

ALLIED RESEARCH LABORATORIES

Report of Investigations
For the Month of June, 1946

M. VAN LOO

#177 - Pigment Studies

Work continues on the study of white pigment opacity factors.

It will be recalled that in the report for May the term H.P.V.C., "Hiding Pigment Volume Concentration" was introduced. This term differs from the customary P.V.C. or P.V. in that here the extender pigment is considered as part of the vehicle rather than as pigment. It was shown that this is true so long as there is sufficient binder to prevent High Dry Hiding.

It was also shown that as the Hiding Pigment Volume Concentration is increased the hiding efficiency per pound is decreased. Work has been extended to a number of different opacity pigments and it may now be concluded that the efficiency of High opacity pigments is affected to a larger degree by volume relationships than is true of the lower opacity materials.

An illustration of the practical effect of the above relationship was given in the report for March, page ten, when it was shown that two Semi-Lustres were practically equal in opacity even though one had 2.5 pounds TiO_2 per gallon, whereas the other had 2.0 pounds.

Below is a tabulation which illustrates the efficiency of several pigments at different concentrations.

Opacities in Sq. Ft. per Pound

H.P.V.C.	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
108 dry	54	51	48	45	41	38	34	31	28	25
461 L dry	45	43	41	38.5	36	34	32	30	28	26
1271 "				62	61	60	59	57.5	56	55
1403 "	183	165	146	128	109	91				
1538 "		128	116	105	94	82	71			
1897 "	76	72	69	65	61	58	54	50	47	43
2132 "				97	88	78	68	58		
2173 "		197	166	145	125	105				
2229 "		228	200	174	147	121				

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All of the above data has been determined on single pigment paints. How this data will translate to multiple pigmentations has not been established. Therefore, pending further work the above data should be considered as tentative.

#162 - Studies in Flat Wall Paint Formulation

Paintercraft 5-In-1 Interior Paste Paint

In connection with the development of an interior paste paint for the Paintercraft line, samples of the paste OJ 810 J and the reducing varnish CVR 452-3 were sent to Cleveland for test. A number of panels were prepared by Lou Donald to check the versatility of this material. The paste OJ 810 J was reduced with the reducing varnish CVR 452-3 and/or mineral spirits to produce a wall primer and sealer, enamel undercoater, flat, semi-gloss and gloss wall paints.

In general the test panels appeared to be quite satisfactory, and the reduced paste paints were similar to our regular Trade Sales products, such as Interior Gloss, Semi-Lustre, Wall Primer and Sealer - Rex 25, Flatrite and Paintercraft One Coat Flat #10.

The finished panels were inspected by Messrs. K. Y. Benson, H. S. Prescott, and S. F. Carlson. It was agreed that some effort should be made to improve the brightness of the paste and reduce the wrinkling tendencies of the enamel reduction. It was also decided that further tests should be made in Cleveland and Chicago, by some painting contractor, to obtain the reaction of the trade to a paste of this type. A 25 or 50 gallon batch of the paste paint and reducing varnish are to be made if sufficient Dehydrol can be obtained for this purpose.

Flat Wall Paints

Work has been under way to improve the odor of our flat wall paints by the use of deodorized solvents. An experimental batch of Flat-Tone White OJ 997 J was formulated using Shell's 8296 Special Mineral Spirits and Regular Base No. 1. A gallon sample was sent to Cleveland for test.

This formulation also contained five gallons of Aromatic Solvent #40, produced by the Union Oil Company, to improve the brushing properties. We have found that too low solvency (Kauri-Butanol value) tends to produce sticky brushing, and a small amount of high K. B. solvent is required to prevent a break when high bodied oils are used. This fact was made quite evident when we tested samples of #100 and #140 Soltrols submitted by the Phillips Petroleum Company.

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Semi-Lustre

During the month an investigation was instituted in an attempt to determine the reason for the drop in sheen of Semi-Lustre White when formulated with rather slow thinners such as (141) and (3020). A number of thinners with high to low Kauri Butanol values, boiling in about the same range as kerosene, were obtained from various suppliers.

Based on the test data below, it is quite difficult to determine the reason for the variations in sheen obtained with the various solvents. However, it appears that a high Kauri Butanol value associated with not too high a boiling range, gives the best results, with the least drop in sheen.

Aromatic Solvent #40, produced by the Union Oil Company, was found to be one of the best thinners. This sample had the least effect on the sheen of Semi-Lustre White and only minor differences in wet edge were noticeable as compared with (3020).

(See next two pages for charts)

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Thinners Used and Characteristics

Solvent	Source	IBP °F.	10% °F.	50% °F.	95% °F.	E.P. °F.	K.B. No.	Odor of Solvent
Ansco Light Retardsol	American Oil and Supply Co.	364	373	382	399	412	50	F -
Ansco Retardsol	"	370	390	430	470	505	32	F -
Ansco Solvent E	"	350	-	405	435	465	74	P
Arosol #12	Anderson- Prichard	344	360	371	392	412	65	F -
Apco # 18	"	360	374	391	434	475	36	F -
Deodorized Apco 467	"	424	434	442	460	480	27	G
Fosolone	Freedom Oil Co.	370	390	420	460	490	25.5	P
Sovasol #6	Socory-Vacuum	368	384	406	438	460	30	P
Aromatic Solvent #40	Union Oil Co.	372	380	385	402	426	65	F
Union Thinner #9	"	369	376	385	401	420	35	G
#45 Thinner	Valsicol Corp.	345	388	448	498	535	88	F -
#407 Solvent	Shell Oil Co.	380	402	434	468	500	77	F
Hy Naphtha #6	Deep Rock Oil Corp.	-	-	-	-	-	31.6	F -
#5 Enamel Solvent	Standard Oil (Indiana)	372	400	432	465	497	44	F -
Solvesso #100	Esso Marketers	300	-	327	350 90%	370	81.5	F -
Standard #410 Thinner	Standard Oil (Cal.)	362	376	394	426	447	45	-
35/42 Solvsol	Tidewater	350	361	377	398	418	85	F
(6021)	-	-	-	-	-	-	75	F
(348)	-	-	-	-	-	-	33-40	F
(3020)	-	-	-	-	-	-	40-48	P

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Semi-Lustre Tests on Rex 210 Formula of 8-22-45

Paint No.	Solvent Used (16 gals./100)	Viscosity Fresh #3 Orifice	Brushing	Flow	Wet Edge	Gloss Panels	Draw-Downs	Drying Set-to-touch
973 J	Amsco Light Retardsol	23.8"	Good	Good	Very sl. short	65	68	0:40
974 J	Amsco Retardsol	24.8"	V. good	"	Good	23	32	1:55
975 J	Amsco Solvent E	21.5"	Good	"	Sl. short	66	66	0:45
976 J	Arosol #12	21.8"	"	"	Very sl. short	60	68	0:45
977 J	Apco #18	24.0"	"	"	Good	54	46	1:15
978 J	Deod. Apco #67	24.1"	"	"	Sl. short	33	26	1:15
979 J	Fosolene	24.3"	"	"	V.S. short	49	33	1:10
980 J	Sovasol #6	26.8"	"	"	Good	64	53	1:10
981 J	Aromatic Solvent #40	23.8"	"	"	V. sl. short	70	72	1:00
982 J	Union Thinner #9	23.4"	"	"	Sl. short	52	72	0:50
983 J	#45 Thinner	23.7"	V. good	"	Good	66	33	1:45
984 J	#407 Solvent	25.2"	Good	Fair +	Sl. short	38	3 4	1:20
985 J	Heavy Naphtha #6	22.5"	"	Fair +	Sl. short	45	42	1:00
986 J	#5 Enamel Solvent	22.0"	"	Good	Good	58	66	1:00
987 J	Solvesso #100	19.0"	V. good	"	Short	73	75	0:40
988 J	Standard #410 Thinner							
989 J	35/42 Solvsol	24.6"	Good	Good	Short	70	71	0:45
990 J	(6021)	20.3"	"	"	"	72	76	0:40
991 J	(348)	20.3"	"	"	(Short on 5 min. lap	76	75	0:30
992 J	(3020)	25.8"	"	"	OK on 5 min. lap	65	54	1:10

Over night drying - good on all samples.

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Samples of regular Wet-Ege Spirits and Deodorized Wet-Ege Spirits were obtained from the Anderson-Prichard Oil Corp. for test purposes. These materials were compared with the sample of Wet-Ege Paint Thinner supplied by the Thompson-Hayward Chemical Company, in the Semi-Lustre White formulation. Anderson-Prichard have made claims similar to those of Thompson-Hayward with respect to wet edge, odor, evaporation rate, etc. As stated in our monthly report for May, our main interest in these thinners is to obtain one that will not dull the gloss or cause flashing and hold a wet edge longer than mineral spirits. The boiling range of the various Wet-Ege thinners compares as follows with that of (348).

	Anderson-Prichard Wet-Ege Spirits (Regular and Deodorized)		Wet Ege Paint Thinner Thompson-Hayward	(348)
	Min.	Max.		
IBP	320° F.	328° F.	334.4° F.	302° F.
5%	326	334	-	311
10%	328	336	348.8	-
20%	332	340	354.2	-
30%	336	344	357.8	-
40%	339	347	361.4	-
50%	342	350	363.2	329
60%	347	355	366.8	-
70%	352	360	375.8	-
80%	357	365	383	-
90%	367	375	395.6	-
95%	380	388	-	374
Dry point	386	394	428	392
Kauri Butanol	33.5	33.5	31.4	35

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Batches of Semi-Lustre White were made using 100% of each Wet-Ege thinner and (348) for the volatile content. The paints were checked for brushing, flow, sheen and wet edge. The Wet-Ege thinners from Anderson-Prichard produced higher consistencies in Semi-Lustre than (348) or the Wet-Ege Paint Thinner from Thompson-Hayward. The Thompson Hayward thinner had slightly better brushing and slightly longer wet edge than the Anderson-Prichard materials.

Based on our tests, the Anderson-Prichard thinners show only a small advantage over (348) with respect to wet edge and do not warrant any further consideration.

#182 - Study of Improved Mixing and Grinding Practices

A study was made to determine the optimum amount of Nuade in Rex 210 and in several of the alternate formulas for Rex 201 Semi-Lustre Ivory, for best production rate. While there is an increase in rate using up to 2% Nuade, the most practical and efficient amount seems to be about .75%, based on the paste weight. Increases in production rates of from 50% to 100% might be anticipated.

The following series of surface active agents were tried in the Rex 471 STP formula, ground at 0.002" setting on the 8" Kent mill. Paste consistencies are in seconds for 10 revolutions on the Stomner using a 700 gram load and the special paste paddle. The amount of agent used was 1% of the pigment weight.

Agent	Paste Consistency	Grind Time	Grind	Print Viscosity #3 Cup
None	12.7	90.5"	2-1/4 H	28.4
Acto 450	11.9	80.8	3	37.5
Acto 550 W	24.0	87.0	2-3/4	45 + 1/4
Acto 600	24.2	80.5	2-3/4	46.0
Nuade	13.2	45.0	2	34.0
Huonix	9.4	90.5	2-3/4	28.8
Tergitol #7	21.8	94.2	2-3/4	51.0
Armeen C	95.0	85.6	2-1/2	65.0
Clearate B 60	8.9	94.2	2-1/2	29.8
(2270)	9.6	95.7	2-3/4	31.0
Ultravet #30	19.3	88.8	2-3/4	50 + 1/16
Anine EO	7.6	93.0	2-3/4	29.8
Encol TC	8.7	89.5	2-1/2	24.8
Enac 101	8.2	96.3	2-3/4	32.7
Encol 14	7.9	90.2	2 1/4	--

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distinction between the remaining panels is rather surprising since the cleaning methods varied from rough solvent wiping with (342) to twenty minutes of intermittent trichloroethylene vapor degreasing.

Enthane Cleaner is a commercial cleaner of the emulsion type, probably consisting of a high boiling petroleum solvent with an emulsifying agent.

#177 - Pigment Studies

Work continues on the study of white pigment opacity factors.

Data is given below illustrating the opacity efficiency of additional pigments at various loadings.

Opacities in Sq. Ft. per Pound

Table 1

H.P.V.C.	10%	15%	20%	25%	30%	35%	40%	45%
9 dry BSWL		19.5	18.5	17.8	17	16	15	14
18 dry BCWL		24.5	24	23	22	21.5	20.5	19.5
412 dry 35/65 PbZn	45	42.7	40.8	38.8	36.8	35	33	
1901 " TiO ₂ Anatase	172	155	137	120	103	86	69	
2030 " " "	168	151	134	117	100	83	66	
2059 " XX 503 ZnO	33	31	30	28	27	25	24	
2140 " RC	97	96	93	87	80	73	66	
2132 " RCHT	86	92	97	88	78	66	58	

* It was noted that whereas all the other pigments in this study increased in opacity efficiency as a straight line function when the H.P.V.C. was varied from 40 to 10%, 2140 dry and 2132 dry, rutile titanium calcium pigments, actually fell off in efficiency as the H.P.V.C. was reduced below the 20% level. Other pigments would probably function similarly at lower volume concentrations. We have a few measurements with 1403 dry and 2173 dry that would indicate that they lose efficiency at the 5% volume level.

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Some work has been done to investigate the manner in which several opacity pigments function together in a given paint. The story is not too definite to date but indications are that the efficiency actually represents a compromise between the total HPVC and that of each individual pigment.

For example, a series of SWP type paints pigmented variously with several lead, zinc, and titanium pigments gives the following comparisons:

No.	Pigments Contained	Column 1*	Column 2**	Actual Hiding Sq. ft./gal.
RB 1428	1403, 2269, 412, 18	406***	383	428
1429	2059, 18, 1538	450	357	398
1430	2059, 18, 1538	533	407	419
1431	2059, 9, 2132	380***	339	371
1432	2059, 9, 2132	557	396	409

*Column 1

Theoretical opacity calculating each pigment's efficiency at its individual volume concentration.

**Column 2

Theoretical opacity calculating the efficiency of each pigment at the efficiency level of the total hiding pigment volume.

***Values for these paints are proportionately lower than those for the others in this column because of the fact that the 1403 dry and the 2132 dry are individually present in the formula at such low amounts that they fall below peak efficiency as described at the bottom of Table I.

All of the above data has been determined using a straight oil vehicle. It is recognized that with different vehicles a given pigment will develop different opacities. Work is contemplated that will establish these vehicle effects.

du Pont will supply rutile titanium calcium Ti-Cal R 25 hereafter in place of the Ti-Cal R 20 - 2142 dry - previously supplied.

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The new R 25 is reported to have different characteristics from that supplied previously under this same trade designation.

Tabulated below are the results of our tests with this new material:

Texture - Hoover Muller Test

New Ti-Cal R 25 is similar in texture to the old 2142 dry, Ti-Cal R 20 which in turn is definitely better than current 2132 dry, Titanox RCHT. This new Ti-Cal R 25 is not as good in texture as the old Ti-Cal R 25.

Wetting - Plastograph Test

Wetting tests showed Ti-Cal R 25, lot 1601, to be just slightly slower in wetting than 2132 dry, RCHT. 2142 dry, R 20, is markedly higher in vehicle requirement. Identical batches made with 2132 dry, 2142 dry and Ti-Cal R 25, lot 1601, respectively, gave the following plastograph readings:

	Initial Peak	Plasticity - Brabender Plastograph			
		2 min. mix	5 min. mix	10 min. mix	20 min. mix
2132 dry	180 units	150 units	115 units	100 units	95 units
2142 "	340 "	240 "	235 "	230 "	220 "
Ti-Cal R 25					
Lot 1601 (new)	240 "	150 "	150 "	120 "	105 "

Opacity

Comparing Semi-Lustro formulas made with the new Ti-Cal R 25 as against 2132 dry, 2142 dry, and old Ti-Cal R 25, all were found to be equal in hiding. The Ti-Cal samples all were between 398 and 403 sq. ft./gal. @ 95 C.R., while the 2132 rated 414 sq. ft./gal.

Brightness and Color

Brightness measurements on the above Semi-Lustros showed all paints to be practically equal for brightness @ 85 - 86%. Color on all was similar, being rated at 10.3 - 11.6 on the Hunter simplified color index

A-B
C .

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Viscosity

Paint viscosities of these pigments show the new Ti-Cal R 25 to be quite close to 2132 dry, having just slightly higher body, 2142 dry giving considerably higher body than either RCHT or the new R 25.

Summary

According to these tests, the new Ti-Cal R 25 will serve as a suitable alternate source for 2132 dry (not 2142 dry).

Chalk Discoloration of Rutile TiO_2 Pigments

A series of SWP Gloss Whites have been made using blends of 1403 dry, free chalking anatase TiO_2 , with various chalk resistant anatase and rutile titanium oxides to determine whether it is possible to formulate with chalk resistant types but not show the yellow discoloration associated with the rutile titanium oxides, 2173 and 2269 dry.

18 days exposure in the Weather-O-Meter give the following results with the TiO_2 combinations indicated:

<u>TiO_2 Portion of SWP Gloss White Pigmentation</u>	<u>18 days Weather-O-Meter Yellow Discoloration</u>	<u>Chalk</u>
75% 1403 dry 25% 2174 dry	None	None
75% " " 25% 2229 "	"	"
75% " " 25% 2228 "	"	"
50% " " 50% 2030 T "	"	"
75% " " 25% 2147 "	"	"
50% " " 50% 2269 "	Slight	"
50% " " 50% 2173 "	"	"
100% " "	None	"

The Weather-O-Meter tests will be continued to active chalking as the yellow discoloration reported with the rutile oxides seems to appear in the chalk. Outdoor exposures will be made to check the accelerated tests.

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is about double the rate on the regular formula, grinding the color in the entire batch. The use of Acto 450 in the colored portion of the paste does not result in an appreciable change in production rate, but does cause a reduction in the consistency of the milled pastes. Acto 450 causes a small increase in rate on the white portion of the paste. If the colored pigments were to be added as flush colors or color bases the grinding rate would be increased, but the total cost would not be lowered, due to the increased cost of the color bases.

#162 - Studies in Flat Wall Paint Formulation

Paintercraft 5-In-1 Interior Paste Paint

Work was continued on the development of a Paintercraft Paste Paint and reducer to overcome the difficulties experienced with wrinkling in heavy films of the high gloss reductions in the Cleveland tests. The Varnish Research Division submitted certain reducing varnishes, as described in their section of this report, varying oil lengths, methods of preparation, and metal contents. The studies of drier contents were extended to determine optimum percentages of metals to obtain satisfactory drying with minimum wrinkling in heavy films.

The results of the tests to date indicate that about 0.31% lead, 0.022% manganese, 0.022% cobalt and 0.12% calcium produces the least wrinkling when used in conjunction with CVR-563 (20-gal. Pentalyn A-Dohydrol varnish).

In the case of the reducing varnishes, it was quite evident that the shorter varnishes produced the least wrinkling. However, we have selected the 20 gallon varnish CVR-563 for our use based on the more desirable varnish length produced when used for the enamel reduction.

Samples of the Paste Paint and reducer CVR-563 were sent to Cleveland for test, together with a number of display panels designed to show the versatility of the various reductions. Work is being continued to further improve the control of wrinkling, after which arrangements will be made for larger scale tests.

Flattone

Cleveland reported that the odor on samples of Flattone White made with Shell's 8296 Special Mineral Spirits and Regular Base #1 is of less intensity than regular Flattone made with (3020) and (348). After the thinners had evaporated, the two samples were found equal with respect to odor. Shell's 8296 Mineral Spirits and Regular Base #1 represent Shell's deodorized type of thinners.

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A number of additional experimental batches of Flattons White were made on the laboratory mixer to determine whether a satisfactory dispersion can be obtained without grinding. However, to date we have been unable to obtain the same hiding as produced by regular milling. Easy wetting pigments such as RCHT-X have been used in place of 2132 dry, but it appears that grinding is necessary to obtain dispersion and to develop maximum opacity.

Tests on Pliolite S-5

A sample of Pliolite S-5 Flat Wall Paint submitted by the Goodyear Tire and Rubber Company was compared with Flattons White and a laboratory batch of flat wall paint made on the Pliolite formula S-103-100. Their sample had settled very hard and required considerable agitation to produce a smooth consistency. The Pliolite flat had sticky brushing, excessive flow, and lapped badly after six minutes. The uniformity of tint and sheen were considered rather poor. When the Pliolite Flat was applied over glue size, the washability was quite good.

Based on our tests, we do not believe that a flat of this type would be acceptable to the painter trade.

A sample of Pliolite S-5 Floor Enamel S-102-300 Tile Red was also compared with Porch and Floor Tile Red Rx 158 for brushing, flow and drying. The brushing properties were found to be quite similar to our regular Porch and Floor. However, it would be difficult to do a good paint job as it was too short on wet edge and lapped badly in less than five minutes. The Pliolite S-5 enamel set-to-touch in 5 minutes as compared to 42 minutes for Porch and Floor Enamel. The Pliolite S-5 enamel will be compared with Porch and Floor Enamel for adhesion to concrete and abrasion resistance.

Enameloid

In a study of the effect of aluminum stearate, 547 dry, and calcium stearate, 1826 dry, upon the settling characteristics of Rx 710 Enameloid White, a series of batches developed excessive seeding. These batches settled appreciably overnight, but showed no correlation between the varying amounts of stearates present and the extent of seeding. They were formulated with 2147 dry, Titanox A 24, or 2229 dry, TiPure R 510, ground in either (3109) or (4103).

An enamel which showed only slight seeding was obtained by grinding the "post-war" grade of 2228 dry, TiPure R 110, in (4103). Increased seeding resulted in this enamel with the introduction of 547 dry, aluminum stearate. The effect on seeding was in direct proportion to the amount of 547 dry introduced. 1826 dry, calcium stearate, showed no

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tendency to increase seeding. These enamels will be aged in the package and will be checked for settling and seeding characteristics at a later date.

Viscosity increased slightly with each addition of 547 dry, but was relatively unaffected by the addition of 1826 dry. See table of data below:

Rx 710 Type Enamel		2228 dry in (4103)	
Soap per 100 gal.	Viscosity #3 orifice	Grind (Hegman)	Seeding
0	27.7 sec.	6 $\frac{1}{2}$	1
1 # 547 dry	28.9	5-3/4	2
2 # " "	30.5	5	3
3 # " "	29.4	5	5
4 # " "	31.0	5	5
5 # " "	31.8	5-3/4	7
1 # 1826 dry	28.2	5-3/4	1
2 # " "	28.8	5-3/4	1
3 # " "	27.4	5-3/4	1
4 # " "	28.0	6	2
5 # " "	28.7	5-3/4	1

Seeding rated 1 for slight to 7 for excessive.

Porch and Deck Paints

Panels 8097 through 8120 C were examined after 28 months exposure 45° south at the Chicago Exposure Farm. This series consists of a group of tests of porch and deck paints on Kromik primed steel panels with both pigmentation and vehicle variations. This is the same group of paints which were also applied on Yellow Pine and Douglas Fir, on which reports were distributed under date of July 23, 1945.

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Inspection of the steel panels shows the following trends:

1. The forty-gallon ester gum Dehydrol varnish, V-11168, is approximately equivalent to the forty-gallon ester gum linseed varnish, ARV-3373, in rust control but considerably superior in erosion control.
2. Rutile titanium dioxide with Micro Velva extender is the best pigmentation tried in either the Dehydrol or linseed varnishes.
3. The following pigmentations are good in either vehicle, (Note - This does not hold over wood surfaces):

Leaded Zinc - Micro Velva
Titanox RC - Magnesium Silicate
Titanium Dioxide - Leaded Zinc - Magnesium Silicate
Lead Titanate - Leaded Zinc - Magnesium Silicate
Leaded Zinc - B.C.W.L. - Magnesium Silicate

4. The following pigmentations are fair in either vehicle:

Lithopone - B.C.W.L. - Magnesium Silicate
Lithopone - Leaded Zinc - Magnesium Silicate
Leaded Zinc - Magnesium Silicate

5. Zinc sulphide or lithopone with extender (magnesium silicate) give poor performance in either vehicle.

#97 - SWP 471

Spreading rates and total film thicknesses were calculated for the series of exposure panels 10781 - 9 C, F described in the June report, designed to evaluate the effect of variations of film thickness on durability.

1st Coat Reduction (Rx 471)	Spreading Rate 1st coat (Based on orig. paint vol.)	Total Film Thickness
1 pint (2)	444 sq. ft./gal.	.0039"
1 pint (1294)	467 " " "	.0038"
1 pint (2) - 1 pint (1294)	684 " " "	.0033"
2 pints (2)	540 " " "	.0036"
2 pints (1294)	654 " " "	.0033"

(continued on page 13)

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At the present time some substitutions of pigments for each other in Semi-Lustre have been made based on their opacity index values determined in an oil vehicle. The Semi-Lustres were quite close for opacity, and therefore there is some possibility that the index might be applied regardless of vehicle.

#182 - Study of Improved Mixing and Grinding Practices

Surface Active Agents

A series of 900 gallon factory batches of Rex 701 - Enameloid Ivory were earmarked for large scale testing of the relative efficiencies of varying amounts of Acto 450, CW (2343). The necessity of clearing out factory overstocks, in advance of inventory, forced a break in this series after two batches had been run. These showed a doubling of grinding efficiency with the use of 1% Acto 450. The batch containing 1% of Acto 450 was ground at the rate of 124 gallons per hour as compared to the 65.5 gallons per hour rate attained on the control.

A new series will be required for continued study on this rex as future production will be on formulas replacing the vehicle NV 1734 with either (3109) or (2853)G.

A screening of available grind aids is being effected by a study of the change in Stomper consistencies brought about by the addition of 2% active agent to a Rex 710 type paste having a Plastograph consistency of 300 units.

Acto 450 is being used as a standard, with agents performing as well or better being selected for further study. The present list of interesting materials follows, with efficiency factors expressed in terms of per cent paste consistency change:

<u>Agent</u>	<u>Efficiency</u>	<u>Supplier</u>
Acto 450	100	Stanco, Inc.
Armeen T	92	Armour and Company
Mixed Amyl Naphthenes	98	Sharples Chemical Company
Encol PL-50-3	99	Emulsol Corp.
Amine EO	104	Carbide and Carbon Chemical Co.
AM 118.5 C	134	Armour and Company
Encol EO-50	136	Emulsol Corp.
AM 118.5 B	144	Armour and Company
AM Coco-B	148	" " "
AM Ac 118.5 C	161	" " "
Armeen C	165	" " "
AM Ac 118.5 B	167	" " "

0007-SWP-045205

0007-SWP-000114576

E. VAN LOO
Cont.

#177 - Pigment Studies

A bulletin is in preparation which reviews and illustrates the application of the opacity data which has been reported piecemeal in past monthly reports. This bulletin will be circulated to the regular mailing lists.

In the report for July data was given which illustrated how a group of lead, zinc, titanium paints developed opacity for the most part proportional to the theoretical hiding calculated on the basis of the total Hiding Pigment Volume Concentration. That work was extended to determine specifically how this proportionality might be expected to exist. It was found by studying rather simple mixed pigment paints that with greater quantities of high opacity pigment in the formula the deviation from theoretical is greater than when the quantity is lower.

The following results are reported as evidence:

<u>Paint No.</u>	<u>Pigmentation</u>	<u>Theo. Opacity in Sq.Ft./Gal.</u>	<u>Actual Opacity</u>	<u>Ratio A/T</u>
RB 1705	12% by vol. 1403 dry 24% " 18 "	489	558	1.14
RB 1706	18% by vol. 1403 dry 18% " 18 "	551	640	1.192
RB 1707	24% by vol. 1403 dry 12% " 18 "	614	734	1.195
RB 1708	6% by vol. 1403 dry 14% " 412 " 10% " 18 "	479	558	1.16
RB 1709	10% by vol. 1403 dry 10% " 412 " 10% " 18 "	519	635	1.22
RB 1710	10% by vol. 1403 dry 6% " 412 " 14% " 18 "	500	585	1.17

Several tests have been made to evaluate the importance and the magnitude of vehicle effects on pigment opacity. It is the conclusion to date that the opacity of a pigment is markedly affected by changes from one vehicle to another. We do not know whether this holds true proportionately for all pigments. There is some indication that it does not, but the results are not sufficiently conclusive to set up the pattern.

0007-SWP-045206

0007-SWP-000114577

M. VAN LOO
Cont.

#122 - Cont.

Rex 705 - Enameloid Jade

Work on Rex 705 - Enameloid Jade has been completed with a study of the effect of grinding each of the colored pigments, phthalocyanine blue - CP 558 and Hansa Yellow - 12105 dry, plus 1/6 of the white pigments 2140 dry and 2147 dry separately, with and without Acto 450. An attempt was made to counteract the bodying effect of the phthalocyanine blue CP 558 by concentrating the Acto 450 addition in that fraction of the paste, but no advantage was gained in going above 2% Acto by weight of the pigment.

Upon grinding the two-thirds portion of straight white pigment remaining in the formula and incorporating it with the colored fractions above, average grinding efficiency increases were found to be in the 100% range listed in the July report.

31% of this increase is due to the use of 2% Acto 450, which raised the mill output from an average rate of 10.7 gallons per hour at 5-1/4 H grind on the 13" 3-roll Lehmann mill to 13.3 gallons of 6 H grind paste per hour.

#162 - Studies in Flat Wall Paint Formulation

Paintercraft 5-in-1 Interior Paste Paint

Additional work was done on the Paintercraft Paste Paint to determine the optimum drier combination to overcome wrinkling in heavy films of the high gloss reduction. A considerable number of drier combinations were studied, to determine the optimum percentages of metal required for satisfactory drying with the minimum wrinkling in heavy films.

The results of these tests indicate that the percentage of lead may be as high as 1% but the manganese and cobalt should be held at approximately 0.02% metal.

Factory batches have been made on the Reducing Varnish CV 7025 and on the paste liquid CV 7024 for the above product. These liquids are to be used in the manufacture of 50 gallons of the 5-in-1 Interior Paste Paint which will be tested in Cleveland and Chicago on one or two large jobs.

New samples of ASP Clay No. 1 and No. 11 were submitted by Commerce Petroleum Company for inspection. The two clays were tested for grinding and body characteristics in the Paintercraft Paste Paint - CH 8025 as compared with the present inert combination of 566 dry and 1348 dry (Santocel #45). The two clays were found to be satisfactory for body but not equivalent to the present inert combination for brightness.

0007-SWP-045207

M. VAN LOO
Cont.

162 - Cont.

To answer an inquiry from S-W, Montreal we have conducted a few tests to check the "ghosting" tendencies of Flat-Tone White containing 4% D.D.T. They reported that experimental Flat-Tone batches containing 4% D.D.T. show rather bad ghosting. To check their results we selected a titanium calcium pigmentation and a lithopone pigmentation as represented by the Flat-Tone formulations dated 2-28-44 and 6-27-46.

Our tests show only minor differences in "ghosting" between the paints made with or without D.D.T. The titanium calcium pigmentation using regular (3880)E, however, was found to be quite superior to the lithopone pigmentation using the vehicle combination of CV 7014, (4107) and CW (1996).

Semi-Lustre

During June an investigation was started to determine the reason for the drop in sheen of Semi-Lustre White when formulated with rather slow thinners such as (141) and (3020). In connection with this investigation, we obtained a number of thinners with high to low Kauri Butanol values, boiling in about the same range as kerosene.

As stated in the monthly report for June, it appears that a high Kauri Butanol value associated with not too high a boiling range gives the best results with the least drop in sheen.

In addition to the data given in the June monthly report, we are listing a re-arranged chart covering the previous data and the evaporation time of one drop of each respective thinner from the surface of a filter paper. In most cases the decrease in gloss occurs only with the slow evaporating solvents .

0007-SWP-045208

0007-SWP-000114579

Semi-Lustre Sheen Versus Solvent Characteristics
(Rearrangement of M. Van Loo's Table in June, 1946 Allied Research Report)

		<u>IBP</u>	<u>10%</u>	<u>50%</u>	<u>95%</u>	<u>EP</u>	<u>Evap.</u> <u>1 drop</u>	<u>Kauri</u> <u>But'l</u>	<u>Body</u> <u>SW-3</u>	<u>Brush-</u> <u>ing</u>	<u>Flow</u>	<u>Wet Edge</u>	<u>Gloss</u> <u>Brush</u>	<u>Blade</u>	<u>Se</u> <u>T</u>
1	(348)	302	315	340	385	394	18 min.	33-40	20.3	G	G	Short-5'l.	75	75	
2	Amsco Lt. Retard	364	373	382	399	412	18 "	30	23.8	G	G	V Sl Sh	65	68	
3	(1257)-Solv.100	300		327	(350)	370	8 "	81.5	19	VG	G	Short	73	75	
4	(6021)Shell TS28	306	324	337	(369)	400	11 "	75	20.3	G	G	Short	72	76	
5	(4021)35/42 Solv	350	361	377	398	418	19 "	85	24.6	G	G	Short	70	71	
6	(4021)Arosol 12	344	360	371	392	412	No spl.	65	2 1.8	G	G	V Sl Sh.	60	68	
7	Amsco Solv E	350		405	435	465	14 min.	74	21.5	G	G	Sl Sh	66	66	
8	Union 9	369	376	385	401	420	33 "	35	23.4	G	G	Sl Sh	52	72	
9	Union 40	372	380	385	402	426	1:06	65	23.8	G	G	V Sl Sh	70	72	1
10	Deep Rock HNG						1:25	31.6	22.5	G	F +	Sl Sh	45	42	1
11	(3020)#3 En Solv	372	400	432	465	497	1:05	44	22.0	G	G	Good	58	66	1
12	" " "	360m	392m	430	497M	500M	1:03	40-48	25.9	G	G	OK-5'l.	65	54	1
13	Sovasol 6	368	384	406	438	460	33 min.	30	26.8	G	G	G	64	53	1
14	Fosolene	370	390	420	460	490	56 "	25.5	24.3	G	G	V S Sh	49	33	1
15	Apco 18	360	374	391	434	475	No spl.	36	24.0	G	G	G	54	46	1
16	Dead Apco 467	424	434	442	460	480	1:05	2 7	24.1	G	G	Sl Sh	33	26	1
17	Shell 407	380	402	434	468	500	1:10	77	25.2	G	F +	Sl Sh	38	34	1
18	Amsco Retardsol	370	390	430	470	505	32 min.	32	24.2	VG	G	Good	23	32	1
19	Valsolal 45	345	380	448	498	535	1:19	88	25.7	VG	G	Good	60	53	1

M. VAN LOO
Cont.

#162 - Cont.

Enamels

A Rex 710 Enameloid White type formula with "post-war" grade 2228 dry Ti-Pure R-110 in (4103) showed reduced seeding on all batches containing less than four pounds of stearate per 100 gallon formula after aging 30 days in the package. Settling ranged from none to slight with batches containing 3 to 5 pounds of calcium stearate, 1826 dry per 100 gallons, and showed the greatest stability. The bodying effects of aluminum and calcium stearates were equal at the time of this observation. See settling and seeding test data below:

Rex 710 Type Enamel
2228 Dry in (4103)

<u>Soap/100 Gal.</u>	<u>Viscosity #5 Orifice</u>		<u>Seeding</u>		<u>Settling</u> <u>1 Mo.</u>
	<u>Fresh</u>	<u>1 Mo.</u>	<u>Fresh</u>	<u>1 Mo.</u>	
0	27.7"	32.8"	1	1	V. sl.
1# 547 Dry Al. Stearate	28.9	32.0	2	1	Sl.
2# "	30.5	33.0	3	1	Sl.
3# "	29.4	32.8	5	2	Sl.
4# "	31.0	34.3	5	5	Sl.
5# "	31.8	35.0	7	6	V. sl.
1# 1826 Dry Ca. Stearate	28.2	33.0	1	1	V. sl.
2# "	28.7	34.3	1	1	V. sl.
3# "	27.4	33.0	1	1	None
4# "	28.0	34.5	2	2-1/2	None
5# "	28.7	35.0	1	2-1/2	None

Seeding rated: 1 = slight to 7 = excessive.

0007-SWP-045210

0007-SWP-000114581

M. VAN LOO
Cont.

#162 - Cont.

Drier Retention

A comparison of the relative effects of Soligen and Ferro calcium naphthenates on drying characteristics of Rex 710 Enameloid White is under way. Two-tenths of one per cent (.2%) calcium naphthenate as calcium, based on vehicle solids, was added to the regular (3109) type formula for Rex 710.

Soligen calcium naphthenate tended to body the enamel some, retarded settling appreciably during the first week of package time, and accelerated the dry-to-touch stage. Ferro calcium naphthenate promoted increased stability, but was less desirable than the Soligen product on every other score.

	<u>Regular Rex 710</u>	<u>+ Soligen Ca</u>	<u>+ Ferro Ca</u>
Viscosity - #3 orifice	66 sec.	79 sec.	86 sec.
Dry-to-touch - fresh	58 min.	56 min.	80 min.
Dry-to-touch - 1 week	60 min.	39 min.	70 min.

In the course of a study of the drier retention characteristics of Rex 729 Enameloid Black and Rex 467 SWP Black as affected by the presence of calcium or iron naphthenates, it was observed that iron naphthenate had a definite and opposite effect upon the grinding efficiencies of these two materials. With Rex 729 pigmented with carbon black beads 2019 dry, in AV 30, the presence of iron naphthenate retarded the grind to the extent that only a 4-1/2 H grind was obtainable in 34 hours as against a 6-1/2 H grind on the regular formulation in 18 hours of grinding time. With Rex 467 carrying carbon black 1728 dry in (2) and (2853)G, the effect on grind was reversed. The regular material produced a 4-1/2 H grind in 10 hours as compared to a 6-3/4 H in the presence of 0.1% calcium or iron naphthenate, as metal, in the same grinding time. The naphthenates showed no advantages in drying.

Floor tests have been made in the basement of Building 531 comparing Porch and Floor Enamel Tile Red - Rex 158 with Pliolite S-5 Tile Red Floor Enamel S-102-300 (OJ 53 K) and Vinylite Floor Paint Red WS 38 A. The floor was treated with 10% HCl and washed clean with water. The enamels were applied as two coat work without reduction, with 24 hours' drying between coats.

0007-SWP-045211

M. VAN LOO
Cont.

#162 - Cont.

The regular Porch and Floor Enamel was rated best for brushing, the Vinylite poorest. The Pliolite S-5 enamel was quite satisfactory for brushing but was short on wet edge. The difficulties of obtaining adhesion with Vinylite on an old concrete floor previously painted were illustrated when the paint came off in one practically intact sheet within a few weeks. The film itself had good elasticity and tensile strength.

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

Attempts have been made to reproduce Titanium Pigment's low pigment volume Finish Coat House Paint - EX 4508. In connection with this work the Varnish Research Division has supplied two processed oils based on formulas recommended by Titanium Pigment Corporation:

CVR 573 (Titanium Pigment's VM2182M7 lined oil)

CVR 572 (Titanium Pigment's magnesium oxide treated linseed oil).

Their lined linseed oil VM2182M7 is a very heavy bodied oil, actually a semi-solid at 35 to 40% non-volatile. When preparing the paint EX 4508, we experienced considerable trouble in incorporating the CVR 573 with the balance of the vehicle, due to incompatibility. Work has been discontinued on this formula until we receive further information and samples of the Heat Bodied Linseed Oil (viscosity 680 - 720 poises) from Titanium Pigment Corporation as used for the preparation of their Lined Linseed Oil VM-2182M7.

#97 - SWP 471

The Varnish Research Division submitted three Z-2 to Z-3 bodied oils for evaluation in SWP, comparing linseed and soya oils.

CVR 569 - Linseed - (44)
Body - 50 seconds, S-W at 75° F.
Color 8 - 9

CVR 570 - Pittsburgh SO 500 Soya
Body - 57 seconds, S-W at 75° F.
Color 9 - 10

CVR 571 - Soya - (1273) + 0.3% catalyst
Body - 56 seconds, S-W at 75° F.
Color - 10

0007-SWP-045212

(Cont.) Agent	Paste Volume	Grind Rate G.P.H.	% In- crease	Grind Hegman	Dry Time Ratio	% Alter Consistency Change
Acto 450 - CW (2343)	31.1	25.5	54.5	6	1.00	100
Armeen-C	29.9	25.5	54.5	6	1.00	100
Diocystyrol phosphonate	31.9	24.2	45.5	6-1/4	.73	92
Monocapryl acid ϕ phosphate	32.2	23.2	40.5	6		114
Amine EO	36.0	23.2	40.5	6-1/4		104
AM 118.5-C	32.4	20.5	24.2	6-1/4		104
AM 1181.5-B	31.7	20.2	22.7	6		104
Armeen T	33.2	19.7	19.4	6		92
2-2-4 #1061	34.2	19.5	18.2	6		100
Diamyl acid phosphate	31.7	19.0	15.2	6		92
Mixed amyl naphthenates	36.00	17.5	6.0	6		90
Control	36.7	16.5	-	6		
AM 118.5-R	36.4	15.9		6		98
AM Coco-R	36.4	13.2		6 +		71

Dry time ratio = Drying time batch/drying time, control.

#162 - Studies in Flat Wall Paint Formulation

Paintercraft 5-in-1 Interior Paste Paint

Factory batches of the Paintercraft 5-in-1 Paste Paint were made for refinishing the general offices at Cleveland. The paste paint was reduced for application as a flat wall paint and wall primer and sealer. The paints supplied include: 30 gallons CH 8040 - Paintercraft 5-in-1 Interior Wall Primer and Sealer shaded to approximately Sencroft Green, 30 gallons CH 8041 - Paintercraft 5-in-1 Interior Flat White shaded to Sencroft Green, 30 gallons CH 8042 - Paintercraft 5-in-1 Interior Flat White.

In additional work to determine the role played by the solvents used in Semi-Lustre as affecting gloss, evaporation rates were run on the same group of solvents previously reported in June and August. The results are shown in the data on the next page.

0007-SWP-045213

412540-DMS-4000

Solvents Tested		Evaporation Rates on Solvents Used in Semi-Lustre																Gloss in	
Hours:		Time Required for Evaporation at Room Temperature																Kauri	
																		Semi-Lustre	
																		Draw-	
																		Brush	
																		down	

(348)	23%	56%	86%	100%														33-40	75	75
Amsco. Lt. Rotard	7	21	40	61	70	98	100											30	65	68
(1257) Solv. 100	21	56	86	100	100													81.5	75	75
(3021) Shell T520	20	55	90	100														75	72	76
(4021) 37.32 Solv.	9	29	63	77	85	100												85	70	71
(4021) Aerosol 12	8	22	44	65	79	100	100											65	60	68
Amsco Solv. E	11	30	53	73	83	99	100											74	68	68
Union 9	5	16	31	48	59	95	100											35	52	72
Union 40	6	19	37	58	67	92	95	99	100									65	70	72
Deep Rock HME	17	35	49	60	64	75	77	80	85	88	91	94	95	99	100			31.6	45	42
(3020) #3 In Solv	4	11	20	31	37	00	65	72	80	85	90	94	96	100				44	58	66
(3020) " " "	19	41	54	64	70	86	99	94	98	100								40-48	65	54
Sovasol 6	4	11	21	31	38	64	70	82	91	97	100							30	64	52
Pesolene	4	12	21	31	37	55	69	67	76	82	90	98	100					25.5	49	55
Deed. Apco 467	6	17	29	41	46	62	66	73	81	88	94	100						27	33	26
Amsco Rotardsol	4	11	18	27	32	49	53	59	66	72	77	83	85	92	94	100	32	23	32	
Valiscol 45	4	9	14	21	26	42	46	53	61	66	75	81	83	91	92	100	88	66	35	

M. VAN LOO
Cont.

#162 - Cont.

Kauri-butanol and gloss values are repeated from previous reports for purposes of comparison. It is immediately evident that slow evaporating rates accompanied by low solvency power lead to low gloss (viz., Rosolene, Deodorized Apco 467, Amsco Retardsol), and even when solvency power is high, slow evaporation introduces a tendency toward lower gloss (Velsicol 45).

Drier retention

After aging in the package over a period of 30 days, Rex 729 Enameloid Black and Rex 467 SWP Black, show no evidence that either calcium or iron naphthenate have any effect upon their drying rates.

#160 - Painting of Bricks

A sample of Turesco Waterproof Paint manufactured by the Turesco Service Company of Chicago has been checked for waterproofing concrete block. Two coats of the Turesco Water Paint were applied on concrete building block and periodic checks were made for water seepage.

The Turesco sample was found to be similar in brushing but not as good in its waterproofing properties as Aquella or X-Tite. One of the weaknesses of this product is its tendency to crack upon drying in areas where a heavy coat is applied.

An inspection was made on September 5 of the Waterfoil paints applied on March 20 to the south side of the new warehouse. The Waterfoil paints were exposed with Brick and Stucco White - Rex 910, Galvite Paint White and Gray, Bonding Cement White, X-Tite (Wesco Water Paints), and two Kan-Tone paints formulated by the Emulsion Research Laboratory for exterior durability. All paints were applied as two coat work.

At the end of 5-1/2 months' exposure, the Waterfoil exposures were rated good in general appearance, and no chalking or washing was evident. However, Waterfoil, Bonding Cement and X-Tite all showed some signs of flaking where they had been applied over cracked areas in the cement foundation. The lack of proper adhesion over these areas appears to be a weakness in this type of material. However, the adhesion in general appeared quite good at the end of 5-1/2 months' exposure.

The sample of Waterfoil prepared on the basis of the analysis of their material was rated poor in adhesion and in general appearance due to a large amount of flaking over the entire surface of the exposure. The lower rating for the oil type paints is due to rust staining and the adherence of dirt.

0007-SWP-045215

0007-SWP-000114586

#103 - Cont.

The Resin Research Department has furnished two samples of alcoholic solutions of "B" stage bis-phenol resin and of "B" stage butyl phenol resin as possible copolymerizing agents with polyvinyl butyral. One sample of each had been dried in a partial vacuum under carbon dioxide, and one sample of each had only that water removed which would float in a separatory funnel. When incorporated in a pigmented coating containing one part of PVB to one part of phenolic resin to one part of titanium dioxide and baked on a molded phenolic plastic, these "B" stage resins all gave slightly yellow finishes of poor covering power. The undried sample of bis-phenol was best and the undried sample of butyl-phenol was the worst from the standpoint of yellowing. However, all were far superior to Bakelite's BV 9700. Attempts to use a PVB - "B" stage phenolic coating as a primer under a vinyl copolymer top coat were unsuccessful, as the copolymer will not adhere to the phenolic primer any better than it does to the original phenolic plastic. Perhaps a variation in the curing and baking schedules of primer and top coat would alleviate this difficulty. At any rate, further investigation is indicated.

Metal Protective Paints .

The Dow Chemical Freeport plant has had some difficulty due to wrinkling when chlorinated rubber top coats are applied over excessively heavy primer films. In an attempt to be of some assistance to the Dallas Technical Service Department, films of special Kromik primers were made in pigment-volume-concentrations ranging from 25% to 70%. The films were spread with the Di Costanzo doctor blade set at 0.005, 0.008, 0.010 and 0.015 inches clearance, respectively. After the films had dried for 8 and 16 hours, they were recoated with Vermilion Chlorinated Rubber Paint - Dow 151.

The results indicate that it should not be necessary to formulate this type of primer at p.v.c.'s above 50% to eliminate the wrinkling of the top coat, thus avoiding rusting tendencies of primers at higher pigment loadings. Kromik at 50% p.v.c. is above the line of critical permeability, but the relatively impervious chlorinated rubber top coat may add resistance to rusting. To check this point, panels are now on test in 3% salt spray.

#177 - Pigment Studies

Distribution of the opacity bulletin awaits the receipt of planograph reproduction of the individual pigment opacity charts.

0007-SWP-045216

0007-SWP-000114587

#162 - Studies in Flat Wall Paint Formulation

During the month the Resin Research Department submitted four bodied soya oils, as listed below, for possible use in Flat-Tone White.

		<u>Body</u>	<u>Color</u>	<u>A. V.</u>	<u>Solids</u>
CV 4513	SO ₂ Treated Soya	11' 56"	14	10.8	100%
CV 4519	Air-CO ₂ -SO ₂ Treated Soya	7' 30"	Dark	10.4	100%
CV 4517	{ SO ₂ -CO ₂ Treated Soya + .5% Catalyst	4' 21"	8	7.4	100%
CV 4518	{ SO ₂ -CO ₂ Treated Soya + 1% Catalyst	4' 37"	11	8.0	100%

The special soya oils were used in conjunction with a small percentage of zinc resinate, equivalent in length to a 100 gallon varnish and introduced for the solids of (3880)E in the Flat-Tone White formula of February 28, 1944. In all cases where the special oils were used, the flats were short in flow and poor in drying characteristics. Based on the work to date, it does not appear that a flat wall paint can be made from this type of soya oil that would be satisfactory in drying, flow or washability.

Pliolite S-5 Flat

Work on the development of a flat wall paint based on Pliolite S-5 has been unsuccessful, due to sticky brushing and excessive flow, typical of vehicles of this type. At the suggestion of Goodyear's representative, small amounts of water and a larger percentage of Apcosol 3 A were introduced to improve the brushing.

The introduction of water produced a considerable increase in the body of the paint and it finally bodied to a paste consistency. Larger amounts of Apcosol 3 A had a tendency to thin the flat, but did not decrease the stickiness sufficiently for proper application.

Enamels

Studies of Settling and Seeding in Rex 710 Enameloid White.

Two series of enamels have been observed in this study. The first made up with rutile TiO₂ R-510 2229 dry ground in (3109) and let down on the regular Enameloid White Rex 710 (3109) - (4100) type formula, was originally rejected for the purpose of this study as all items in the series showed what was considered excessive seeding when fresh. Amounts of aluminum and calcium stearate present in the various batches that comprised this series ranged from 0 to 5 pounds per 100 gals.

0007-SWP-045217

0007-SWP-000114588

#162 - Cont.

The same variations of stearate content were made in the second series of enamels using post-war quality 2228 dry R-110 TiO_2 ground in (4103) and let down on the regular (4103)-(4100) Rex 710 type formula.

During the course of this seeding study, it was observed that seeding ratings were reflecting a similar yet separate quality of film which could better be described as film texture. This is measured by the extent to which granular material breaks through the surface of a wedge shaped film, and can be differentiated from slight seediness by microscopic examination or by the fact that it has no tendency to grow upon aging.

The microscopic method of analysis is over-sensitive, as with it all enamels studied rate seedy. We have therefore adopted the aging method, checking for evidence of growth either as to size or number of particles and labeling enamels demonstrating such growth, "seedy." With this system, the first rating of a given .000 to .003 inch enamel film is listed as "texture or seeding." Subsequent ratings are then listed either as texture when no growth is evidenced, or as seedy when rating increases. Once an enamel is transferred into the seeding column, it will remain there. Seeding and/or texture are rated on a scale ranging from 0 to 10, with a seeding rating of 5 or higher being objectionable.

Upon adopting the above system of evaluation of seeding, interest was renewed in the original test series prepared for this study. The results obtained from it are in agreement with those from the second series.

Seeding and Settling Data

<u>Stearate</u>	<u>Fresh</u> <u>Texture</u>	<u>1 Month</u>				<u>3 Months</u>	
		<u>or</u>		<u>Seeding</u>		<u>Settling</u>	
<u>Lbs.</u>	<u>Type</u>	<u>Seeding</u>	<u>Texture</u>	<u>Seeding</u>	<u>Settling</u>	<u>Texture</u>	<u>Seeding</u>
2229 dry in (3109)-(4100) type Rex 710 formula.							
0	-	Seedy	2	Not rated		6	7
1	Al	"	2-1/2	"	"	6	6
2	"	"	3	"	"	6	6
3	"	"	4	"	"	6	5
4	"	"		7	"	10	3
5	"	"		5	"	6	3
1	Ca	"	2	"	"	4	3
2	"	"	2	"	"	4	3
3	"	"	2	"	"	3	2
4	"	"	3	"	"	2	1
5	"	"	4	"	"	4	1

Ratings: 0 = None 5 = Considerable 10 = Very bad.

0007-SWP-045218

0007-SWP-000114589

#162 - Cont.

		<u>Fresh</u>		<u>1 Month</u>		<u>3 Months</u>		
<u>Stearate</u>	<u>Texture</u>							
	or							
<u>Lbs.</u>	<u>Type</u>	<u>Seeding</u>	<u>Texture</u>	<u>Seeding</u>	<u>Settling</u>	<u>Texture</u>	<u>Seeding</u>	<u>Settling</u>
Post-war 2228 dry in (4103)-(4100) type Rex 710 formula.								
0	-	1	1		1	1		1
1	Al	2	1		2	1		1
2	"	3	1		2	2		1
3	"	5	2		2		5	1
4	"	5	5		2		7	1
5	"	7	6		1		8	1
1	Ca	1	1		1	1		0
2	"	1	1		1		2	0
3	"	1	1		0		3	0
4	"	2		2-1/2	0		3	0
5	"	1		2-1/2	0		3	0

Ratings: 0 = None 5 = Considerable 10 = Very bad.

On the basis of these data, it is apparent that calcium stearate is superior to aluminum stearate both as to its anti-seeding and anti-settling characteristics, when used with 2229 dry in (3109) and post-war quality 2228 dry in (4103).

In both series, considerable to bad seeding had developed during 3-month aging with the presence of from 3 to 5 pounds of aluminum stearate per 100 gallons, while objectionable seeding was developed in no case during this period where calcium stearate was used.

Three pounds calcium stearate per 100 gallons does efficient work as an anti-settling agent as demonstrated by the enamel series using 2229 dry in (3109). The suspension characteristics of post-war 2228 dry in (4103) were so exceptional that the anti-settling characteristics of the stearates in this series were largely obscured.

The Harshaw Chemical Company has submitted six samples of various technical grades of aluminum stearate. These are being studied as to their effect on seeding in Enameloid White Rex 710 as compared with regular factory stock aluminum stearate - 547 dry and calcium stearate - 1826 dry.

Test enamels were formulated with 3 pounds of stearate and 270 pounds 2229 dry ground in (3109) and let down on the regular (3109)-(4100) type Rex 710 formula.

0007-SWP-045219

0007-SWP-000114590

#162 - Cont.

Full bodied material has been set aside to age at 100° F. and normal room temperatures, and a one pint sample of each item has been reduced 20% with mineral spirits (3:8) and is also aging at 100° F.

A list of the special aluminum stearate samples follows:

<u>Sample No.</u>	<u>Type</u>	<u>Al₂O₃</u>	<u>Free Fatty Acids</u>
Tech. No. 40	Mono-stearate	14.76%	4.49%
" " 27	Di-stearate	7.78	16.49
" " 72	" "	9.80	6.25
" " 101	" "	7.47	11.91
" " 34	Tri- "	6.68	24.43
Type B	Al. laurate	11.74	9.24

The milling characteristics of all the special aluminum stearate batches were the same as that containing stock 547 dry. Aluminum laurate bodied excessively on the mill, and required milling to effect complete dispersion of the bodied paste particles on reduction. It also caused excessive body in the fresh enamel, but this was substantially reduced after aging one week in the package at 100° F.

There was no observable growth in granular material during the first week. The relative efficiencies of calcium and aluminum stearates reversed themselves as suspending agents under the conditions of this investigation. Calcium stearate samples showed very slight settling, aluminum stearate samples, none. Aluminum laurate showed more settling than calcium stearate in the full bodied material. In the reduced samples, settling characteristics were in the order of those of the full bodied series with the addition of slight settling where the mono-stearate was used.

Miscellaneous

A sample of SRF Carbon Black, submitted by Witco Chemical Company, was compared with 104 dry lampblack and 101 dry carbon black for color, strength and undertone. SRF Carbon Black is very similar in these respects to 104 dry and is especially indicated where a blue undertone is desired, at about half the cost of 104 dry. The Cleveland Technical Service Department is handling further evaluation.

0007-SWP-045220

0007-SWP-000114591

#162 - Studies in Flat Wall Paint Formulation

Samples of the proposed Decorator's Color Mix Flat - H 8900 and the proposed tinting bases sent in by Mr. Oxley were checked for general performance with the original laboratory development - OJ 817 J. Tests on uniformity, over surfaces such as Flat-Tone, Enameloid, Deco-tint, glue size, etc. gave results similar to the original development. As previously pointed out, the uniformity of any flat wall paint depends upon the uniformity in porosity of the surface. The new Color Mix Flat - H 8900 produced a uniform job on a sealed surface but varied in uniformity of tint over the various products. On the other hand, these variations in uniformity were no greater than would be obtained with any competitive flat or calcicoater we have tested to date.

Semi-Lustre

The Vehicle Research Department has submitted a tall oil modified (2957)E - CVR 618 for evaluation in the Semi-Lustre White formula of 8-15-39. The modified (2957)E was used in conjunction with CVR 621 (blown soya) as a gallon for gallon replacement for regular (2957)E and (2351). In addition to the regular double strength lithopone pigmentation, a second modification was included based on titanium calcium.

The laboratory batches based on these changes were very thin in body and very poor in drying characteristics. On the basis of our tests it is quite apparent that a considerable improvement would have to be made in the drying properties of the tall oil modification of (2957)E before a satisfactory finish could be made from this varnish.

The blown soya CVR 621 was also introduced for the (48) in the Semi-Lustre White formula of 6-25-46. The bodied soya produced a slightly higher initial body than (48) but after several days of aging the consistencies were very close. Properties such as flow, brushing, drying and sheen were similar to the regular.

Enamels

Settling and Seeding in Enameloid White - Rex 710

A series of enamels has been prepared in which various titanium pigments were dispersed in the regular (3109)-(4100) type Rex 710 formula and evaluated as to their bodying, seeding, and settling characteristics. Each enamel contains 3 pounds of aluminum stearate per 100 gallons except as otherwise noted in the pigment column of the table of data below.

Observations were made on materials when fresh, and after one week's and one month's aging in the package at approximately 100° F. Full bodied and reduced materials have been studied, with results varying only as to degree of settling. Data listed will therefore be limited to that gained from the full body materials.

0007-SWP-045221

#162 - Cont.

All exhibited very satisfactory suspension characteristics, with Titanox A-MO 1901 T dry, and rutile TiO_2 pigments R-200 (2173 dry), R-610 (2174 dry) and R-510 (2229 dry), showing only very slight settling after one month's storage. The most pronounced settling occurred in the 2229 dry stearate-free sample.

Objectionable seeding is apparent in only two cases. They are 1403-T dry with 5 pounds of zinc oxide - 108 dry present, and the sample formulated with Titanox RA-NC. The reduced material from the rutile TiO_2 R-610, 2174 dry, showed a slight tendency to seed after one month's storage. Its seeding rating rose from a 3 to a 4, which is still not objectionable. The range from 5 to 6 would be considered objectionable.

Excessive bodying is in evidence in both samples containing zinc oxide - 108 dry. Zinc oxide was incorporated with an anatase and rutile type pigment for comparison with the zinc treated pigments Ti Pure R-610, 2174 dry, and Titanox RA-NC. It is interesting to note that the zinc treated pigments fall into the group that displays satisfactory body characteristics at this stage of the investigation.

Experimental data is tabulated below:

Pigment	Grind	Fresh		1 Week				1 Month			
		Vis. #3	Texture or Seeding	Vis. #3	Texture	Seeding	Settling	Vis. #3	Texture	Seeding	Settling
1403-T 108	6	82"	1	111"		7	0	145"		7	0
1403-T	6	60	1	56		2	0	59		1	0
1901-T	6	51	4	48	4		0	52	4		1
1901-RT	6	68	2	63		4	0	63		3	0
2030-T	6	74	1	65	1		0	68	1		0
2147	6	58	1	54	1		0	59	1		0
2173	6	62	4	50	4		0	49	3		1
2174	6	46	3	43	3		0	46	3		1
2229	6	33	2	39	2		2	40	1		1-1/2

(Cont.)

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Pigment	Grind	Fresh		1 Week			1 Month				
		Vis. #3	Tex- ture or Seed- ing	Vis. #3	Tex- ture	Seed- ing	Settl- ing	Vis. #3	Tex- ture	Seed- ing	Settl- ing
2228	6	55"	1	48"		2	0	48"		3	0
Titanox RA NC	6	44	2	44	2		0	45		6	0
2229 108	6	36	6	71	2		0	79	1		0
2229 1826	6	31	1	43	1		0	42	1		0
2229 No Stearate	6	30	1	56	1		2	37	1		1

Ratings: 0 = None 5 = Considerable 10 = Very bad

Test enamels using various special technical grades of Harshaw Chemical Company's aluminum stearates are showing reduced efficiencies for these materials along with regular factory stock aluminum stearate - 547 dry, when compared to calcium stearate - 1826 dry as an anti-settling agent for 2229 dry in regular (3109)-(4100) type formula for Enameloid White - Rex 710 after one month's aging in the package. This is now in agreement with previous tests on the basis of which we have reported the superiority of calcium over aluminum stearate in anti-settling characteristics.

The tri-aluminum stearate and two calcium aluminum stearate samples are equal at the one month period. A very slight bead can be picked up on the end of a 6" spatula by scraping the bottom of the can containing these materials. The bead is washed off by the enamel that flows from the blade. Di-stearates Tech. #27 and #72 show observably heavier beads but are rated 1, the same as calcium and tri-stearates as their differences are not sufficient to justify separate ratings when viewed from the standpoint of a practical evaluation of relative suspension characteristics.

On seeding, regular aluminum stearate - 547 dry showed considerable when fresh, but has improved slightly during the 30-day aging period. Di-stearates Tech. #37 and #72 showed a slight tendency to seed at the 1-week observation and wet back during the balance of the 1-month period. The tri-stearate Tech. #34 moved into the seeding column at the 30-day inspection. Calcium stearate continues to perform to the best advantage.

0007-SWP-045223

#162 - Cont.

Aluminum laurate promotes the highest viscosity, 48" S-W cup, #5 orifice at 75° F., but is not objectionable.

See experimental data tabled below:

Stearate	Fresh			<u>1 Week</u>			<u>1 Month</u>				
	Vis. #3	Seed- ing	Tex- ture or	Vis. #3	Tex- ture	Seed- ing	Settl- ing	Vis. #3	Tex- ture	Seed- ing	Settl- ing
547 Al Stearate	39"	5	33"	5			0	39"	4		3
1826 Ca "	34	1	32	1			1	43	1		1
5# 1826 Ca"	34	1	32	1			1	41	1		1
Al Laurate	50	2	37	1			1	48	1		2
Al Stearate Tech. #40	41	2	33	2			0	41	2		3
" #27	42	3	36			5	0	44		3	1
" #72	43	4	35	3			0	44		2	1
" #101	45	1	38			2	0	44	2		2
" #34	44	2	39	2			0	47		3	1
No stearate	31	2	28	2			2	36	2		8

Ratings: 0 = None 5 = Considerable 10 = Very bad

#97 - SWP 471

During the month the Vehicle Research Department have submitted two additional SO₂ bodied soya oils, CV 7028-2 and CV 7028-3 for evaluation in SWP Gloss White. The characteristics on each are listed below:

	<u>Body</u>	<u>Color</u>	<u>A.V.</u>
CV 7028 - #2	56" G.H.V. at 77° F.	7-8	13.75
CV 7028 - #3	47" " " "	8	9.7

0007-SWP-045224

#177 - Pigment Studies

The evaluation of the various samples of magnesium silicate extenders has been completed, with the following results:

Name	Residue 325 Mesh	Oil Abs.	100 Rubs		Hoover Texture 200 Rubs		300 Rubs	
			(a)	(b)	(a)	(b)	(a)	(b)
3 X International Asbestine	2.50%	26.7	2-1/2	3	3	4	3-1/2	4
MSK Talc, Loomis	0.09	28.0	3	4	4	4-1/2		
Loomis #15 Micro-nized.	1.15	34.5	4	4-1/2	4	4-1/2		
Loomis #151-A	2.10	36.9	3	3-1/2	4	4-1/4		
Fibrene Dust (Sierra Talc Co.)	Slight trace	35.0	4-1/2	5	5	5		
Fibrene C 400 (Sierra Talc Co.)	Trace	31.7	4	5	4	5		
Velvetone Talc (Blue Star Mines)	.84	30.2	2	3	2-3/4	3-1/2	3-1/2	4-3/4

(a) Hoover texture. Readings in the (a) columns represent the first break point on the Hegman gauge.

(b) Hoover texture. Readings in the (b) columns represent the mass break point on the Hegman gauge.

Paints were made on the current SWP Gloss White formulation, substituting the magnesium silicates for the 20 dry component called for in the formula. The paints were ground in order on the 3-roll Kent mill without making changes in the mill setting. The characteristics of these batches are as follows:

Paint No.	Mg. Silicate	Grind Hegman	Time	Viscosity		Wt./Gal.	Paint Flow	Paint Gloss
				Initial	3 Wks.			
RB 1753	3 X Asbestine	2	10'	33"	41"	14.96	Good	Excel.
RB 1754	MSK Talc	2-3/4	9'	24.8"	26"	14.97	Good	"
RB 1756	Loomis #15 micronized	3	9'	34.0"	36"	14.90	Fair -	"
RB 1755	#151-A	2	9'	39.0"	37"	14.96	Fair -	"

(Cont.)

0007-SWP-045225

#177 - Cont.

Paint No.	Mg. Silicate	Grind Hegman	Time	Viscosity		Wt./Gal.	Paint	
				Initial	3 Wks		Flow	Gloss
RB 1752	Fibrene Dust	3-1/4	9'	26.0"	28"	14.84	Fair -	Excel.
RB 1751	Fibrene C 400	3	9'	21.9"	21.6"	14.82	Fair -	"
*RB 1759	3 X Asbestine	2	12'	25.0"	<u>9 days</u> 37"	14.99	Good	"
*RB 1760	Velvetone Talc	2	13'	19.5"	22.4"	14.99	Good	"

*Paints 1759 and 1760 were made separately from the larger group of tests. This would account for the difference in grind time and viscosity.

In addition, photomicrographs were made at 200 X showing the representative particle characteristics of the various extenders. They indicate the following:

International 3 X Asbestine. Very large particle size.
Very acicular.

Loomis MSK Talc. Large particle size. Acicular.

Loomis #15 Micronized. Fine particle size. Acicular.

Loomis 151-A Talc. Medium large particle. Very acicular.

Fibrene Dust - Sierra Talc Co. Fine particle. Acicular.

Fibrene C 400 - Sierra Talc Co. Fine particle. Acicular.

Velvetone Talc - Blue Star Mines. Medium large particle. Flat plates.

#182 - Study of Improved Mixing and Grinding Practices

Final screening tests were run on Rex 710 Enameloid White enamels using the laboratory Lehmann 11 inch 3-roll mill. The following active agents were used in the proportion of 1% based on the weight of pigment:

0007-SWP-045226

0007-SWP-000114597