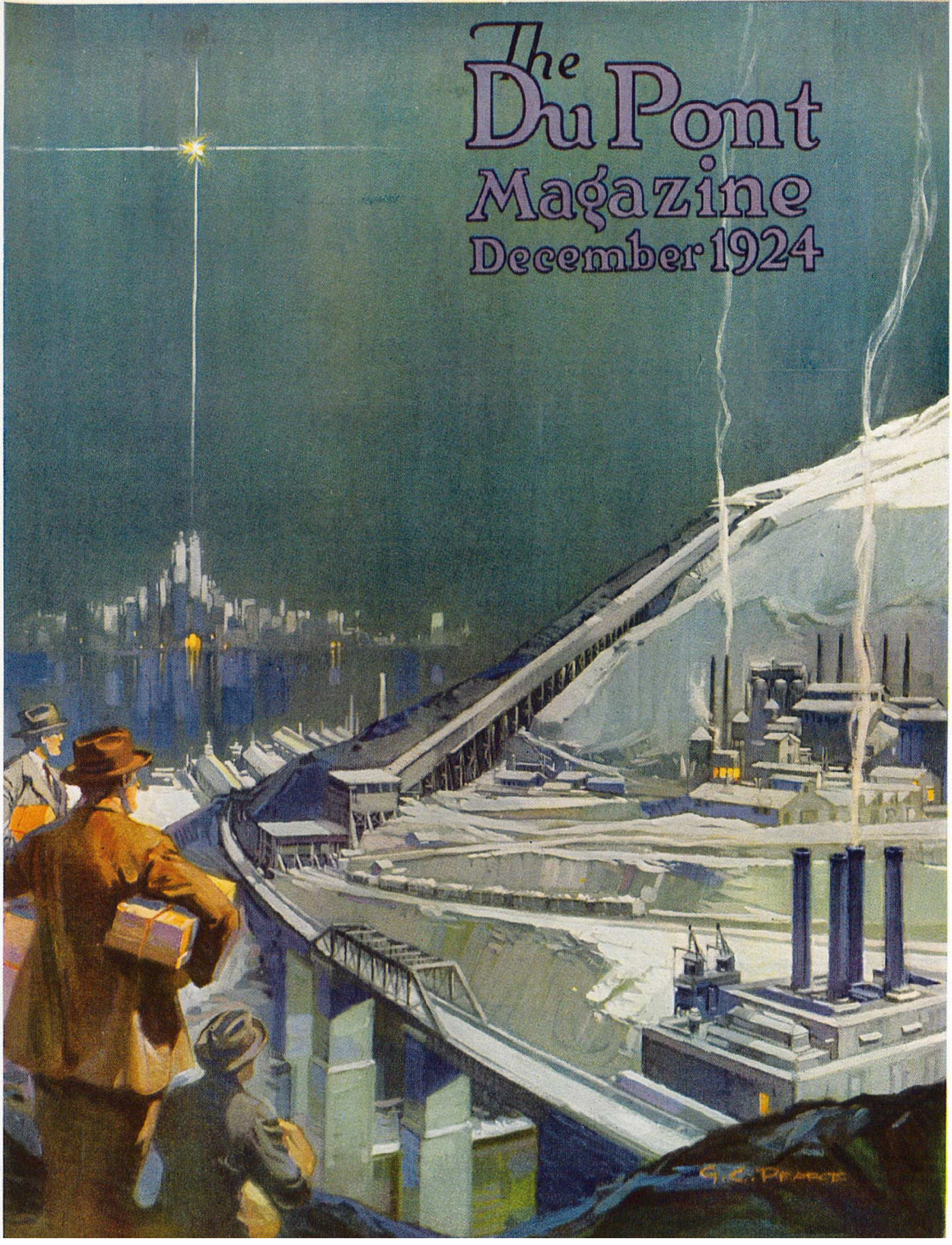
The DuPont Magazine
December 1924



These Accessories are Important! Select them with Care

BE SURE that the du Pont label is on your blasting accessories as well as on the explosives themselves—for the finest explosives made will not deliver maximum effect unless used with the best detonators and accessories. The experience of 122 years enables the du Pont Company to offer the most efficient and economical accessories for every class of explosives work.

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

Write for Blasting Accessories Catalog containing description of above accessories and practical information about their use.

E. I. DU PONT DE NEMOURS & CO., Inc.
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Wilmington, Delaware

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Du Pont Products Exhibit, Atlantic City, N. J.

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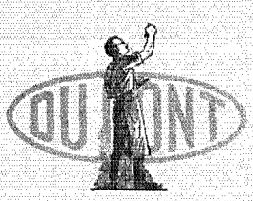


Vol. XVIII DECEMBER, 1924 No. 12

The Outlook on Business

Economic conditions are distinctly favorable to business improvement

So many readers have indicated a special interest in Mr. Hayford's business outlook articles that we are passing along his latest forecast; it is the latest one available for publication in this number. Necessarily these forecasts are prepared several weeks before our magazine reaches you, and during that interval the conditions surrounding business may change. As this forecast was written prior to election day, please bear in mind that it reflects Mr. Hayford's opinions at the time he wrote rather than at the time you read. It is based upon his analysis of conditions as they relate to general business activity, industrial activity, crops, commodity prices, the banking and credit situation and other purely economic factors affecting business and the direction of its trend.—EDITOR.

By F. LESLIE HAYFORD
Economic Statistician
General Motors Corporation

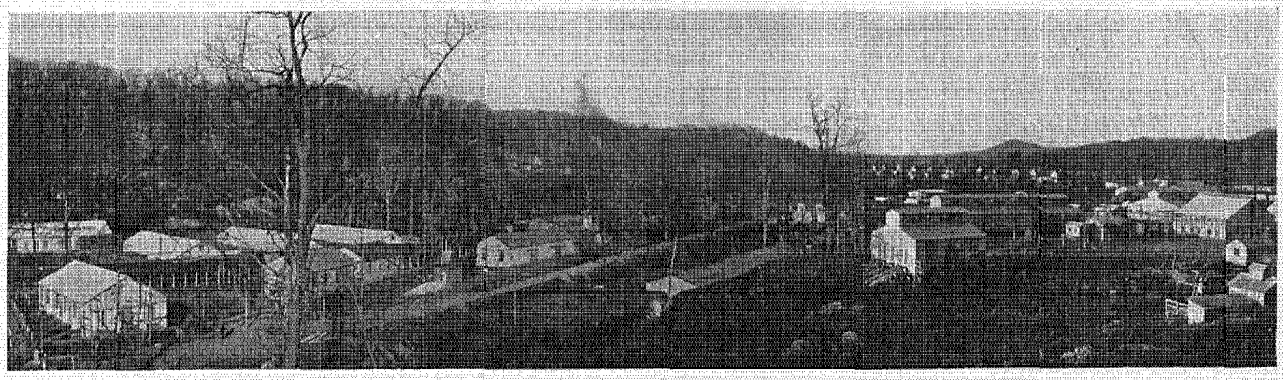
THE outlook for business continues to be favorable. Although the rate of improvement has apparently slowed down during the past three or four weeks, there is nothing in the present situation which indicates an approaching reversal of the upward trend. Obviously there is conservatism in making commitments, much of which is evidently due to the political uncertainty. It is also quite possible that without this deterrent influence business improvement might be subject to halting spells. The fact remains, nevertheless, that economic conditions are distinctly favorable to business improvement.

The money and credit situation is ripe for business expansion. An abundance of credit is available at unusually low rates. With a return of confidence in the future this might quickly become an effective factor.

The present and prospective large volume of construction work should prove a maintaining influence.

The greatly improved agricultural situation resulting from the rise in the prices of farm products assures a larger purchasing power on the part of the farmers than has existed for several years. The buying power of industrial communities is probably less than it was a year ago, but it is likely to improve as industrial activity increases.

Furthermore, an increased demand from European countries for American agricultural products and raw materials appears probable during the coming year.



A partial view of the Cap Works, Pompton Lakes, New Jersey, where du Pont blasting caps are made

The Mite that Makes Dynamite Mighty

The little blasting cap is a big factor in the explosives industry, and the story of its development is briefly outlined here

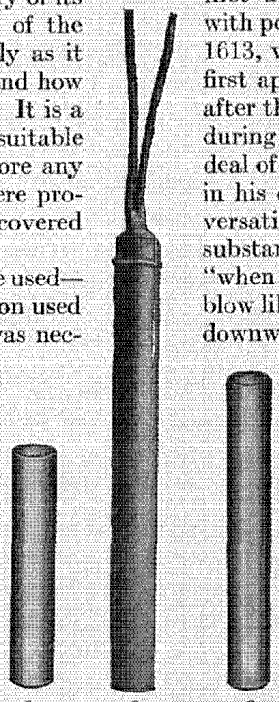
By N. I. STEERS
Director, Special Products Division
Explosives Department
E. I. du Pont de Nemours & Co., Inc.

THE blasting cap is the detonating agent used to set off charges of high explosives. Essentially it consists of two parts: the shell—a small metal cylinder closed at one end; and within it a satisfactory explosive charge that can be ignited either electrically or by means of safety fuse. The story of its development is more or less a chronology of the evolution of military explosives, particularly as it relates to shells, the charges used in them and how they were adapted for use in blasting caps. It is a curious fact that shells and the materials suitable for charging them were developed long before any of the common high explosives of today were produced; also that the first high explosive discovered was a powerful detonating material.

Black powder—probably the first explosive used—was in existence as early as 1320. It was soon used for military purposes, but for 200 years it was necessary to have a flame available to ignite it.

About 1500 the flintlock appeared. This was an improvement in that it made the spark more easily available when needed. In stormy weather, however, the wind had a tendency to blow the light meal powder from the vent or pan, and the firearm was useless in rainy weather unless precautions were taken to keep the powder dry. It was not until 1521 that a small paper capsule was utilized to hold and protect the igniter or primer from the elements. This early invention was probably the starting point in the development of caps and cartridges.

Many years passed without any notable advance in the use or manner of use of explosives until a Dutchman named Cornelius Drebble, in 1600, discovered how to make fulminates of gold and silver. These two salts were the first high explosives known, but they were too violently sensitive for practical use. It is interesting to note that the first authentic reference to drilling and blasting with powder for the removal of rock carries the date 1613, when Martin Weigel, of Freiburg, Germany, first applied it commercially. That was 293 years after the discovery or invention of gunpowder. But during these years there was undoubtedly a great deal of experimentation going on, for Samuel Pepys in his diary of November 11, 1663, reports a conversation with a Dr. Allen who described to him a substance called fulminating gold, a grain of which "when put into a silver spoon and fired will give a blow like a musket and strike a hole through a spoon downward without the least force upward."



1 2 3

1. No. 6 Du Pont Blasting Cap
2. Du Pont Waterproof Electric Blasting Cap
3. No. 8 Du Pont Blasting Cap

In 1670 commercial blasting was introduced in England, and the practice spread rapidly. The firing of blasts by electricity was apparently first suggested by Franklin in 1751, and by Priestly in 1767, but many years passed before there was any practical development along this line.

In 1786 Berthollet succeeded in purifying potassium chlorate, and investigated its explosive properties, but it proved too unreliable for practical use. His work, however, showing how pure chlorate could be obtained, was useful about ten years later when the first "fulminating compounds" began to appear. These were all mercurial preparations which were mixed with potassium chlorate or sulphur ful-

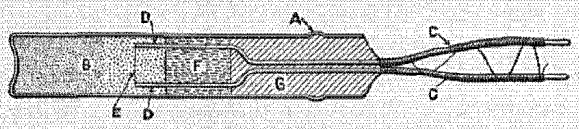
minated upon gradual heating, and were discovered by Bayen in 1796. They were probably mechanical mixtures rather than chemical compounds.

In 1799 Edward Howard is credited with discovering fulminate of mercury, and on March 13, 1800, he announced his discovery to the Royal Society. Because of its sensitiveness and violence, it was held to be impracticable for use as a military powder, except for breaking up ordnance.

The application of detonating powders "to the discharge of firearms" came in 1805, when Alexander Forsyth invented a detonating lock, using a mixture of potassium chlorate, sulphur and charcoal as the detonating compound. In 1807 he obtained a patent covering "percussion locks and all suitable detonating compounds." This lock was a bottle-shaped chamber, mounted near the vent of the musket in such a way that it could be moved over the vent, thus charging it, and then moved to one side during the discharge of the firearm by the impact of the hammer. This was the first improvement of note since 1521, when the flintlock and paper cap appeared.

The broad scope of Forsyth's patent and the tenacity with which he clung to and defended his detonating powder was a barrier to further progress at the time. He could use fulminate, but he would not, and his broad patent estopped others from doing so.

The invention of the metal cap was claimed by both Joshua Shaw and Joseph Egg. The former claimed to have first used a re-usable steel cap in 1814, a pewter cap in 1815, and a copper cap in 1816. His patent application was, however, invalidated by the broad patent of Forsyth. The records indicate that Egg obtained the information on which his patent application was based from a former employee of Shaw's. Apparently the first U. S. patent granted on these caps was issued to Shaw in 1822 for copper and pasteboard caps charged with Forsyth mixture.



Sectional View of Electric Blasting Cap

A is a copper shell, having a corrugation thrown out from the inside, which holds the composition plug more firmly in place; B is a chamber containing the explosive charge; C, insulated copper wires entering the cap; D, the bare ends of the copper wires, projecting through the plug into the charge; E, a fine wire bridge soldered to and connecting the two ends of the copper wires, which is heated by the electric current, thereby firing the explosive charge; F, the composition plug holding the electric blasting cap wires firmly in place; G, the filling material.

In England, Joe Manton had patented a firearm in which the detonating powder was held in a copper tube in the hammer, and later, in the vent or flash-hole itself.

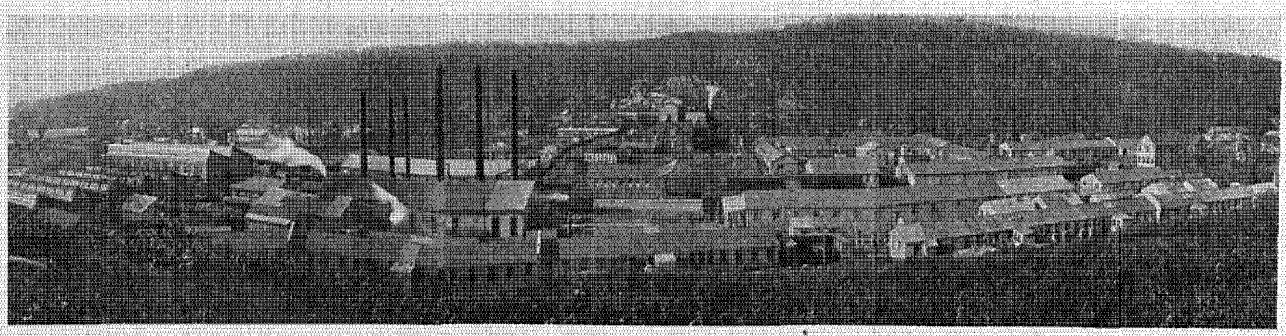
One of the earliest patents issued covering a metal cap was granted to Prelat, a French gun-maker, in July, 1820. The charge material in these caps was not disclosed but was known as a "secret composition."

In 1823, E. G. Wright, an Englishman, published a paper on the preparation of *copper shells* containing *fulminate*. This, apparently, is the first record of the use of the two together. Wright claimed to have used these caps about 1820. Joyce, in England, started the experimental manufacture of fulminate caps and copper shells in 1824. Meanwhile Shaw had begun to manufacture them in the United States, and claimed an annual production of 2,000,000 caps with a fulminate mixture load, subsequent to 1822. All these caps were for use in various types of firearms.

Up to this time the development of detonating compounds had been comparatively slow. Then came a series of discoveries in explosives: Nitrostarch, by Braconnot in 1823; picric acid by Lorrent in 1843; nitroglycerin by Sobrero in 1846; nitrocellulose by Schönbein in 1846; nitromannite by Sobrero in 1847; and dynamite by Alfred Nobel in 1859-61.

Nobel and his father had made nitroglycerin of practical value by 1861. They began to manufacture it for sale in 1862, transporting it in the liquid state and firing it with a black powder cartridge. This container was soon replaced by a glass receptacle for the black powder, which was fired by a fuse. Later an electric wire was submersed in the nitroglycerin, which was heated to the exploding point by an electric current.

As the use of liquid nitroglycerin was very dangerous, because of its sensitiveness, Nobel, in 1864, began the manufacture of dynamite, which consisted of his liquid



Another view of the Cap Works at Pompton Lakes, from a photograph made in 1918

explosive absorbed in porous, inert clay, known as kieselguhr. While this dynamite was very much safer to handle, the addition of so much inert material made detonation more difficult. To solve this problem Nobel evolved "a cone-shaped receptacle made of tinplate and filled with fulminate of mercury," which he claimed would "detonate the dynamite under all conditions every time." He patented this May 7, 1867, specifying a copper shell instead of the tinplate receptacle. This was called "Nobel's Igniter." Thus came into being the prototype of present-day blasting caps.

This development opened up a wide field of experiment. In 1871, Sprengel detonated picric acid with the fulminate cap, the use of guncotton having been the only method available before. Until then, blasting explosives using picric acid or ammonium nitrate bases had never been used much industrially; they were too difficult to explode. With the appearance of Nobel's Igniters, this situation was changed. Old patents were resurrected, and new ones obtained, so that by 1885 picric acid had become the leading military explosive, while dynamite and black powder held its place for commercial explosives use.

In 1891, trinitrotoluene came on the market and was soon used to some extent in dynamite manufacture as a means of reducing its tendency to freeze. This, however, increased the difficulty of detonation. As continued efforts were made to produce less sensitive explosives, stronger blasting caps were required.

The belief that fulminate of mercury was a desirable explosive for blasting caps because of its relatively high velocity of detonation led to the development of many other compounds* whose velocity exceeded that of fulminate. In most instances these substitutes proved worthless for blasting cap charges. Lead azide, tetryl, nitrovene, nitrocellulose and nitromannite are the only ones that have been used for this purpose with much success. Lead azide, however, has the disadvantage of forming large crystals that are extremely sensitive even under water. Some of these materials have a tendency to decompose in moist air or sunlight, or in an acid atmosphere, which is frequently encountered in mining operations. Others possess qualities which make them adaptable for use in blasting cap charges.

Continuously, efforts have been made to provide the strongest and best possible quality of blasting caps that will detonate perfectly the less sensitive products now being made by the explosives industry. This has resulted in the production by some manufacturers of blasting caps of a better quality than would be possible with fulminate of mercury alone. They are made through the use of tetryl, picric acid, nitromannite, nitrocellulose, nitrovene and other compounds, with fulminate of mercury.

A quite common practice in Europe is to use one of these materials as a base charge in a copper or aluminum shell, above which is placed a charge of fulminate of mercury or lead azide as a primer. It is confined in a capsule with a small hole in it through which ignition is effected.

(*Continued on page 16*)

CHRONOLOGY

1300	Black powder known about this time; inventor unknown
1521	Paper caps used to house meal powder primer on flintlocks
1600	Fulminates of gold and silver, by Cornelius Drebble
1613	First authentic reference to drilling and blasting, by Martin Weigel of Freiburg
1663	Gold fulminate becoming known to scholars
1670	Blasting introduced in England
1751	Franklin proposes electrical firing of blasts
1767	Priestly proposes electrical firing of blasts
1786	Pure potassium chlorate obtained by Berthollet
1796	Fulminating powders discovered by Bayen
1709	Discovery of fulminate of mercury by Howard
1800	Announcement of Howard's discovery
1807	Forsyth's patent on detonating lock and detonating compounds
1814	First metal cap—steel—by Joshua Shaw
1815	First pewter cap, by Joshua Shaw
1816	First copper cap, by Joshua Shaw
1816	Patent on a gun requiring the use of a cap, Joe Manton
1820	Patent to Prelat on a copper cap
1823	Fulminate caps, using copper shell, by Wright
1823	First blast fired by electricity, by Harris
1824	Manufacture of copper caps with fulminate charge—Joyce
1824	Manufacture of copper caps with fulminate charge—Shaw
1829	Many simultaneous blasts by electricity, Shaw of New York
1830	Patent on simultaneous blasts by electricity, Shaw of New York
1833	Nitrostarch, by Braconnot
1841	Percussion system for firearms officially adopted
1843	Picric acid discovered, by Lorrent
1846	Nitroglycerin discovered, by Sobrero
1846	Nitrocellulose discovered, by Schönbein
1847	Nitromannite—Sobrero
1859–61	Alfred Nobel experimenting on nitroglycerin
1862	Commercial production of nitroglycerin
1864	Invention of dynamite, by Nobel
1867	May 7, Nobel's patent covering fulminate caps
1867	Picric acid detonated by guncotton primer
1867	Picric acid, ammonium nitrate and potassium chlorate proposed by Borlinetti as a blasting powder
1867	Patent on an ammonium nitrate powder, Ohlsson and Norbin
1871	Picric acid detonated by fulminate caps, by Sprengel
1880	TNT made in laboratory
1883	Tetryl made in laboratory, by Romberg
1884–85	Ammonium nitrate explosive patents issued to Fairer
1885	Turpin established use of picric acid
1890	Lead azide—Curtius
1891	TNT manufactured commercially
1910	TNA—Flursheim
1919	Nitrovene—Stine

*Silver hydronitride, picric acid, trinitroresorcine, diazo di nitro phenol, lead azide, lead styphnate, nitrovene, hexamethylamine, triperoxidediamine, nitrogen tetrasulphate, diazobenzolnitrate, basic mercuric nitromethane, tetra nitro aniline, tetryl, nitropentaerythrit, ethylene diamino chloride, nitromannite, trimercuraldehyde, chlorates, perchlorates, hexanitro di phenylamine, and various nitrates, such as cellulose, starch, etc.

Characteristic Pressure Curves of Shotgun Powders

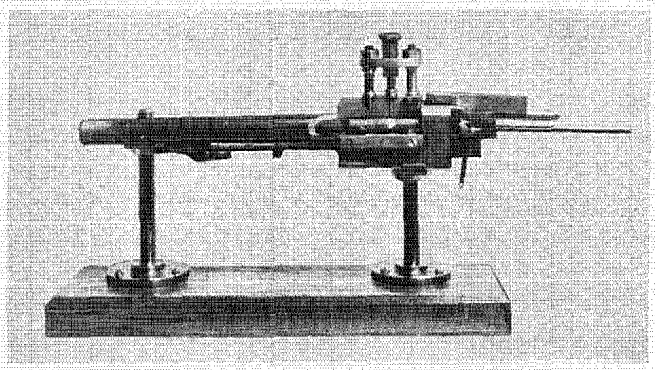
An instructive article that will be of particular interest to sportsmen

By W. H. COXE
Ballistic Engineer
E. I. du Pont de Nemours & Co., Inc.

THIS is a rather formidable title to be associated with the pleasant pastime of hunting or trapshooting. Yet a characteristic pressure curve is of vital importance in studying powders offered to sportsmen.

A motorist usually wants to know the characteristics and qualities of materials entering into the construction of a motor car before he buys it. Having once made his decision, however, he has no further concern with the technical details of construction, if he has chosen wisely; his interest centers on the pleasures of driving the car.

A somewhat similar condition exists with the sportsman, who spends considerable time and thought on the selection of a shotgun. Once the purchase is made, he puts the catalogs away and enjoys its use at the traps or in the field without further study. The gun, however, is only a part of the shooting game; it occupies somewhat the same position to the shooter as the chassis of an automobile does to the motorist. The chassis is useless without the engine. Motive power made the automobile possible. Likewise with shotguns, without motive power—or powder—these guns could not have progressed beyond the crossbow or air-gun stage.



The multi-piston pressure gun used for making ballistic tests of shotgun powders

It is to be regretted that so few followers of the shooting pastime understand or study the performance of powders to anywhere near the extent that motorists try to learn all about the motors of their cars and how they function.

It is difficult to differentiate between the performance of powders without becoming technical. A loaded shot shell, when fired in a shotgun, does its work in such a short interval of time that it is impracticable to draw a comparison with any other science, and for that reason it is necessary to study the performance of powders in the technical terms of the ballistician.

The diagram on the next page shows characteristic pressure curves of the most prominent types of shotgun powders. The lower line of figures represents the first six inches of the breech end of a shotgun barrel. The vertical line represents the pressure in long tons (2240 pounds) that is developed by the various powders. The various curves show the path of the pressure at any distance from the breech, within the first six inches.

It is well known that different charges of shot and powder develop different velocities and pressures. So in a study of this kind it is necessary to load all powders in the same manner. In the test on which this diagram was based, the powders were loaded with three drams—or the equivalent amount of powder to develop the same velocity—with one and one-fourth ounces of shot. This is a good average load. Heavier loads will develop higher pressures, and lighter loads, correspondingly lower pressures.

Curve A was obtained with Ballistite, a nitroglycerin powder made by the du Pont Company. There are other nitroglycerin powders made but as they perform in the same manner as du Pont Ballistite, Curve A can be considered truly representative of them all. You will note that Curve A rises very sharply from the zero point to the highest maximum pressure of any curve, and then falls off very rapidly; also that this maximum pressure is reached between zero and one inch of travel. After the maximum point is reached, the falling-off in pressure follows the progress of the shot charge down the barrel. This high pressure means that Ballistite starts the shot charge in motion with a very quick, powerful blow.

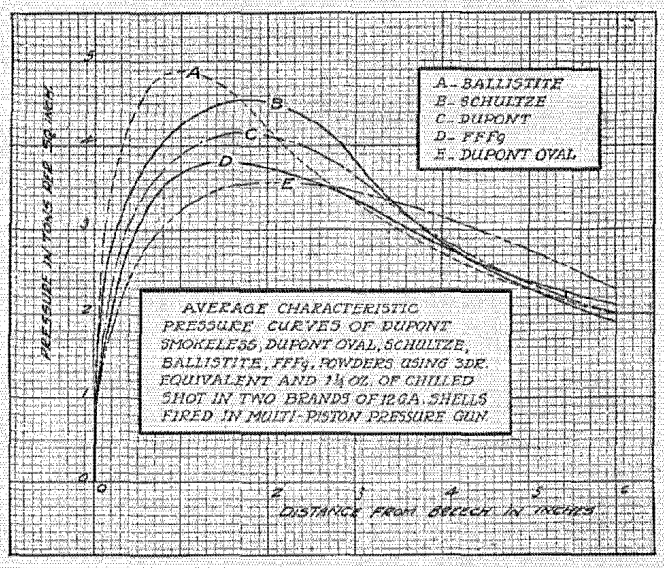
Curve B was developed with Schultze Powder, another du Pont product. This is a soft-grain bulk nitrocellulose powder. There are other powders of this type on the market, but they follow practically the same curve made by Schultze. Note here that the rise from zero to a maximum pressure occurs after the shot has moved a trifle farther down the barrel than was the case with Ballistite. This means that the blow with which the shot is started in motion is somewhat less severe than Ballistite gives.

Curve C was developed by Dupont Smokeless. This is a bulk nitrocellulose powder and the only powder of this type with so hard a grain that it cannot be crushed when rubbed in the palm of the hand. Here the rise in pressure from zero to the maximum is not only a little slower than the others mentioned, but the maximum pressure is somewhat lower to obtain the same velocity.

This means that if the powder were loaded to develop the same maximum pressure as Schultze, the resultant velocity would be considerably higher.

Curve D represents Black Sporting Powder of FFFg granulation, which is representative of all types of black powder for shotgun use. It shows the most favorable relation of any powders discussed so far. It has a lower maximum pressure and gives a somewhat less severe blow to the shot as it starts the charge in motion.

Curve E was developed by using Du Pont Oval Smokeless, the latest development in shotgun powders. It is of the dense nitrocellulose type and is termed a progressive burning powder. A study of the diagram will show that in an equivalent load the rise in pressure from zero to the maximum is the slowest of all types of powders. But a more important feature is that the fall in pressure beyond the maximum point is less rapid than with any other powder. This means that Du Pont Oval keeps on pushing the shot charge as it progresses down the barrel. To the layman this does not appear to be a departure of much consequence, but without this difference, it would have been impossible to make shotgun powder that would develop velocities higher than the older types of powder.



The question sometimes arises whether or not this progressive burning feature might prove dangerous in a shotgun. The answer is, compare Curves D and E. Note that black powder, Curve D, has very nearly the same slope as Du Pont Oval Smokeless, Curve E. It should be remembered, of course, that when Du Pont Oval is used in maximum loads, the maximum pressure is considerably higher than that shown in Curve E; consequently, maximum loads should be used only in guns of superior quality and of approved strength. This, however, holds true not only of Du Pont Oval, but of any powder which is loaded to a maximum pressure.

The shooter may well ask how such characteristic pressure curves are of interest to him. He is concerned only with the penetration and the pattern his gun and shot shell will produce. Penetration is a factor of velocity. Any powder listed here will develop satisfactory velocity. Patterns, however, depend to a great extent on the pressure developed. Any powder that reaches its maximum pressure in an extremely short time-interval will give such an initial blow to the charge of shot pellets that they will be deformed, developing poor patterns. On the other hand, a powder that rises to its maximum pressure in a longer time-interval, will give a less severe initial blow to the charge of shot pellets, and better patterns will result. Primarily, that is why Dupont Smokeless and Du Pont Oval are so far superior to other types of shotgun powders.

But characteristic pressure curves do not tell the whole story, for every powder has its individual points of excellence, and it may not be amiss to mention some of them here.

Black Powder, from a ballistic standpoint, has always performed satisfactorily. It develops high velocities and good patterns with fairly low pressures. The principal objection to its use is the great amount of smoke it gives off and the heavy residue it leaves in the gun barrel.

Schultze Powder is incapable of developing very high velocities without correspondingly high pressures. It may therefore be considered a low-velocity powder, and as such, is very satisfactory for shooters who desire a load with a minimum amount of recoil. Incidentally, high velocities are usually accompanied with heavy recoil, irrespective of the powder used.

Dupont Smokeless has the widest useful range of any bulk shotgun powder. It is equally satisfactory for heavy loads or very light loads. It ranks second to Du Pont Oval in the even pattern distribution it develops in heavy loads and is superior to all powders in medium and light loads.

Ballistite likewise has a wide useful range in all varieties of loads, but its quick-burning property makes it less suitable for heavy loads. Ballistite, however, is waterproof, and this valuable feature, to some shooters, offsets the slight loss in patterns.

Du Pont Oval can be used in a great variety of loads. Its chief point of superiority is in the very heavy loads. Here it surpasses all other types of powders in velocities, pressures and patterns.

It is hoped that the foregoing ballistic data and the brief comment on the individual characteristics of du Pont shotgun powders will be enlightening to many sportsmen, and will help them in choosing the best type of powder for a particular purpose.

Altogether, these powders form a group that sportsmen can select from with every assurance of obtaining good results afield or at the traps, provided they choose suitable loads—and just aim straight.



The Directors' Room, Hartford, Conn., where Aetna officials tested Rug Anchor

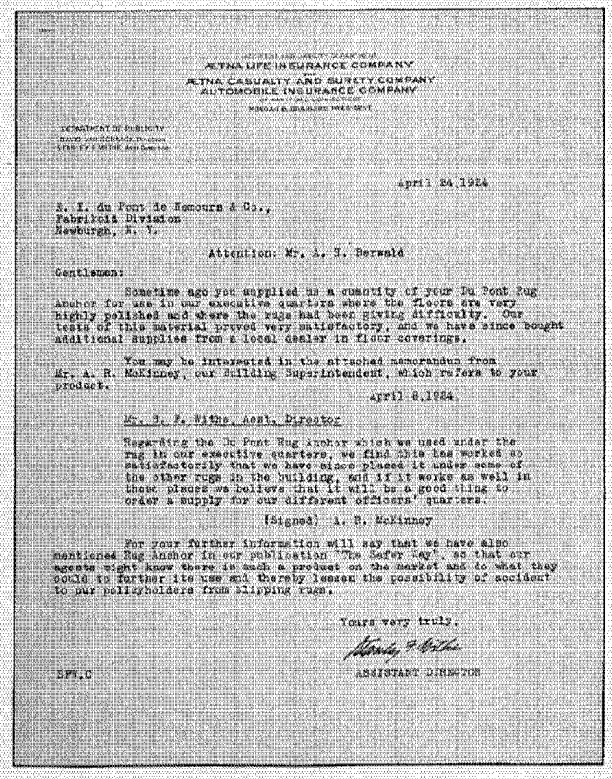
More About the "Frisky, Risky Rug"

The Aetna Life Insurance Company endorses Rug Anchor after making tests in its offices

MEN in great accident insurance companies have inside information as to how to keep safe. Signing checks for policyholders who have been injured in innumerably different ways suggests a lot of don'ts to the people who, by proxy at least, have to foot the bills. These "insiders" know from insistent evidence that one of the finest places to watch one's step is when that step is about to descend upon some innocent-looking rug lying upon a polished floor. They know that the magic carpet of the Arabian tale could not whisk one off more quickly or deposit him more rudely than can the product of the modern loom under certain conditions which are unfortunately all too common.

The Aetna Life Insurance Company, of Hartford, Connecticut, is not only one of the world's greatest life insurance companies, but it does a tremendous volume of accident insurance business, and in this department it has found that the slipping of rugs on smooth floors is a very common cause of accidents in the home. It, therefore, became interested very early in our product, Rug Anchor, and has supported our efforts to popularize and increase its use so that more Aetna policyholders could be indeed "safe at home".

But before giving Rug Anchor publicity in its own mediums, as it has done, the Aetna Company first protected its own officials against possible injury from the Oriental rugs used in its executive offices, which also gave opportunity of testing its efficiency under the close scrutiny of those interested in it.



AETNA LIFE INSURANCE COMPANY
AETNA CASUALTY AND SURETY COMPANY
AUTOMOBILE INSURANCE COMPANY

DEPARTMENT OF PUBLICITY

April 24 1924

E. I. du Pont de Nemours & Co.,
Fabrikoid Division
Newburgh, N. Y.

Attention: Mr. A. T. Berwald

Gentlemen:

Sometime ago you supplied us a quantity of your Du Pont Rug Anchor for use in our executive quarters where the floors are very highly polished and where the rugs had been giving difficulty. Our tests of this material proved very satisfactory, and we have since bought additional supplies from a local dealer in floor coverings.

You may be interested in the attached memorandum from Mr. A. R. McKinney, our Building Superintendent, which refers to your product.

April 8,1924.

Mr. J. F. Withe, Asst. Director

Regarding the Du Pont Rug Anchor which we used under the rug in our executive quarters, we find this has worked so satisfactorily that we have since placed it under some of the other rugs in the building, and if it works as well in those places we believe that it will be a good thing to order a supply for our different officers' quarters.

(Signed) A. R. McKinney

For your further information will say that we have also mentioned Rug Anchor in our publication "The Safety Way", so that our agents might know there is such a product on the market and to what they could to further its use and thereby lessen the possibility of accident to our policyholders from slipping rugs.

Yours very truly,

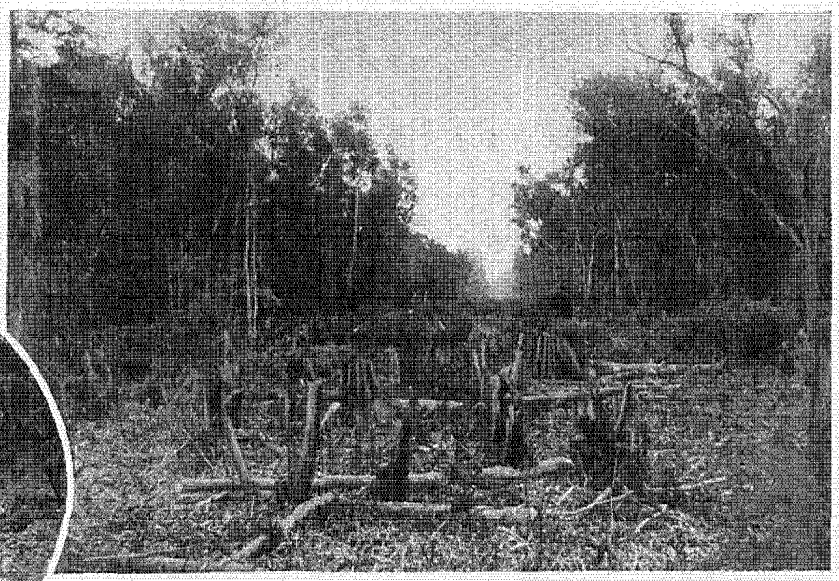
ASSISTANT DIRECTOR

EFH.C

Practically this whole story is told in the letter reproduced here. It is well worth reading by any person who is faced with the menace of slipping rugs, or by any dealer in floor coverings who does not already sell this product.

To inform those who may not have read about Rug Anchor in previous issues, we will say that this material is a fabric treated on one side with a heavy layer of impervious, resilient compound, which takes a vacuum grip upon the floor and clings thereto without the

(Continued on page 15)



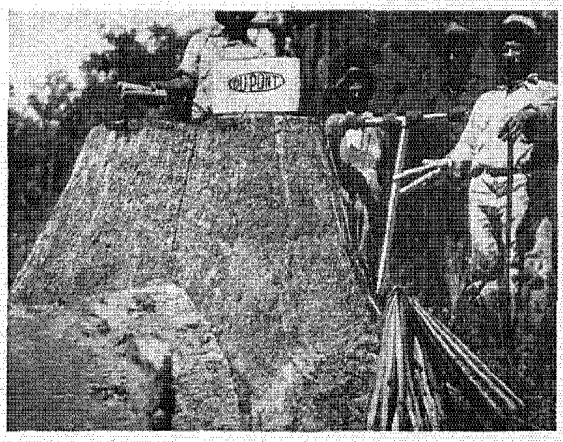
Right—The right of way just before the blast. Circle—This sign was posted at points where test shot was made and at passways leading to swamp lands



A New Record in Ditching with Dynamite



Above—Large gum stumps directly in right of way of ditch. Below—Many such stumps, measuring from 3 to 5 feet in diameter, were encountered in this ditch line

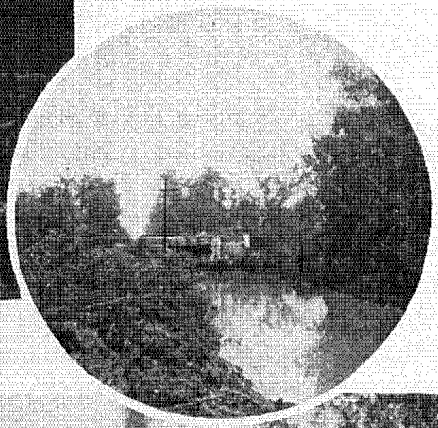


ALTHOUGH the use of dynamite in the excavation of ditches has a wide range of economical application, being primarily dependent only upon the presence of sufficient moisture to permit of the propagation method of explosion, it appears that the economy of its use increases as the obstacles to other methods of ditch excavation increase. Probably the two greatest obstacles to ditching by hand or by dredging machines are heavily wooded land and soil that is too soft to support land machines. As these conditions are generally found in the southern states, the accomplishment of many drainage projects there has been delayed because of excessive costs of ditching by the usual methods.

Such conditions played an important part in the drainage problem of Patterson, Louisiana. For many years various plans to provide outlet drainage for the town area had been considered, but the estimated cost of doing the work by usual methods was far beyond the financial reach of the town. As the result of a survey by Mr. F. R. Shaw, an engineer of the U. S. Public Health Service, it was found that by excavating a ditch 20 feet wide and 3½ feet deep, parallel to the edge of the town, and by using tide levees and tide gate culverts, advantage could be taken of daily tidal fluctuations of a nearby bayou so as to drain not only the town area but also a considerable portion of an adjacent swamp.

The chief difficulty lay in the fact that for its full length—approximately 8000 feet—this ditch would have to be made through a cypress and gum swamp. Mr. Shaw suggested that the cheapest method of work under existing conditions would be blasting the ditch with dynamite. His recommendations led the town officials to have a demonstration shot made by a





Left—This view shows you the unusually good results of the shot. Circle—Note the close proximity of the blast to the Southern Pacific Railroad

At Patterson, La., a ditch 1200 feet long was blasted with one shot at a remarkably low cost

By W. B. ALFORD, Technical Representative,
E. I. du Pont de Nemours & Co., Inc.

representative of the du Pont Company and this resulted in the adoption of the whole project.

The timber was cut along the right of way but the stumps and trunks were left. Some of the stumps measured as much as 5 feet in diameter. After the clearing had been done, ten men were put to work punching holes and loading charges. In 3½ days they had made 3850 feet of canal, 10 feet wide at the bottom, 20 feet wide at the top and 4 feet deep. This means that 6930 cubic yards were excavated in this short time, a remarkable accomplishment, considering that very heavy roots, logs and stumps were also thrown out by the blast. Two pounds of 50 per cent du Pont straight dynamite were loaded to the linear foot and the shots were fired by the propagation method.

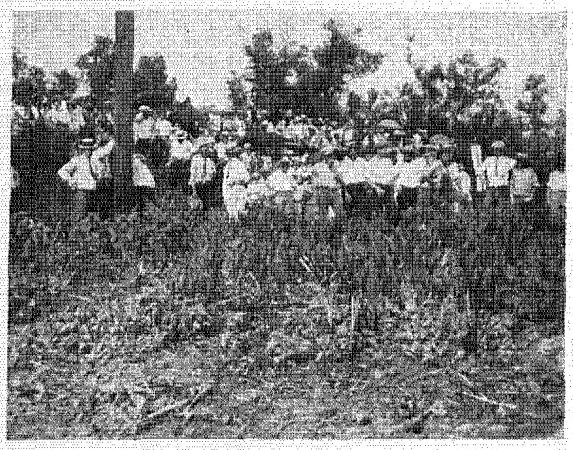
The first shot established a record in ditching with dynamite, for 1200 feet of ditch were blasted in a single shot with a single blasting cap. Previously, for a ditch of this size, 500 feet has been thought a long stretch to blast in one shot, even in ground clear of stumps and roots.

The people of Patterson were much surprised at the speed of this work and pleased with the economy with which it was accomplished. The total cost, including clearing of the right of way, the dynamite, placing the charge, and light trimming of projecting roots, amounted to 40 cents per foot, as compared with estimates of from $1.50 to $2 per foot for excavation by other methods. The volume excavated was 1.8 cubic yards per foot, making the cost per cubic yard, 22 cents.

The completed ditch with tide levees and tide gate culverts will adequately drain a town area of one square mile and will make possible full control of the mosquito and malaria problem.



Above—Loading dynamite for the shot. Note the heavy logs and debris. Below—The blast was witnessed by 1500 people standing on the Southern Pacific tracks



Selling with Cellophane

How manufacturers and others are using this material to speed up sales

By S. L. JOHNSTON

JUST a few decades ago a very large part of the merchandise sold over retail store counters was handled in bulk from bins, barrels, boxes, bags and pails. Now, comparatively little merchandise is handled that way. Relegated to the cellar are the old cracker barrel, the spice box, the candy pail—they are all relics of an older day in the art of merchandising.

The unit package now predominates. It carries the manufacturer's name and label to identify and mark the quality of the product contained. The package itself is made of materials in keeping with the character of the product. The label design, copy, typography, colors and all other factors that enter into what we may call a "dressy appearance" of the package are the work of experts. Quality merchandise, properly packaged and displayed, thus helps to sell itself.

"Clothes Make the Man"

And with equal truth it may be said that a well-groomed, attractive package "makes" the product it contains, at least so far as salability is concerned.

With packages, as with persons, a good appearance counts. Quality merchandise clothed in a distinctive Cellophane wrap looks the part.

Among the materials available for giving unit packages the distinction of a truly fine appearance, Du Pont Cellophane—the Super Wrap—easily ranks first. This material was originally made in France and exported in limited quantities for the use of American manufacturers. Now it is being made in America by the Du Pont Cellophane Company, whose factory at Buffalo, New York, is the only one on this side of the Atlantic. Ample stocks are being made to meet the demands of a growing list of users.

American manufacturers are using Cellophane chiefly to wrap high-grade merchandise, and for this purpose it approaches the ideal. It is a light-weight, strong, flexible sheet of glass-like transparency and luster that not only enhances the beauty of a package or product, but also protects it. Packages wrapped with Cellophane always look fresh and clean and presentable even though they may have been used for months for counter or window displays. If the container is a thing of beauty—and it usually is—this super wrap accentuates its charm and adds to the salability of the merchandise.

Because this material is positively oil and grease-proof, it is especially suitable for wrapping containers for oils and greases. Where leakage is sure to leave unsightly stains to mar the appearance of an ordinary package wrapper, the same package, if wrapped in Cellophane, always looks fresh and clean and spotless.

In packing toilet accessories, such as tooth brushes, combs, hair brushes and other strictly personal requisites, Cellophane is useful for still another reason. These articles are not readily salable over the counter unless they are in the original factory package, properly wrapped and sealed, and obviously sanitary. As a sanitary wrapper Cellophane cannot be improved upon; for articles enclosed in this super wrap can be sterilized in the factory, and they will remain so.

Department stores have found interesting uses for this material. For example, large Cellophane envelopes are used to enclose bolts of cloth on display at dress goods counters. The color and pattern of the fabric can thus be plainly seen by the customer without the necessity of opening up each package. This eliminates constant handling and the likelihood of soiling dainty fabrics. In the millinery department also, Cellophane is used, not for protection, but for a decorative purpose. Ribbons, artificial flowers, sequins and beads in an endless variety of finishes—and all made of Cellophane—are used for trimming hats. Here the desirability of the material lies in its beauty, daintiness and brilliancy, and the ease with which it can be fashioned into many shapes.

Packers of dried fruits and nuts use Cellophane with advantage in presenting their products in small unit packages. The transparency of the material permits a clear view of the contents; also it is a sanitary package.

The candy industry, of course, was among the first to adopt the Cellophane wrap. Today, all of the largest and most prominent manufacturers are using it not only as a fancy package wrap, but as a wrap for individual pieces of their quality candies.

There is a large field for its use as a wrap for soaps and perfumes. A Cellophane-wrapped cake of soap retains its proper condition indefinitely, besides making an attractive package. For perfumes, this super wrap prevents evaporation and adds beauty to the distinctive containers.

Small packages of fancy cakes and cookies are now being wrapped in Cellophane for protection and also to make the unit thoroughly sanitary. For similar reasons many bakers are using the material to wrap special brands of bread and cake that need this extra attention to make them readily salable.

Manufacturers of tobacco products use it as a wrap for cigarette packages, and for individual cigars. This appeals particularly to the discriminating cigar smoker, because he can see what he is buying and can better judge its quality.

(Continued on page 11)



Form-Fitting Chairs



They lighten labor and increase its results

A KING sits on a throne—but no more than he can help. Being a privileged person, he tolerates its straight-backed, cramping dignity on a few state occasions, but does all the rest of his sitting in the most comfortable chairs he can find.

Mary Jones sits all day pounding a typewriter in your office, or operating a machine in your factory. Mary has no royal privileges; day in and day out she must use the chair with which you have provided her. Lucky for her—and for you—if she can work in that chair comfortably *and efficiently* until the whistle blows.

And if Mary is lucky because the particular make of chair with which your office or factory is equipped happens to fit her, then Susie Smith and Joe Brown, and altogether too many others, will be out of luck and less efficient, for Nature has not molded all your employees to a uniform size and shape as your chairs have been standardized. She has made them all different and each should have a seat that helps in getting the job in hand done—getting it done correctly, promptly, effectively—without the handicap of physical discomfort and fatigue.

If you wish to conserve the energy and physical fitness of those employees who now sit perched on the edges of, or slumped back or slipped down in chairs that do not fit them—in no position or physical condition to do good work—try out Adco Posture Chairs. These chairs are designed to fit the individual rather than the mass. They can be adjusted to the form and personal preference of whoever is to use them—"glove fitted" as it were—so that whether a person be tall or short, stout or slender, he can sit naturally in this chair with a grateful support at his back, right where it feels the best and consequently does the most good.



This Adco Posture Chair can easily be adjusted to fit anybody

Adco Posture Chairs are made in various models but all are easily adjustable both as to the height of the seat from the ground and also the position of the back rest relative to the seat. Furthermore, the back rest is swiveled so that it adjusts itself automatically to the back contour of the occupant. The open space between the back rest and the seat permits sitting *into* the chair and getting full benefit of the support which the back rest affords. One of the models has a revolving swiveled seat and is especially adapted for working at the desk.

All models of this chair are of tubular steel frame construction, joined by heavy rivets and finished in black japan. This type of construction makes chairs that take up the minimum of floor space and greatly reduce the fire hazard.

The matter of comfort and appearance has been given further consideration in the upholstery of these chairs. The seats and backs are deeply padded with genuine hair and covered with a good grade of Du Pont Fabrikoid. The manufacturers wanted a covering material that would stand hard service without losing its attractiveness, and that, being waterproof, could always be kept clean and sanitary. They say, "We tested various materials and standardized upon Du Pont Fabrikoid because of its attractive patterns and fine wearing qualities."

Adco Posture Chairs meet every requirement of the American Posture League, and go even further. Many important concerns are using them most satisfactorily in offices and factories. We understand that the telephone companies use a large number of these chairs, after thorough tests had been made by their engineering departments.

Adams, Groesbeck Company, No. 1 Platt Street, New York City, who are makers of the Adco Posture Chair, will be glad to assist you in determining the correct type of chair for your office or factory workers and to install the necessary chairs on approval.

Selling with Cellophane

(*Continued from page 10*)

These are only a few among the many uses of Cellophane, but they indicate the adaptability of the material for wrapping purposes. Doubtless further investigation and research will develop still other uses.

American manufacturers are resourceful and progressive. Some of them who are reading this now are probably wondering if Cellophane will not meet some requirement of their own. To any one who has a package problem to solve, the Du Pont Cellophane Company offers the facilities of its organization. Samples of the material and data will be promptly furnished on request.

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Vol. XVIII DECEMBER, 1924 No. 12

The Season's Greetings

IT has long been the custom for friends to wish each other well at Christmas time. So, in keeping with this good old custom, and speaking for the du Pont organization, we extend our heartiest greetings: a Merry Christmas, friends, to you and yours, and may contentment share with prosperity in all your efforts throughout the year.

Another Plant to Produce Duco

THE Flint Varnish & Color Works, Inc., whose capital stock is owned by E. I. du Pont de Nemours & Company, has recently sold its entire assets to the du Pont Company.

The Chicago Works and the business applicable thereto has been assigned to the Paint and Varnish Division of the Paint Department.

The Flint Works and the business applicable thereto has been assigned to the Chemical Products Division of the Cellulose Products Department, and will be employed by that department in conjunction with the Duco development in serving the automobile trade. This plant, which is now in production on Duco, was needed to help the two plants at Parlin keep up with the rapidly growing demand for this popular auto and furniture finish.

To Make Film for the Movies

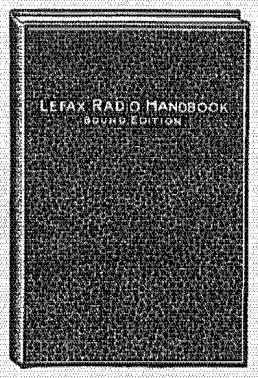
THE du Pont-Pathe Film Manufacturing Corporation has been formed by E. I. du Pont de Nemours & Co. of Wilmington, Delaware, Pathe Exchange, Inc., of New York, and Pathé Cinema Société Anonyme of Paris, France. This new corporation has been incorporated at Dover, Delaware, for the manufacture and sale of cinema film and has an authorized capital of $1,200,000 eight per cent cumulative preferred stock and 10,000 shares of common stock of no par value.

It will commence business with a fully equipped manufacturing plant and research laboratory located at Parlin, New Jersey, where the manufacture of cinema film has been developed and carried on for several years by the du Pont Company. The sales office will be in the Woolworth Building, 233 Broadway, New York.

For the "Radio Bug's" Christmas

One of these books will be sure to please

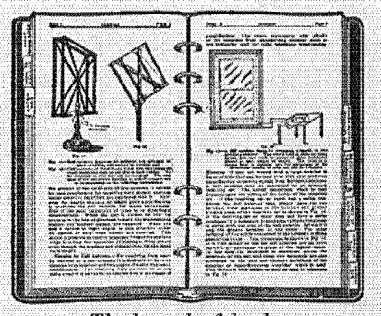
THERE is only one thing that will tickle the radio bug as much as getting 2-LO or some other long-coveted, far-distant station, and that is receiving a Lefax Radio Handbook for Christmas. This handy little volume is just crammed full of pertinent facts about radio. It is so worded as to be easily understood by the novice yet comprehensive enough to be of great value to the veteran radio fan. The information contained in this book is indispensable to the many who build their own sets and maintain them efficiently, and it is especially gratifying on its own account to the ingenious American youth who cannot be quite satisfied with anything unless he knows all about it.



The main divisions of this handbook are devoted to chapters on "What Radio Does," "How to Receive Radio," "Antennas," "Fundamental Principles," "Lines of Advance in Radio," "Assembly of Receiving Sets," "Accessories and Construction Details." The subdivisions cover the entire science of radio broadcasting and its reception.

Although complete in every detail, this book is of a very handy size and can easily be carried in the coat pocket. It is supplied in both a bound and a loose-leaf edition, either one entitling the purchaser to monthly supplementary service at a small additional price.

Both editions of the Lefax are very attractively bound in black Du Pont Fabrikoid. This binding fits them for long, hard service and gives a lasting beauty to the books that the publishers undoubtedly had in mind when they wrote us, "The best radio handbook should have the best binding. That is why we chose Du Pont Fabrikoid."

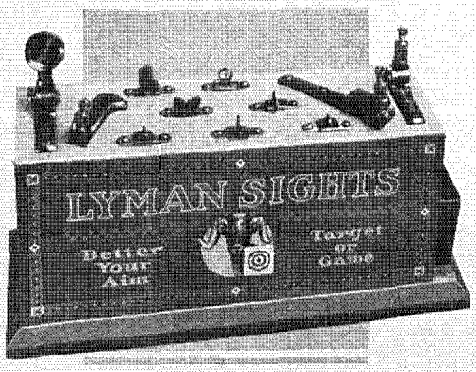


The loose-leaf book

One of these Lefax Radio Handbooks will make a most acceptable Christmas gift to anyone who now owns a radio set or who eventually will have one. This book is a solution for many of your gift problems. The price of the bound volume is $2, and the loose-leaf edition $3.50. These books can be obtained promptly from your dealer or by writing to Lefax, Inc., Ninth and Sansom Streets, Philadelphia, Pa.

Making It Easy to See the Sights

SELLING gun sights used to be a big trial to the average sporting goods dealer. It was next to impossible for him to select and keep in stock an assortment of sights that would give sportsmen what they wanted and yet yield him a profit on his investment. There were so many different models of guns to be fitted that the dealer usually was out of the particular sight wanted, and it was difficult to keep the stock he did have in good condition. Gun sights had a way of getting mixed up and confused. Some of them had removable parts and extra attachments that got lost or mislaid. A great number of sporting goods dealers preferred to sell the sights from the manufacturer's catalogue rather than to keep a stock on hand.



Gun sights displayed on this stand are sure to attract the sportsman's attention

This situation has been materially benefited in a very practical way by the Lyman Gun Sight Corporation, of Middlefield, Connecticut, through putting on the market an assortment of sights on a display stand, which is illustrated here. In almost any sporting goods store that you enter now you will find this assortment, not hidden away where sights usually were kept, but right out in a prominent position selling more sights than the dealer had ever thought possible before.

In this assortment there are eleven Lyman Gun Sights so selected that they cover a wide range of standard American firearms. They are screwed fast to the top of the cabinet and cannot become misplaced. Illustrated and numbered on the bottom of the cabinet are shown the make and model of all guns for which each sight is adapted. A metal pocket at the side holds literature describing Lyman Sights and their operation. This leaves nothing to guess work and simplifies the selling of gun sights very materially.

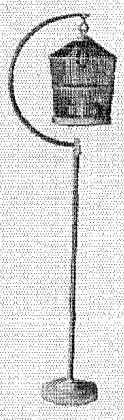
The Lyman people recommend that when a dealer sells one sight on the cabinet, he immediately order another to replace it, and thus keep his assortment complete.

One problem in making this cabinet was to get a material for the top in a color that would contrast nicely with the sights — a cover that would also be dustproof, sun-fast and non-staining. For this purpose the Lyman Gun Sight Corporation used Du Pont Fabrikoid.

The tan-colored Fabrikoid harmonizes well with the cabinet and assures a clean base that always remains attractive. Such practical uses of Fabrikoid are appearing more and more in the manufacture of display cabinets and fixtures.

The eleven gun sights on the cabinet, shown in our illustration, list for $30. Dealers can obtain them from all sporting goods jobbers or from the Lyman Gun Sight Corporation direct.

Something New in Bird Cages



THE "bird in the gilded cage" is unhappy. She looks upon her home with a jaundiced eye, for while it was once thought to be truly luxurious, now it suffers sadly by comparison with the newer, more up-to-date cages which are made of a material that is quality all the way through and better constructed throughout.

The Andrew B. Hendryx Company, of New Haven, Connecticut, has been making fine bird cages for fifty-five years, and is now manufacturing one that comes close to the ideal. The accompanying illustration gives you some idea of what it looks like, but fails utterly to portray the rich coloring and beauty of the material or the expert workmanship that helps to make this cage a veritable work of art.

Both the stand and the cage are made of Pyralin, which the Hendryx Company says is "an ideal material for bird cages." Solid Pyralin stock is used—not a surface coating applied over some other material. From this smooth, hard material there is nothing for the bird to "pick off." And the cage can be kept clean and sanitary merely by washing with soap and water, which does not harm its rich, lustrous finish in the least nor affect its permanent color.

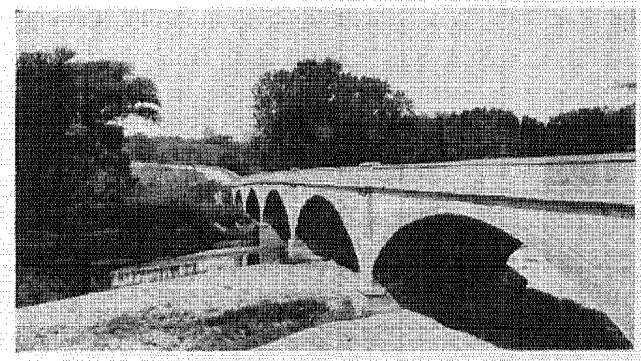
The cage is 17 inches high and 11¾ inches wide, and is equipped with an invisible seed guard. Shields protect the feed cups, which are mounted on removable mats to facilitate cleaning. The stand is 5 feet 4½ inches high. Additional details will gladly be furnished to interested readers, who should address inquiries to the Andrew B. Hendryx Company, at New Haven, Conn.

Engineering with Explosives

Du Pont dynamite breaks down the concrete rails of a Lincoln Highway bridge, so that better accommodations for heavy traffic can be provided

By O. B. MONAHAN
Sales Representative
E. I. du Pont de Nemours & Co., Inc.

THE Lincoln Highway, the best-known transcontinental highway in the United States, was built to accommodate twentieth century automotive transportation. And it was designed not only for the tremendous burden of traffic that, it was estimated, would pass over



A view of the bridge before the work was undertaken

it daily at the time of its completion, but anticipated increase in traffic for years to come was also taken into account.

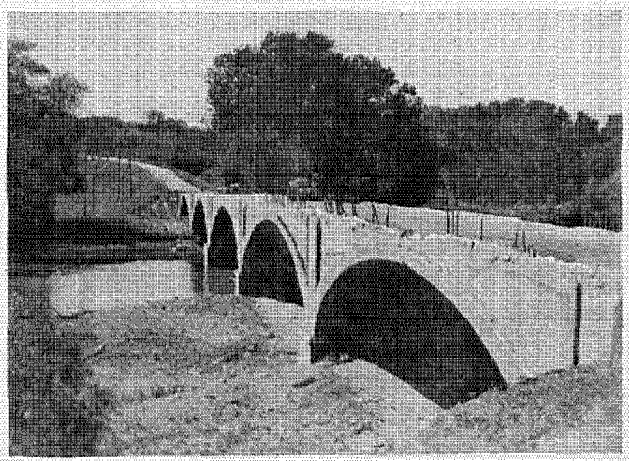
In a few years, however, travel has increased so much more than was expected that parts of this great highway—particularly the bridges—are now inadequate, and engineers are confronted with the problem of reconstructing sections of it. To cite an example:

The section of the Lincoln Highway that passes through Iowa, "the state where the tall corn grows," is a credit to the Iowa State Highway Commission, of which F. R. White is chief engineer and F. A. Mann of Ames, Iowa, construction engineer. In building this road, these men attempted to take care of the ever-increasing demands of Americans who use the automobile to "see America first." The road was scarcely completed, however, before it was found necessary to increase its carrying capacity. One of the places that offered the most difficulty was the bridge over the Racoon River, three miles west of Jefferson, Iowa. This is a fine, arch concrete bridge, 422 feet long and 16 feet wide, with a rail 3½ feet high on each side. This bridge was found unequal to the burden of traffic and the problem of enlarging it was a perplexing one for the State Highway Department. Finally it was decided to "cantilever out" 4 feet on the original bridge, and Lundgren, Reis & Company, of Des Moines, Iowa, was employed to do the work, under the supervision of Engineer F. K. Preston.

The job called for demolishing the rails, which were 8 inches thick and extended the entire length of the bridge. They rested upon and were joined to the base of the bridge, which was 24 inches wide and 12 inches thick. The contractors were at a loss to find the most economical method of doing this work, until they heard of Jay G. Jackson, a professional blaster of Jefferson, Iowa, who has the reputation of being able to do unusual and difficult jobs with dynamite. Mr. Jackson assured them that this one was easy.

After some preliminary experimenting, the most effective method of operation proved to be: To place charges of one-half pound of 60 per cent du Pont straight N. G. dynamite at the base of the rail, on each side. Three such charges at a time were placed and were detonated with du Pont electric blasting caps until the rails were sheared off. The result of the work can be seen by comparing the two accompanying illustrations.

The cost of demolishing these rails without dynamite, it is estimated, would have been more than 1000 per cent of the cost involved with dynamite. This is just another instance of the part dynamite plays in modern engineering, aside from the well-established lines in which it has been used for years. Explosives properly handled are great mediums of efficiency to engineers, and often a well-directed inquiry about a problem will result in the difference between red and black ink in closing the books when a job is completed.



How the bridge looked after the blasts. The rails were heavily reinforced with iron bars, both horizontal and lateral

The du Pont Company maintains an efficient organization that is always glad to furnish suggestions and data, as well as to assist in carrying out the practical operation, on any real problem confronting contractors.

Score-Keeping Made Easy

Fabrikoid table covers are very helpful to players of the ancient Chinese game

ON Madison Avenue in New York City, and particularly near the intersection of Fifty-seventh Street, the passerby finds himself especially attracted by the many little shops full of really charming articles that exhibit unusual originality and fitness for use in the home and for appropriate gifts to discriminating friends. And now when the idea of selecting gifts for Christmas is uppermost in the shopper's mind, these places are all the more attractive. One of these unique shops—and one that is especially distinguished by the appeal of its offerings—is Cargoes, at No. 585.



All ready for a game

Among the many creations Cargoes has originated have been several ideas carried out in Fabrikoid, and one that has proved to be very popular is the Mah Jongg table cover you see illustrated here. This is an attractive cover made of green, blue or yellow Fabrikoid, bound in red or black moire ribbon. It is cut out at the corners so that it will fit either the large or the small card table, and it is weighted with clear Chinese glass ornaments on a black cord. An adjustable ball which slips up or down the cord fastens the cover securely to the table.

Both the score count and the doubling score for Mah Jongg—or Pung Chow—is printed right on the cover, so that individual score-keeping is easy. Each player can figure his own score by referring to the score chart imprinted on the table cover before him.

When it is not being used, the cover can be folded without injury. Should it become wrinkled, it can be pressed smooth again. If dust gathers on it, or if it becomes spotted, it can be cleaned easily with a damp cloth, and the Fabrikoid will be none the worse for wear. Altogether, it makes a very attractive and practical cover.

This Mah Jongg cover is only one of several similar table covers that Cargoes is offering. The same idea is carried out in a printed bridge cover and in a plain Fabrikoid cover that can be used for many purposes. Any one of these covers will make an excellent Christmas gift for some friend who likes to play Mah Jongg, Pung Chow, bridge or any of the other popular indoor games. And it's always an acceptable prize.

Fabrikoid has been of great assistance to Cargoes in its department for interior decorations, too. It has been used for cushions on iron garden furniture, for large garden umbrellas, for screens, boxes, and many other things, and has proved to be so easily adaptable that it is not surprising this shop uses it so extensively.

More About the "Frisky, Risky Rug"

(*Continued from page 7*)

aid of anything but its own weight, so that there is no possibility of damaging the floor or its finish as is the case when ordinary metallic fasteners are used.

And the rug is equally immune from damage; it is not fastened down, but is merely laid upon the upper surface of the Rug Anchor. This brown and black fabric of whipcord weave holds the rug in place firm and flat simply by the frictional resistance between the two.

For best results the entire surface under the rug, back of the fringe, if any, should be covered with Rug Anchor. This impervious material will prevent any moisture or dust from penetrating the back of the rug. It will absorb much of the impact of walking from all portions of the rug, and should there be any bad joints or rough places in the floor it will smooth these over and shield the rug from their gnawing action.

Rugs laid upon Rug Anchor do not buckle and crawl when a vacuum cleaner is used. They do not wrinkle and have to be smoothed out frequently—there are no wrinkles to be stepped on that will eventually injure the rugs.

More than three hundred dealers in floor coverings recommend and sell Rug Anchor. Its price is so little, compared with the value either of the limbs or of the rugs it protects, that few people need be urged to buy it once they know it is available.

If you have any trouble getting Rug Anchor, please let us give you the name of a nearby dealer.

The Mite that Makes Dynamite Mighty

(Continued from page 4)

The detonation of this blasting cap is initiated with the fulminate, and the base charge builds it up to a greater velocity and strength than would be possible with fulminate alone.

It seems safe to say that the explosives industry, as we know it, had its real beginning when Nobel first employed fulminate of mercury in a metal shell to detonate his kieselguhr dynamite. He contributed most to the initial development of the industry by showing the world the useful nature of nitroglycerin, by inventing dynamite and blasting gelatin, by evolving a detonator to make these products usable in a practical way, with comparative safety, and finally, by giving Gelignite and Ballistite to the world.

Many refinements and extensions have been made since Nobel's blasting caps appeared. We now have caps for use with safety fuse, electric blasting caps, waterproof electric blasting caps, electric blasting caps for use in shooting oil wells thousands of feet deep, delay action electric blasting caps, and other types of detonators for special uses.

Although the first four hundred years of explosives history show relatively slow progress, the contributions of the past century constitute the most active part of the record. Today, there are probably more trained minds working on explosives problems than ever before in history, so that the coming years would seem to hold great promise of future achievements.

No organization in the history of the explosives industry has done more to keep abreast with new developments than the du Pont Company. None spends so generously in research work and in testing raw and finished products, and none has gone so far to insure quality control of the ingredients used in manufacturing explosives and their accessories. In this connection it may not be amiss to mention that du Pont operates nitrate mines in Chile; charters steamships to bring the ore to the United States; uses the ore to make acids; refines glycerin; produces wood pulp, a better absorbent than kieselguhr and one that makes possible a more perfectly balanced explosive. Using these and other ingredients, the Company manufactures dynamite, which is packed in boxes made at its own box plants from logs cut from its own timberlands. And with the same thoroughness blasting powder, blasting caps, electric blasting caps, blasting machines and other accessories are also produced.

While commercial explosives and military explosives, blasting caps and percussion caps, all have the same parentage and have developed more or less along parallel lines, the reader will hardly need to be told that while the mite that makes dynamite mighty today has something to do with the uses of warfare, it has much more to do with the development of the nation's industrial life and progress.

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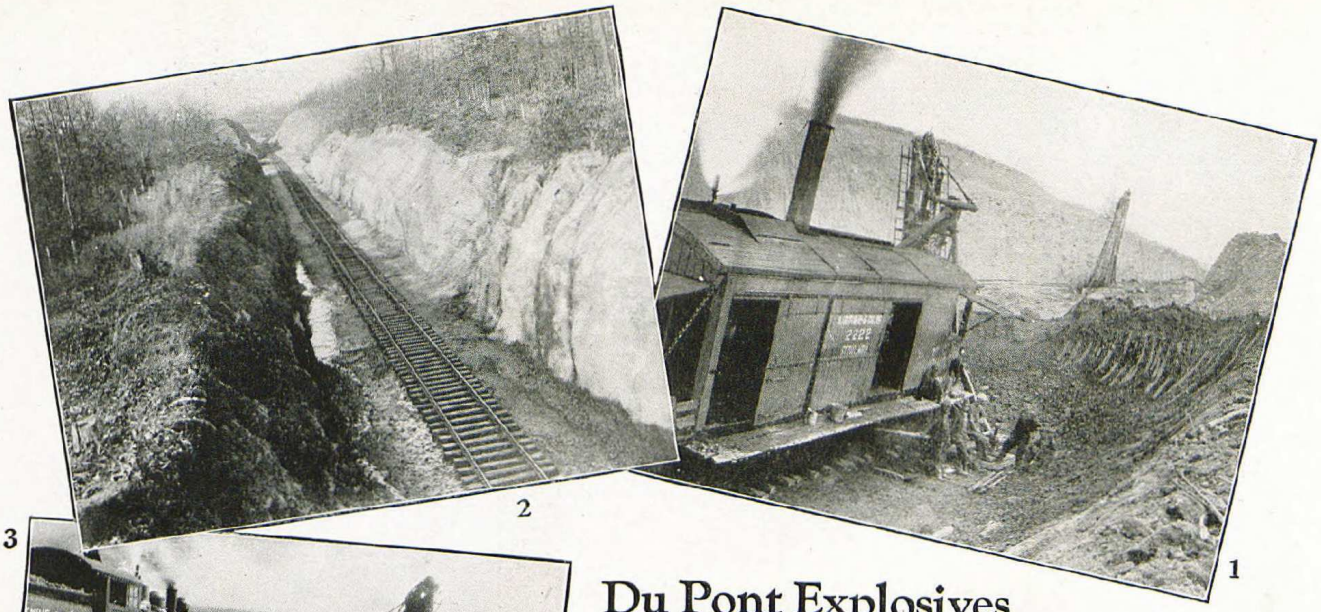

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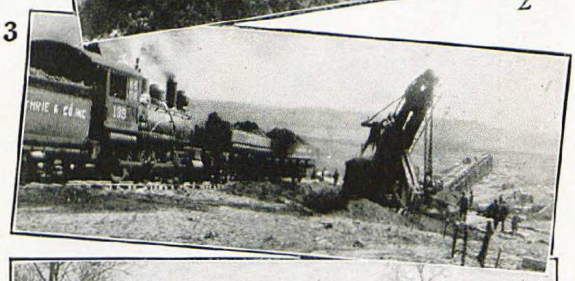



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1. *One of the 17 steam shovels employed on the job.*

2. *Section of track laid at western end of new construction Illinois Central Railroad.*

3. *Part of the "standard gauge" outfit—three 60-ton locomotives and thirty 12-yard Western air-dump cars.*

4. *One section of the dump trestle extending across the Pond River bottom.*

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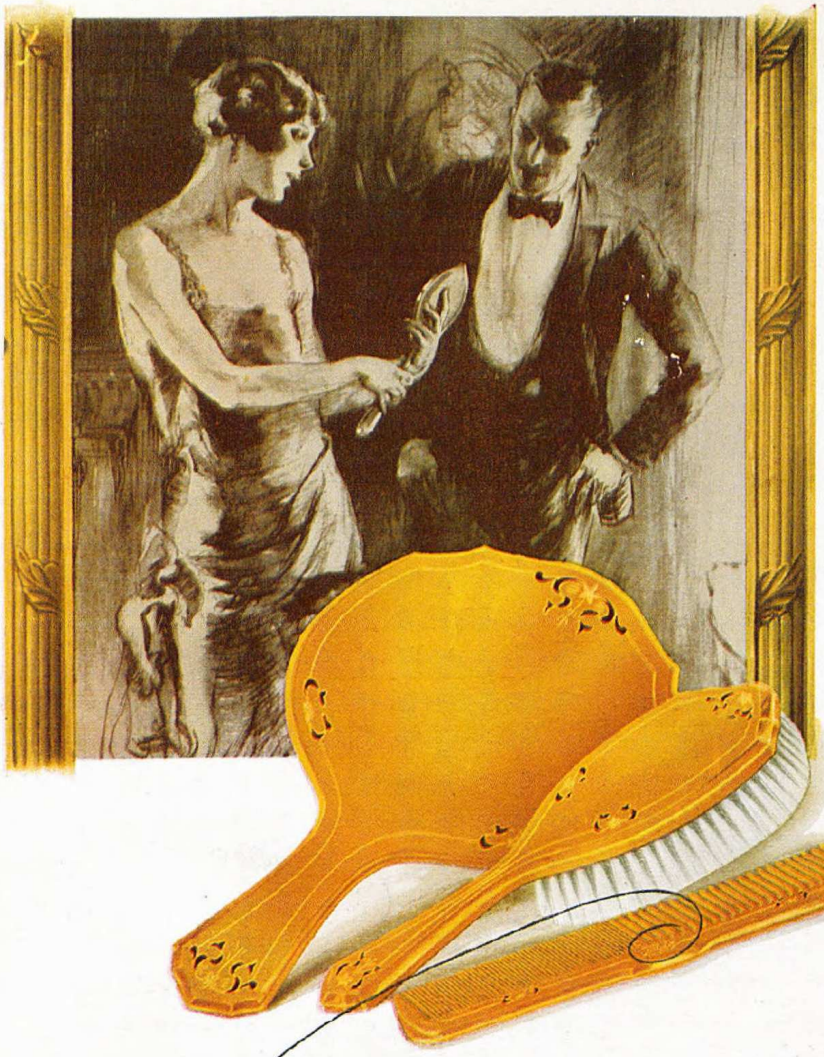

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