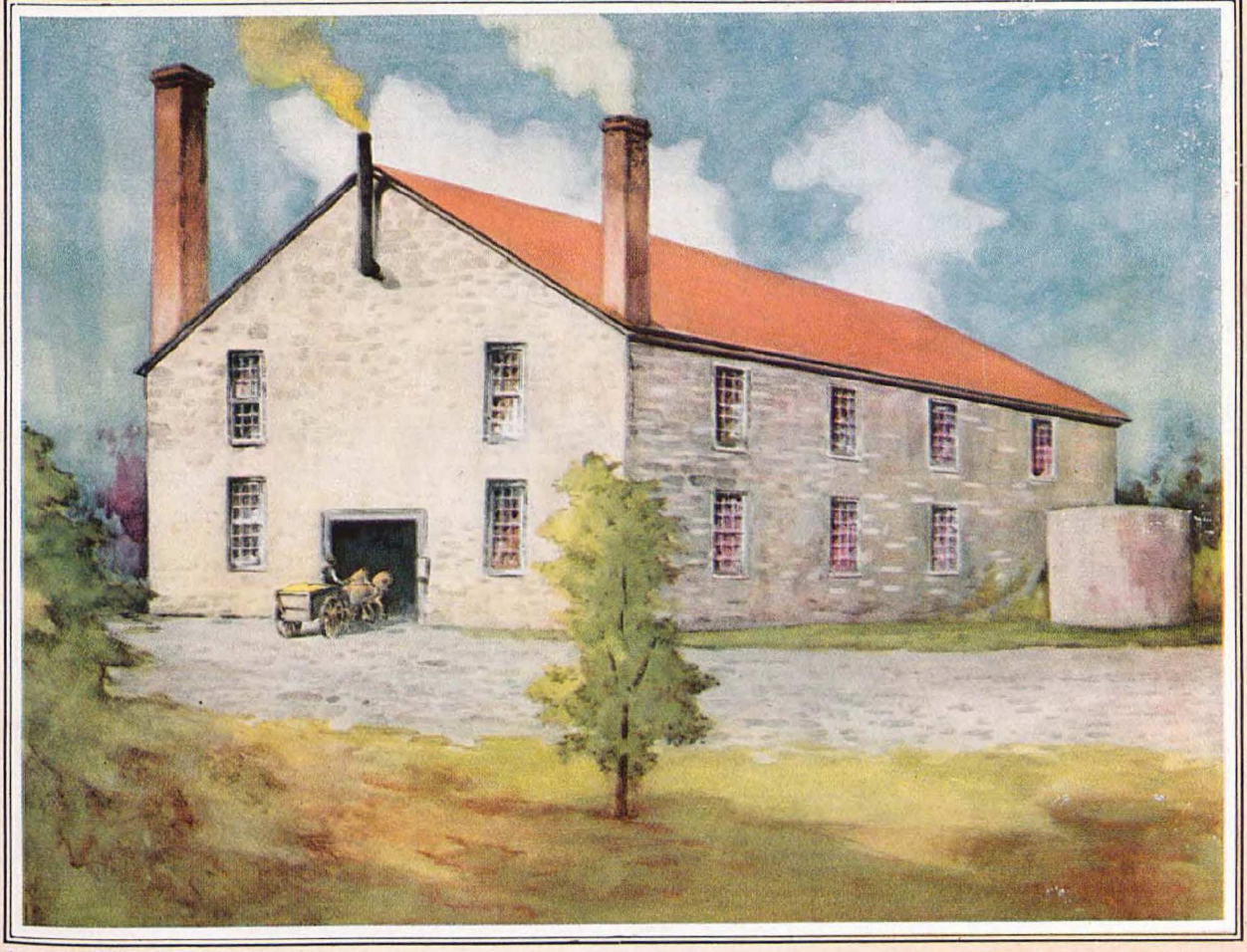

From a drawing by Frank H. Taylor

Sulphuric acid was first made in America by John Harrison, a Philadelphia chemist, whose lead chamber building at Kensington is shown here. The business he founded in 1793 is now owned and operated by the du Pont Company

The DuPont Magazine

May 1925

K

Obtain Better Blasting Results at Lower Cost

Du Pont chemical engineers ensure uniformity of quality by chemical control through every step of manufacture from raw material to finished product.

WHEN you buy du Pont explosives you buy something more than a commercial product.

Back of every pound of du Pont explosives is the knowledge and experience gained during 122 years in the development and production of explosives.

The uniformity of its products has made the du Pont Company's explosives standard throughout the world. This uniformity is obtained through the exercise of the most careful selection of all materials and the complete chemical control of every stage of production from raw material to finished product.

Because of the quality and efficiency of du Pont explosives their users do obtain *better* blasting results at *lower* cost.

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Explosives Department

WILMINGTON DELAWARE

DU PONT

POWDER MAKERS SINCE 1802

THE
DU PONT
MAGAZINE

DU PONT

Vol. XIX MAY, 1925 No. 5

The Application of Explosives to Coal Mining in Great Britain

[Last summer Mr. Hiscock studied coal mining practices in the United States. Before returning home he graciously consented to tell Du Pont Magazine readers how explosives are used in England's coal mines. We commend his article to you for careful reading.—EDITOR.]

By W. G. HISCOCK, B. Sc.,
F. I. C., Assoc. M. I. Min. E.,
Research Dept. Nobel's Explosives Co., Ltd.

THERE can be no denying the fact that explosives are of vital necessity to the life of any of the great industrial countries, and it is no idle jest to say that were any of these countries cut off from their supplies of explosives they would sink back to third rate powers. The prosperity of a nation depends to a considerable extent upon its mineral wealth and the cost at which these minerals can be placed upon the world's markets. In contrast to the scarcely touched resources of the United States, the mineral wealth of Great Britain has been exploited since the days when the Phoenicians visited Cornwall to mine lead and tin, and further, Great Britain is diminutive in size. The total consumption of explosives will therefore be considerably lessthan in the United States and the amounts consumed by individual industries will be entirely different. In Great Britain by far the greatest part of the explosive output is consumed by the coal mines; thus according to H. M. Chief Inspector of Mines report for 1923, the following amounts of explosives were consumed in that year:

(1) Mines under the Coal Mines Act.. 31,898,884 lbs.
(2) Mines under the Metalliferous Mines Act..... 1,457,169 lbs.
(3) Quarries under the Quarries Act.. 5,040,735 lbs.
(4) Total (includes few miscellaneous quantities)..... 38,414,590 lbs.

In view of the outstanding importance of the application of explosives to coal mining this phase of the situation will be dealt with in this article.

Historical Survey

The value of coal as a fuel was recognised in the early Norman period when it was termed "sea-kole" and was picked up on the seashore having been washed out of the outcrops on the coast. It is recorded that in 1306 a man was condemned to death for the pollution of the atmosphere due to the burning of "sea-kole." Active coal mining continued from about this period and it is certain that in the Elizabethan days, black powder was used in coal winning in underground mines. Partly owing to the fact that the seams were near the surface and partly due to the low value placed on the miner's life, gas or dust explosions do not appear to have been mentioned until early in the last century. After several serious disasters recorded between 1800–1830 the first Government Commission was appointed in 1835 to investigate the dangers attending coal mining. No action was taken, however, until 1872 when the Coal Mines Regulation Act was passed which among other things issued regulations regarding the use of black powder. The next great advance was due to Sir Frederick Abel who, in a report to a government commission in 1886, condemned black powder and recommended the use of the then recently developed high explosives, in conjunction with the water cartridge. He also condemned as dangerous the use of safety fuse, invented by William Bickford of Tuckingmill, Cornwall, in 1831, and recommended the electric detonator. During the years 1890–1896 the coal owners carried out useful work on certain flameless explosives. Following the recommendations of a government committee and the Explosives in Coal Mines Order of 1896, in which certain explosives were prohibited in fiery mines, the Woolwich Testing Station was instituted in 1897. The test carried out here controlled the explosives which could be used in fiery mines between 1898 and 1914 and the list contained such well known names as Monobel Powder, Roburite, Bellite, Bobbinite, Carbonite and Samsonite.

Since the 15th of March, 1914, only those explosives which have passed the Rotherham test are permitted for use in fiery mines. The Rotherham testing station was erected in 1911 and put into use in 1912. The gallery test—so called because the long steel chamber into which the explosive is fired is meant to represent a normal

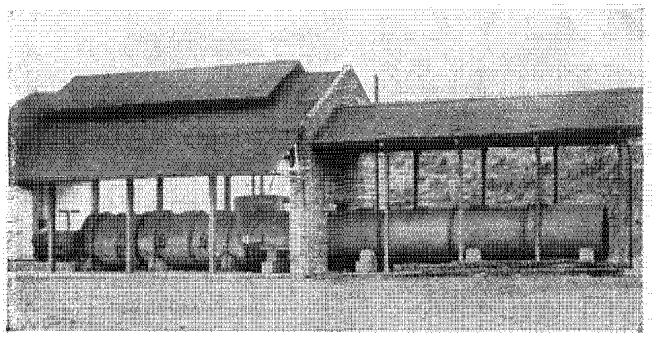


Fig. 1—The testing gallery of the British Government

mine gallery—is carried out in the apparatus shown in Figure 1.

The test consists in finding the maximum charge of the explosive which fails to ignite both a sensitive mixture of coal gas and air and a mixture of coal dust and air. Coal gas has been chosen owing to the difficulties of obtaining and transporting firedamp itself and because it forms a more sensitive mixture with air. A charge of the explosive is placed without tamping, in a specially designed gun and fired into the uniform mixture 8.5—9.0 per cent of coal gas in air contained in the explosion chamber of the gallery. An ignition can be seen through the glass windows at the side and it also has the effect of emitting a flame from the paper covered portholes at the top of the gallery. Testing is continued until the maximum charge is found which does not ignite the mixture at all in five successive shots. The testing is then continued with coal dust-air mixtures. The explosive in this case is fired, again without tamping, into the gallery which contains several pounds of finely ground coal dust—the most fiery obtainable being used as standard—placed partly on the walls and partly on a movable platform at the mouth of the gallery gun. The maximum charge of explosive which fails to ignite both the gas-air mixture and the coal dust-air mixture is called the "charge limit" of the explosive. Not more than this limit is allowed to be used in one borehole in fiery mines.

In order to assist the coal mine operators to compare the strengths of the permitted explosives on the permitted list, a test similar to the U. S. Bureau of Mines ballistic pendulum test is carried out. A photograph of the apparatus is shown here. A 4-oz. shot tamped with 2 lbs. of china clay is fired from a specially designed gun and the momentum of the projected clay transferred to a very heavy steel mortar. The recoil of the mortar is measured and recorded. As this measurement only records the heaving effect of an explosive and not its shattering effect, the value of the results obtained is not very great and cannot be said to give a representation of the action of an explosive in a borehole.

Although the introduction of stringent regulations in the mines and the modification of explosives have effected an enormous saving of life, yet it must be admitted that ignitions of firedamp and air directly traceable to permitted explosives still occur. In view of this the Secretary of State for Mines appointed a Committee in 1923 to carry out research into the causes of, and means of preventing, the ignition of firedamp and coal dust by the firing of permitted explosives. The Committee is carrying on its work in two main directions, namely—

(1) Investigations in connection with the gallery test.
(2) Scientific researches into
   (a) The characteristics of an explosive which determine its liability to ignite mixtures of inflammable gas and air or coal dust and air.
   (b) The characteristics and conditions of existence of the inflammable mixtures of firedamp and air and coal dust and air, which enable them to be ignited.

Methods Employed in Shotfiring in Mines

In view of the fact that coal mining in Great Britain has been in active operation for centuries, it is not sur-

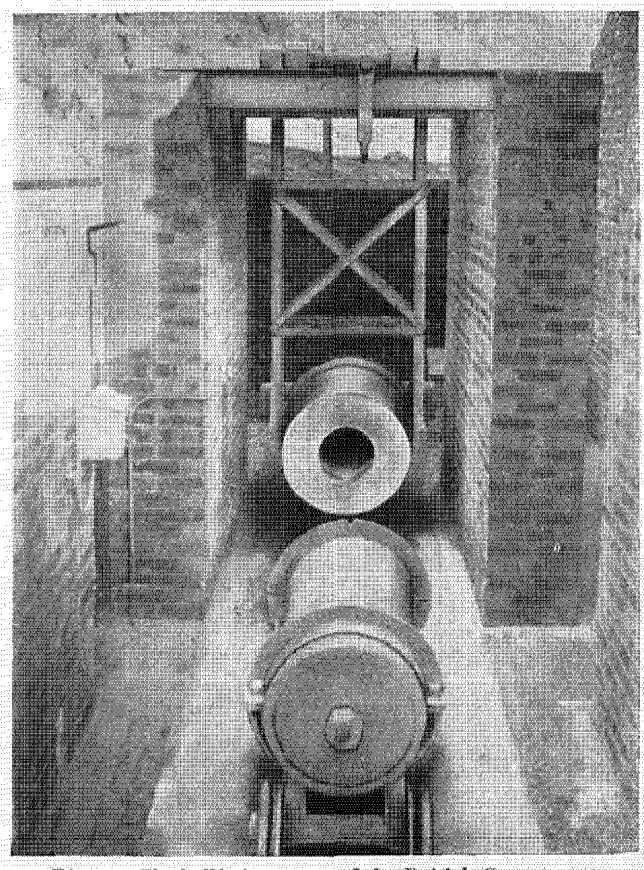


Fig. 2—The ballistic mortar of the British Government

prising to find that the upper seams have all been worked out and at present the coal is being mined at comparatively great depths. Naturally this will affect the system of mining employed and although the pillar system, universally used in the United States, is still employed in some of the thick seams, about 90 per cent of the mines are now operated by the longwall method. The essential feature of the latter method is that the whole of the coal is removed at once without first subdividing it into pillars, to be taken away at a second working. The roof is temporarily supported by wooden

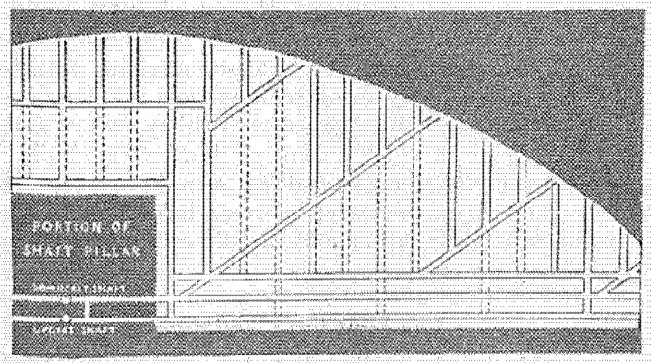


Fig. 3—Opening out a 4-foot seam by advancing the longwall

props to protect the workmen at the face and later by pack walling of stone, to preserve the roads and maintain the ventilation. A general idea of the method may be obtained from the illustration which shows the opening out of a 4-foot seam by advancing longwall undercutting by means of machines.

Blasting is carried out in mines using longwall working for the following purposes:

(A) Winning coal at the face.
(B) "Ripping" or "Brushing" the roads.
(C) Driving cross measure drifts.

(*A*) *Blasting in Coal*

The great advantage possessed by the longwall system is that normally the roof weight bears on the coal at the face and makes the coal more workable. In many mines this roof weight is so arranged that explosives are not needed for this operation at all. The hewer simply undercuts the coal and the weight of the roof forces it down in large blocks. On the other hand, it happens with some very soft coal seams, that unless the face is advanced rapidly, the coal is crushed and powdered and its market value decreases.

Normally the coal is undercut to a depth of 3–5 ft. on the night shift by longwall machines and the coal worked during the morning shift. Where the coal is hard and adheres to the roof, shotholes are drilled at intervals along the face and the coal blown down. A typical example of this work is shown in Figure 4.

In this work the charges used are very small, usually of the order of 2–4 oz. and very seldom over 6 oz. By the Explosives in Coal Mines Order of 1913, it is enacted that except in the case of anthracite mines, no shot may be fired unless the coal is undercut to a greater depth than the depth of the shothole.

As would be expected the ventilation is very good along a straight face of coal; accumulations of firedamp are very uncommon and explosions very rare occurrences. Ignitions of gas caused by coal shots have invariably been traced to bad ventilation at "dead ends" caused by falls of roof interrupting working, faults, etc.

(*B*) *"Ripping" or "Brushing"*

In those seams in which the tubs or cars cannot travel along the face it is necessary to run "gateways" forward as the face advances so that the coal can be loaded with as little difficulty as possible. These "gateways" are driven parallel up to the face from "cross gates" at distances varying from 11–50 yards apart. In this operation it is usually necessary to blast down the roof, the stone being packed away at the road sides forming the pack walls.

A typical example of this operation is shown in Figure 5, page 15.

Either one or two shotholes are drilled 4–5 feet back, depending on the nature of the strata and the width of gateway required. Two holes are shown above, but in many cases only one hole, placed centrally, is required. The charge, of course, varies with the depth of hole, thickness of the burden below and the nature of the strata, but in fiery mines it cannot be above the charge limit of the explosive and is usually about 1 lb. of Dynobel No. 3 or Samsonite No. 3 per shothole.

(*Continued on page 15*)

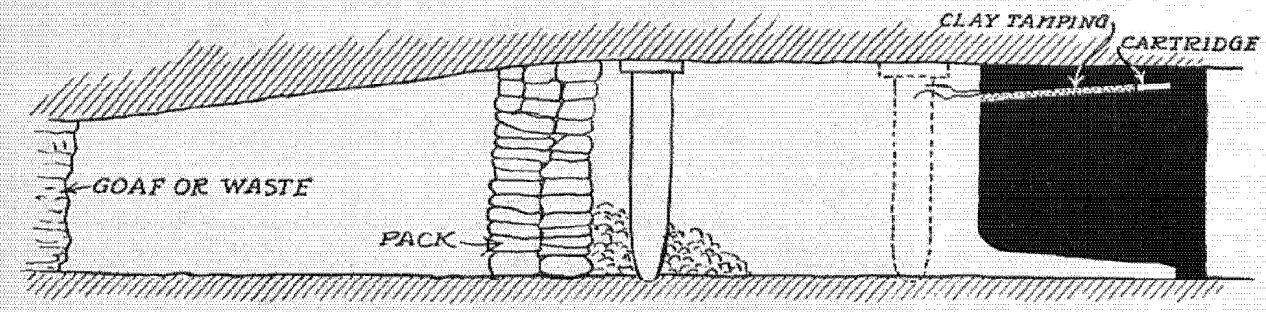


Fig. 4—Position of the shot hole in blasting coal

Dynamite Solves Another Problem

How concrete foundation walls were safely blasted under the shadow of a glass-walled building

By DOROTHY G. SEAMAN

IF I had only known before what dynamite could do, I should be much richer today in time, money and experience," said the superintendent of the Millville (N. J.) Manufacturing Company, as he stood looking at the men working on the removal of the foundations of a building in the very heart of the millyard, and thinking of past operations of like nature.

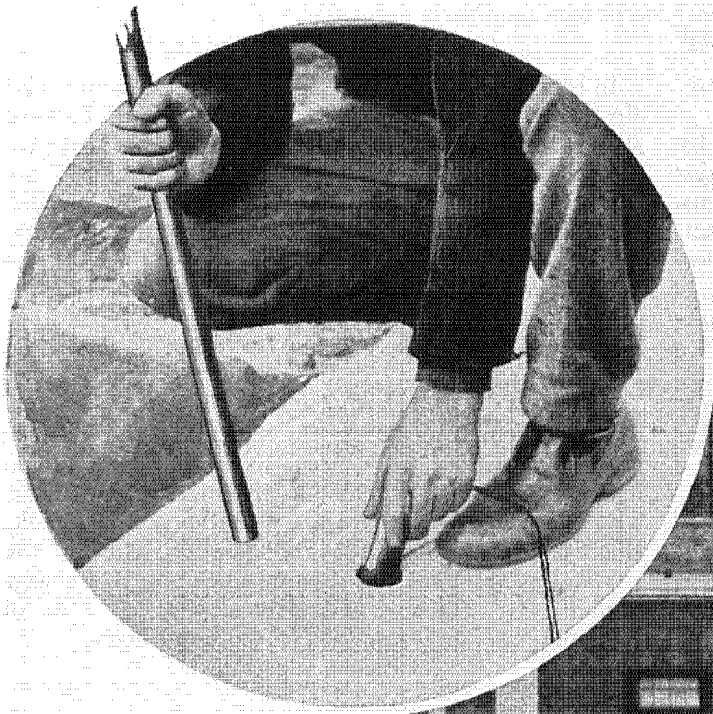
"Not long ago," he continued, "we decided to tear down this building, which was a frame structure, and put in its place a new and improved brick mill. The razing seemed the smallest part of the job—simply ripping down the frame-work, then breaking up the foundation with pick and sledge. Down came the building in record time, but not so the foundations. The builder had builded well—this was no house built on the sand, for he had placed a light frame structure on walls of concrete re-enforced with a network of wrought iron bars, one and a half inches in diameter.

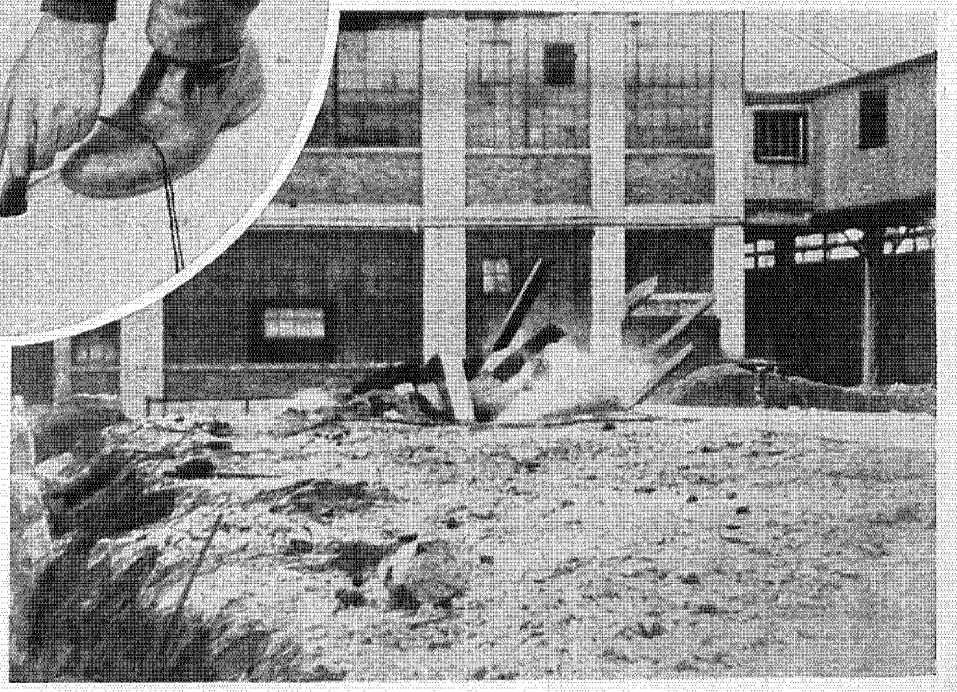
"The work came to a stop. Human strength could not combat iron and concrete. Then somebody said, 'Blast it out with dynamite!' That sounded fine until I recalled the location of the place and then my decision was made. Those walls were within thirty feet of the side of another mill which was all windows. Other buildings, all having numerous windows, were in close proximity. Then, to make matters worse, a brick sluice-way carrying water to another mill ran directly underneath the doomed structure.

Can blast inside buildings

"My last hope died, but the same man said he had heard that things could even be blasted out inside of buildings, without damage to the surroundings, so why should I worry with thirty feet to spare?

"The upshot of the whole thing was that I sent for a professional blaster and he assured—yes, guaranteed—that he could take out those walls without so much as cracking a window-pane. He was a man well along in years, and when he told





"I was disappointed and certain that the blast would be a failure. What chance had a three-inch stick of dynamite against a wall of concrete?"

"The blaster shouted a warning—and pressed the plunger! A dull explosion was heard, the barricade moved up and then settled back into place again. Nothing spectacular, nothing loud, nothing was hurled into the air!"

me of some of the jobs he had done and of his years of service, I became convinced that dynamite must be safe if he were alive and confident of its safety and power after all those years of experience with explosives."

Pointing to a corner completely cleaned out by the blaster and ready for the builder, he said with enthusiasm, "See what a fine job he has done! The sluiceway is directly under that corner and it is just as good apparently, as the day it was built in spite of the explosions above it. Just walk around and see for yourself what can be done with dynamite if you only know how."

I accepted his invitation, and, as it was my first chance to see a blast being prepared, I scouted around and asked questions of anybody and everybody who would listen.

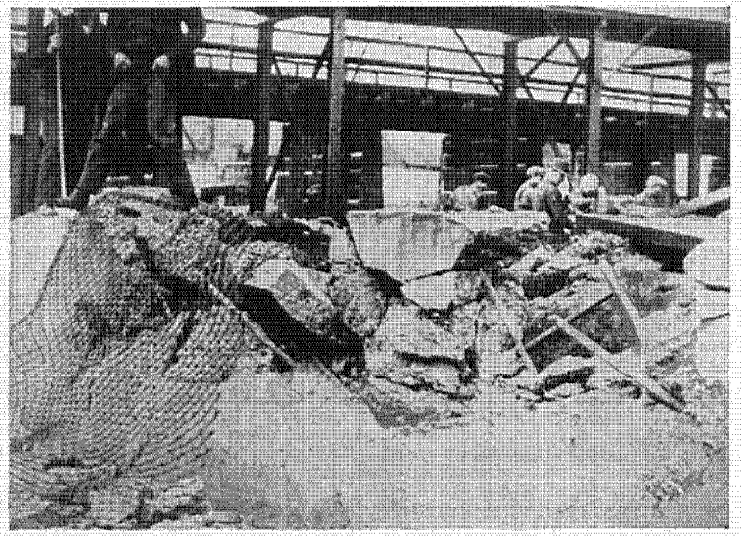
How they loaded the holes

Some of the workers were drilling holes for the dynamite cartridges with an electric drill, others were shoveling away the debris left by the last explosion, and still others were helping the blaster. One man told me, upon being asked if he were not afraid of dynamite, that he kept far away from the "old man" at first, but now they all had discovered that dynamite, properly handled, was as harmless as a kitten.

The shock I received when I went over to see the actual loading of the holes will not soon be forgotten. It had been so thoroughly impressed on my mind that those re-enforced walls were all but immovable, that I expected to see at least two regular eight-inch cartridges put into each hole. I could hardly believe my eyes when I saw the blaster carefully cut a stick into thirds. He then inserted the electric blasting cap and dropped the primed cartridge into the hole, his assistant adding some sand and tamping it down carefully. Well, I thought, it must be proper to attach wires to each piece in the same hole.

I watched him prepare another piece, but when it was done, he put it into the next hole. I was disappointed and certain that the blast would be a failure. What chance had a three-inch stick of dynamite against a wall of concrete?

After the required number of holes were loaded, the men placed a barricade of heavy wire netting and planking over the section to be dynamited.



The blast left the wall a cracked and toppling skeleton of its former self. The factory windows? Not even a pane of glass was broken

The blast

The stage was being set for the finale—the explosion itself. The working gang all moved away, the blaster connected the wires to his blasting machine, shouted a warning—and pressed the plunger! A dull explosion was heard, the barricade moved up and then settled back into place again: Nothing spectacular, nothing loud, nothing was hurled into the air!

There, it was a failure, just as I thought! Nevertheless, I hurried over to see just what had happened. The men removed the planking, and then the wire netting, leaving exposed to incredulous eyes, the concrete wall which had been built a foot and a half thick, and re-enforced with inch-and-a-half iron bars, a cracked and toppling skeleton of its former impregnable self. One man sauntered over and gave a section a push with his hand, and down tumbled pieces of concrete and iron bars! It meant only a little work for the men to complete the job at that spot.

As I left the scene my thoughts centered on two disclosures of the day—the tremendous power within a little stick of dynamite, and the fact that it could be used with such restraint, for not a single pane of glass was broken in the nearby building.

"Ditching With Dynamite"

OUR caption is the title of a new booklet recently issued by the Explosives Department of the du Pont Company. Almost every one knows that ditching can be done by hand labor, by machines and by means of explosives; but just how to use explosives to the best advantage is not clear to many people. That is why this booklet has been prepared—to throw new light on the use of explosives for ditching purposes.

This 6 x 9-inch booklet contains thirty-six pages of text matter, and is copiously illustrated with halftone etchings, and line diagrams. The text presents much practical data about the technique of ditch blasting in various types of soils, with records of actual operations, methods, costs and results.

You can obtain a copy of this booklet by addressing a card to any branch office of the Explosives Department—see list inside back cover—or by writing direct to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

A Catalogue on Wheels

Business-building catalogues are usually books, but here's an interesting exception: The Ohio Brass Company's catalogue is a specially equipped automobile that has toured through forty-six states in a successful drive for business. The car is covered with Fabrikoid

By F. W. HOTCHKISS

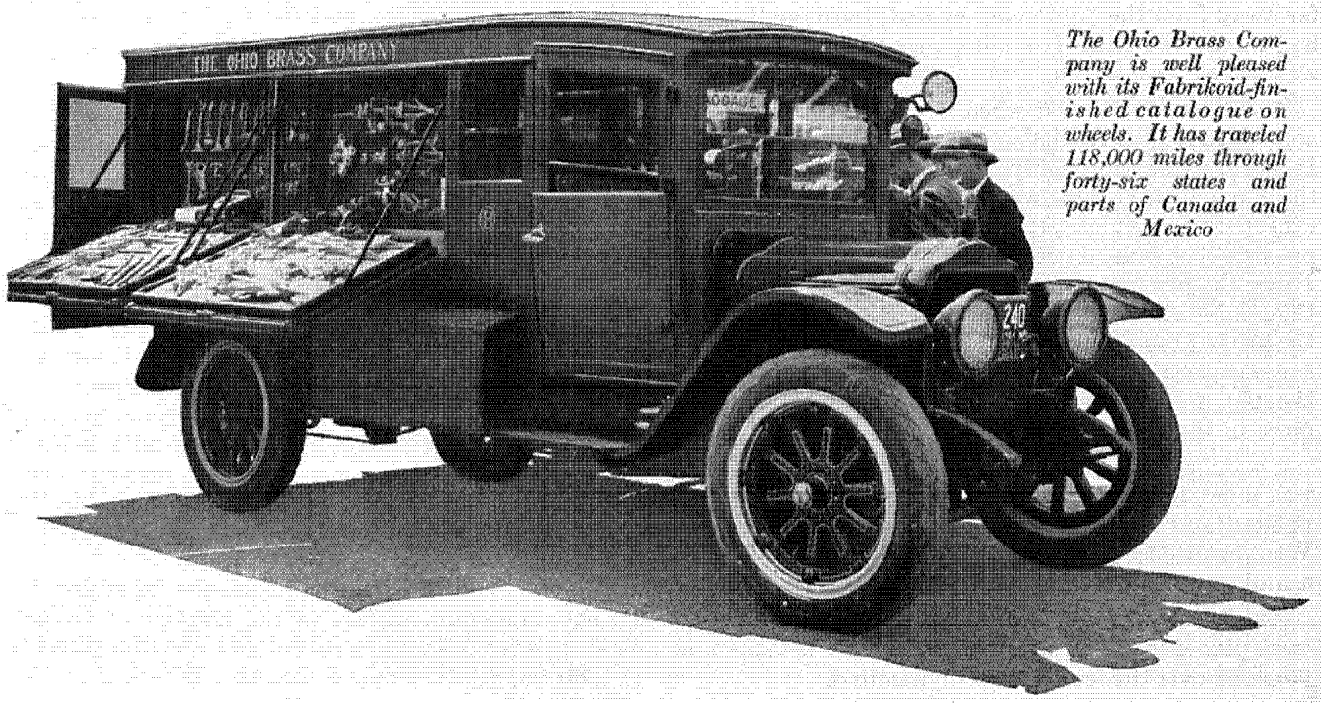
THE officials of the Ohio Brass Co., of Mansfield, Ohio, knew that they could increase the sale of their excellent line of electrical supplies if they could show them to more people connected with mines, power plants and factories. The question was, how could so bulky and complete a line be carried from place to place—in many instances far from main highways—where their prospective customers were located?

In 1920 a truck was purchased which was fitted with a special body. This body was ingeniously arranged so that it permitted a very complete display of their products. Each side of the body was fitted with two panels which opened downward, revealing compartments in which were arranged samples of trolley materials and rail bonds. The center of the truck was used for storage of bulkier samples such as welding machines and headlights.

The truck, when ready, was started on a visit to many important mines, electric railways and power plants throughout the country with such profitable results that it has been kept going ever since. In its journeys to date it has covered forty-six states and has been in British Columbia and Mexico, traveling a total of about 118,000 miles. It has certainly proved a most valuable and effective "catalogue" for the company that sponsored it. As this "catalogue" truck has been continually exposed on its wanderings to rain and snow, dust and dirt, it has been a real problem to keep its finish in attractive condition. Between the years 1920 and the early part of 1923, it was necessary to have it refinished three times. In the spring of 1923, in an effort to cut down this frequent expense and at the same time to keep the truck looking trim, it was refinished with a covering of Du Pont Craftsman Fabrikoid both inside and out, with the exception of the hood and fenders. Since then the truck has completed two years of service with the Fabrikoid covering and has started off on this year's journey looking as neat and trim as ever.

Mr. C. H. Burkhalter who has piloted this truck in its cross-country tours, recently wrote as follows: "I consider Fabrikoid a very superior finish. The truck has been covered with this material for two years and I believe you will agree with me that it is in nearly as good condition as the day it went on the road new."

Surely this is a wonderful tribute to the Fabrikoid finish and to the far-sightedness of the Ohio Brass Company in adopting it for the "touring catalogue." There's no end of ways to use Fabrikoid with advantage.



The Ohio Brass Company is well pleased with its Fabrikoid-finished catalogue on wheels. It has traveled 118,000 miles through forty-six states and parts of Canada and Mexico

Logging Up to Date

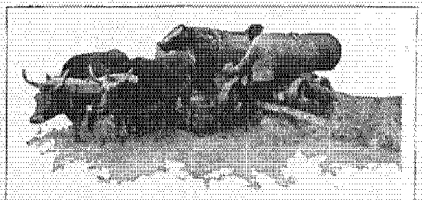
Transportation is a big factor. Just a few notes here and some interesting pictures of a new log road opened up in Washington's westernmost county

By J. J. DONOVAN
Vice-President
Bloedel-Donovan Lumber Mills

LESS than twenty years ago the usual requirement for a logging operation consisted of axes saws, cant-hooks and a few teams of cattle and horses. Altogether a first-class outfit could be financed for about ten thousand dollars. Today logging operations call for railroads, engines, skidders, miles of cable and many other accessories, so that the investment for equipment alone often passes the million dollar mark.

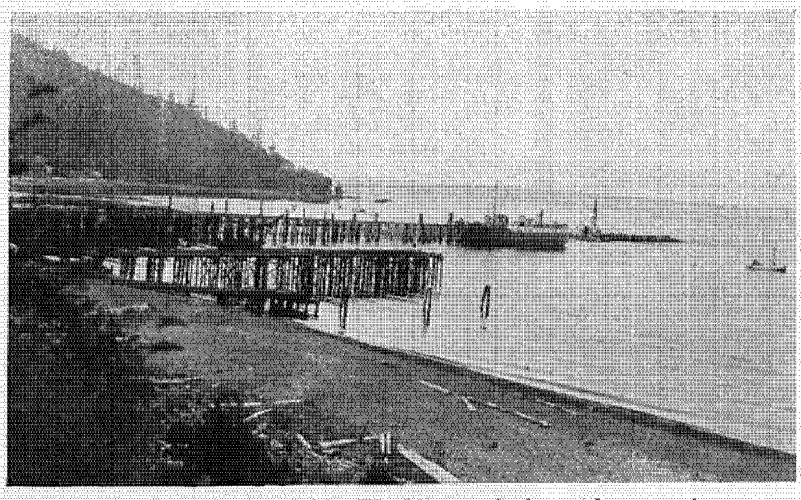
A recent development of this order is the new 25-mile logging railroad of the Bloedel-Donovan Lumber mills in Clallam County, Washington. The road starts at tidewater from Sekiu, near Clallam, and extends southward to Tyee, where it crosses the Spruce Railway built by the U. S. Government during the World War. It will reach into the greatest untouched forest of the United States — the Olympic.

The photographs reproduced on the next two pages will give some idea of this road and will show some interesting phases of its construction. Much heavy rock work was encountered and at one place it was necessary to drive a tunnel through the mountainside, all of which was done with the aid of du Pont explosives. Before this is printed, the contractors, Stewart & Welsh, of San Francisco, will have completed their work and logs will be rolling over the line to Clallam. There they will be made up in deep-sea rafts and towed to the Bellingham Cargo Mill of the company, 100 miles away. An output of 150 million feet annually is expected.



Reminiscent of older days

UP-TO-DATE logging operations are equipped with every facility for doing work by the most practical methods. Explosives are used not only for road building, but for many other purposes. According to one writer there are not less than seventeen different ways in which high explosives serve the logging industry.—*Editor.*



The loading wharf at Sekiu, Washington, is the northern terminus of the railroad

The Bloedel-Donovan Company owns or has contracts on 40,000 acres of douglas fir and spruce, with much larger areas available. Last year 250 million feet of lumber were cut in its mills — the largest production by a single company in the United States. Two thousand men are employed, about seven hundred in the five logging camps and the remaining thirteen hundred in the four saw mills and their auxiliaries.

The Clallam Lumber Company, consisting of J. D. Lacey, of New York City, W. F. Keeney, of Grand Rapids, Michigan, and their associates who are heavy timber owners, have a half interest in the road. The Chicago, Milwaukee and St. Paul Railroad Company also has certain interests in a portion of the line.

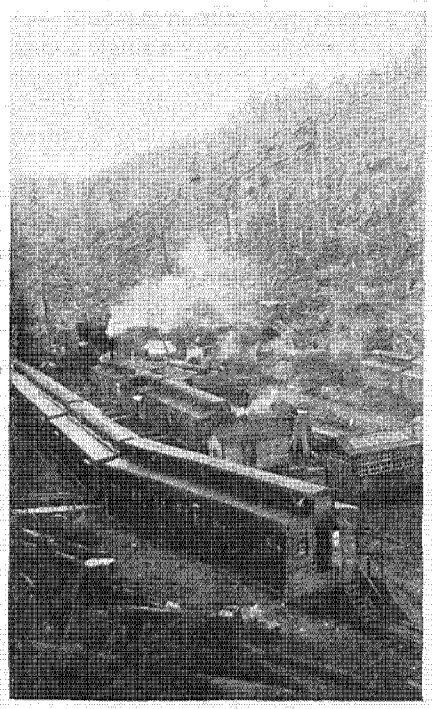
The track is laid with new 70-pound rail, and as the construction is up to the standards of regular lines, this road can easily handle heavy tonnage.

The rolling stock for the present will consist of six locomotives and about 200 cars. One locomotive recently received from the Baldwin Works is a 200,000-pound "Mallet," equipped with the latest devices for economy and power; the others are lighter. There are about 70 cars now running and 80 more under construction at Seattle. Connection with the mainland proper is via company barges landing at Sekiu or via C. M. and St. P. Ry. barge service from Port Townsend.

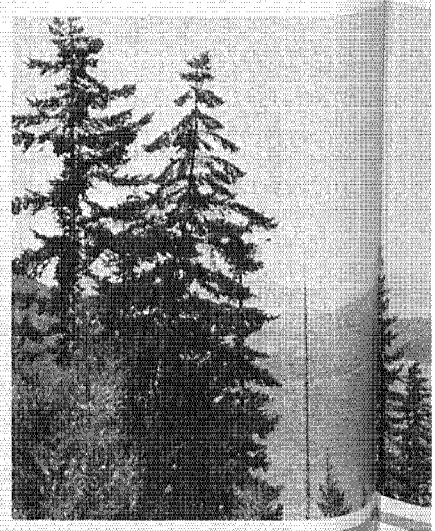
The improved working and housing conditions for logging crews also deserve notice. The men work eight hours a day. They are housed in steam-heated, electric-lighted cars built somewhat like Pullman coaches. Each man has a private locker and the sleeping berths are all "lowers." The food served is noted for its high quality. Thus the men are made comfortable, and the equipment can be moved from place to place quickly, which is another big operating advantage.

Some Views of the Up-to-date Bloedel-Donovan Loggi Ra

Below—Clallam Camp, where the workmen live in cars instead of bunkhouses. It's easy to move a camp like this

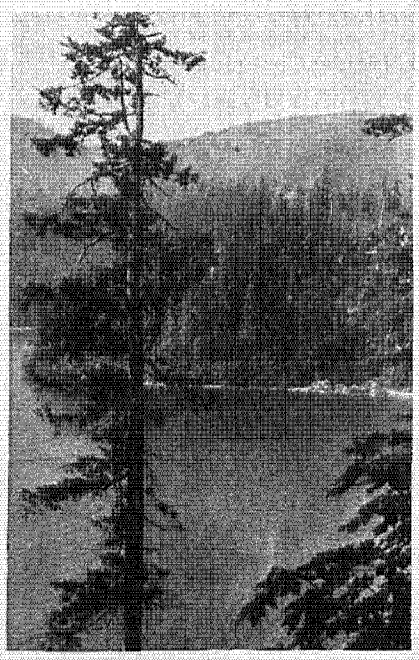


Above—Some hard digging



Right — Showing a picturesque view of Lake Sutherland from a vantage point on the heights above its timbered shore

Below—Beaver Camp, with its long row of bunkhouses, is typical of many logging camps to be found in the Northwest



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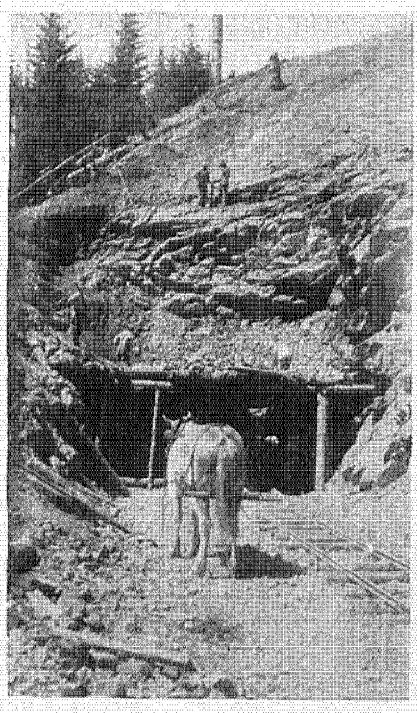
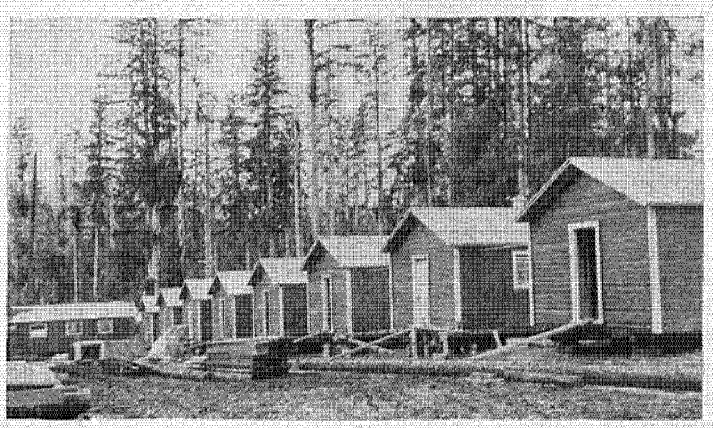
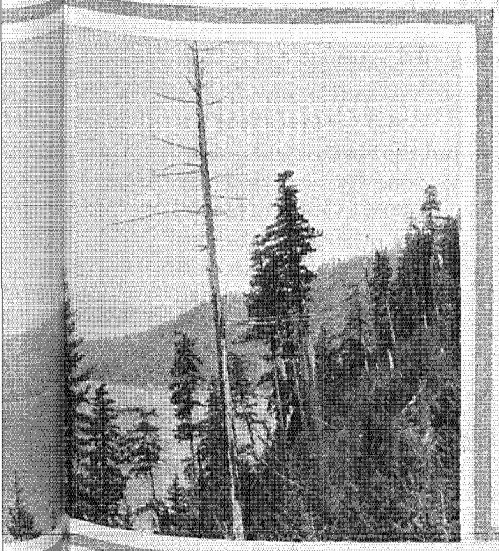


Above—Reminiscent of construction days when the blasting crews were kept busy with excavation problems

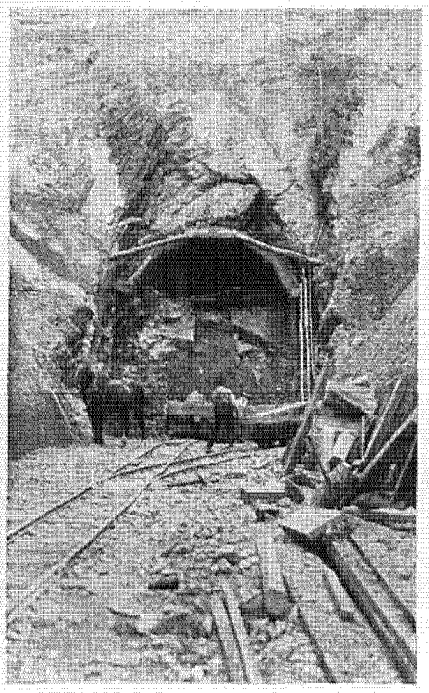


Above— Tpproach the pho made a advance allasted t al of the explosive tunnel c ntered i g the lin tunnel. reproduce work had The well-h the foregr sections. used in excavatio other

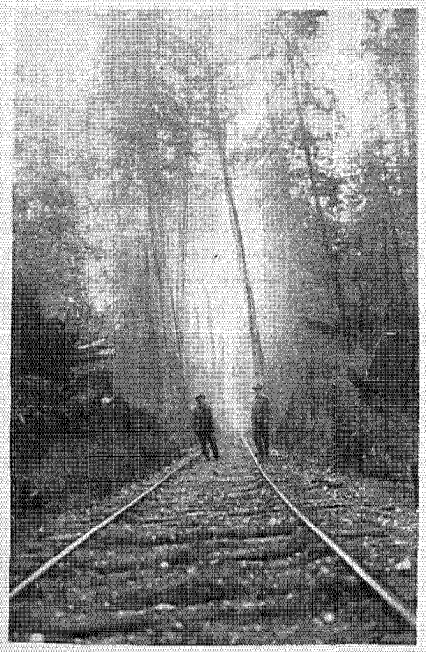
Railroad and Its Environs in Northwestern Washington



Below—Driving a tunnel was one phase of the construction work. This view illustrates the bench-heading method



...ake Crescent. ...rested shores



The Olympic Highway

Left—Looking ahead over a straight-away section of the Bloedel-Donovan lumber road in Washington

Below—The Summit Cut where much excavation work was done. Note the excellent construction of the track line

...pproach to the ... the photograph ... made after the ... advanced stage. ... ballasted track in ... of the finished ... explosives were ... tunnel and for ... entered in many ... ng the line

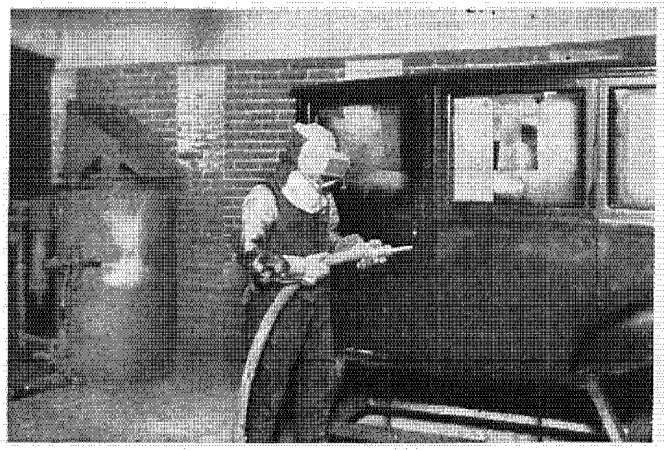
Above—There was no lack of variety in the work of the contractors. This view shows the trestle over Canyon Creek

Auto Refinishing With Duco

How the Wilmington Auto Company handles the work of making old cars look like new with du Pont products

By WALTER KIDD
President
Wilmington Auto Company

THOSE who are interested in automobile refinishing have doubtless read many articles and heard many controversies about the best method of applying Duco. I know of no one best method for all plants. After three years of experimenting we think we have found the best method for the Wilmington Auto Company. It meets the requirements of our business and gains these three objectives from an operating standpoint: (1) Progressive flow of work; (2) reduction of fire hazards, and (3) healthy working conditions.



The old finish is removed from the body by sand blasting, which is the surest and quickest way

The secret of successful Duco refinishing can be summarized in two words—cleanliness and surfaces. After many experiments we have found that the best and surest way to obtain an absolutely clean surface is to sandblast. I do not mean to say that one cannot get an absolutely clean surface by any other method, but sand blasting is undoubtedly the surest and quickest way.

Sand blasting is done in a closed room specially equipped for the purpose. After the old finish has been taken off the body is moved to the spray booths where all undercoats and Duco finishing coats are progressively applied. These spray booths, equipped with powerful exhaust fans, are the most approved type to insure healthy working conditions and to reduce fire hazards. After each undercoat is put on, the body is placed in a drying room with the heat maintained at about 125° Fahrenheit.

Following are the undercoats referred to in the order of their application:

A. One coat . . F-6199—Blue Diamond Dark Oxide Metal Body Primer
B. Two coats . F-6769— " " " " Sanding Surfacer
C. One applic. F-4562— " " " " Glazing Putty
D. One coat . . F-6769— " " " " Sanding Surfacer

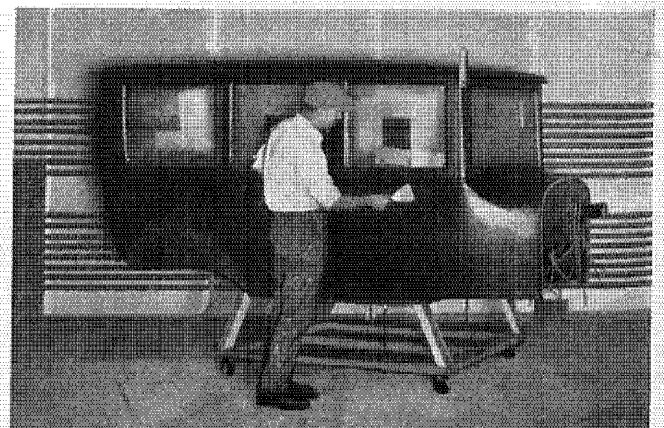
We have found that better and quicker work can be done by applying the glazing putty after two coats of sanding surfacer have been put on, than otherwise. Before the last coat is applied the body is rubbed with No. 220 sandpaper, and after the coat is applied the body is given a wet rub with No. 240 sandpaper, or with No. 320 if necessary. Of course, in some rare cases, where file marks or dents still show, a little more work is required, but on 90 per cent of the jobs the treatment outlined gives an exceptionally fine surface.

The body is now ready to apply the Duco color coats. Opinions vary both as to the equipment for doing this work and also as to the correct method of application. We use a gun delivering a fine spray about six inches wide. The material applied is a mixture consisting of 60 per cent Duco and 40 per cent thinner. It feeds into the gun by gravity, as shown in one of the accompanying etchings, and is discharged under a head of 80 pounds air pressure.

The material is sprayed on in "double coats"; that is, two coats are put on in one operation, and after a four-hour drying period, two more are applied. If the body is to be finished in a dark color, spraying on two double coats—the equivalent of four coats—is quite sufficient. The advantage gained by doing the work this way is that the finish obtained is uniformly smooth.

As for rubbing and polishing Duco, we have obtained best results by using for the former No. 320 wet sandpaper and for the latter Duco Rubbing Compound No. 2, and finally a polish to complete the job.

Now the chassis: This is cleaned with gasoline and air spray in a well-ventilated room free from open fires or lights. Smoking is prohibited. Next it is blocked



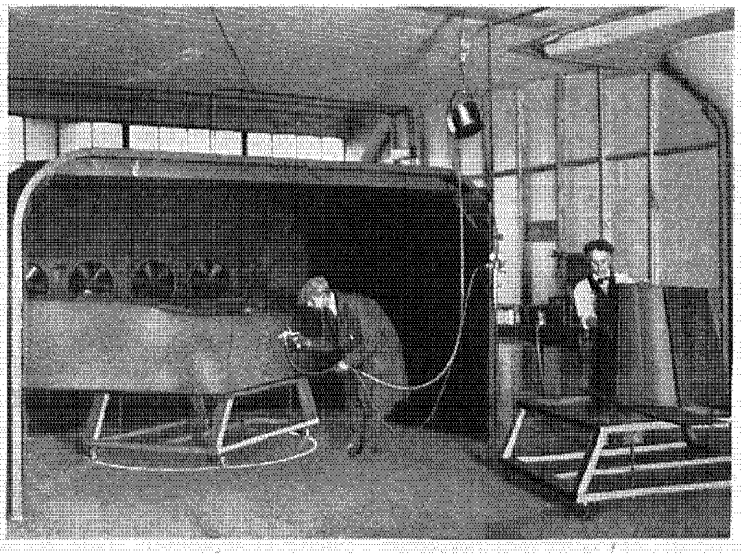
Applying the glazing putty to make the surface uniformly smooth

up. Then it is sprayed with F-6060—Air Drying Chassis Black, and the motor is painted with F-6525—Air Drying Gray Motor Enamel. The fenders and other regularly enameled parts are coated with Duco by methods which have been previously described.

If any nickeled parts need refinishing we have facilities for doing that work; thus our equipment is complete in all details.

After all refinishing work is done, the car is reassembled for delivery.

One may ask if all this equipment is necessary. Perhaps not, but if a Duco refinisher aims to do the best class of work in volume and at the least cost, he should be as well equipped as conditions will justify. There are, of course, many refinishing shops doing good work without an equipment so extensive as ours. The factory system requires too large a production to be practicable in all shops. On the other hand too little equipment is equally futile. Let no one imagine he can rent a shack somewhere, spend two or three hundred dollars for equipment and qualify as an expert Duco refinisher. The business at best is not a bonanza; it does require equipment, and it does require skill and experience.



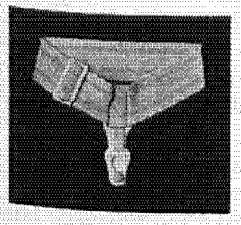
Spraying on a coat of Duco in one of the booths. This view gives you a good idea of the up-to-date equipment used

Because Duco dries quickly many people think the refinishing work can be done very quickly. They forget that the cleaning and undercoating work must be done first, and that takes time. Again let me say, the secret of successful refinishing with Duco is cleanliness and surfaces.

A car properly refinished with Duco cannot be distinguished from a new one except by the model. It costs a little more, but it pays, for Duco finish is wonderfully attractive and remains so a long, long time.

Garters That Never Rust

WHERE is the man who does not recall the day when he cast off the garb of youth and became a man—the day when outgrown short pants were replaced with long trousers, when long stockings yielded to short socks, when those old elastic bands that used to hurt so above the knee were discarded for regular man-sized garters?

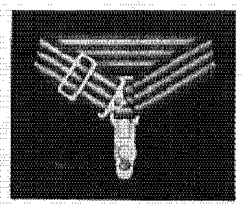


That was a day of thrills. You helped buy that outfit and you were proud of it and of what it signified. You were a man and henceforth could wear clothes like Dad's.

Nowadays you buy suits and socks and garters without a thrill. Calm judgment dictates your purchases. You are critical about materials, styles, details of workmanship. Even when you buy a pair of garters, you examine them carefully before making the purchase. For experience has taught you many things about them.

Every man knows that a poorly constructed garter can cause a lot of irritating troubles. If the webbing is unsuitable there's discomfort. If the metal fixture is bulky or improperly designed or made, it becomes unfastened frequently, causing annoyance and sometimes embarrassment. And if it touches and chafes the skin, there is the possibility of an infection. Especially in summer time a corroded metal fixture becomes a hazard in this way.

Realizing these disadvantages of the metal garter clasp, the Cordo-Hyde Company of Brockton, Massachusetts, has perfected and is now marketing an improved type of garter that meets all specifications for dependability, comfort and appearance. The garter clasp is not made of metal; it is Pyralin, a non-metallic, non-corrosive material. It is light weight, is positive and instant in its grip, can be quickly and safely adjusted and is dependable.



The webbing is of the right width and elasticity to insure comfort. As for appearance, the accompanying etchings, showing two styles, need no explanation.

These garters are made in a variety of styles, the pull-on or cast-off, single or double grip, of silk, fiber or mercerized cotton webbing in solid or variegated colors. They sell for fifty and seventy-five cents a pair. The O. A. Miller Treeing Machine Company of Brockton, Massachusetts, is the selling agent.

THE
DU PONT
MAGAZINE

Published and copyrighted by
E. I. DU PONT DE NEMOURS & COMPANY, Inc.

Subscription, 50 cents the year

E. R. MANCHESTER.....*Editor*

Vol. XIX MAY, 1925 No. 5

Another Pioneer Industry

NO other fluid, excepting only water, is so universally used in the chemical industry as sulphuric acid, the king of chemicals. It transcends all others in importance and is the vital fluid of all the nation's industries. For chemistry touches every industry in one way or another, and sulphuric acid is as indispensable to chemistry as iron is to metallurgy.

The production and use of sulphuric acid has possibly contributed quite as much to our national wealth as have iron and steel. Indeed, one authority states that "the civilization of a country may roughly be gauged by the amount of sulphuric acid made in it."

The cover illustrations of this magazine in recent months have portrayed incidents and scenes and events relating to the early history of the du Pont Company, beginning with 1802 when E. I. du Pont de Nemours established his first powder mill near Wilmington. The illustration this month is a departure and is intended to carry you back to some of the early history of another pioneer industry launched in Philadelphia by John Harrison in 1793.

John Harrison is referred to in the city directory of that time as a "druggist and aqua fortis manufacturer." He was the first manufacturer of sulphuric acid in America, also one of the first to produce white lead commercially. And the business he started was maintained and expanded by his sons and grandsons for nearly 125 years, or until 1917, when the du Pont Company purchased it as the starting point in establishing its own paint and varnish business.

E. I. du Pont was a pupil of Lavoisier; John Harrison, a pupil of Priestly. As manufacturers, du Pont and Harrison were contemporaries, each serving the nation in a different way.

Harrison's first "leaden chamber," to quote Scharf & Westcott's *History of Philadelphia*, "was of trifling capacity . . . . about one carboy of vitriol in a working day, or about 300 carboys a year, making altogether about 45,000 pounds."

In 1807 he built what was for that time a large lead chamber, 50 feet long, 18 feet wide and 18 feet high, with a capacity of over 350,000 pounds of sulphuric acid a year. At that time the acid was worth fifteen cents a pound. This plant was located on Green Street west of Third, but not for long, for on May 14, 1809, his laboratory was destroyed by fire, and he moved his plant to Kensington Avenue and 18th Street. There on a tract of about fourteen acres he built the lead chamber unit we show in our illustration. It was approximately 100 feet long, 36 feet high and 36 feet wide, with double the capacity of his earlier chamber. Approximately one ton of Sicilian sulphur was burned each day. This unit was centrally located within the plant area and was surrounded by many other stone and wooden structures where other chemicals were made, among them pyroligneous and acetic acids and their dependent products; white and brown sugar of lead; also oxides of lead, colors, alum, copperas, iron liquors and other compounds.

The concentration of sulphuric acid until Harrison's time was accomplished in glass vessels. It was an expensive process and one that resulted in the breaking of many receptacles, until Eric Bollman, a chemist, made a platinum still, weighing 700 ounces, with a capacity of 25 gallons. This was used for acid concentration by Mr. Harrison for fifteen years. Thus he was the first American to use platinum as a catalyst in the production of sulphuric acid by a method then known to only a few persons in Europe.

The facilities at Kensington ultimately proved insufficient and a new and larger plant was built at Gray's Ferry, where there was thought to be ample room for further expansion. With the beginning of the World War, however, still larger facilities were needed and an additional plant was built at Paulsboro, N. J.

Reverting to the founder of this business, John Harrison may be credited with doing more to influence the establishment and development of the chemical and paint industries than almost any other man of his time. In recognition of his work one of the chemical laboratories of the University of Pennsylvania bears his name.

The products of Harrison, like the products of du Pont, have always enjoyed the highest repute for quality. And this same high-quality standard is rigidly maintained for all the products which are now being made and sold under the du Pont label.

Fibersilk Now Called "Rayon"

The Du Pont Fibersilk Company, with headquarters and a plant at Buffalo, New York, and another plant at Old Hickory, Tennessee, has adopted the name "Rayon" for its product and has accordingly changed its corporate name to Du Pont Rayon Company.

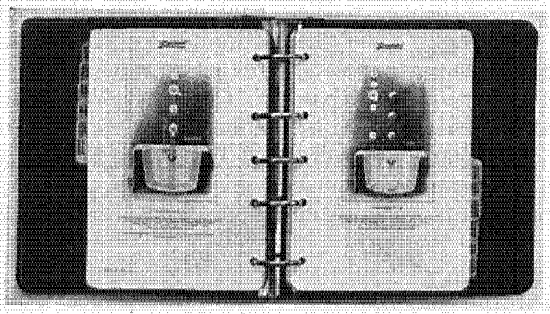
This change was made because it was felt that the term "artificial silk" was detrimental to all concerned. The product is not artificial, nor is it silk. Rather it is a separate and distinct fiber, and therefore just as much entitled to a name of its own as cotton or wool. So its name in future will be "Rayon."

"I Would Rather Fight with du Pont"

The Pittsburgh advertising executive who said that was not in a warlike mood; it was just his way of paying du Pont a compliment

By A. H. BERWALD

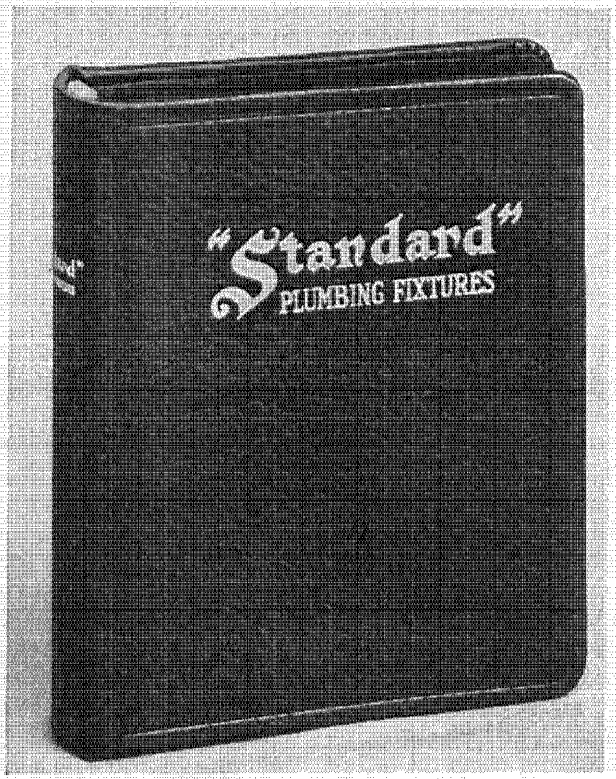
PRINTERS and binders usually expect a customer for whom they are producing a large catalogue in unusually large quantities to insist upon their cheapening the book in ways that will bring down the total cost. This rule was rudely upset last fall when the Standard Sanitary Manufacturing Company, of Pittsburgh, Pa., placed an order for printing and binding a large catalogue which was not only a record breaker in the number of copies required but also in the masterpiece quality which was insisted upon in every detail, so that its 50,000 customers—the plumbers, architects and building contractors of this continent — could find the catalogue itself as perfect as the products listed inside of it.



It is a loose-leaf catalogue of the sturdiest ring-binder type

Think of 50,000 catalogues in a single order, each book approximately 8 by 10 inches and weighing 4½ pounds. It took 97½ tons of paper alone for this job—paper made to the Standard people's own specifications so that it would have the super-strength and fine printing qualities desired.

From this paper a total of 20,000,000 pages were printed, 400 pages to the book. In each book there were 1141 illustrations, an average of three to a page. The index pages were made with transparent tabs, also indexed, so that every item catalogued in the book is findable on the instant.



This catalogue is covered with Du Pont Fabrikoid

As our illustrations show, this is a loose-leaf catalogue of the sturdiest ring-binder type. So that the binder might be in keeping with the general attractiveness of the book and give it the maximum protection in service, the Standard Sanitary Manufacturing Company specified Du Pont Fabrikoid for both the outside covering and the lining of these binders. For the outside covers was selected the heaviest and best quality of Fabrikoid specially adapted for the purpose. A total of 14,000 yards of Fabrikoid went into the covers. As our company was naturally very much pleased that Fabrikoid covers were specified for this great catalogue job, which for various reasons, and especially for the supreme quality achieved, was creating unusual interest in many directions, it seemed in order when recently I met the advertising manager of the Standard Sanitary Manufacturing Company to thank him for favoring our product and to ask upon what considerations he had decided to specify it.

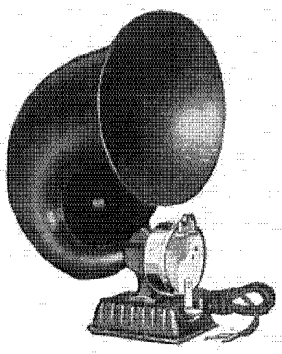
I was a bit staggered at first by his reply: "I chose Fabrikoid because I would rather fight with du Pont."

Just what did he mean? However, I soon came to and realized that this was only his terse way of paying our company one of the keenest compliments it had ever received. In our further conversation he made it clear that when he satisfied himself that a material of the Fabrikoid type would make the most durable and beauty-keeping cover for his new catalogue, he decided upon using Fabrikoid itself because of the additional safeguard which he knew existed in the ability and habit of our company to make good if our material should prove faulty in any way.

I also learned that he had used Fabrikoid on several previous occasions for the Standard Sanitary Manufacturing Company, and I concluded that he would rather fight with du Pont because his past experience has taught him that the chance for any such hostilities is exceedingly remote.

A Loud Speaker Proportioned to Its Job

The new G-G-H Portable Baby Grand model is made of Pyralin and is housed in a Fabrikoid carrying case



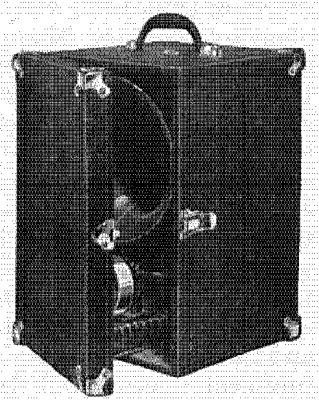
The horn is made of Pyralin

A MAN is, of course, much larger than his vocal organs, but the voice of a radio set — the loud speaker unit and horn —is often much larger than all the rest of the set. In the home this makes little difference, but in portable sets, where the available space in an automobile, canoe or other conveyance is very limited—where space must be saved—the more compact the reproducing horn, the more practical the outfit.

The Grigsby-Grunow-Hinds Company, of Chicago, Illinois, has done two things to help the radio fan who likes to "tune-in" while touring or camping. This company has produced a Baby Grand model of its loud speaker, so constructed that it takes up comparatively little room; and there has also been provided for this little reproducer a stout traveling case that gives it perfect protection on its journeys.

The horn itself is made of Pyralin, which eliminates all harshness or metallic sounds. That is because Pyralin is non-metallic and has no audible period of vibration—a property that we have referred to before in describing other loud speakers made by the Grigsby-Grunow-Hinds Company. The new model, illustrated here, has been completely redesigned with the result that tone qualities have been so much improved that it is said to be the best loud speaker on the market.

The manufacturer claims that the volume of tone from the Baby Grand model is greater than from most horns, excepting only those of the large concert type, and an adjustable volume control enables the user to obtain the maximum from his set at will.



And it fits neatly into this Fabrikoid carrying case

The traveling case is covered with a good grade of Du Pont Fabrikoid which insures that the reproducer will be protected from moisture under all conditions, and that the case itself, which is scuff-proof, non-absorbent and cleanable, will always retain its original attractiveness.

Anyone who needs a small, compact reproducer and who wants to protect it against damage and accident when traveling, will find the combination described here ideal. The reproducer complete with the Fabrikoid traveling case retails at $15.00. The price without the case is $7.50. Readers who desire to purchase this equipment are requested to write to the Grigsby-Grunow-Hinds Company at 4540 Armitage Avenue, Chicago, Illinois.

Another Du Pont Product—Everdur No. 50

This corrosion-resistant metal—an alloy of copper and silicon—will be manufactured and sold by the Du Pont Everdur Company

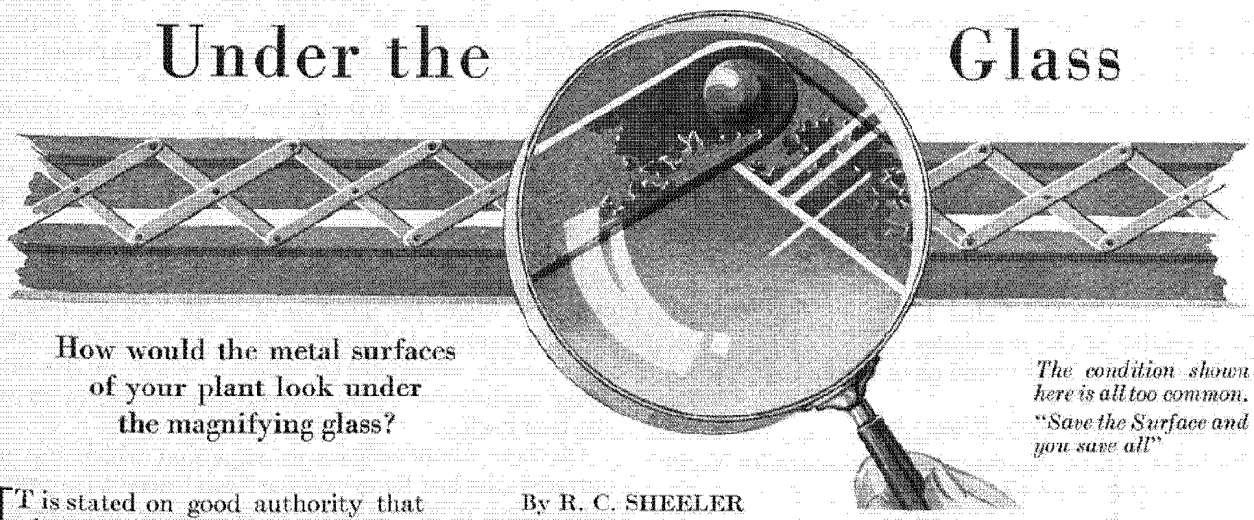
DU PONT EVERDUR COMPANY has been organized to take over the manufacture and sale of the metal alloy known as Everdur No. 50, heretofore handled by the Du Pont Engineering Company.

This corrosion-resistant metal is a discovery made by du Pont chemists in their search for an alloy to meet the requirements of the company's many chemical activities. The use of acids and chemicals, particularly hydrochloric acid, presented many problems which the metals heretofore available for the construction of plant equipment did not meet. As a result of a number of experiments a copper-silicon alloy was produced which was found to be highly resistant, not only to hydrochloric acid, but to a large number of other corroding liquids. It has a tensile strength above the acid-resistant bronzes, makes sound castings, is easily machined and has been found to be available for a great number of purposes. It can be fabricated into practically all forms obtainable from steel, including cold drawn seamless tubing.

It has been used extensively in a number of manufacturing operations, not only by the du Pont Company, but by many others which require corrosion-resistant machinery and equipment. Its use has extended into mining operations, where the metal has been found to be highly resistant to gases and aciduous waters of the mines. It has been made into wire screening and found resistant to the ravages of seashore atmosphere.

The new company, which will operate as a subsidiary of the du Pont Company, will manufacture the metal at Wilmington, Delaware.

Under the Glass



How would the metal surfaces of your plant look under the magnifying glass?

The condition shown here is all too common. "Save the Surface and you save all"

By R. C. SHEELER

IT is stated on good authority that the American public is taxed with the staggering loss of $600,000,000 yearly, due to the ravages of rust and corrosion of metal surfaces. How much of this is being contributed by *your* plant and equipment? How long has it been since you gave it a thorough inspection? What are you doing to prevent the increasing destruction of the countless metal surfaces subject to the action of the atmosphere, gases, fumes and manufacturing processes which slowly but surely sap their strength and life?

The only answer to the problem of rust prevention is paint and varnish. The use of these two products is the only salvation for thousands of industrial plants, for without them many factories would soon be a mass of junk. As it is, thousands of dollars will be spent this year for replacement of metal parts, due to carelessness in properly protecting them from destruction.

Right now, while you think about it, plan to inspect your plant and equipment thoroughly inside and outside. This is the only method that will insure timely attention being given them and permit steps to be taken to prevent further property destruction.

Should you desire a du Pont expert to confer with you regarding your protection problems, you need only address any of the offices of the Paint and Varnish Division shown on the third cover page of this number, and du Pont co-operation will be fully extended.

The Application of Explosives to Coal Mining in Great Britain

(*Continued from page 3*)

This same operation has been the cause of several disquieting gas explosions caused by the detonating of charges in opened fissures and roof breaks which are feeding firedamp. The breaks often extend beyond the 25-yard limit necessary for gas testing and may be unnoticed; the gas flame may thus be propagated along the break to an unsuspected accumulation of gas.

(C) *Driving Stone Drifts*

The methods employed in driving cross measure drifts through the strata between coal seams differ considerably. In the first place the strata vary enormously and small coal seams emitting firedamp may be met with. Usually in Great Britain the drifts are about 6 feet x 6 feet and are worked about 3 feet per bench

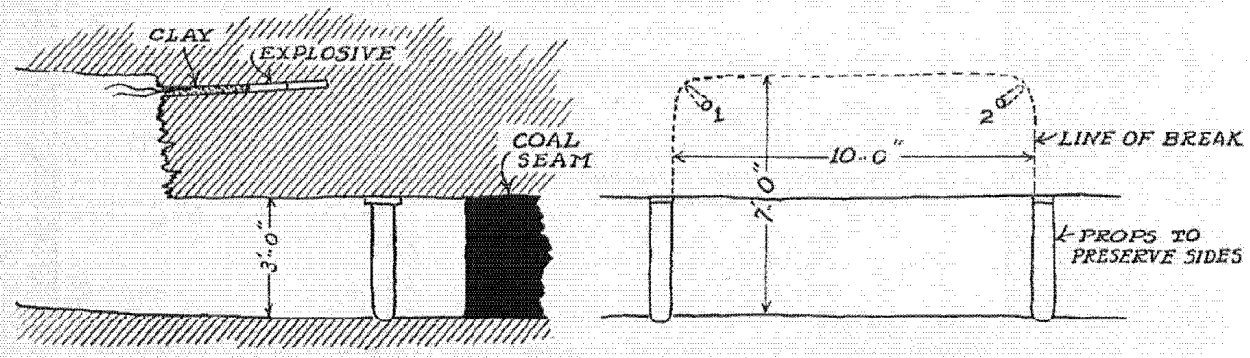


Fig. 5—Side and front elevation of a typical example of ripping a gateway in longwall working

of 6—10 shots. The shots are most often fired one at a time with the exception of the cut holes or "sumpers"; heavy blasting is avoided if possible. A typical example of a round in moderately hard strata is shown in Figure 6.

The position of the holes will depend on the situation of the bedding planes in the strata and the nature of the intervening layers. In Figure 6 the stratum is moderately hard and eight holes are necessary; the holes would be fired in rotation 1 to 7, the holes being drilled after each shot is fired and "mucked." It is often found that once the "breaking-in" shot has been carried out, a large quantity of the remainder can be released with a bar. The charges used would be of the order:

Fiery Mines Only

Shotholes 1 (fired together)	20 oz.	Samsonite No. 3	
" 2 & 3, and 4 & 6	16 oz.	"	"
" 5 & 7	12 oz.	"	"

The drift is periodically tested for gas, in the case of fiery mines, before each shot, and is ventilated by brattice screens or more often by pipes.

Considerations on the Safety of Explosives in Mines

The Mines Department of the British Government has laid down very stringent regulations with regard to the use of explosives in mines. These regulations are stringently enforced by the prosecution of offenders and there is no doubt that the enforcing of these regulations has had a considerable effect on the reduction of the number of accidents which occur annually. There are still, however, a number of accidents which may be traced either to the carelessness or to the ignorance of the operator. The British permitted explosives have been modified until they are as safe as any explosives used in the world and very probably they have now been made weaker than is necessary. The future of the application of permitted explosives lies more in the education and choice of shotfirer than in the modification of the explosive itself, as practically all accidents are due to the misuse of explosives or shotfiring appliances. While not advocating firing in the presence of gas, there should be no danger in firing a properly charged normal shot in a mine, even in the presence of a dangerous percentage of firedamp, as all the heat energy is expended in doing the work necessary to bring down the coal or rock. Even in the case of a slightly overcharged shot the chances of ignition are remote, as the interval of time during which the coal or rock is set in motion is sufficient to allow cooling of the hot gases before they meet the inflammable gas mixture. This is particularly true in the case of the modern permitted explosive where the duration of flame is of the order of 0.00025 second. It is therefore necessary to trace some abnormality either in the explosive itself, in the shotfiring appliances, in the shotfiring practice, or in the stratum itself.

Of these abnormalities no explosion which has occurred in the last five years has been traced to improper functioning of an explosive or detonator. Misuse and abnormality in the strata have been responsible for all the explosions. A shotfirer working in a hurry is more dangerous than any explosive when properly used in a fiery mine. It must be recognized that the smallest charge of an explosive can ignite an inflammable firedamp-air mixture in broken strata. With regard to the last point, the ignition of a firedamp-air mixture by the firing of an explosive is due to the combination of at least two factors—high temperature and high pressure. In the case of blown-out and overcharged shots ignition may not occur, as the explosive energy is dissipated rapidly in expanding into the open air. Thanks to the comparatively large lag in ignition of firedamp-air mixtures, the temperature attained through compression and conduction at the layer where the explosive gases and firedamp-air mixture meet may not be high enough for a sufficient interval of time to cause flame at that layer. In the case of a gas pocket, however, the firedamp-air mixture is imprisoned and therefore not free to move before the wave front. Ignition must therefore occur, and if a fiery mixture is present in the strata and mine heading, the ignition may spread. Here everything must be left to the intelligence and experience of the shotfirer.

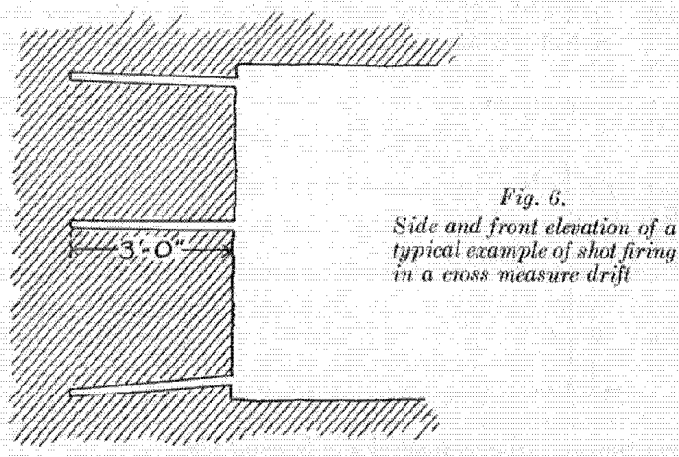


Fig. 6.
Side and front elevation of a typical example of shot firing in a cross measure drift

PLANT STANDARDIZATION SYSTEM

COLOR KEY	Interior Surfaces—Office	USE
1		Walls
2		Ceilings
3		Dado
4		Woodwork & Doors
5		Radiators
6		Floors
	Interior Surfaces—Factory	
A		Primer for new metal surfaces
B		Finish for metal surfaces
C		Machinery Guards
D		Machinery
E		Oil Tanks
F		Cold Water Pipes
G		Gas "
H		Air "
I		Oil "
J		Live Steam Pipes (Covered)
K		Exhaust Steam Pipes
L		Heating System

COLOR KEY		USE
M		Fire Equipment, Sprinkler System Fire Doors
N		Sand Pails
O		Hand Mark for Doors
P		Wall & Ceiling
R		Dado
S		Cement Floors
	All Exterior Surfaces	
10		Body for wood buildings
11		Trim " " "
12		Primer for new metal surfaces
13		Finish for all metal surfaces, including galv. iron roofs, siding, etc.
14		Finish for doors
15		Hand Mark for doors
16		Oil Tanks
17		Water Tanks
18		Fire Equipment
19		Chassis of Trucks
20		Body of Trucks

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