526 dry. The replacement was on the basis of equal zinc oxide content, adjusting with basic lead carbonate. The paints were tinted to match SWP 462 Cream and SWP 365 Slate, painted over 450 Undercoater, and exposed at Coffeyville and Florida.

Panels 7078-83 B, exposed vertically both south and north at Chicago, were discontinued after 22 weeks (summer and fall) exposure. This series was designed as a special accelerated exterior exposure test to evaluate the chalking tendencies of various titanium oxides when used in house paints. The pigmentation consisted of one part TiO_2 to two parts of magnesium silicate, with the binder essentially 50/50 raw linseed/bodied linseed by volume. The pigment-volume-concentration was 49% to accentuate chalking. The paints were applied over SWP 450 Undercoater.

The paints showed cracking and erosion in less than two months, both south and north, and very bad cracking and erosion at 22 weeks. Ratings at one week intervals from the start of the exposure indicate the following order in decreasing chalking and increasing dirt collection: Titanox A, Ti-Pure R 200, Titanox RA-10-HO, Titanox RA-10-LO, Titanox AA, and Unitane R-250. The last two were the only ones to accumulate more than a moderate amount of dirt on the south exposure before chalking and cleaning started.

M. VAN LOO
Cont.

#177 - Mildew Inhibitors

Panels 6245-8 F were examined after 18 months' exposure in Florida. These panels compare S-W's Mildew Resistant Treated Undercoator - Gloss White system with a stock sample of Cook's M. R. White and two of our laboratory reproductions of Cook's formula. These panels were of considerable interest in August, 1942, when they showed the SWP Mildew Resistant Treated Gloss White to be seriously discolored (yellowish) at four months, but no mildew, while Cook's showed heavy infestation of mildew.

At 18 months the situation is more or less reversed, with Cook's stock sample having the best appearance in the series, very white, and with only moderate mildew, while the SWP Mildew Resistant Treated Gloss White is now definitely grayish and seriously mildewed. The laboratory batches of Cook's paints show good whiteness but have almost as much mildew as the SWP guide. The Cook paints are definitely inferior in durability as regards checking, cracking, and early erosion.

The reversal of appearance apparently took place at about 12 to 14 months' exposure in Florida. Chicago exposures still show no differences worthy of note. Further work must be done.

#160 - Painting of Bricks

An examination was made of a series of stucco and concrete paints applied approximately four years ago on the south brick and cement wall on Building 510 of the Kensington plant. The paints include S-W Brick and Stucco Paint Rex 15526, SWP 450 Undercoater, and a number of resin emulsion paints, including Rezicote White #500, Cook's Resin Emulsion Paint, and New England Whiting Resin Paint. Several other brick and cement coatings were also applied, such as S-W Bonding Cement, Medusa Portland Cement, Chlorinated Rubber Primer OJ 152 C, etc., as outlined below.

The S-W Brick and Stucco Paint was in fairly good condition on all tests regardless of the reduction used. The only surfaces showing any flaking and peeling were those directly under the windows, where the rain washes down concentrated chemicals. No differences in durability were noted due to various percentages of oil added to the first and second coats of Brick and Stucco Paint.

SWP 450 Undercoator shows more cracking and peeling when used under Brick and Stucco Paint than the latter self-primed. Chlorinated Rubber Primer OJ 152 C appears to be the best primer from the durability standpoint, although there was some localized peeling on the concrete. From our experience with this primer on cement asbestos shingles we know this peeling would have been eliminated if a durable finish coat such as SWP or Brick and Stucco Paint had been used. All resin emulsion paints used in the test showed bad failure after four years' exposure.

The details of the examination follow:

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Cont.

#102 - Studies in Flat Wall Paint Formulation

Flat Wall Paints

Considerable time was spent on the development of a rutile titanium calcium pigmentation for Flat-Tone which would have reasonable control of "ghosting" and adequate washability, such as previously characterized the lithopone-zinc sulphide formulation. The prime purpose was to eliminate the zinc sulphide and reduce raw material cost.

A number of tests were run using as the prime vehicle V 11152 Limed Bodied Oil Reduced, in which the lime content was reduced to improve the washability. Variations ran from 110% to 70% of the lime theoretically required. The results did not show any advantage in washability due to lower percentages of lime soaps.

Robertson of Titanium Pigment Corporation stated that by far the most important factor in controlling "ghosting" was the acidity of the binder, which must be reduced below a certain minimum to control penetration. To check this point, a number of tests were run using the very low acid vacuum bodied linseed oil ORO 37 in conjunction with solutions of the neutral Velsicol and Piccolyte resins as the vehicle for pigmentation with rutile titanium calcium. In spite of the low acidity of the vehicle, the tinted paints showed definite "ghosting" on a 10 minute lap.

The Varnish Research Division developed a 40 gallon Dehydrol ester gum varnish ARV 5238 or V 11161 which is showing considerable promise as a flat wall paint vehicle for use with rutile titanium calcium. V 11161 is far superior to V 11152 in washability as well as "ghosting," and brings the performance of the rutile titanium calcium pigmentation up to that of the earlier lithopone-zinc sulphide combination. Formulations for Flat-Tone White and tint base have been submitted to Cleveland for approval.

Based on the above work, a new formula was developed for Paintercraft Flat #10, using V 11161. The pigmentation was changed from anatase to rutile titanium calcium, maintaining the same hiding. The new formula is equivalent in quality and performance with a saving of 4-3/4¢ per gallon in raw material cost as compared with the regular formula of 4-28-42, as shown by the following:

	Hiding	Vehicle Solids	R. M. Costs
Flex 65610 4-28-42	21,000 units	42.6%	$84.12
Flex 65610 Proposed - OJ 964 G	21,000 "	38.6%	79.30

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Semi-Lustre

Experimental formulas for Semi-Lustre white and tints, utilizing (3848)E P. E. Rosin linseed varnish, were developed and tested against standard formulations. (3848)E seems to give semi-gloss wall paints equivalent in quality to the standard products which used (3173), a maleic P. E. rosin linseed vehicle. Costs are slightly higher.

Substitute pigment combinations to conserve TiO_2 and titanium calcium were also checked in Semi-Lustre formulations. Substantial quantities of lithopone can be used satisfactorily with titanium calcium, and a combination of lithopone and titanium barium equal to the standard pigmentation for opacity, is also feasible. While these substitutions can be made with no sacrifice in quality, the costs per gallon are increased considerably.

The newly developed 40 gallon ester gum Dehydrol varnish V 11161 was tried out in Semi-Lustre. Results to date are not encouraging due to the high viscosity at low solids of this vehicle.

Enameloid

A sample of Cook's V 1055, a P. E. rosin Dehydrol variation of (3848)E was evaluated and found to be a satisfactory enamel vehicle. It gave an enamel very close in most respects to one made with regular (3848)E. Tack-free drying was slightly faster but hardness as measured by the Sward Rocker was somewhat lower for the Dehydrol vehicle. Water and soap resistance were about equal. Package stability over a three week period was good for both. The Dehydrol varnish showed less embrittlement in a film aged for 56 days than did the corresponding linseed regular (3848)E.

The comparative evaluation of typical Enameloid formulas from 1938 to date, mentioned in the October report, has now been completed. Exposure panels described there are now on test in Florida. Extracts from a separate report prepared from the data accumulated follows:

"Enamel Evaluation
November 30, 1945

1. General Statement

Raw material shortages and government restrictions have forced us to make many changes in the composition of our various Trade Sales products. It is a matter of speculation as to what extent the quality of our merchandise has been affected by these changes in formulation. It is also a matter of some concern as to how our present materials compare with competitive products.

This evaluation is an attempt to answer the above questions with respect to the quick drying household enamel line.

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2. Conclusions

White Enamels

(a) Present day production of Enameloid White using a P. E. Rosin Linseed or a Piccolyte-Polypale Linseed vehicle is only slightly inferior to the best we have ever made. The brightness, or "whiteness" is not as good as that obtained when alkyds were used and the drying is somewhat slower. However, the color is superior to the earlier formula with the phenolic-wood oil vehicle. Film embrittlement is more rapid, but adhesion is better than when the alkyd was used.

(b) Our current Enameloid White is superior to the Pittsburgh and Sears Roebuck products and on a par with du Pont's and Devoe's. It is somewhat inferior to Nu Enamel White, a premium priced material. (This product is outstanding in opacity.)

Tinted Enamels

(a) Current production of Enameloid Ivory is slightly inferior to former production when modified phenolic resins and tung oil were available. The drop in quality is principally in lowered hot water resistance and in soap or alkali resistance. In other respects quality has been maintained quite well and in some cases improved. Better brushing, longer wet edge and freedom from skinning in partially filled containers are characteristic of present day production.

(b) Enameloid Ivory is on a par with the du Pont and Pittsburgh products and superior to those of Nu Enamel and Sears Roebuck. It seems slightly inferior to the particular Devoe tints which were tested. (The label analyses of these samples of "Honey" color indicate that they may be old stock. One analysis shows "alkyd" resin and the other "phenolic" resin in the vehicle.)

The Performance Rating charts which follow, may be of interest. The relative importance assigned to each quality in drawing up these ratings is arbitrary and very much open to criticism. We do believe, however, that the final averages pick out the best and poorest enamels and indicate those which are approximately equivalent in quality.

3. Selection of Enamels for Test

Formulas for Enameloid White and Enameloid Tints ("Ivory" was used as being typical) were carefully reviewed and for purposes of this evaluation it was decided to go back to enamels containing a wood oil-modified phenolic resin vehicle as the starting point. Laboratory batches of these formulas, and of subsequent revisions, were ground out and used in our tests. Samples of competitive products were purchased from regular retail agencies in Chicago. They were as follows:

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Cont.

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du Pont's "Duco" White Enamel "War Emergency"
du Pont's "Duco" Ivory Enamel "War Emergency"
Devoe and Raynolds "Mirrolac" White
Devoe and Raynolds "Mirrolac" Honey (Ivory not available)
Devoe and Raynolds "Mirrolac" Honey (N)
Sears Roebuck and Co. Master-Mixed "4-Hour Enamel" White
Sears Roebuck and Co. Master-Mixed "4-Hour Enamel"Ivory
Nu Enamel Co. "Nu-Enamel" White
Nu Enamel Co. "Nu-Enamel" Ivory
Pittsburgh Plate Glass Co. "Waterspar" Enamel White
Pittsburgh Plate Glass Co. "Waterspar" Enamel Old Ivory

4. Tests

The enamels were judged for:

(a) Drying, hardness and print resistance.
(b) Water resistance.
(c) Soap resistance.
(d) Brushing properties.
(e) Opacity.
(f) Film embrittlement.
(g) Brightness (in case of White Enamels).

Competitive enamels were not penalized for excessive settling in container. We have no way of knowing how long these materials had been in storage. Poor grinds were also overlooked (as in the case of one of Devoe's tints). We do not believe this is generally characteristic of the enamel."

Panels were attached to the report showing results of cold water and boiling water tests, and soap tests, and 0.005" draw-downs on Morest charts to show relative opacities were also included. Tables showing detailed results follow:

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Cont.

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Porch and Deck Paints

Panels 7602-31 C and F were placed on exposure at Chicago and Florida covering the various Porch and Deck paints described in the October report. This series further evaluates the exterior exposure value of a series of varnishes paralleling the Enameloid series, including both leaded zinc and rutile titanium calcium formulations.

#103 - Metal Protective Paints

Ferrous Ammonium Phosphate

In the October report, results of tests using Ferrous Ammonium Phosphate in the Bureau of Ships 52-P-18 primer were described. In that work, Ferrous Ammonium Phosphate was substituted for 30% of the zinc chromate volume. A similar series of tests has been run on the Maritime Commission's 52-MC-29 (Tent.) primer. In this second series Ferrous Ammonium Phosphate again replaced 30% of the zinc chromate by volume. One exception is a paint in which Ferrous Ammonium Phosphate was substituted for the entire zinc chromate volume normally contained.

In these tests the Ferrous Ammonium Phosphate acted much like a mica. The film appeared quite porous and the material had practically no rust inhibitive properties by itself. A panel painted with the paint containing the 100% substitution of the Ferrous Ammonium Phosphate for the zinc chromate showed all-over rusting after 24 hours in distilled water, whereas those paints containing zinc chromate are showing no rusting in distilled water after 12 days' immersion.

In the salt water immersion tests of the 52-MC-29 (Tent.) primers no preference could be shown for the paints containing Ferrous Ammonium Phosphate. There was some indication that the test material was somewhat less resistant to corrosion than the standard formula. This is counter to the results reported in October when testing in the 52-P-18 formulation. Salt spray tests on the 52-MC-29 (Tent.) have not progressed to a significant point.

Iron Oxide-Zinc Chromate-Magnesium Silicate Tests

In the report for August the results of salt spray tests on this ladder series were described and conclusions drawn regarding the merits of iron oxide versus magnesium silicate, and the optimum zinc chromate concentration for economy and protection. This series has now been repeated under more carefully controlled conditions and have removed the anomalies within the set which discredited the earlier work. The conclusions from this repeat set are similar to those in August, namely:

EMULSION RESEARCH DEPARTMENT

#161 - Emulsion Binder Paints

A - Gloss Resin Emulsion Paints

The work of the last month on the above topic has been toward the improvement of gloss and the development of washability. Successful washability so far has been achieved with marked success, but at a sacrifice of gloss and color.

Through the great variety of formulas made we have been able to find some oleoresinous vehicles that give some promise of washability of themselves. We have found that certain of these vehicles also have gloss high enough to be considered for a full gloss line. By blending them with alkyd varnishes greater washability has been obtained, but at a sacrifice in gloss into a low semi-lustre range.

We have also found that certain highly colored catalytic materials greatly aid in washability, but are objectionable on color grounds.

Variation in the method and materials of manufacture of the protective colloid also show a wide variation in results on drying and consequent washability. Test batches indicate that washability far superior to Kem-Tone may be anticipated in low gloss per mil semi-lustres. (Note: All formulations have a high full-gloss angular sheen.)

As yet there has been only cursory examination of available emulsifying agents, but it also has been shown that they have a very pronounced influence on the formulation in regard to many important physical characteristics such as gloss, washability of the brush, washability of the paint film, application characteristics, and the package stability of the product.

A series of shading bases have been made and are being tested in semi-gloss formulas to observe the effect of aging upon the gloss of shaded materials. Age effects are of extreme importance and attention must be given this detail.

Another approach to the problem of semi-gloss emulsion paint has been started with the background of the work on T-1279 serving as base experience. Initial results showed poor washability also, but results on new wash test panels show great promise.

These materials, too, have high angular sheen, but low specular reflection.

B - Outside Kem-Tone

The nine formulations developed for outside exposure were painted out for wash tests and now have completed all wash tests. While we make no claim that wash tests are directly related to outside durability, such tests

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introduce some of the effects of weather through the erosive character of the cloth against the panel, and the thorough saturation of the surface with water - even more than in a rain. Inasmuch as wash tests can be completed in a relatively short time they are the first tests to indicate the general direction formulations should take for greatest outside durability.

A new factor has been developed to indicate in a single figure the quality of a formula in regard to washability. We know from the great number of wash tests in the past, that the best products continue to develop in washability with time due to a progressive drying of the oil and the consequent effect of the drying oil or its by-products upon the casein in rendering the casein more insoluble.

Therefore we have proposed the weighted value called "The Wash Index Number" which results from the average number obtained from the "break" at five days plus two times the value at fourteen days plus four times the value at thirty days. Thus, in a single value we have an index to the quality of the tested material as to its washability, and in some degree its general durability.

The nine formulations above mentioned showed the following "Wash Index Numbers."

Number	Wash Index Number
WP 1260	296
WP 1261	193
WP 1262	111
WP 1263	150
WP 1264	351
WP 1265	182
WP 1266	212
WP 1267	104
WP 1268	210

Averaging these wash index numbers we arrive at a value of 205, and if we pick 23 production batches of Ken-Tone at random and figure the average wash index number we arrive at a value of 134. This is an indication that we may expect greater durability than from regular Ken-Tone formulations, with our outside developments. Further, selecting the most promising of these formulas, and by a study of their compositions as compared with those of lesser quality, a rather clear direction seems indicated toward a generally tighter type of film - i.e., a higher concentration of oleoresinous phase and a lower pigment concentration.

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Also, the general trend of the vehicle is narrowed down to that of either an alkyd vehicle or possibly a very long heated bodied vehicle may be of promise.

Formulations made with (320) show a tendency to yellow on outside exposure, but otherwise seem promising. Castor oil (113) dries too slowly to show up well in wash tests, but may develop on outside exposure into a promising component of the vehicle.

A glycerine-neofat-phthalic alkyd showed the best wash tests of all the alkyds used. It remains to be found whether a high or low resin percentage is the most effective type alkyd vehicle to use for exteriors.

We have received a letter from Mr. G. G. Hohmann, that the gallon samples submitted for California exposure have been applied on suitable test buildings October 21. It is anticipated that a considerable passing of time will be necessary to show failure of any of these materials, so until some definite results develop from our outside exposures we will have to proceed with newer formulas based upon results of wash index numbers.

We have also painted a series of cement shingles which were first aged on the side of a residence for several years in comparison with some that have never been exposed to the weather. Inasmuch as there is a large market for painting and repainting these shingles, and because they are alkaline in nature, greater durability can be expected from resin emulsion paints than present conventional formulations. Reports will be made of this development also from time to time.

(See also the paragraph under gloss resin emulsion developments in relation to painting exteriors of domestic frame residences.)

C - Wetting Agents

Further work on conductivities of wetting agents. Five wetting agents with varying degrees of conductivity were selected and used in making test batches of Kem-Tone to determine differences, if any, in the final product.

Wetting Agents and Properties of .1% Solution

Control		pH	R/Ohms
WP 1379	Nacconol (CP 935)	8.15	3570
WP 1380	Active 16.8% (CP 935)	5.7	1470
WP 1381	Active 31% (CP 935)	9.1	2820
WP 1382	Active 51.5%	8.6	4100
WP 1383	Santomerse #3	6.4	5400

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Water Paint

	Wetting Agent Used	Visc. 50%	pH	Brush-ing	Edge	Brush Wash	R/Ohms 16.2% Soln.	1% Soln.
Control								
WP 1379	.43%	28"	8.67	Sl.drag	Fair	Good	930	11100
WP 1380	.82%	40"	8.7	V.good	"	"	880	10700
WP 1381	.43%	45"	8.71	V.good	"	"	1100	12100
WP 1382	.26%	40"	8.72	Good	"	V. good	990	11900
WP 1383	.43%	49"	8.72	V. good	Good	V. good	950	10800

The commercial wetting agents Nacconol and Santomerse #5 are superior to those prepared by us (CP 935) in that they contain less impurities in the form of electrolytes as shown by the direct resistance reading of a .1% solution. However, the Kem-Tones prepared did not show any appreciable difference. We believe this due to the use of the tall oil vehicle, which because of its high acid value reacts with any residual alkali forming soaps which have an additive wetting function. The value of high resistance wetting agents would be more prominent when used with a more neutral vehicle.

D - Casein and Casein Substitutes

1. Casein

(a) Dispersion in water containing Keltex, Anti-foam, and Dowicide A, gave a paste consistency. Dispersion itself was good, but there was cohesion. pH 5.52.

(b) With dispersing agent, sodium perborate, the results were only fair. Gelatinous particles were still present after the usual agitation. There was little foaming on addition of the perborate. The final pH was 8.7. The cold dispersion showed good cohesion, although not equal to the usual BX 666 formula. Continued heating would have produced a better dispersed casein. The perborate has proved very successful in dispersing alpha-protein.

(c) Lactic casein smells less of zoo than hydrochloric or acetic-precipitated casein.

2. Corn protein

It has been observed that sodium perborate replacing borax in casein dispersions increases the viscosity of the solution. Perborate was tried out with corn protein which ordinarily makes a rather fluid solution.

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(a) Corn protein with perborate 11% and ammonia 18.5% on the weight of the protein gave a very fluid solution, dispersion fair, pH 9.85.

(b) With 22% perborate and 18.5% ammonia based as above, the dispersion was better, viscosity considerably higher, pH 9.6.

(c) In comparison borax 22% with 18.5% ammonia gave a better dispersion yet with equal viscosity. pH 9.85.

Conclusion: Sodium perborate did not have as great an effect on the viscosity of corn protein solutions than did borax.

3. S-Protyn-AN, a new corn protein product.

(a) Two attempts were made to disperse S-Protyn-AN in the formula BX 664 replacing corn protein. In both cases dispersion was incomplete after agitating and heating at 170° F. for one hour after the addition of the solvent. A very dark solution resulted at the addition of sufficient ammonia to maintain the pH at 9.0. S-Protyn-AN required more water than corn protein, however, made a more viscous solution with good cohesion. A Kem-Tone batch prepared with the above solution replacing BX 664 corn protein formula gave excellent results.

4. A.D.M. Special Soya Protein obtained from Cook

(a) Dispersion was attempted on a formula similar to BX 664 containing borax and anti-foam. There was considerable foaming. Results were poor after heating an hour at 110° F. A considerable amount of additional water was required to make a workable mixture.

5. Alpha-protein

Alpha protein can be dispersed very well with the use of borax as solvent at a temperature of 160° F. Four variations in formulas were compared.

(a) 12.6% protein, linseed oil and driers, Keltex. The solution was quite viscous and cohesive when warm, on cooling became rubbery. pH 8.23.

(b) 11.6% protein, tall oil, Keltex. pH 7.6. Results as above.

(c) 12.8% protein, as (b), no Keltex. pH 7.6. Results were about the same as the other two, but showed a slight improvement when cooled, being less rubbery, more fluid.

(d) 12.8% protein as (c) but dispersed with sodium perborate. This solution showed the best results, being more fluid when warm, and of good consistency when cooled. pH 7.75

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Ken-Tone batches were prepared using the above solutions replacing BX 664.

	pH	Visc. (50%)	Brushing	Wet edge	Brush Wash	Washability 5 Days-250 Rubs
WP 1386 Cont. with BX 664	8.6	22"	V.good	Good	(Water: sl. haze (Soap: V. good	Break: 103 rubs
WP 1387 Solution No. 1	8.2	48"	Good	Good	Water: V. good	" : 62 "
WP 1388 " " 2	8.2	67"	Good; v. sl. drag	Good	Water: V. good	" : 32 "
WP 1389 " " 3	8.2	22"	V.good	Good	Water: V. good	" : 74 "
WP 1390 " " 4	8.3	35"	V.good	Good	Water: V. good	" : 50 "

Sodium perborate and ammonia with alpha-protein does not increase viscosity as with casein. Dispersion was poor. pH 9.9.

6. Aratine (Wesco)

Sodium perborate and ammonia did not increase viscosity. The product resembled flour paste, dispersion poor, pH 9.01.

7. Chlorinated Casein

As reported last month a series of casein samples chlorinated in various suspending media showed promising results in a bacteriostatic study. Three of the samples were determined for their chlorine content, as tabulated below. As assumed, the bacteriostatic effect of the treated casein was in direct proportion to their chlorine content.

Suspending Media	Chlorine Content	Bact. Count
a. Hydrochloric Acid 1:500 dist. H_2O	4.63%	1
b. Phosphoric Acid 1:500 dist. H_2O	1.83%	5
c. Acetic Acid 2:500 dist. H_2O	.3%	72
d. Boric Acid 20:500 dist. H_2O	-	100
Blank: untreated casein	0%	2000

8. Evaluation of Off-Grade Casein

Casein batches prepared from off-grade casein:

	1st Day Odor	30th Day
a. Casein control using stock casein	Sl. pine	Sl. casein
b. Control using wetted casein	Sl. pine, sl. flat	Sl. pine

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	1st Day Odor	30th Day
c. Wetted casein with 2 x wt. sod. perborate replacing borax	Sl. pine, sl. peroxide; better than (b).	Sl. pine, sl. glue
d. Wetted casein with 3 x wt. sod. perborate replacing borax	Sl. casein, sl. peroxide	Sl. glue

Results were favorable in all cases.

Ken-Tone batches prepared with off-grade casein batches (above):

a. Control with stock casein batch
b. Control with wetted casein batch
c. Wetted casein with 2 x sod. perborate
d. " " " 3 x " "

	1st Day Odor	30th Day	Mold Growth 30th Day
a.	Sl. oxidized oil	Sl. oxidized oil, sl. moldy	Slight to none
b.	V. sl. oxid. oil	Sl. oxidized oil, moldy	V. sl. to slight
c.	Sl. oxid.	Sl. moldy	Numerous to sl.
d.	Sl. oxid.	Sl. oxid.	None to v. sl.

Results showed a tendency toward a slight oxidized oil and a moldy odor. Both odors would not be prevalent in a room as compared with the above carton test due to a greater exposure to air. The mold growth at 30 days is no indication that the same will happen in a room. Variations in the surface to be painted and moisture in the general atmosphere will show different results.

E - Evaluation of Preservatives

Moldicide showed poor results as a possible preservative for Ken-Tone. 0.1% in 5% casein solution did not prevent putrefaction within a 24 hour period.

F - Other Ken-Tone Raw Materials

Electrolyte impurities in shading bases.

An examination was made of the following shading bases used in Ken-Tone in 1% solutions.

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	pH	R/ohms
BX 26 green	7.6	62,000
BX 650 black	6.76	39,000
BX 674 Alizarine lake	5.7	42,000
BX 951 yellow iron oxide	5.32	57,000
BX 953 " " "	6.4	67,500
BX 957 blue	6.65	4,960
BX 958 red iron oxide	6.2	175,000
214 red iron oxide powder	5.7	51,300
CP 558 blue powder	5.7	240,000
CW 1853 Base SF yellow iron oxide	5.5	153,000
D 2681 Hansa yellow	5.75	70,000
Distilled water	7.0	300,000*

The resistances of the solutions ran very high, indicating a presence of a minute content of electrolytic impurities.

G - New Colors

1. Turquoise, Cameo Rose

A satisfactory formulation for two of the new shades, Turquoise and Cameo Rose, has been worked out using one pound of anatase titanium dioxide and one pound of barium titanox per gallon of paint. These colors contain 0.82 lb. of linseed oil per gallon of paint. Emulsion stability, uniformity of appearance, working properties, hiding power, and washability are excellent. Midland Green, and Avalon Blue will also be made on this formula. An alternate formula containing no barium titanox, and requiring 1.4 pounds of anatase titanium dioxide per gallon has also worked out.

2. Montrose Coral, Aqua, Stratford Green

The above three colors were somewhat more of a problem than the Turquoise and Cameo Rose. A satisfactory formula has been developed, which gives a very uniform film in two coats at all times, and a satisfactory one coat job about half the time. At present, this formulation is very much lacking in washability. We are working toward the improvement of this property.

The above three colors require 1.5 pounds of rutile titanium per gallon of paint. The inert pigments consist of 1.5 pounds of Celite and 2.0 pounds of talc. 0.82 pounds of oil are used. We have evaluated a series of materials as substitutes for our regular talc in this formulation. Pyrax HP proved to be satisfactory and soapstone proved to be outstanding. The paint made with soapstone showed improvement in emulsion stability and uniformity of appearance over the paint made with our regular talc.

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The manufacture of the three deepest colors is a more difficult job than the manufacture of the other colors. Because of the small amount of soap present in the formula, extreme care must be taken in the preparation of the protein and casein solutions so that their maximum value as protective colloids is obtained.

Several production batches have been produced on this formula with very good results. However, both raw materials and manufacturing procedure must be carefully watched.

Inasmuch as all seven of the intermediate and deep colors require considerably more oil than the light colors now being produced on a tall oil formulation, tests have been started in which various amounts of linseed oil have been replaced with Dehydrol.

H - High Dry Hiding Formula

A satisfactory high dry hiding type of formula has been developed for the light colors, which requires 0.5 pounds of rutile titanium dioxide, 1.0 pounds of barium titanox, and 3.0 pounds of lithopone per gallon of paint. Hiding power tests show this paint to equal the present light tint formula in dry hiding. This formula requires the use of 0.82 pounds of linseed oil per gallon of paint. Work on the substitution of Dehydrol for linseed oil is in progress.

Kem-Tone Quality Control

During the past month 390 plant batches of Kem-Tone were checked for pH, weight per gallon, viscosity, shade, emulsion stability, and application characteristics.

With the exception of a small percentage of batches which were characterized by high application viscosity, which detracts from the hiding power of the paint, the production was uniform in character.

In addition to the above work, two room tests were made on the new deep colors to check color uniformity.

Specialties

Spachtling Compounds

We have formulated 38 variations of a spachtling compound having the following general formula:

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Grams	Material No.	Name
500	45	Gypsum
10-100	2077	Clay
20-75	2198	Celite
140-225	1779 or Mica #160	Mica
100	523	Dextrine
0-80	Metso	Sodium Meta Silicate
1-10	1715	Dowicide A
250-375	(12)W	Water

By such a series we plan to determine the relative effect of each component upon the general formula. Such observation will ultimately result in determining a ratio of components having the most favorable qualities for application and convenience in use. The sought for qualities are:

1. Plasticity
2. Drying ability
3. Workability
   (a) Without bulging
   (b) Without pulling and flaking
4. Hardness
5. Low shrinkage
6. Light color

This outline serves as a guide so that observations of resultant quality can be correlated with the variations in composition. Those changes that realize the greatest improvement toward attaining the quality of the outline can then be adapted to the spachtling compound formula.

1. Plasticity

This quality is mainly controlled by Celite, clay, and water. The optimum proportion of the three is to be determined with respect to other qualities, such as shrinking and drying.

An increase in clay content improves the plasticity of the mass, and lowers proportionally the amount of water necessary. The pounds of clay that may be added are limited, since clay lengthens the period of time required for thorough drying. About 3% clay appears to be the maximum which can be added to the compound without hampering results. The ability of clay to aid plasticity was tested against trial batches containing 1 and 2% Bentonite clay (144l dry) respectively. Equivalent plasticity resulted with a batch containing 6 - 8% regular clay. This comparison proved regular clay to be better for our purpose, as Bentonite has the disadvantage of shrinking out of proportion to its per cent concentration.

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Spachtling Compounds - Cont.

The effectiveness of clay is counterbalanced by Celite. Celite shortens the batch, or in other words, it decreases plasticity. An additional proportion of water is consequently necessary to bring back plasticity. A batch prepared without clay and containing 10% Celite was too stiff for practical use, but in over night drying tests showed improved shrinking and drying characteristics.

By varying the proportion of clay to Celite, we can adjust plasticity, but with respect to the other properties desired, the ratio seems constant. Batches containing 1 - 2% clay and 3 - 5% Celite were generally the most favorable in quality.

2. Drying Characteristics

The rate of evaporation of water from the pigments depends upon at least three factors:

(a) Exposed surface area/gram mass.
(b) Porosity of mass.
(c) Water absorption characteristics of material.

We are aware that a large ratio of surface area per gram mass will aid rapid drying. On this account, the rate of drying differs with the depth of the crack filled. The average mix will show toughness within two hours for small cracks, 6 - 12 hours for cracks 1/2" wide and 1/4" deep, and 36 - 48 hours for a large fault 1/2" deep having a 1-1/2" diameter. In addition, the rate at which the water will come to the surface through the body of the mass depends upon the porosity of the material and the water absorptive capacity of the components.

Observation has revealed that regardless of percentage range of a batch, the ratio of two parts clay to three parts Celite will give the shortest drying period. Reason for this phenomenon is not evident, but it is theorized that the optimum porosity is reached at this ratio. The clay particles are distributed over a large porous surface and prevented from aggregation, thus increasing the total drying surface.

In addition, it has been found that Metso, sodium meta silicate, in concentration as low as 1/2% will noticeably increase the drying period of the patch. Because of its effect on drying, the use of Metso was discontinued.

3. Workability

The ease of application by knife is the test used to determine the workable properties of the compound. A stiff formulation, one without plasticity, requires more energy to work the compound in order to overcome excessive internal friction, while some plastic compounds require additional attention

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Spachtling Compounds - Cont.

because of other properties. In short, stiffness hinders workability, yet plasticity is not synonymous with good working qualities. By studying the effect of mica on the spachtling compound, we have corrected many of these difficulties. Mica is favorable toward working qualities when present in quantity around 14%. Lower percentages increase undesirable clay-like characteristics of the batch, while higher percentages create bulging. As bulging, pulling, and flaking are eliminated from the compound, workability can be considered at its best.

(a) Bulging of Patch

Normally, as a knife is pulled across the surface of a freshly filled plaster crack, a flat surface will result. When bulging occurs, the plastic patch will lift upward, producing a bulge which follows the knife as the pressure moves forward. This bulge remains, making it difficult to remove excess paste or to produce a level surface in the cracked area.

(b) Pulling and Flaking

The cause for "pulling" has not been clarified, and further study is necessary before we can obtain definite control over this effect and reduce it. Pulling may be described as the effect which causes the paste to pull away from the edge of the hole as the knife is worked over the surface of the patch. It is interesting to note that many formulations were free of pulling.

Flaking may be described as a rough, broken appearance occurring when the knife is drawn along the surface of the paste. Generally, this effect can be attributed to a deficiency in the water requirement. Care must be taken not to add excess water, since the compound will lose its body and become sticky.

4. Hardness

Hardness desired of the dried patch is defined as the degree of hardness that will allow a nail to be driven into it without causing cracking. It was found that concentrations of Metso (sodium meta silicate) as low as 1% developed excessive hardness of the batch. These Metso batches were studied up to 10% concentration. The hardness was noted to increase and patches formulated were unable to withstand the strain of a nail driven into them.

It is known that Celite will increase hardness, but the amount necessary to give the desired hardness is not yet known.

5. Shrinkage

Since drying of this type of spachtling compound depends upon the evaporation of water, some shrinkage is to be expected. The extent of shrinking depends upon the size of the crack filled. We have formulated compounds which give promising results on cracks as wide as 1/2" and deep as 1/4". Shrinkage over larger areas is noticeable but not excessive. A second applica-

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Spachtling Compounds - Cont.

tion of spachtling compound over these areas will give good results.

6. Color

The brown discoloration of the dried patch is due to the grade of Dextrine binder. Substitution of a better grade will give better color if better color is necessary.

Conclusion:

The effects of clay, Celite, mica, and Metso on the general formulation were investigated. As a result, the composition and % shown below indicate the best patch thus far developed.

SC-47

Grams	% Composition	Material
500	49.82	45
30	2.99	2077
20	1.99	2198
140	15.95	Mica #160
90	3.96	523
1	.10	1715
22.10	22.18	(12)W

Work on aids and plasticizers will continue in the attempt to improve the general qualities of SC-47.

#155 - Wall Paper Evaluation

(a) Samples of Style Perfect wall paper submitted by United Wall Paper Company are being received daily.

The wall paper is tested for washability, fade resistance, adhesion, brittleness and design flaws.

Results indicate that United are continuing to maintain the quality of the wall paper at a high standard.

(b) Samples of Kem-Tone Trims are also being checked quite frequently. The latest shipments of samples show considerable improvement over last month's production.

#170 - Army-Navy Specification Work - No work on this project during month.

#174 - Oleoresinous Wrinkle Varnishes "

#175 - Blackout and Camouflage Paints "

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Cont.

#12 - Cont.

		% Oil in Film	% of Oil Absorbed
Percolation extraction, petroleum ether, 4 hour air dry		55.0%	45.0%
Soxhlet " , " " , "		44.0	56.0
Percolation " , acetone, "		68.0	32.0*
Soxhlet " , " , "		70.5	29.5*
Percolation " , ethyl ether, "		65.0	35.0
Typical Nelson values,**	6 hour air dry	57.0	43.0
"Neutralized" Oil Paint, Titanium Pigment Company's EX-4140			
Percolation extraction, acetone, 2 hour air dry		73.0	27.0*
" " , petroleum ether, 2 hour air dry		70.0	30.0*

**Using ethyl ether, Soxhlet extraction.

The investigation of volatile material loss on drying has yielded much more definite results, the only doubtful point being the actual volatile content of the paints at the time of use, which could cause a minor error. This is being checked with freshly made paints. The method is essentially the same as that used for routine determination of non-volatile content; that is, a vacuum oven at 105° C. is used to drive off the volatile material to constant weight. First, however, the samples are air-dried for a specified time and the loss of weight is checked. The paints were tested in the form of .005" draw-downs on 4" x 4" duralumin plates. This, of course, is not equivalent to wood, which is impossible to use, but affords a controlled film thickness. An average of four runs of the old formula of Rex 450 Undercoater at 4 hours' air-drying shows a loss of 83.1% of the total volatile material. This is entirely on an experimental basis, involving no assumptions as to original volatile content. At 5 hours' dry, a single run gives nearly the same result, but at 5 hours the loss of volatile material increases to 85.3%. With new stock Rex 450, 4 hours' air dry results in an average loss of 83.7%. The use of a correction factor based on these results should increase the accuracy of our oil absorption measurements by at least 1.5%.

#162 - Studies in Flat Wall Paint Formulation

Flat Wall Paints

Alternate formulas were developed for Flat-Tone White and tint base using 2142 Ti-Cal R 20 and 20 L for 2132 Titanox RC HT and 20 HC. Ti-Cal R 20 produces higher consistencies than Titanox RC HT. The 2142 dry has made no change in the performance of the new material, although there may be a slight drop in washability. Such factors as brushing, flow, uniformity of tint and sheen appear to be equivalent to the regular formula.

The new formulas were sent to Cleveland for distribution.

#162 - Cont.

Enameloid

New vehicles similar to (3850)N, but made without "blowing," were submitted by the Varnish Research Division for evaluation in Trade Sales enamels. ARV 3307 is a Velsicol-Dehydrol varnish, 25 gallons long, with 50% solids at E body. ARV 3306 is a Velsicol-Maleic Ester varnish 25 gallons long with 50% solids at F body. These varnishes were evaluated in Enameloid Ivory, Rex 711, comparing them with factory production of (3850)N made from Velsicol, Rosin and Dehydrol.

The following observations were made:

Lab No.	Varnish	Wt./Gal.	Visc. at 75° F. #3	Brushing Properties
BC 672	(3850)N	9.90	30"	Satisfactory
BC 673	ARV 3306	9.92	28"	Fair; sl. tendency to sag
BC 674	ARV 3307	9.90	20"	Satisfactory; trifle thin

		Drying					Printing	
Lab No.	Set-to-touch	Condition 4 Hr.	Condition 6 Hr.	Condition 24 Hr.	Tack-free	Sward Hardness 24 Hr.	1#/Sq. In.	2#/Sq. In.
BC 672	150'	Tacky	Sl. tack	V. S. T.	27 Hr.	12	V.V.S.	V. S.
BC 673	150'	V. tacky	Tacky	V. S. T.	28-30	10	"	"
BC 674	180'	Tacky	Sl. tack	V. S. T.	28-30	10	"	"

Lab No.	Resistance to H_2O - 24 Hr.	Recovery	Resistance to 1% Soap Sol. 3 Hr.	Recovery
BC 672	Slight whitening and milky	Incomplete (3 Hr.)	Some dulling and whitening	Incomplete
BC 673	Slight haze	Recovered (1/2 Hr.)	"	"
BC 674	Slight haze	Recovered (1/2 Hr.)	"	"

A regular factory production batch of the Velsicol-Dehydrol varnish (not blown), V 11162 similar to ARV 3307, was checked in Enameloid, Floor Enamel and Flo-Lac formulations.

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Cont.

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Enameloid

Formula	Varnish	Type	Dry to Touch	4 Hr. Dry	6 Hr. Dry	24 Hr. Dry	Sward Hardness 24 Hr.	Pigmentation
BC 632	(3848)E	P.E. Rosin Linseed	70'	VT	VT	VST	18	TiO_2 and titanium calcium
BC 608	(3850)N	Rosin Velsicol Linseed	70'	VT	VT	ST	12	"
BC 672	(3850)N	Rosin Velsicol Dehydrol	85'	VT	ST	VST	14	"
BC 674	ARV 3307	Velsicol Dehydrol	105'	VT	ST	ST	10	"
BC 678	V 11162	"	95'	VT	ST	ST	10	"
BC 683	(3850)N	Polypale Velsicol Linseed	80'	VT	ST	ST	10	"

Floor Enamel

BC 679	(3850)N	Rosin Velsicol Dehydrol	75'	T	-	TF	16	Titanium Calcium and Calcium Carbonate
BC 680	V 11162	Velsicol Dehydrol	95'	T	-	VVST	12	"

Flo-Lac

BC 681	(3850)N	Rosin Velsicol Dehydrol	75'	-	T	ST	14	-
BC 682	V 11162	Velsicol Dehydrol	115'	-	T	ST	12	-

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Formula	Water Resistance 24 Hr.	Recovery	1% Solution Soap Resistance 3 Hr.	Recovery
BC 683	Slight dulling and milky	Dull - milky	Discolored - dull	Dull - milky
BC 678	Very slight dulling and milky	Almost complete	" "	Incomplete
BC 632	Slight dulling and milky	Slightly milky	" "	"
BC 672	Slight dulling and milky	Slightly milky and dull	" "	"
BC 608	Slight dulling and milky	Incomplete	" "	"
BC 674	Very slight dulling and milky	Very, very slight haze	" "	Slightly discolored and dull
BC 679	Dull and white	Slight dulling and milky	" "	White and dull
BC 680	" " "	"	" "	" " "

The batches of BC 679 and BC 680, Floor Enamels, which had the calcium titanium pigmentation were repeated with the new lithopone pigmentation. These enamels, BC 688 and BC 689 withstood the above water and soap tests perfectly, showing no film deterioration.

It was concluded from various tests that V 11162, the Velsicol Dehydrol vehicle made without blowing, would be as satisfactory as regular (3850)N for Trade Sales lines. In general, the drying is a trifle slower, but the resistance to water and to alkali is somewhat better.

#103 - Metal Protective Paints

Ferrous Ammonium Phosphate

The results of salt spray tests on Impedex (ferrous ammonium phosphate) in the Maritime Commission Zinc Chromate Primer 52-MC-29 bear out the negative results reported earlier in Bureau of Ships primer 52-P-18. The panels were divided into two sections, A and B. Section A has a top coat of Low Visibility Gray as well as primer, while Section B has primer only. After 1500 hours, all panels showed bad rusting on Section B, but those paints containing Impedex were slightly worse than the standard. At the scratch on Section A there was

EMULSION RESEARCH DEPARTMENT

#161 - Emulsion Binder Paints

A. Wetting and Emulsifying Agent Section

(1) Surface Tension and Conductivity Measurements

We are interested in obtaining performance and electrolytic impurity curves of the commercial wetting agents which are used in experimental and regular resin emulsion formulations. Those wetting agents which effectively depress the surface tension of water at room temperature are to be considered. Those agents which are dispersing agents cannot be investigated at present, other than to verify them as of this type. Measurements of surface tension and conductivity were carried out in a series of dilutions containing 0 - 5% of the active ingredients. The data obtained for each dilution was collected and curves were plotted and drawn. The graphs obtained for each wetting agent can then be compared to determine their relative efficiency and purity from ionizable salts.

Surface tension was measured on a direct reading duNouy tensiometer which had been standardized with reference to distilled water at 22° C. The value used for the distilled water was 73 dynes/cm. Conductivity was measured with a conductivity bridge equipped to give scale reading in ohms. Since the constant of the electrolytic cell is unity, a direct reading of the specific resistance can be made. All samples were measured at 18° C. Six commercial agents have so far been evaluated. The compounds are listed in order with respect to their efficiency at .1% concentration.

Chart I

Surface Tension vs. Concentration

Wetting Agent	.01%	.1%	.5%	5%
Span 20	29.8	28.6	28.6	27.5
Santomerse D	38.3	32.9	35.2	33.1
Santomerse 3	38.6	34.7	34.6	33.0
Nacconol	41.6	35.3	34.5	32.8
Advawet #35 Mod.	37.3	35.8	35.5	35.1
Nekal BX	54.8	41.4	34.4	33.3

The curve of surface tension versus wetting agent concentration is hyperbolic wherein the decrease of surface tension is very rapid for concentrations below .05%; above .1% the curve levels off.

Nekal BX is the least efficient of the group tested, but it is also a dispersing type agent and has both qualities of wetting and dispersing. Although the final decrease in surface tension is satisfactory, a concentration 4 - 5 times greater than the average agent is required before the slope becomes asymptotic to the X'-X axis. In other words, the rate at which Nekal BX disperses the surface tension is 4 - 5 times slower than the average wetting agent tested.

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Santomerse D reaches maximum efficiency at .1% concentration. The surface tension at this point is 32.9 dynes/cm. As seen by chart I, the curve then slopes upward and the maximum value for surface tension is not reached again until the concentration approaches 5%. The other curves are regular and follow in efficiency the general hyperbolic pattern.

Conductivity measurements of the solutions will indicate the impurity as ionizable salt present in the sample. The wetting agents, being predominantly sodium salts of large organic acid compounds, will show some ionic activity; however, their dissociation constant as compared to salts of strong acids and bases is small. Chemically pure samples of these wetting agents are not available for us to use as standards to calculate the % impurity but by comparing resistance of solutions for each compound, we can obtain their comparative purities, and select the most pure.

Data on conductivity was reduced to log values before the curves log resistance vs. log concentration were plotted. Santomerse 3, Santomerse D, Nekal BX, and Nacconol showed the greatest resistance drop. The curve appears to be a straight line with slope of approximately - 1. Span 20 and Advawet #35 Mod. gave irregular shaped curves, maintaining a relative high resistance as concentration increased. The chart below presents the wetting agents in order of decreasing resistance or relative increase in ionizable salts present.

Chart II

Resistance vs. Concentration

Wetting Agent	.01%	.1%	.5%	5%
Advawet #35 Mod.	Off scale	130,500	62,500	9,750
Span 20	" "	98,500	27,100	6,700
Santomerse 3	44,500	5,800	1,530	195
Santomerse D	38,500	4,900	1,300	176
Nacconol	26,800	3,400	830	110
Nekal BX	18,100	2,180	490	66

The following agents had little or no surface tension depressing qualities: Daxad 11, 21, 23; Darvan #1; Blancol #1, Leukanol, and our own CP 935.

The data obtained has for its purpose a backlog of information on commercially available wetting agents, and a source of physical chemical data that may shed light on emulsion problems as further data can be accumulated, interpreted, and applied to our problems.

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(2) Wetting Agents

More samples of CP 935 were submitted to us by our Chemical Products Department for conductivity tests. These samples were prepared with special care in controlling the per cents of active ingredients, per cent of total solids, and the pH. Tests on former CP 935 lots (October report) have indicated that more uniform per cents of active and total solids, and a more neutral pH might give a higher resistance reading indicating less electrolytic impurities. Below are the results obtained:

			pH Conc. Sample		.1% Active Ingredient		
Lab.	% Active	% Total Solids	C. P.	Allied	Gm/100 cc	pH	R/Ohms
24	25.1	33			.398	5.7	2650
25	31.2	37			.321	6.1	3210
27	28.1	34			.355	7.05	3200
38	32	39			.312	7.23	3380
39	24.8	35			.403	3.4	2570
47	24.4	38			.409	7.35	4200
48	29.4	37	7.9	6.55	.340	6.3	3700
49	25.5	35	8.2	4.7	.392	5.75	3700
50	27.0	37	8.3	4.95	.370	7.6	4000
Naba	100%				.100	5.9	3800

These samples show a marked improvement over the original; the average ohms resistance (R) reading being 3441 as compared with 2665 of the former lots. The latest samples (47-Naba) can be compared with commercially available Santomerses and Nacconol in regard to electrolytic impurities.

B. Protein Section

(1) Chlorination of Casein

20% of casein was suspended in 1:500 hydrochloric acid and was chlorinated by passing the gas through in a steady stream, washed by decantation, and filtered. The residue was placed in a double boiler and an attempt was made to disperse the particles with ammonia. The solution darkened considerably on the addition of ammonia, but became lighter with continued heating at 160° F., taking on a jelly-like appearance. Dispersion was not complete. The pH was 6.04. Odor, when cold, gave no trace of casein, only pine oil.

The physical properties of casein seem to be altered by any degree of chlorination.

The desired quality of bacterial resistance is reached, but the alteration of dispersibility characteristics is so nega tive in value as to produce a casein of no practical value, at present, in resin emulsion paints.

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Cont.

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(2) Studies in Dispersion with Amino Solvents

Casein, corn protein, alpha-protein, and S-Protyn-AN dispersions were made with the following solvents: (a) 2 amino 2 methyl 1 propanol; (b) 2 amino 2 methyl 1-3 propanediol; (c) tri-hydroxy methyl amino methane.

Briefly, the procedure is as follows: agitate the protein while cold for 1/2 hour, add the solvent and start heating. At 120° F. add the Dowicides and pine oil. Heat to 160° F. and hold until dispersed.

Ammonium hydroxide was used as the control solvent in each case. Results obtained showed little difference in the dispersions obtained with the four solvents. However, within a limited range the different solutions can be classed as being good or fair from a 1 - 4 rating. Comparisons are shown in the table below:

	pH	Foam	Dispersion	Hard Film	When Dispersed	Body Hot	Body Cold
Casein							
Sol. #A	9.7	Yes-1	Good - 1	Hard - 2	Cold	Good	Good - heavy 4
B	8.75	" 4	" 3	" 2	160° F.	"	" 1
C	8.05	" 2	" 1	" 1	Cold	"	" 2
NH_3	9.35	" 3	" 2	" 1	Cold	"	" 3
Corn #A	10.3	No	Good - 1	Hard - 4	At 160° F.	(Fluid;	Gel-v. fluid
B	9.4	No	" 3	" 3	+ 160° F.*	(little	Gel - fluid
C	8.6	Sl.	Fair	" 3	+ 160° F.	(body	Gel - v. fluid
NH_3	9.6	No	Good - 2	" 3	At 160° F.	(	Gel - fluid
Alpha Pro. #A	10.0	Yes	Good - 2	Hard - 1	+ 160° F.	(Fluid;	Gel - thick
B	8.9	"	Good - 3	"	+ 160° F.	(fair	Gel; semi-thick
C	8.2	"	Good - 4	"	+ 160° F.	(body	Gel; very thick
NH_3	8.6	"	Good - 3		+ 160° F.	(	Gel; thick
S-Protyn-AN							
#A	10.0	No	Poor	Hard	% 160° F.	Heavy	Some cohesion paste-thick
C	8.3	"	V. poor	"	+ 160° F.	Med. hvy	Little cohesion paste least thick
NH_3	8.65	"	Poor	"	+ 160° F.	" "	Some cohesion paste med. thick

* + 160° F. indicates that additional heating at that temperature was required, as contrary to at 160° F. which means that dispersion was complete at the time the solution reached that temperature, or cold which falls within 65 - 120° F. range.

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3. Casein and Casein Substitutes

S-Protyn-AN, corn protein product

Two batches, WZ-3 and FM-9, of S-Protyn-AN were received by us from the Corn Products Refining Company. A sample of the protein was also obtained from our factory stock. Each was dispersed with ammonia for a comparative study. Results are tabulated below:

	pH	Body	Dispersion	Film Hardness
Stock S-Protyn-AN	8.6	Good	Fair - 2 (intermed.)	Hard - 2
S-Protyn-AN - WZ-3	8.6	"	" - 3 (least)	" - 1
" FM-9	9.0	"	" - 1 (best)	" - 1
S-Protyn-AN FM-9 with 2 X wt. sodium perborate replacing borax	8.6	"	" - 1 (best)	" - 1

Stock S-Protyn-AN and sample WZ-3 showed the presence of minute, insoluble, black specks. In Kem-Tone these specks appear as foreign dirt particles in the brushed surface. FM-9 was a more superior batch. In solution it had the greatest viscosity. Since a complete dispersion of the protein particles was not obtained with the usual method of soaking 1/2 hour, and heating at 160° F. for 1/2 hour, with the first three samples, the fourth (FM-9 and water) was allowed to stand over night, and heated the following day with ammonia and sodium perborate at 140° - 170° F. for four hours. A complete dispersion was not obtained, although results were better. However, we believe that the extent of dispersion does not make a notable difference in the quality of the final paint product as indicated by two test batches prepared with S-Protyn-AN - FM-9 replacing corn protein (2199 dry). The results of the general examination of the two batches are listed below:

			Washability			
	Viscosity	Brushing	Brush Wash	5 Days 250 Rubs	14 Days 500 Rubs	30 Days 500 Rubs	Color of Rex
WP 1411	95" (12 oz.-7 oz.)	Good	Good	No break in film	370 (B)	475 (B)	Turquoise
WP 1417	68" (12 oz.-6 oz.)	"	"	60 (B)	67 (B)		Aqua Blue

Inasmuch as the above batches were made on different days on different formulas with no thought of comparison in mind at the time of manufacture they are of interest because they indicate the general good quality of S-Protyn-AN in reference to washability as a substitute for corn protein (2199 dry).

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C - Bacteriological Section
(1) Odor Tests

A. Leroy Hotel Complaint

Kem-Tone batches 65407 C 1463 R, 65407 C 1253 X
65403 C 1413 A, 65403 C 1403 H

Tests were run on the only available sample - 65407 C 1253 X.

1. Bacteria count - 0.

2. Odor test (carton method) - no putrefaction. The odor trend varied from slightly pine oil and slightly oxidized oil (1st day) to slightly moldy and slightly oxidized oil (30th day).

D - Gloss Kem-Tone Development Section

Shading bases, especially made for use in gloss resin emulsion paste paints, have, as stated in the December report, been made up and aged at 120° F. to note the effect of age (on the material in the package) upon gloss and color constancy.

Color	Effect on Color	Gloss per Mil (Aged) Effect on Gloss Orig.	Now
Robin Egg #50	Slightly lighter and bluer	48.5	33
Pea Green #53	Considerably lighter and less intense	55.0	42
Cream #48	" " " " "	40.0	37
Orchid #49	" " " " "	44.0	34.5
Blue #51	" " " " "	43.0	43.0
Tan #52	Color slightly whiter	56	41.5

The conclusion that may be drawn from these tests is that after several years aging a drop of about 20% in gloss may be expected and a slight change to a lighter shade will be observed in the color.

A change of 20% in gloss is barely observable to the human eye and would not be a cause for complaint in trade sales items. In some instances the color change would be enough to notice, if one part of a room were painted one year and another part, in direct conjunction, be painted several years later. In the samples under test this was noted with colors employing hansa yellow and alizarine red. Possibly other colors would be found more stable and it is always to be remembered that these are forced aging tests - as time has not permitted a true age picture to be available.

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Washability of the dried films of semi-gloss is still a serious problem. While we can produce washability equivalent and perhaps better than Ken-Tone (flat), it must be borne in mind that these semi-gloss and gloss materials will be used in kitchens and baths, where washability is a much more important factor than in a bedroom or living-room. No doubt, it will also be used extensively on woodwork, which is washed often.

During the last month we have made samples using a series of commercial emulsifying agent varying from complete oil solubility to complete water solubility and are now completing wash tests upon them. While these agents do not give us gloss in our final films, still their effects upon washability may indicate the general type of agent to use for maximum number of desirable qualities to be obtained in the product.

As soon as we have obtained sufficiently improved washability, it is intended to start formulation on outside type semi-gloss and gloss materials upon wooden siding. As the public is accustomed to some gloss in exterior house paints, no doubt extremely flat formulas for wooden frame construction would meet strong sales resistance if offered. While we acknowledge that resin emulsion paints have limitations, we do not know the extent of them, therefore are probing as many angles as the size of our staff and the limitations of time will permit.

For example, upon hasty judgment one might object to the small amount of binder-solids present per gallon. Yet this can conceivably become a virtue with development of very superior binders, that would be too costly to use as freely as linseed oil. In other words, if the quality of the film is sufficiently high, it does not matter that the film is very thin.

E - Exterior Resin-Emulsion Paint Development Section

Two samples from the series of outside Brick and Stucco paints previously reported on were selected and tinted to a deep ivory.

Brush-outs were made on asbestos siding and exposed 12-10-43 in the Dry Color Department Fade-Ometer. Results of the accelerated weathering are being observed and data recorded. A report will be made upon formula and durability at a later date.

A more recent formula O.W.P. #1 was also exposed. This is of a high angular sheen type, and greater durability is expected. Accelerated weathering was started 1-5-44.

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F - General Kem-Tone Formulation

1 - New Colors

(a) Intermediate Shades

The four intermediate shades (Midland Green, Avalon Blue, Turquoise, and Cameo Rose), are in production and no manufacturing difficulties have been encountered. Formulas have been distributed to all plants. The formulas for these four colors contain .82 pounds of linseed oil and .45 pounds of tall oil per gallon. Laboratory batches in which the linseed oil is partially replaced with Dehydrol are being evaluated.

(b) Deep Colors

The three deep colors (Montrose Coral, Aqua, and Stratford Green) containing the pigment combination of 1.5 pounds of rutile titanium, 1.5 pounds of Celite and 2.0 pounds of talc were not satisfactory from a production viewpoint. The replacement of talc with soapstone showed considerable improvement, but availability and uniformity of soapstone is uncertain.

A new formulation for the deep colors containing 1.5 pounds of rutile titanium, 0.5 pounds of lithopone, 1.5 pounds of Celite, and 1.25 pounds of talc as the pigment content per gallon was started in production. The vehicle content was raised slightly. This formula worked out fairly well in production. However, at times the paint made as above appeared slightly unstable during manufacturing and it was necessary to add an additional quantity of lecithin in order to improve the emulsion. It was also found that the presence of a small amount of Digylcol Oleate S made a considerable improvement in emulsion stability. The exact cause of the variations in emulsion stability on this formula have not yet been determined. However, we believe that variations from batch to batch in the vehicle are at least partially responsible.

The present deep color formula contains .94 pounds of linseed oil, .15 pounds of tall oil, and .15 pounds of ester gum per gallon of paint. The possibility of replacing part of the linseed oil with Dehydrol is being investigated.

Formulas on the deep colors have been distributed to all plants.

(c) High Dry Hiding Type Formula

The high dry hiding type of formula has been put into production on the light tints at the Chicago plant and has proven to be very satisfactory from the manufacturing angle. This formula makes possible a considerable saving in titanium dioxide in the light colors. Although the pigment cost on this formula is lower than that of the previous formula, the total cost is about three cents per gallon more because of the increased oil content. This formula represents an improvement in quality and all around performance over the previous tall oil formula. This formula contains .82 pounds linseed oil,.45 pounds tall oil, and .10 pounds ester gum per gallon.

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Unfortunately, Midland Green, and Avalon Blue showed ghosting on this formula, so these two colors were transferred to the intermediate shades formula.

The replacement of part of the linseed oil in this formula with Dehydrol is also being investigated.

(d) Washability of Deep Colors

The washability of the three deep colors is definitely less than the other Ken-Tone shades. Work directed toward improving the washability of these colors is in progress in the laboratory.

It has been found that relatively small amounts of lead titanate improve the washability of Ken-Tone. However, the inclusion of 10 pounds per 100 gallons in the deep color formula offered no improvement. The use of more lead titanate detracted from the appearance of the paint. Further work will be done on this angle, however.

It was found that the presence of 0.3% of potassium dichromate in the deep color formula definitely improves washability. The reaction between the protein and dichromate is catalyzed by light after the film has dried. Package stability tests on this paint are in progress.

(e) Wetting and Emulsifying Agents

The deep color formula was set up with Santomerse D specified as the sole wetting agent because of the manufacturing difficulties encountered with this formula. It was not thought advisable at the time to complicate the picture with a series of wetting agent substitutes including CP 935 with which some trouble had previously been encountered. However, other wetting agents including CP 935 have recently been tested in production and have been found satisfactory in this formula.

G - Specialty Products Quality Control Section

A. Ken-Tone

During the month of December, the Ken-Tone Quality Control group tested 583 batches of Ken-Tone. Of this amount 506 batches represented Chicago production.

During December, production was started at the Chicago plant on the new colors tested. This amount represents close to 100% of production of the new colors.

Room tests totaled 18. Majority of these tests were of the intermediate and deep colors.

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A recheck was made of the first production batches made on the tall oil formula, which were manufactured in July, 1943.

313 batches, representing production from the different plants were checked for viscosity and pH upon receiving the material, and then again after a period of time, using material from the same container, in order to determine what changes, if any, occur with respect to viscosity and pH, once the container has been opened.

The following is a resume of results obtained.

Viscosity

(a) Application viscosity of plant batches representative of production, as a whole, was satisfactory this past month.

(b) Batches manufactured in July, on the tall oil formula, and stored at temperatures ranging from 60° F. to 100° F. were tested. Results were favorable with little or no change in viscosity.

(c) The viscosity of the 313 batches representing production from all the plants was, for the most part, quite uniform, both with respect to checking viscosity upon receipt of the material and re-checking material taken from the same containers after a period of several days.

pH

(a) The pH of production batches was quite uniform during the first two weeks of December. During the latter part of the month, there was a tendency toward a high pH, but we believe that this situation is about under control.

(b) Batches manufactured in July, on the tall oil formula, and stored at temperatures ranging from 60° F. to 100° F. were tested. Results were favorable, with little or no change in pH.

(c) The pH of the 313 batches representing production from all the plants, was, for the most part, quite uniform, both with respect to checking the pH upon receipt of the material and re-checking material taken from the same containers after a period of several days.

Shade

All plants have done an excellent job of adhering to the color standard.

Emulsion Stability

(a) Some difficulties were encountered when the initial batches of the new deep colors were manufactured, but, since overcoming these defects, we have not experienced any trouble with respect to emulsion stability.

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(b) Batches manufactured in July, on the tall oil formula, and stored at temperatures ranging from 60° F. to 100° F. were tested. Emulsion stability remained unchanged over this period of time in the package.

Application Characteristics

Ken-Tone manufactured on the new Hi-Dry Hiding, Intermediate, and Deep color formulas has shown up superior to any paints we have had in the past, with respect to brushing.

Our new formulations seem to give brushing with less slip than on the tall oil formula, but just the right amount of drag without being sticky, or dragging.

Washability

A total of 842 wash tests were run this past month. This includes a check of production of the Cleveland, Newark, Detroit, Oakland plants, as well as Chicago, and a number of experimental tests of laboratory formulations. Also included in this number were wash tests on material packaged and put into storage since July.

(a) Washability of our pastels and intermediates on our latest formulations is excellent. This applies to all our plants on the pastels, the only intermediates being manufactured during December coming from the Chicago plant.

Washability of the deep colors manufactured at the Chicago plant, after a normal drying period of two weeks, is very good.

Room Testing

Room tests conducted during the past month gave very good results and indicated that our intermediates are ready for commercial use as a one coat paint.

Our deep colors have shown considerable improvement over our recent initial efforts and do an excellent one coat job over some surfaces and an excellent two coat job on all surfaces.

Testing of the pastels on the Hi-Dry hiding formula showed very favorable results.

B - #155 - Wall Paper Evaluation

(a) Samples of Style Perfect wall paper submitted by United Wall Paper Company are being received daily. The following is a condensation of results obtained from tests during December.