

The **Du Pont** **Magazine** **March, 1924**

International
Crow-Shooting Contest
See pages 4 and 5





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Like du Pont Explosives

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FOR one hundred and twenty-two years we have constantly carried on experiments and research work seeking to improve Blasting Practice in the mine, in the quarry, in road-making, in construction work and on the farm. The development of du Pont Blasting Accessories has progressed hand-in-hand with that of du Pont Explosives, each the necessary complement of the other, until today they are recognized as standards the world over.

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Delay Electric Blasting Caps
Fuse
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Galvanometers
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Leading Wires
Cap Crimpers
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Thawing Kettles

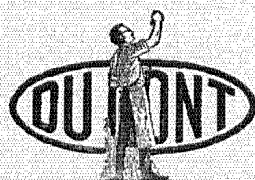
Write for our booklet "Blasting Accessories"

E. I. du Pont de Nemours & Company, Inc.
Explosives Department
WILMINGTON, DEL.



EXPLOSIVES ~ SERVICE

THE DU PONT MAGAZINE



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MARCH, 1924

No. 3

The Review and the Outlook

Present conditions and the developments of 1923 indicate that 1924 will be a year of good business, although probably not a boom year

GENERAL Business Activity. At the beginning of 1923 the improvement of business, which followed the depression of 1921, was still in progress. The expansion continued during the first three months and then rather unexpectedly ceased. Although the average of wholesale prices had risen only moderately, the prices of some commodities had advanced sharply. Wage rates in a number of industries had also risen markedly and labor shortages were reported in various sections of the country. The building trades were especially affected, with the result that construction costs shot up rapidly and occasioned serious concern. There began to be a feeling that the pace had become too fast for safety. Various large building projects were postponed, notes of caution were sounded, there was talk of an increase in Federal Reserve rediscount rates, and an attitude of conservatism appeared. Stock market prices moved downward, commodity prices declined, a sense of uneasiness with regard to the future began to spread. Forward buying fell off, and, although production in most industries continued high for some months, general business activity gradually receded. In the third quarter the readjustment to a lower level of activity became more marked, although the change was at no time precipitate. This readjustment continued, but at a slower rate, and before the end of 1923 there were signs that it had about run its course.

The decline in business from the peak reached in the spring to the end of the year amounted to about 10 per cent, according to the index published by the Chamber of Commerce of the United States, which is reproduced graphically on the next page.

By F. LESLIE HAYFORD

Economic Statistician
General Motors Corporation

throughout the year, reflecting the large, steady volume of employment, increased wages, and the somewhat bettered general condition of farmers.

Industrial Activity. Manufacturing output, which had increased rapidly the latter part of 1922, continued to expand during the first four or five months of 1923, reaching its peak a month or two later than the volume of trade. A gradual curtailment then occurred, continuing practically throughout the remainder of the year. This reduction in output as a whole from the peak of early summer to the end of the year probably did not exceed 15 per cent, although in some industries it was greater than this, while in a few production was maintained at high levels throughout the year.

The large volume of building construction during 1923 notably exceeded that of any previous year. Although the aggregate value of building contracts awarded declined during the summer as a result of the rapid rise of costs early in the year, the reduction was not drastic and, as costs were moderately reduced, an increase in building activity occurred the latter part of the year, being especially pronounced in the New York district—New York State and Northern New Jersey.

The iron and steel industry, which had expanded operations rapidly during the early months, with orders accumulating in spite of record production, suffered a continuous contraction during the last seven or eight months of the year. Average daily pig iron production declined 24 per cent from the peak reached in May

Retail trade, judging from the figures for department stores, chain stores, and mail-order houses, was well maintained

and was smaller in December than in any month since November, 1922. Unfilled orders of the U. S. Steel Corporation fell off 40 per cent between the end of March and the end of November, and although a slight increase was shown in December, the unfilled tonnage at the end of the year amounted to only 4,445,339 tons as against 6,745,703 tons at the end of 1922.

Cotton mill operations, which had expanded the last half of 1922, reaching their peak around the end of that year, remained fairly stable at a point slightly below this level until about May, 1923, and then fell off sharply for a couple of months, later recovering considerably but not again reaching the early-year level.

The automobile industry enjoyed an unprecedented demand, well maintained throughout the year. The combined production of passenger cars and trucks amounted to approximately 4,000,000 vehicles, or 55 per cent more than in 1922.

Industrial employment increased during the first quarter of 1923 and declined only slightly thereafter. In November — the latest month for which comprehensive data are at hand — it still was apparently greater than at the beginning of the year. The volume of factory employment in 1923 is estimated by the Federal Reserve Board as about 13 per cent larger than in 1922. As the trend of wages was upward during most of 1923, there was a considerably larger purchasing power in industrial sections than in 1922.

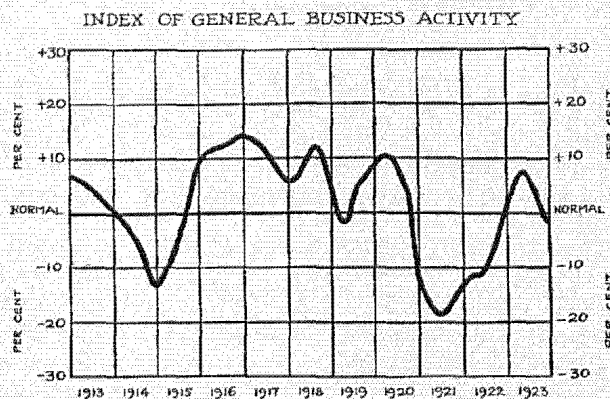
Agriculture. Farming conditions showed improvement in some sections and the reverse in others, but on the whole the purchasing power of the farmers apparently increased. The U. S. Department of Agriculture, on the basis of prices at the farms on December 1, estimated the aggregate value of all crops at \$8,323,000,000 as against \$7,900,000,000 in 1922. The wheat crop, however, was estimated as worth about 18 per cent less than that of 1922. On the other hand, the estimated value of the cotton crop was 29 per cent greater than that of 1922. Hog prices were unusually low, but the number of hogs raised and sent to market was large. The spottiness of conditions in agricultural regions has made for great unevenness of farmers' purchasing power, but taking the country as a whole this purchasing power is apparently somewhat greater than a year ago.

Movement of Goods. One of the outstanding achievements of the year was the handling of traffic by the railroads. Although freight car loadings were considerably greater in nearly every week than in the

corresponding weeks of any previous year, and the year's total established a new record, there was almost no car shortage, even in crop-moving season. This was due in part to the large expenditures made by the railroads for equipment, roadway and structures, totaling more than a billion dollars. The prompt movement of goods undoubtedly prevented duplicating orders and tying up credit which probably would have appeared had there been traffic congestion.

Commodity Prices. The average of wholesale prices advanced moderately during the first quarter of 1923, with marked increases in the prices of some individual commodities, especially raw materials. As forward buying fell off, weakness developed in commodity markets, and the general price average declined from April until August, when signs of stabilization appeared.

During the rest of the year the movement of the price average was within narrow limits. At the end of the year the wholesale price index of the U. S. Bureau of Labor Statistics was two-thirds of one per cent above its low point for the year, and 5 per cent below the peak reached in March. The decline from the peak to the low point recorded in August had been less than 6 per cent. The fluctuations of the year were



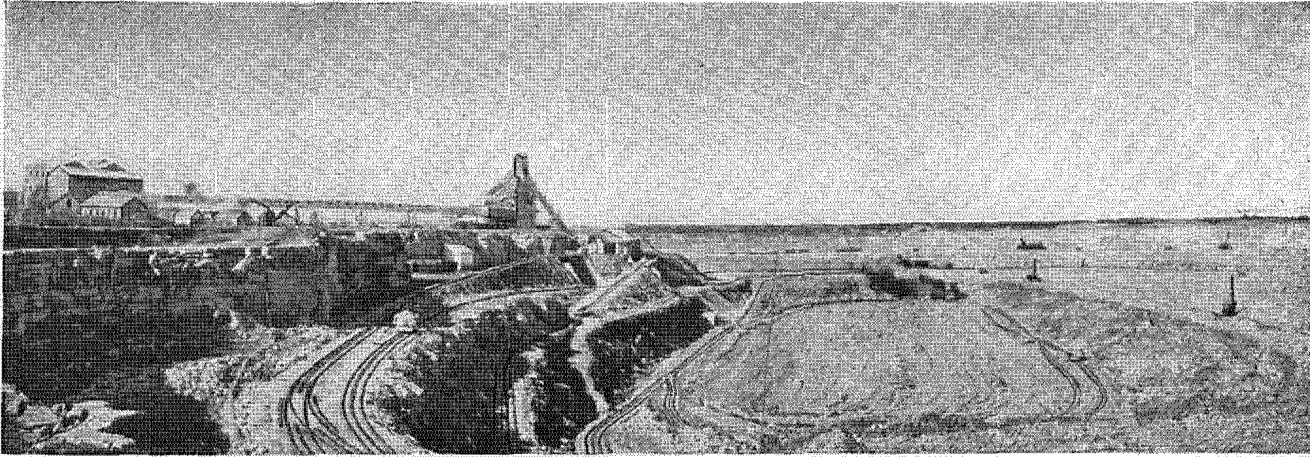
less in extent than in any year since 1915. Moreover, during 1923 some of the maladjustment which had existed between the prices of various groups of commodities was partially corrected; that is, the differences in the relative prices of numerous commodities were lessened. This has improved the general price situation.

The following tabulation shows the price index numbers for December, 1922, and December, 1923, of the various commodity groups which are combined to form the composite index of the Bureau of Labor Statistics. In each case the numbers represent the percentage which prices in December, 1922, and in December, 1923, formed of the average prices of the same group of commodities for the year 1913.

	December 1922	December 1923
Farm products	145	145
Foods	144	147
Cloths and clothing	194	203
Fuel and lighting	216	162
Metals and metal products	131	142
Building materials	185	178
Chemicals and drugs	130	130
House furnishing goods	182	176
Miscellaneous	122	116
All commodities	156	151

It will be noted that average prices of fuel and lighting materials were 25 per cent lower than the year before,

(Continued on page 12)



This panoramic view of the Michigan Alkali Company's quarry will give you some idea of its interesting layout

Quarrying Limestone in Michigan

Briefly describing the well-equipped and efficiently operated quarry
of the Michigan Alkali Company

THE Michigan Alkali Company is one of the largest producers of soda ash and allied products in

By W. J. McHENRY
Sales Representative
E. I. du Pont de Nemours & Co., Inc.

the world, and its quarry, located near the shore of Thunder Bay in Alpena County, Michigan, is a large one, as our illustration shows. Operations are conducted on three levels, the layout suggesting a vast amphitheater, with the quarrymen blasting three rows of seats for giant spectators.

The rock quarried here is of the "Traverse Series", high in lime content and low in both sulphur and silica. In quarries of this size the largest type of well drills is used. These machines carry 5½-inch bits, and while the spacing between holes varies, the practice is to sink holes on approximately 15-foot centers. Buffers are carried in front of each face. The primary blasts bring down the rock with good fragmentation, although secondary shooting is required to break up the larger pieces. The explosives are used so effectively that the steam shovels rarely pause in loading the rock into cars. It is unusual to see one stop on account of hard digging except in wintertime when icy conditions occasionally cause trouble.

The method of transporting rock from the shovels to the crusher is interesting. Quarry cars, electrically operated, shuttle back and forth apparently without

human control, for there are no motormen or trainmen visible. The cars are controlled by a tower operator. By turning the current on or off certain sections of the track line, he can move the cars or stop them wherever he desires. This Woodford Engineering system of control is said to be the most up-to-date method of handling quarry cars.

The crusher serving this pit quarry is advantageously located near the quarry floor. The rock passes through

heavy rolls — the largest type made by the Allis-Chalmers Company. In a few moments they can crush the contents of a 15-ton car. The material from the crusher drops into skips and is conveyed into the screen house which is located approximately 119 feet above the crusher. The rock runs by gravity over the screens where it is sized, thence to loading bins. The larger sizes of rock are dumped into large hopper-bottom cars and hauled to the steel dock for steamer transportation to the plant at Wyandotte, Michigan, while the smaller sizes are taken to the Huron Portland Cement plant nearby.

The Michigan Alkali Company is well equipped for efficient operation in every branch of its work. Hundreds of thousands of pounds of du Pont explosives have been used in this quarry with entire satisfaction.

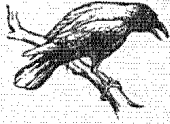


A close-up of the rock pile after a blast. The driller, shown at left center, is preparing for a secondary shot

The International Crow-Shooting Contest

Sportsmen of two nations will shoot to win 79
individual prizes and 210 team
prizes worth \$2,500

The contest starts March 15, and ends
June 15, 1924



THE crow is the farmer's greatest menace. By helping him rid his property of this pest through organized crow-shooting competitions, you will be making the first real advance toward a better feeling between landowners and sportsmen.

The Vermin List. While this campaign has been fostered to start what is hoped will be a means of getting rid of marauding crows which, due to their great numbers, are considered the worst enemies of song, insectivorous and game birds, the following—where permitted by state laws—should also be killed:

Snapping turtle	Sharp-shinned hawk	Red squirrel
Great horned owl	Cooper's hawk	Water snake
Snow owl	Kingfisher	Crow blackbird
Weasel	Woodchuck	Goshawk
Hedgehog	Hunting house cat	Field rat
Starling	Bobcat	Gopher

The Competition. Shooters will compete for valuable merchandise to be awarded to winners of the "Grand International Individual Contest" and the "Grand International Team Race." The conditions governing these contests will be explained in the following paragraphs:

Eligibility. Any citizen of the United States and Canada is eligible to compete. Individuals as well as teams can enter the contest, and in the case of teams the members will receive individual as well as team credit, provided that before competing as a team the members composing it shall enter their names as a team unit with any local sporting goods or hardware dealer.

Entry Blanks. These can be procured from any sporting goods or hardware dealer in your vicinity, or, on request, a blank will be mailed direct to you by the du Pont Company. Fill it out and turn it over to your local dealer who will enter your name on his record. All your kills must be turned over to the dealer for scoring.

Point Credits. The contest will in each case be a race for points,

By FRANK WINCH
Assistant Director of Sales
Sporting Powder Division

and scores will be compiled by crediting individual and team contestants with "kills" on the following basis:

<i>Species of vermin</i>	<i>Points to be credited</i>
Crow	1
Sharp-shinned hawk	5
Cooper's hawk	5
Goshawk	5
Great horned owl	5
Weasel	3
Bobcat	25
Red squirrel	2
Snow owl	2

All others mentioned in vermin list, 1 each.

Extra Award of Points

Killing 25 crows	in one day by one contestant	15
" 3 hawks	" " " " " "	5
" 3 owls	" " " " " "	5
" 3 bobcats	" " " " " "	25
" 5 weasels	" " " " " "	10
" 5 red squirrels	" " " " " "	5

Note: Proportionate credit will be given for kills exceeding the number shown in the foregoing table.

For example, a contestant killing 35 crows in one day scores 35 points, plus 15 points for killing the required 25 in one day, plus pro-rated credit for killing the extra 10—that is, $\frac{2}{5}$ of 15, or 6 points—making his total score for the day 56 points. Contestants will receive one full point credit for resulting fractions of one-half point or over, but will lose credit for fractions less than one-half point.

Evidence of Kills. This means actual evidence. The dealers will demand proof before giving you credit for reported kills. Acceptable evidence will be heads of crows, tails of weasels, hedgehogs, woodchucks, hunting house cats and red squirrels, and the

It's Always Open Season on Vermin

WHY wait for the next hunting season? There's plenty of shooting right now. The woods and fields are full of crows, red squirrels, weasels, owls, bobcats, hawks and other pests which must be checked if our native game birds are to be kept from extinction.

Hunt these pests now! It means full game bags next fall. It's the duty of every sportsman to join in this campaign. It's good sport, too; and with the big International Contest as an added incentive, duty becomes a pleasure with the opportunity to win prizes that are well worth while.

Get in the contest and win one of these prizes!

heads of all other species included in the vermin list.

Exception. Only one exception will be permitted, and that is in states where bounties are paid on crows and other bird-and-crop destroyers. If the dealer is empowered to pay the state bounty, well and good. If not—and the contestant wishes to secure his bounty on the kill—the dealer is authorized to give credit on presentation of a certified statement of the kill as declared to and accepted by an accredited bounty officer. The dealer may accept this evidence in lieu of actual evidence.



Great Horned Owl

Evidence of kill must be turned in every two weeks to the sporting goods dealer, who will enter on his record under contestants' names the date, number of crows and other pests killed, and the number of points credited. If requested to do so, he will also give each contestant a receipt for all evidence of "kills" so that the shooter may know his standing at all times.

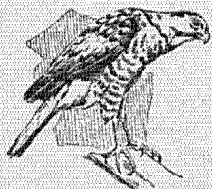
After registering the number of credits for any contestant's kill, the dealer will immediately destroy the evidence.

Dealers' Reports. Every two weeks during the contest period dealers are expected to report to the du Pont Company, on forms provided for that purpose, the names of all individual and team contestants, their kills, and the number of points credited to shooters. Local dealers must certify to the correctness of these fortnightly reports.

The prize winners of the "Grand International Individual Contest" will be determined from a compilation of the scores reported by the dealer. The individual contestant who scores the largest total number of points shall be declared the winner of the first prize, and the others in their respective order.

The winning team in the "Grand International Team Race" will also be determined from dealers' score reports. This race will be conducted as follows:

1. Teams shall originally be composed of 20 men.
2. Names of the team members shall be registered with the local dealer at the beginning of the contest, and he shall report to the du Pont Company, on blanks supplied for that purpose, the personnel of each team reporting to him.
3. It will be an elimination contest. The ten high men on each team, as determined at the end of the contest period, shall be considered as qualified team members; and the total scores turned in by these ten-man team units shall be made the basis for determining the winning teams in this race. Team prizes will be awarded alone to team units.



Cooper's Hawk

Prizes: Seventy-nine prizes will be awarded to winners of the "Grand International Individual Contest," and 210 prizes will be awarded to winning teams in the "Grand International Team Race." Altogether there will be 289 prizes of a total value of \$2,500.

For Winners of the Grand International Individual Contest

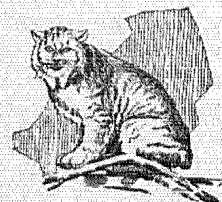
1.	\$100 in merchandise to be purchased from local dealer
2.	75 " " " " " " "
3.	50 " " " " " " "
4.	25 " " " " " " "
5 to 29.	15 " " " " " " "
30 to 54.	10 " " " " " " "
55 to 79.	5 " " " " " " "

For Winning Teams in the Grand International Team Race

1.	\$250 in merchandise purchased from local dealer
2.	150 " " " " " " "
3.	100 " " " " " " "
4.	90 " " " " " " "
5.	80 " " " " " " "
6.	70 " " " " " " "
7.	60 " " " " " " "
8 to 21.	50 " " " " " " "

At the completion of the contest and when the winners are determined, an order will be sent to each one, so that the merchandise may be purchased locally. Winners may thus choose their own prizes within the value of the award, and the du Pont Company will pay the bill in the proper manner.

Publicity. In order that contestants may know how they stand in the race for points, it is suggested that sporting goods and hardware dealers shall post conspicuously in their stores a large sheet on which will be shown from time to time the standing of all local contestants reporting to them.



Bobcat

The progress of the contest and finally the names of prize winners, when determined, will be reported in sportsmen's magazines of national circulation. The du Pont Company will also issue special bulletins to every sporting goods and hardware dealer in the United States and Canada who co-operates in this contest.

Less vermin means more game. Hunt vermin from March 15 to June 15 and you'll have more game to hunt next fall. This contest furnishes an added incentive. Get in—and win a prize. Every contestant, whether a merchandise prize winner or not, will receive a coat lapel button.

Entry blanks for contestants, as well as report blanks for dealers' use, are now available and will be mailed on request to all interested in this organized crow-hunting competition. Please address all inquiries to Sporting Powder Division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.

How Qualities of du Pont Coated Fabrics are Determined*

Part I

By ERNEST B. BENDER and N. M. NICKOWITZ

Respectively, Chemical Superintendent, Fabrikoid Division, and Chief Chemist, Fairfield Plant, E. I. du Pont de Nemours & Co., Inc.

USE of specifications in the purchase of all sorts of materials is a safeguard which large manufacturers have adopted very generally in this country. Purchasing departments are submitting lists of detailed characteristics and qualifications on which bids are to be based and testing laboratories are more and more examining goods received to determine whether the specifications drawn up are being met by the vendors.

The tests which we will describe are, perhaps, more thorough than any single user requires, but the reader will be able to pick out those tests which are of interest in his particular case and, perhaps, after some laboratory work, will be able to adapt them exactly to his needs.

Manufacturers' Tests Good for User Also

There are three general types of tests which are applied to coated textiles: First, those which might be more properly called observations, since they depend upon the senses, to determine feeling, pliability, color, grain, lustre, etc. There are few accurate ways of carrying out and recording such observations. For the most part they are a matter of personal opinion, and perhaps it is not desirable that they should be reduced to an exact qualitative basis.

The second class of tests consists of observations made in the laboratory by use of machines which give definite, quantitative data on the property being tested. These tests are the ones upon which the manufacturer and the purchaser must generally depend to determine and record the quality of the goods in question.

The third class of tests comprises those which depend upon actual service for determination of the desirability of the goods. Such tests, of course, are very slow and, in general, are not very useful in connection with purchase specifications. They should, however, be employed by every purchaser of coated cloth, because they show the relation between his laboratory tests and actual service. They will help him to revise his laboratory methods from time to time to predict more accu-

ately the qualities which the goods will show in service.

Scrub Test: There are many classes and types of artificial leather and rubberized fabrics and it is difficult to discuss all of them with relation to a single test. Certain tests, however, can be applied to almost all classes of goods. The one we consider the most important

single test for pyroxylin-coated fabrics or leather substitutes is the so-called "scrub" test.

[This test was thoroughly described in the October, 1923, issue of the DU PONT MAGAZINE, and its importance in determining the endurance of coated fabrics thoroughly developed. It is, therefore, eliminated from this reprint.]

Physical Tests on Rubber: In conjunction with the usual tests on the finished product, the manufacturer of rubber-coated fabrics finds it desirable to make physical tests on the compounded rubber. The tests consist of determining the tensile strength, elongation, and set. The rubber is prepared for these tests by sheeting it out

on a small experimental calender to a definite thickness. Test pieces are cut from these sheets by means of a die and the tensile strength, elongation and set determined by a tensile strength testing machine similar to that shown in Fig. 4, page 15.

Tests of Coating Important to Manufacturers

These tests are very important from the manufacturer's point of view, since they give him an absolute means of measuring the quality of the coating compound both before and after aging. It is not practicable, of course, for the purchaser to make these tests and perhaps just as well, since he can obtain a good idea of the quality from the scrub test, and other tests which will be explained below.

Besides testing the compound periodically in this manner, a manufacturer of rubber-coated fabrics should never make a change in a compound without first determining its effect by the above means.

Aging Tests: Purchasing of coated textiles of all kinds up to the present time has been based far too much on appearance and price. When consideration has been

(Continued on page 14)

REALIZING the need for a more intimate knowledge of pyroxylin-coated and rubber-coated fabrics on the part of its subscribers, *Automotive Industries* requested the Fabrikoid Division of the du Pont Company to describe the methods of testing used in its laboratories. These facts, having been presented in recent issues of *Automotive Industries*, proved to be of so much benefit to automobile manufacturers that they are here reprinted, with some slight omissions. We do this because the tests described and the qualities which are determined thereby are of value to users of coated fabrics in all fields.

The second part of this article will appear in an early issue. —Editor

*Reprinted from "Automotive Industries," copyright 1923, by the Class Journal Co.

Harnessing Grasshopper Glacier

The Montana Power Company's Mystic Lake project is a difficult one, but du Pont explosives are making the work easier

THE mountains of Montana are not as high as those of Wyoming and Colorado, but they are not less rugged. In fact, many of their peaks are so precipitous that even daring mountain climbers are satisfied to admire them from the valley below.

Granite Peak, situated about twelve miles north of the northeast corner of Yellowstone Park, rises to an altitude of 12,847 feet. On its slope lies the famous Grasshopper Glacier, which contains layer upon layer of prehistoric grasshoppers so well preserved that they look as though they had alighted only yesterday. The ice field covers an area of seven hundred acres, and since its discovery about fifty years ago, it has shown practically no change.

The water formed by the gradual melting of the ice drains through a series of narrow canyons and lakelets to Mystic Lake, which is tucked away in the Beartooth Mountains, forty-seven miles south of Columbus, Montana, the nearest railroad station.

Mystic Lake is about two miles long, one-half mile wide, and of unknown depth. Its surface is 7,650 feet above sea level, surrounded by towering snow-capped peaks, standing out on the landscape in splendors that even the artist cannot reproduce. A whole volume could be written about this vast panorama of compelling beauty and grandeur. The falls through which it discharges its icy waters into the West Rosebud River are about 400 feet high. Even in the driest season, the volume of water tumbling over these falls is enormous. The potential power it could develop is hard to compute.

Recently, the Montana Power Company was granted a lease to develop and utilize a part of this power. It sent its hydraulic engineers into these mountain fastnesses, far away from habitation, where they spent months making surveys a thousand feet or more above the floor of the canyon.

Their final survey was reported about as follows: Tap the lake 46 feet below its natural surface with a tunnel 6 feet by 7 feet and 1,000 feet long. From this tunnel construct a shelf on the mountainside, 12 feet wide, for

By E. H. SIMPSON
Sales Representative
E. I. du Pont de Nemours & Co., Inc.

a distance of 9,000 feet. This shelf, or "flow-line" as the engineers call it, will accommodate a 5-foot wooden stave conduit, which will be connected with the tunnel, and a permanent tramway for bringing in the material, and for future maintenance. This "flow-line" and the tunnel have an even fall of 4 feet to the 1,000 feet, or a 40-foot fall for their combined length. From the end of the flow-line the wooden stave conduit will be con-

nected to a 48-inch steel penstock, which will drop down the canyon 2,700 linear feet to the power house — 1,003 feet measured vertically — giving the highest head of any hydro-electric plant in Montana, and will develop 15,000 horse power.

The power to be derived from this source is but another unit in the already comprehensive system of the Montana Power Company. It will confer innumerable benefits upon the people of this part of Montana, and will assist in hauling

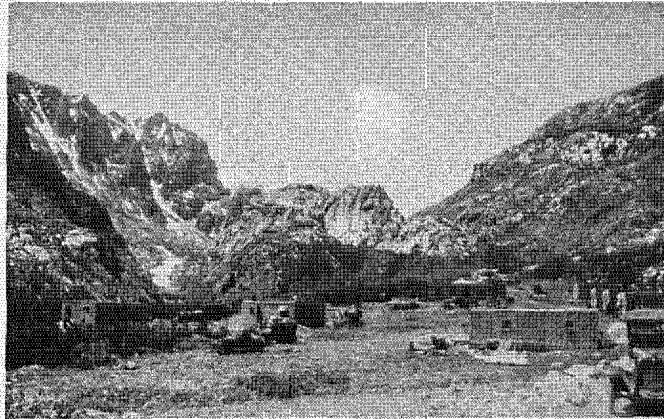
heavy trains over the Chicago, Milwaukee & St. Paul Railway. The contract for constructing the tunnel, flow-line shelf, and penstock way was let to the Winston Bros. Company of Minneapolis, Minnesota, in January, 1923. Mr. W. J. Rohan was placed in charge.

From every angle this is a man-sized job, as the illustrations on the next two pages will show. All supplies have to be hauled forty-five miles from Columbus to the base camp at the power house site. More than 18,000,000 pounds of material will be required. The contract for hauling was let to the Montana White Company, with George B. Selvidge in charge.

From the base camp, supplies are drawn up the mountainside by block and tackle, or on pack animals. It is not economical to move heavy machinery, such as steamshovels, to such elevations; so man power, explosives, and compressed air are the only power used.

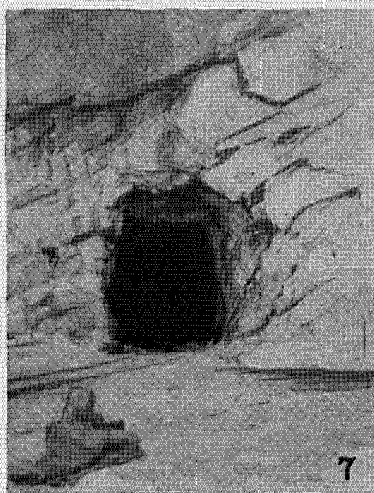
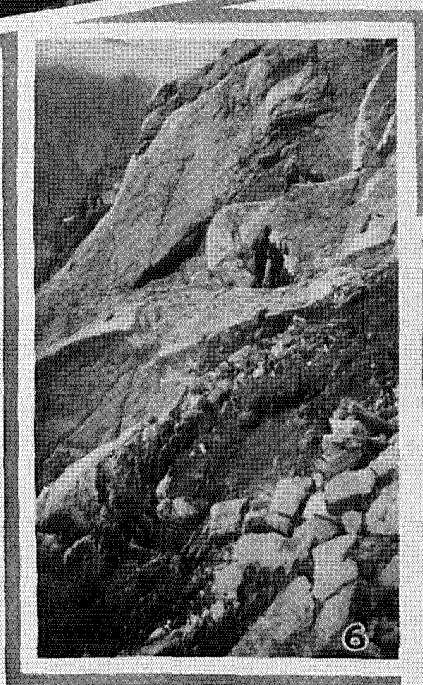
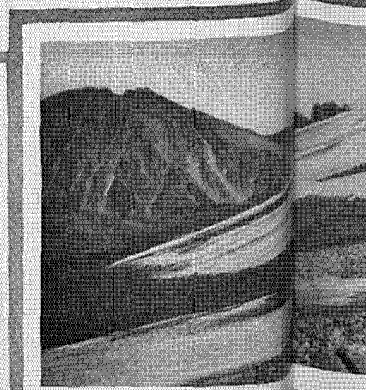
Two heavy-duty stationary air compressors were located in the canyon below, and air is piped to the various locations on the flow-line shelf. At the upper end two portable compressors were drawn up to the flow-line level, to furnish air for drilling in the tunnel.

(Continued on page 16)

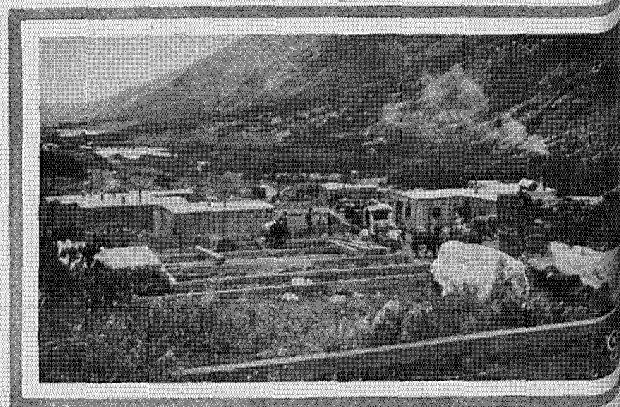


A close-up of the Winston Bros. Company construction camp, with a partial view of the snow-capped mountains encircling it to afford protection from the elements and inspiration for those who are developing the Mystic Lake project

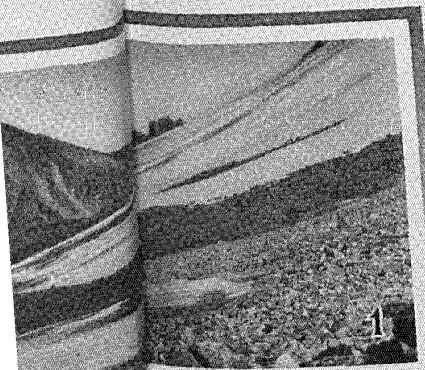
These views show you where the Montana Power Company



1. Grasshopper Glacier, Montana, the source of water power.
2. A more interesting view; the "snout" of the glacier (center) is said to be 70 feet high.
3. Mystic Lake, tucked away in the Beartooth Mountains, is a natural reservoir of great beauty.
4. An enormous volume of ice water tumbles over the edge of the cliff below. At one place there is a vertical fall of 184 feet.
5. One section of the 9,000-foot shelf, or "line" for the 5-foot wooden stave condenser.
6. At work on the flow-line shelf. This photo gives you some idea of the task before the blasters.
7. The east portal of the water tunnel, 6 feet high, and 1,000 feet long.
8. Pashia mountain below.
9. The river needs a dam.
10. The east where used.
11. Where right.
12. Storage dynamite.
13. Another view of the east.
14. The company.



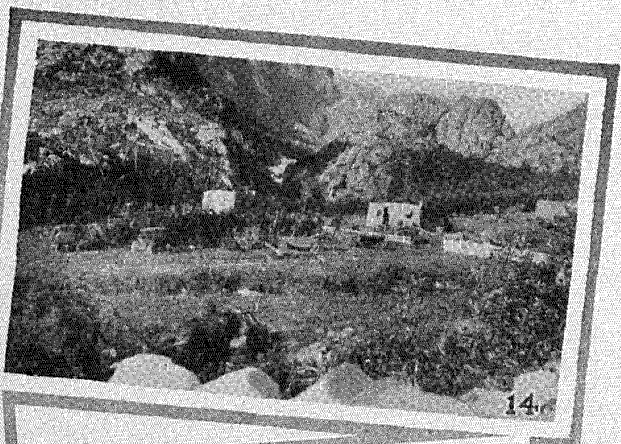
wer Company is preparing to make a glacier pull railroad trains



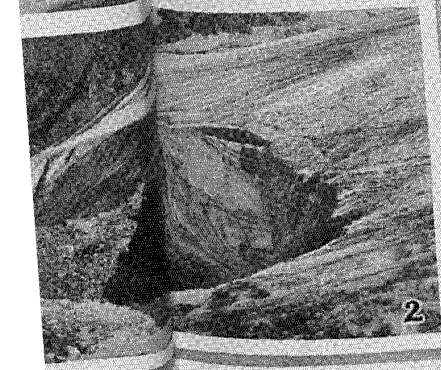
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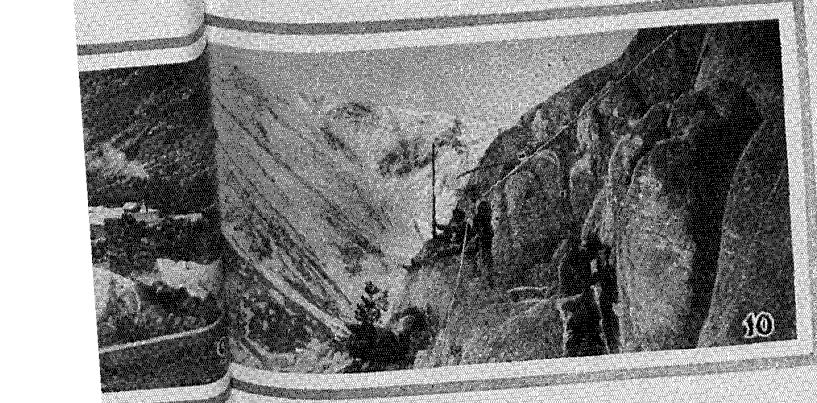
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8. Pushing ahead along the steep side of the mountain, with the river hundreds of feet below.
9. The material yard is a base point for supplies needed on the mountain heights.
10. The engineers make their preliminary survey, where falls mean fatalities. Note the ropes used for safety.
11. Where the water falls vertically. Note, at the right, a portion of the flow-line.
12. Storage and delivery. Transporting du Pont dynamite up the mountain is a job for pack animals.
13. Another view of the flow-line showing where the explosive is used.
14. The construction camp of the Winston Bros. Company with an interesting background.



10

The Remedy

How can gangsters be stopped? The National Rifle Association believes it can be done by teaching citizens and officers of the law to shoot straight

NO subject of vital interest to sporting goods dealers and sportsmen is receiving so much unfavorable publicity as the sale of firearms to citizens. True, most of the propaganda at present is directed against handguns, i. e., the revolver and automatic pistol. For this reason many sportsmen and dealers whose particular interest lies in the rifle or shotgun have failed to take any particular note of the progress of the anti-gun-law agitator.

This agitation to regulate the sale of pistols and revolvers has been carried on for some years, but only within the past two years have the efforts of the anti's assumed an organized aspect. So far as is known, there is no association organized to put across anti-gun laws. The interesting question is accordingly raised: Who is financing the apparently organized propaganda? Considering that the only class benefited by the proposed anti-firearms laws would be the gangsters, is it possible that the campaign funds are being raised from among that class? An interesting editorial in the January 1 issue of the official publication of the National Rifle Association, "The American Rifleman", has raised this point.

So much for the "anti" campaign. It is a reality and a menace. But what can be done about it?

In the first place, the only successful way to combat an organized campaign is by means of another organized campaign. The National Rifle Association, with headquarters in Washington, D. C., has championed the gospel of straight shooting in the United States for fifty-three years. Sponsored by the War Department, it would appear to be the logical organization to counter-

By C. B. LISTER
Staff, National Rifle Association
Washington, D. C.

act the efforts of the gangsters in the direction of anti-firearms legislation.

The reason assigned for wanting to abolish the sale of firearms to citizens is that the average citizen does not know how to use a gun after he gets it. The obvious answer to this is to train every citizen in the proper use of firearms. Another point of immediate bearing on the present popularity of gun-toting by criminals is the fact that most officers of the law with whom they have to cope do not know any more about handling their guns than the average citizen does. In other words, the criminal, though he may be but an amateur with his gun, is nevertheless an expert in comparison with law-abiding citizens and officers of the law with whom he knows he will come in contact in his work. Few criminals have any greater desire to be killed than the average citizen, and it is undeniably true that when the police of a community are taught to use their guns, when they are equipped with standard, efficient artillery, and when the fact that they know how to shoot becomes evident in one or two encounters, the prevalence of gun-toting criminals in that community immediately becomes a thing of the past.

Under the direction of Major K. K. V. Casey the police force in Wilmington, Delaware, was equipped, about 1916, with one of the most modern police shooting plants in the United States, at a time when Wilmington, with its ship yards, leather factories, explosives plants, railroad shops, and similar industrial enterprises, was a Mecca for the floaters of the nation. Prior to the installation of the range and a standard course of shooting instruction and regular practice, shooting affrays were



Are American citizens still interested in the rifle? This picture, showing how they turn out on Government ranges when they are given the opportunity, is answer enough

relatively common, and a number of fearless officers met their deaths because they were untrained. Since the range was installed and the officers were taught how to use their guns, there has been only one shooting affray in which an officer was killed, and that was shortly after the range was opened. Even in that instance, the mortally wounded policeman, slipping down the telegraph pole behind which he had taken cover, got his man from the sidewalk. Since then, there have been, I think, only four cases of gun play in the city and in every instance it has been the criminal who was foolish enough to reach for his gun and who "went West".

The New Jersey State Constabulary has similarly taken keen interest in revolver practice. Major Mark O. Kimberling, deputy superintendent and adjutant of the New Jersey State Police Force, has this to say:

"After passing his entrance examination and receiving his appointment, every man is required to go through a three months' training period, during which time he is given a most thorough course in musketry. The revolver being the most important weapon in this service, a thorough course is given to particularly prepare the men with the knowledge necessary in handling this weapon. We find that after a man qualifies with the revolver it gives him confidence. We try to give as much publicity as possible to the records made by our men in revolver shooting, and we are very proud of the fact that in every case where there has been occasion to shoot at a criminal, the trooper has dropped his man with the first shot. This fact is well-known among the criminal classes, and they indicate great respect toward all the state troopers. In a number of cases where criminals have been apprehended by the state police, they have been free in stating that no one else could have taken them, but that they were afraid to offer resistance because they knew the state troopers knew how to use their weapons."

Strange as it may seem, none of the advocates of anti-firearms legislation has at any time advocated that the police be taught to use their guns. Nor have they advocated that honest citizens be taught to protect their own and other people's property. It is inconceivable that, in any locality where a civilian rifle club is active, a band of five criminals could drive down Main Street, cut the telegraph wires and hold the entire population at bay, while the bank and post-office were robbed, and then drive off unmolested. In any community where there were a few men equipped with the

service rifle or even the .22 calibre long rifle, the criminals on guard outside the bank would be picked off one by one, and those inside would lose their fighting qualities promptly.

This, then, is the campaign planned by the N. R. A. for 1924: First, to assist the police departments in every community, where they want assistance, to learn how to use their guns, and the more efficient service rifle for long range attack.

Second, to interest the hundreds of police departments who at the present time for one reason or another care nothing about pistol-shooting practice; and, having interested them, to see that they are properly instructed.

Third, to assist in organizing civilian rifle clubs in every community in the United States, and to provide the incentive for consistent rifle and pistol practice by arranging local matches, zone championships and the National Rifle Matches at Camp Perry, Ohio.

Fourth, to urge the installation of rifle galleries in educational institutions so that coming generations of Americans may know how to protect their homes and property, not only from foreign invaders, but from the more insidious borers from within, the criminals within their own communities.

Encouraging progress has been made since the War in all the directions outlined, but the surface has just been scratched.

The National Rifle Association has a work to do that is of vital interest to every dealer and every sportsman. It is not an association interested alone in the dyed-in-the-wool target-shooting class.

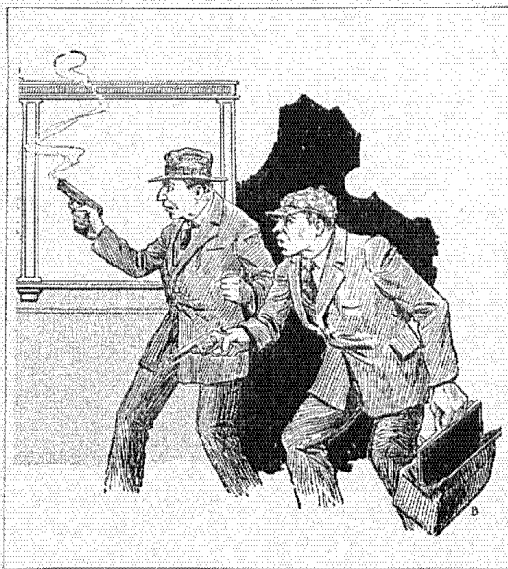
To dealers who feel that they will do their community, as well as themselves, a material service through the organization of police or civilian clubs, every possible co-operation will be extended.

To American citizens who wish to foster the work of this association in their communities, every possible aid will be granted.

The anti-gun law can be intelligently viewed only from the standpoint of a public menace.

The dealer will naturally regard it as a menace to a part of his business.

The only lasting and satisfactory remedy for the epidemic of "anti" agitators now in progress and for the prevalence of banditry is a proper education of the police and the citizens along the lines suggested.



Bank robberies will be less frequent when officers of the law and citizens learn how to shoot straight

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Vol. XVIII

MARCH, 1924

No. 3

Delivering du Pont Explosives Safely

THE du Pont Company does not permit any of its employees to transport blasting caps or electric blasting caps in the same vehicle with other explosives, nor does it permit the storage of these materials in the same building. These practices are strictly forbidden, and have been for many years.

The company employs traveling supervisors to make inspections of its magazines and delivery equipment to insure full compliance with all regulations. That is a part of du Pont explosives service which is founded on a settled policy of this organization to make every reasonable provision for safety from the first step in manufacture to the final delivery of its explosives products.

The Review and the Outlook

(Continued from page 2)

and that building materials and house furnishing goods were slightly lower; while foods, cloths and clothing, and metals and metal products were higher. The combined average for December, 1923, was $3\frac{1}{4}$ per cent below that of December, 1922.

Banking and Credit. During 1923 the reserve ratio, total reserves, Federal reserve note circulation, and deposits of the combined Federal Reserve Banks showed little change. Total bill holdings increased moderately, the volume of bills discounted and of those bought in the open market being larger at the end than at the beginning of the year.

Statistics of the reporting member banks of the Federal Reserve System show an increase in loans, but one which was at no time very rapid and which was rather moderate in scope. The ratio of borrowings to the combined loans and investments of the member banks also increased, but not greatly.

Rates on commercial paper moved within narrow limits during the past year. After their seasonal decline in January, they advanced until April, getting up to about $5\frac{1}{4}$ per cent. In the summer they eased somewhat and then rose again moderately in response to the autumn seasonal demand for funds. Toward the end

of the year they again declined slightly, being hardly any higher at the end of 1923 than they had been at the close of 1922.

Outlook for 1924

The most reasonable expectation for the next two or three months is that business conditions will not change much, and that the volume of trade and of industrial output and the level of commodity prices and of wages will continue about as they are. There has been little change for several months, and the continued conservatism of the business world makes it unlikely that any immediate or sudden expansion will occur, while the stability and soundness of existing conditions render improbable any early and material recession. It is now generally conceded, even by those who were formerly pessimistic, that a depression is not imminent.

With regard to the more distant future, the most probable development is believed to be the beginning of a moderate expansion of activity before the middle of the year, with increased improvement as the year progresses and confidence becomes fully restored. Of course, business might expand suddenly and rapidly this spring and either boom onward to an eventual crisis or else shortly be brought to a halt for a period of readjustment similar to that of 1923. Such an eventuality does not appear probable, however. Conceivably, too, business might continue throughout the year at about its present level, remaining in a condition of stabilization. But this also does not at present seem so likely as that some gradual expansion will occur.

Building construction promises to be large in 1924. Contracts let during recent months and building permits issued indicate that the volume of construction during at least the first half of the year will be great.

The announced policy of the railroads is to continue the program of physical rehabilitation and improvement so effectively carried forward in 1923. Railroad buying will likely be large, although probably not so large as last year.

With labor almost fully employed at high wages, and with agricultural conditions somewhat better than a year ago, the present purchasing power of the country is great and the demand for consumers' goods is likely to be well sustained.

The recent stability of commodity prices and the lesser inequalities between the relative prices of various commodities than existed a year ago are conditions favorable to business, in that they will tend to increase the confidence of buyers.

The very strong position of the banks, the abundant supply of available credit, and the moderate money rates now prevailing are also important favorable factors.

Present conditions, therefore, indicate that 1924 will be a year of good business, although probably not a boom year.

Blast Down the Old—Roll in the New

How an old shaft house of a Michigan ore mine was demolished with dynamite and a new one substituted without undue loss of time

EARLY last year the Marquette Ore Company decided to replace its wooden shaft house known as "No. 2" at the Mary Charlotte Mine with an all-steel structure. In order to reduce lost hoisting time to a minimum, it was decided to erect the steel structure on a temporary wooden skidway alongside the old shaft house, blast down the old building and move the new one over on rollers to the piers that would be waiting for it.

Work was started immediately on the new piers. Advantage was taken of a tunnel leading through the side of a little hill to the cage road at the shaft, 25 feet below the collar. Then starting from the tunnel, a drift was driven around the shaft, and the excavation for the piers was done by "raising" from this level to the surface. This saved much time, because of the depth and nature of the ground, and the workmen were not exposed to the cold weather and snow.

Work on the new structure was started April 21 and by June 1 it was completed. During July, however, the iron trade looked very promising and labor shortage began to show itself; therefore, to keep the men and to continue hoisting ore, the moving was postponed until early fall.

In September it was decided to move the new building. Plans were made to shut down September 22 and resume operations October 1. Everything was put in readiness to start dismantling the skips, cage, ropes, pipes and electric wires the night of the 22nd. Night-hoisting was stopped and everything was carried out as planned.

The du Pont Company assigned one of its representatives to do the blasting for us. It was quite a job to throw over the old, partly buckled structure, which leaned in a threatening manner toward the new shaft house. We were much concerned that it should not fall that way. As it was considered unsafe to blast the legs adjacent to the new structure, it was decided (1) to shoot out the supporting legs on the side toward which the building might safely fall; (2) by means of a cable attached to the top of the structure, keep a heavy strain to insure its falling in the desired direction, and (3)

By G. D. McLEOD
Mining Engineer

with rotation delayed shots, blast away the remaining supports. This plan was carried out successfully.

About four feet above the piers, holes were bored in all the legs, except those adjacent to the new structure, and a stick of 35 per cent du Pont Gelatin ($1\frac{1}{8}$ by 8 inch) was loaded in each hole. Each charge was primed with a blasting cap. The fuses were cut to varying lengths to insure a proper sequence of the detonating charges. Then the sway braces were cut through and the preparation for the blast was complete.

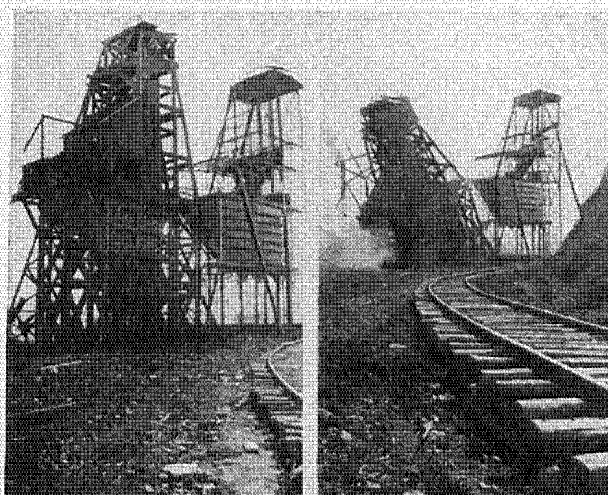
When the charges were fired the Mary Charlotte shaft house inclined in the direction planned and fell, a mass of splintered timber and tangled iron tie-rods. The shot was perfectly executed and was completely successful, as the accompanying illustration shows.

Immediately the work of removing the debris was started, and as soon as this was accomplished the new shaft house was let down on rollers and moved to the new position over the piers, a distance of fifty feet; then it was lowered to the anchor

bolts and secured. The remaining work of replacing the skips, cages and other accessories was soon completed and we began hoisting ore again on October 3.

A rough summary shows the time saved. Forty days were required to erect the new structure on skids; meanwhile hoisting operations continued without interruption. Wrecking the old shaft house and replacing it with the new one involved a close-down of only 11 days, and this time could have been lessened still more if we had worked on a double-shift program. Everybody around the mine worked enthusiastically to "put the job across" and all agree that du Pont is entitled to much credit for its part in it.

Metal-mine ventilation through the use of flexible tubing—such as Ventube—is discussed in Serial 2551, recently issued by the U. S. Bureau of Mines, Department of the Interior. The report is by D. Harrington, supervising mining engineer, whose article "Adequate Ventilation of Metal Mines" was published in our August, 1923, number.



Left, the old shaft house and the new one a few moments before the blasting began. Right, the old shaft house falling in a safe direction

How Qualities of du Pont Coated Fabrics are Determined

(Continued from page 6)

given to quality, only the initial quality has been taken into account, as a rule. It is probably true that the importance of the initial quality has been overrated.

It is natural to assume that a piece of goods with a very high quality when freshly made will maintain a relatively high quality throughout its life. That this assumption is entirely unjustified, when comparing goods from different sources, will be shown later. A piece of goods, such as a high-grade upholstery material, can be made which has an initial scrub of 500, and would, at the end of a year of storage, have a scrub of 5 or 2, or even zero; that is, in the latter case, it would crack on bending. Obviously, this piece of goods is entirely unsuited for its intended use, although when new it was excellent.

What Aging Tests Show

It is much better to have a medium initial quality with a low rate of deterioration. For instance, if a piece of goods scrubs 250 when fresh and then deteriorates to 50 per cent of its original value in a year, it will be a useful and quite satisfactory covering for a cushion at the end of that time and will promise several more years of good service. It is ideal, of course, to have a piece of goods with a high initial scrub and a low rate of deterioration, and this is the goal toward which all manufacturers of high-grade artificial leather are striving, with varying degrees of success.

Accelerated aging tests for pyroxylin-coated material are best carried out by getting the initial scrub on a number of representative pieces and then storing these at 65° C. (150° Fahr.) in a carefully controlled electric oven. The goods are suspended so that there is a free circulation of air about them. They are removed once a week, pieces are cut off for scrubbing, and the remainder returned to the oven.

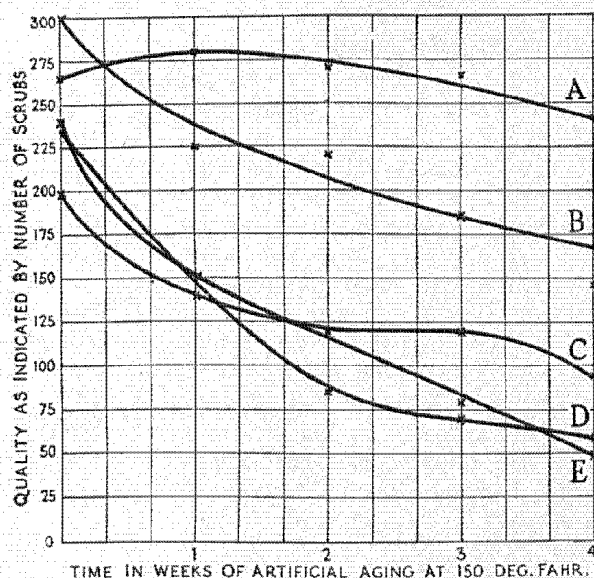


Fig. 1—Typical curves showing deterioration of various types of leather substitutes during artificial aging tests. Material B deteriorates rapidly and is much inferior to A at the end of a week though better at the start. This illustrates the importance of aging quality as contrasted with initial quality. Both materials have a normal or good resistance to deterioration. Curves C, D and E indicate relatively poor aging qualities.

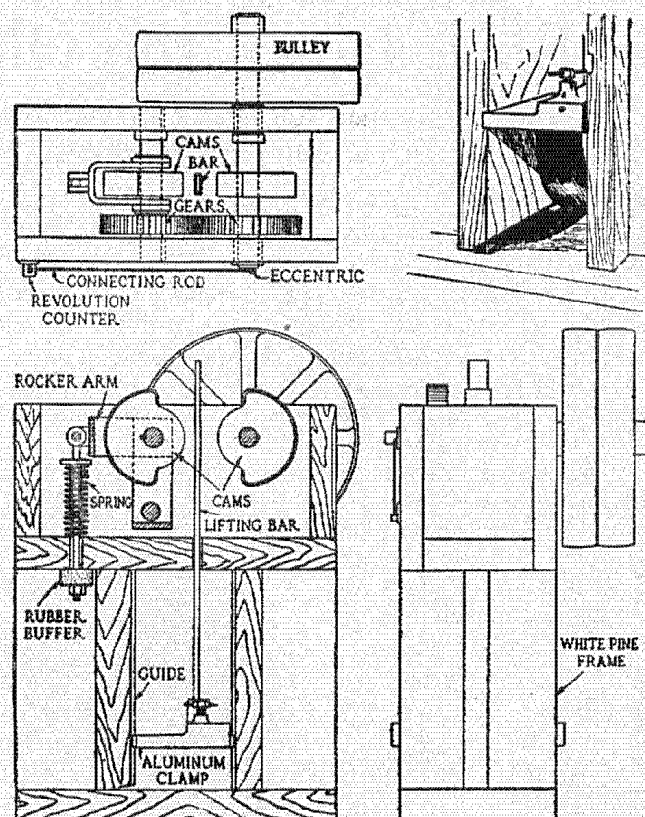


Fig. 2—Apparatus for determining ability of coated fabric to withstand repeated folding

In this way we have at the end of four weeks of storage five scrub tests on each piece. It is common to express the result of this test in terms of percentage deterioration; thus, a piece of goods which scrubs 200 at the beginning and scrubs 100 at the end of the four weeks' storage test is said to have deteriorated 50 per cent.

Scrub test data can be plotted as shown in Fig. 1, and this is probably more enlightening than simply giving the final deterioration percentage. It will be noted that sometimes the scrub of pyroxylin-coated goods is higher after one week's aging than it was when the sample was fresh (Curve A, Fig. 1). This is due to the fact that there are two influences at work during the early period of the aging of artificial leather. One that tends to improve the quality is the loss of residual volatile solvent. The other and opposite tendency is caused by the high temperature inducing decomposition of the ingredients of the coating.

Deterioration During Aging

As long as the loss of solvent and the concomitant toughening of the coating is in rapid progress, it overcomes the loss of quality due to deterioration; therefore quality, as measured by the scrub test, increases. Following this initial rise in quality there is a steady fall, which continues until the material cracks on sharp bending, at which time the scrub is said to be zero.

Progress of deterioration in different types of pyroxylin-coated goods varies somewhat; for instance, the goods may become very oily, and this may be followed by stickiness. In other cases, the goods may lose considerable of their original pliability and finally become extremely brittle. On the other hand, pliability may be retained to the end of the test, but the film may become "mushy" or soft and easily abraded. In

the best type of leather substitute the surface characteristics never become objectionable until the coating has given years of satisfactory service. It is important, therefore, to make observations in respect to these conditions on the samples during the accelerated aging tests.

Four weeks of artificial aging, as described above, has been found to be equivalent to one year of storage.

It probably is true that the combination of the scrub test and the accelerated aging test gives the most important data which can be obtained for judging the quality of pyroxylin-coated textiles that are to be subjected to hard usage.

Aging of Rubber-Coated Goods

Accelerated aging tests for rubber-coated fabrics are carried out in much the same manner as those for pyroxylin material except that the material is stored at 70° C. (158° Fahr.). On finished material, the following tests are made before storage: scrub, anchorage, and combining strength on double texture material. The last two tests are described later. In addition to these tests, some manufacturers also make physical tests on stored compound. These tests are made daily after four days' storage.

Rubber-coated materials usually deteriorate in the following order: The varnish finish first begins to check after storage and this is followed by the rubber becoming less and less elastic, until it finally cracks on sharp bending.

The effect of heat aging on rubber compounds has been well established by the work of Dr. W. C. Geer, who showed that subjecting samples to dry heat at 70° C. (158° Fahr.) for one day is equivalent to six months' normal aging.

For rubber the combination of tests a purchaser could make which would give the most important data would include, in addition to the scrub test and accelerated aging test, exposure tests, anchorage and combining tests. The anchorage and combining should, of course, be made before and after aging and exposure.

Fold Test: In Fig. 2 is shown an apparatus for carrying out what is called the fold test. This machine is operated by an electric motor and causes the goods to be stretched and folded sharply under a 10-lb. weight forty times per minute. The test is continued until the coating shows a distinct break at one of the folds, this being taken as the end point. Fold tests can be carried on also for a definite period of time, after which the goods are subjected to other tests to determine the effect of vigorous folding or creasing.

This test was designed primarily for automobile top materials, but it seldom is used for that purpose today, since collapsible tops are relatively fewer and are seldom let down. The test is especially useful for goods which must receive such action as that given by camera bellows. When used as an automobile top test, it is generally preceded and followed by the hydrostatic test, for much the same reason that the aging test is accompanied by the scrub test.

Hydrostatic Test: In Fig. 3 is shown equipment used for determining the hydrostatic resistance of coated fabrics. The material is tested in duplicate or triplicate by clamping pieces face inward over the flanges on the horizontal pipes which are connected with the vertical main. Water is fed into the vertical pipe at such a rate that the level rises at a rate of 2 ft. per minute. At the first appearance of water on the back of the fabric, which is outside, the water is shut off and the height of the column noted on the gage glass.

Any good top material will stand a hydrostatic pressure equivalent to 10 ft. of water for a long period of time without any leakage. If it stands this even momentarily, its hydrostatic resistance is satisfactory when new. After being subjected to the fold test for a reasonable number of times, say 300, it should stand a pressure equivalent to 2 ft. of water.

Shower Tests Too Gentle

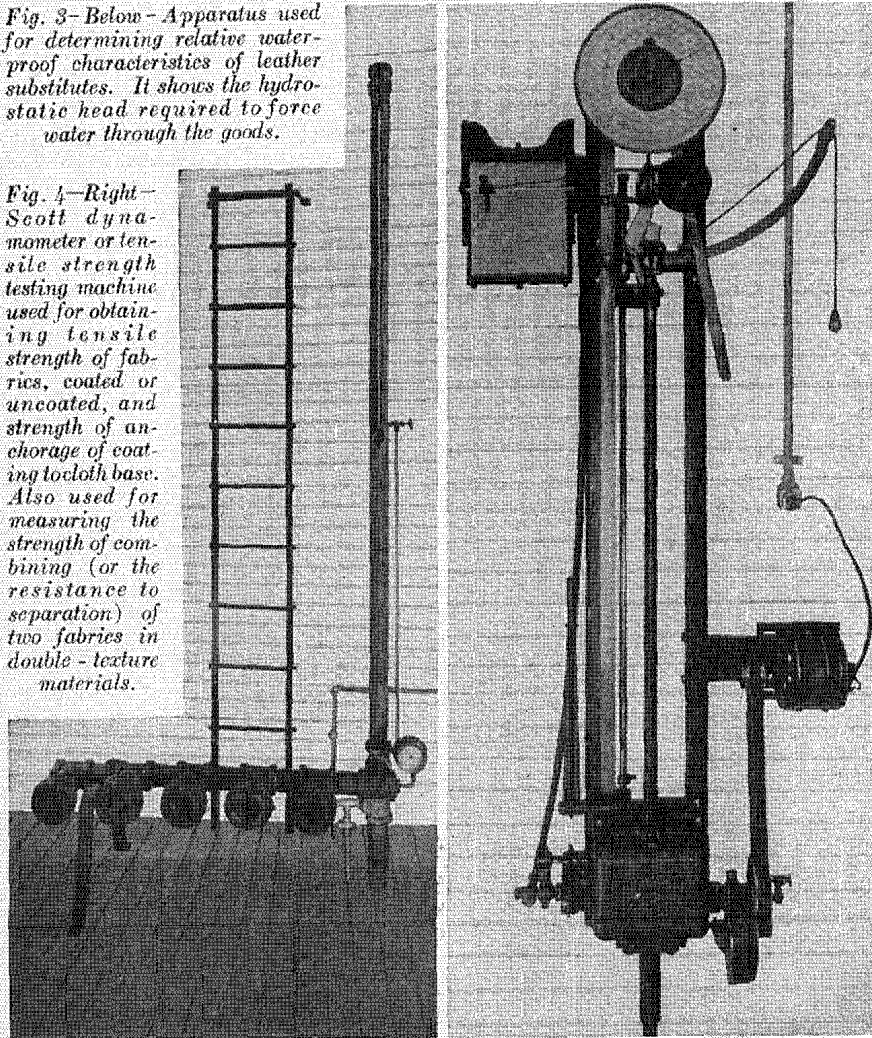
The shower test, which has been employed by the Bureau of Standards, has been used to considerable extent, but it is so gentle in its action that it is useless as a test for waterproofness of top materials.

Cold Crack Test: This test is applicable to pyroxylin-coated textiles, but not to rubber-coated fabrics, as the latter are not affected appreciably in pliability by low temperatures.

Two test pieces, 1 in. wide by 7 in. long, are cut along the warp and two along the filler threads of the fabric backing of

Fig. 3—Below—Apparatus used for determining relative waterproof characteristics of leather substitutes. It shows the hydrostatic head required to force water through the goods.

Fig. 4—Right—Scott dynamometer or tensile strength testing machine used for obtaining tensile strength of fabrics, coated or uncoated, and strength of anchorage of coating to cloth base. Also used for measuring the strength of combining (or the resistance to separation) of two fabrics in double-texture materials.



the material to be tested. These pieces are slightly folded lengthwise and inserted in large test tubes. The top of each test piece is fastened to a wire attached to a cork closing the mouth of the tube. The tubes are placed in a bath of ice and salt adjusted to a temperature of 6.7° C. (20° Fahr.).

Pieces of lead are placed in the bottoms of the test tubes to weight them down so that they will remain in an upright position. The temperature of the bath is determined by a thermometer inserted in a test tube in such a manner that it does not touch the bottom or sides of the tube. Samples are allowed to remain in the bath for 30 minutes, keeping the temperature constant at 20° Fahr. by additions of warm water, or ice and salt, as required.

At the end of this time the sample is removed from its tube and quickly grasped in both hands, having a space of approximately 1 in. between the hands. The hands are pushed together, immediately causing several sharp folds in the test piece. The sample is then examined to see if the film cracked when folded. In some cases where the sample cracks badly a distinct snapping noise can be heard. The results of the tests on the warp and filler samples are reported separately, using the expressions "did not crack," "cracked," or "cracked badly," as the case may require.

This test is of particular value for automobile upholstery, because the material is certain to be subjected to extremes of temperature. It is well known, of course, that any artificial leather or coated leather cracks if the temperature is low enough. For use in a climate like that of New York City a coated fabric should stand 20° Fahr. without cracking. Top materials might crack at a higher temperature and still be satisfactory, but curtains should not crack at 20° Fahr.

[Reference has been made in the foregoing article to the scrub test, which was described in the October, 1923, number of this magazine. A few copies of this issue are still available.—EDITOR.]

Harnessing Grasshopper Glacier

(Continued from page 7)

More than 100,000 cubic yards of rock—gray granite—will be cast down the mountainside in constructing the flow-line shelf. Most of this work is being done by "station men" gangs, each doing its own drilling and blasting. Drilling is done with jackhammer-type drills, 1¼-inch and 2-inch steel being used. Holes vary in depth from a few inches to several feet. Deep holes are "sprung" and all are loaded heavily with 40 and 60 per cent Red Cross Extra dynamite, and fired with electric blasting caps. This is the only safe and efficient method here, as the "get-away" for the men is slow and hazardous, and it is desirable to throw as much material as possible off the grade to avoid handling it. So precipitous are the cliffs and slopes in places that the workmen safeguard against falling by tying ropes about their waists and anchoring the ropes to the cliffs above.

The tunnel is being driven by two shifts a day. The rock is very hard, gray granite. Drilling is done with the wet pattern jackhammer drills, set on a column. Eighteen holes are drilled for each round—five cut holes and thirteen around the rib. Holes are drilled 5½ feet deep. Breakage averages four feet per round. Cut holes are loaded with 80 per cent gelatin and fired with du Pont electric blasting caps. Rib holes are loaded with 60 per cent gelatin and fired with fuse and caps.

More than 100,000 pounds of du Pont explosives will be used on this project.

The speed with which this work is being done is remarkable, considering that winter comes early at this altitude.

The work is being carried on under the direction of H. H. Cochrane, Chief Engineer, Frank Scotten, Construction Engineer, and Joseph E. Bell, Resident Engineer, all of the Montana Power Company.

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Buffalo, N. Y.

Prudential Bldg.

Chicago, Ill.

1814 McCormick Bldg.

Denver, Colo.

406 Ideal Bldg.

Duluth, Minn.

Hartley Bldg.

742 E. Superior St.

El Paso, Tex.

811 Mills Bldg.

Huntington, W. Va.

401-19 Robson-Pritchard Bldg.

Kansas City, Mo.

225 Scarritt Bldg.

Mexico City, Mex.

Edificio de La Mutua, 406

New York, N. Y.

120 Broadway

Pittsburgh, Pa.

Fulton Bldg.

Portland, Ore.

Northwestern National Bank Bldg.

St. Louis, Mo.

17th Floor, Arcade Bldg.

San Francisco, Calif.

569 Mission St.

Seattle, Wash.

Hose Building

2d Ave. & Cherry St.

Scranton, Pa.

710 Traders Bank Bldg.

Spokane, Wash.

721-22 Old Nat'l Bank Bldg., Riverside Ave. & Stevens St.

Springfield, Ill.

716 Reich Bldg.

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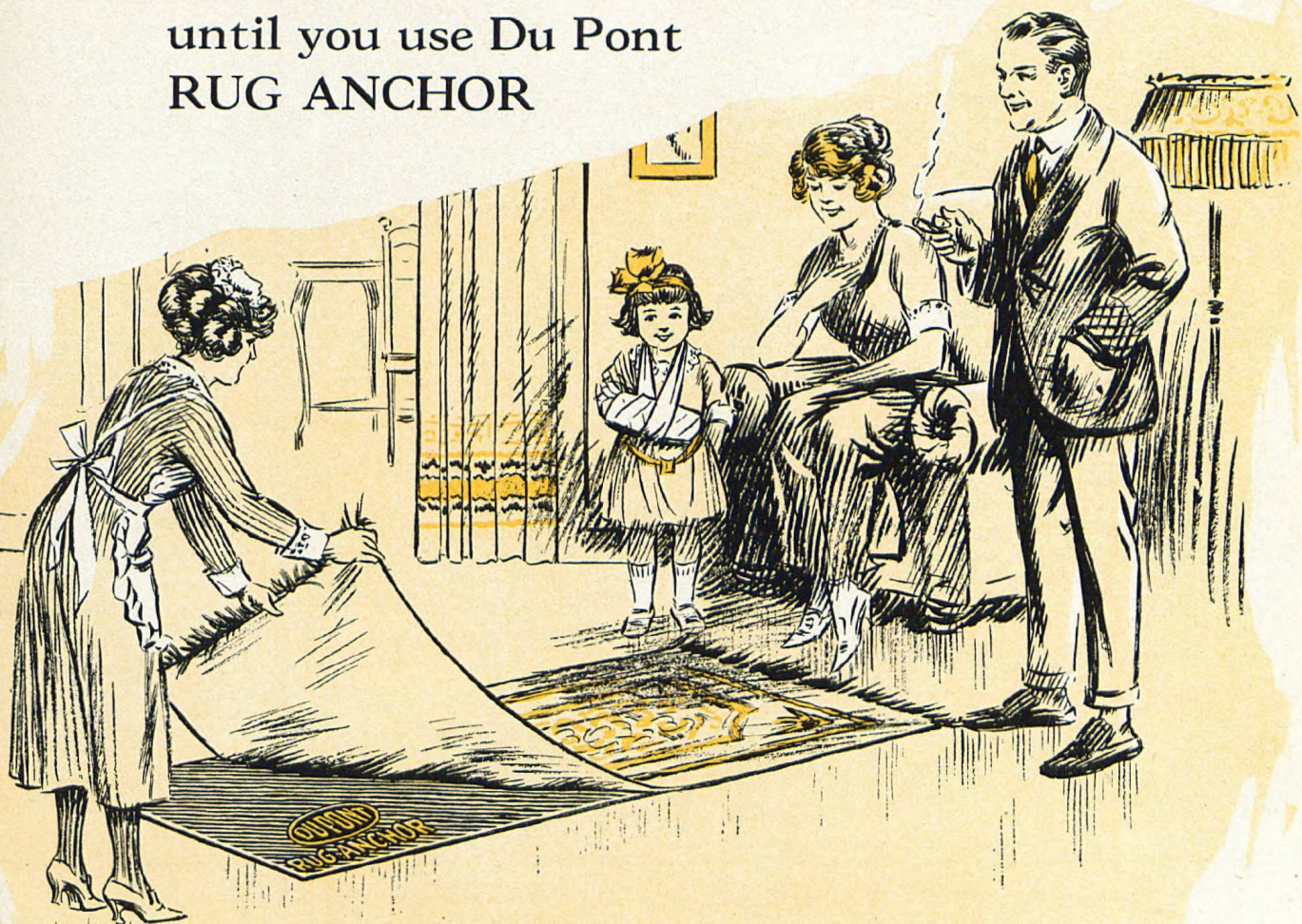
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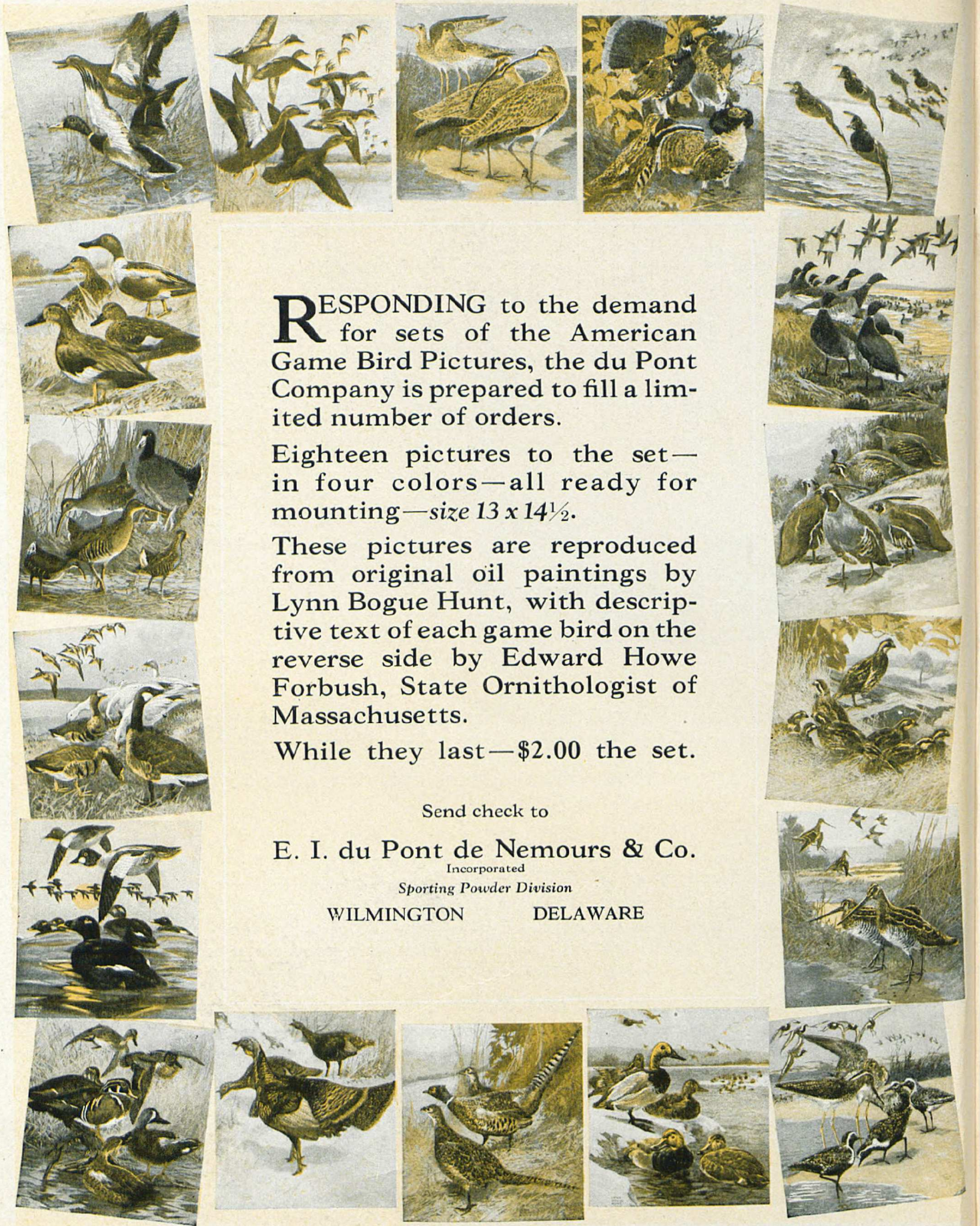
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