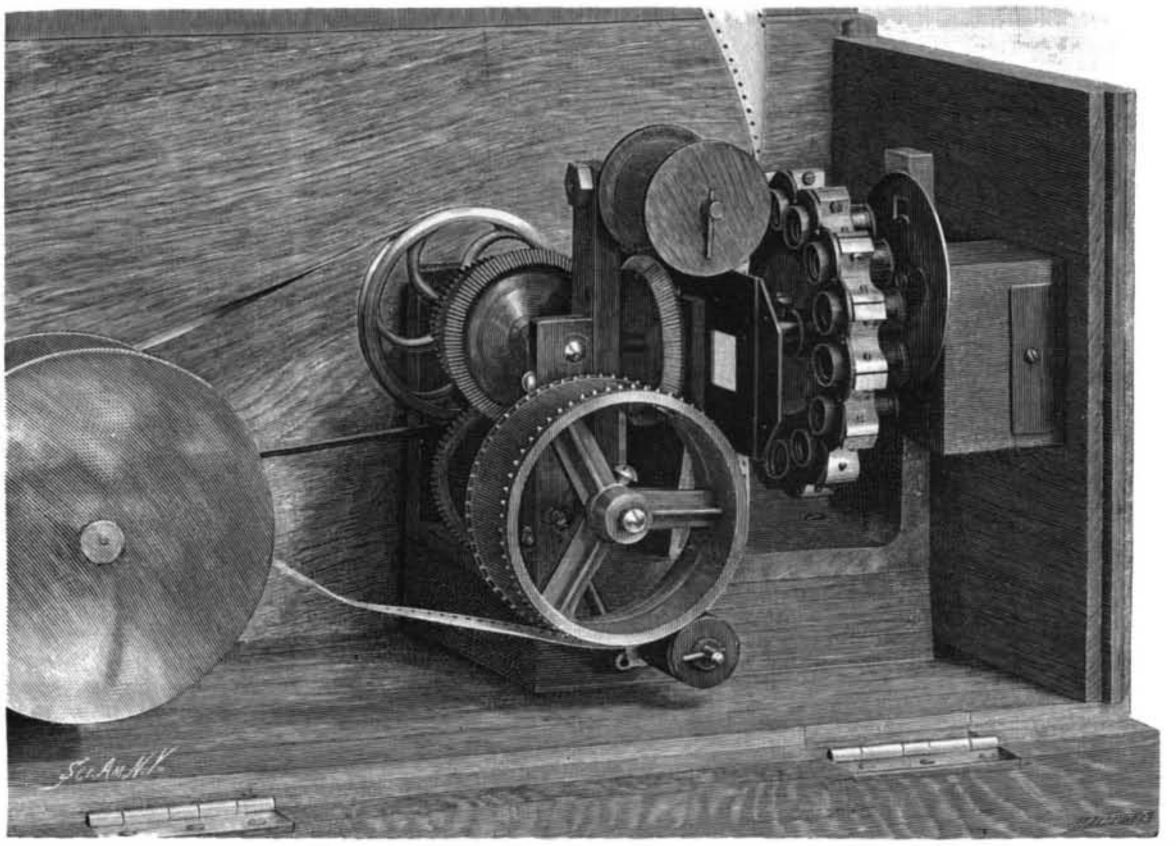


RIBBON PHOTOGRAPHY—A NEW CAMERA.

the loading of the guns was begun. The car was run into the center of the main gun shop, a building 160 feet wide and nearly 1,000 feet long. A gun was then picked up by one of the large traveling cranes, gently lowered into a cradle prepared for it, and the loaded car run rapidly down to the dock. Here the gun was seized by the monster derrick and swung over the deck of the barge, upon which it was lowered and securely blocked, while the car returned to the shop for another gun. As fast as one barge was loaded it was towed aside and another took its place. When all the barges had been thus loaded there were still left five 12 inch rifles, which were placed upon the deck of the derrick itself. The boom of this derrick is a steel built beam 90 feet long and weighs 70 tons, so that as it swung clear across the barge and over the dock, and lifted a gun weighing 116,000 pounds, the list of the float was considerable, but this occasioned no trouble or uneasiness to the experienced handlers.

This shipment comprised forty-six guns, as follows: Fifteen 8 inch rifles of 32,480 pounds each, nineteen 10 inch rifles of 67,200 pounds each, and twelve 12 inch rifles of 116,480 pounds each. The total weight of these guns is considerably over 3,000,000 pounds, and their total value or actual cost is about a million and a half dollars.

The guns are of steel throughout and of the best American make, which is carefully inspected and tested by the ordnance officers at various stages of manufacture. Each gun consists of a steel tube the full length of the gun (about 36 feet in the case of the 12 inch), over which is fitted a second tube called the jacket, which in turn is enveloped by shorter tubes called hoops. The jacket and each successive layer of hoops are carefully bored to a diameter less than that of the tube and preceding layer of hoops. They are then expanded by heat until they can readily be slipped into their correct position, so that in the process of cooling the various parts of the gun are bound together with enormous power. The exteriors of the guns are then smoothly turned in large lathes and the breech mechanisms, "finished like a watch," are accurately fitted.

The 8 inch rifle fires a steel projectile of 300 pounds with a charge of 125 pounds of powder, giving a penetration in steel armor of 14 inches at 1,000 yards; the 10 inch rifle discharges a steel projectile of 575 pounds with 250 pounds of powder, and gives a penetration in steel of 18 inches; and the 12 inch gun is served with a steel projectile 4 feet long, weighing 1,000 pounds, and with a charge of 500 pounds of powder gives a penetration of 25 inches in solid steel. The extreme range of these projectiles is from ten to twelve miles.

Powerful as are these weapons, they are to be followed shortly by immensely more powerful ones, and preparations are now in progress at the arsenal for the manufacture of a 16 inch breech-loading rifle of 125 tons, which will be served with a charge of 1,000 pounds of powder and a steel projectile of 2,300 pounds, giving a calculated penetration in solid steel of 32 inches at 1,000 yards. It is not believed that any vessel can be built which will successfully resist the terrible impact of such a projectile hurled against it with a velocity of nearly 2,000 feet per second.

Simple Lawn Ornamentation.

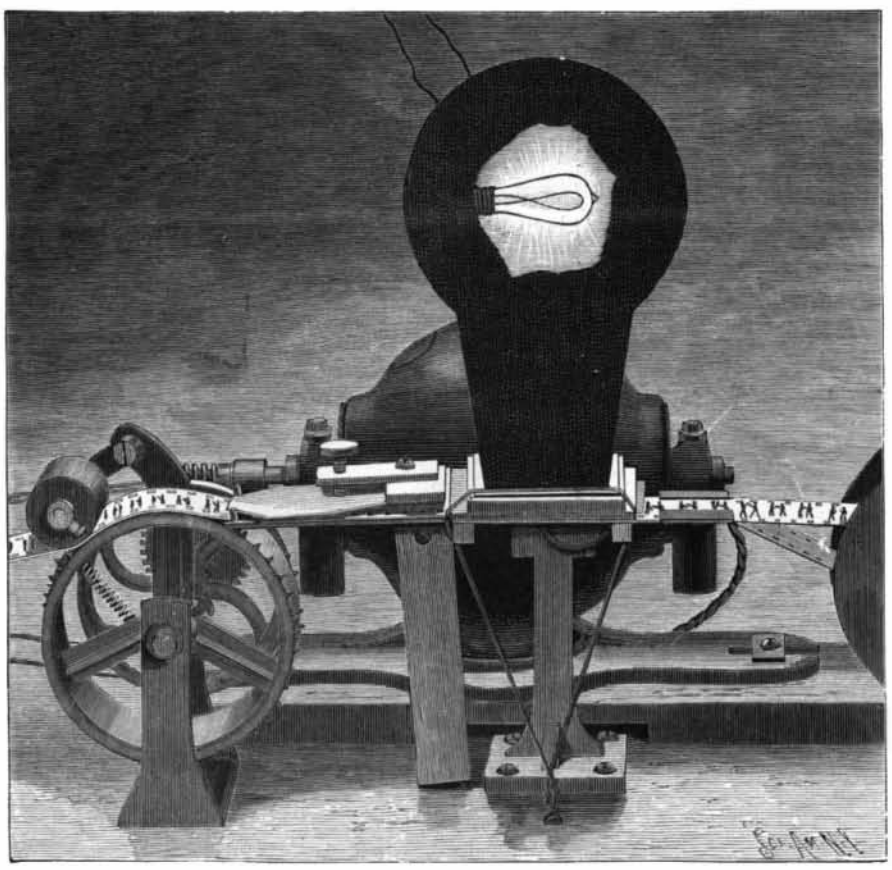
The early flowering crocus, with its brilliant blossoms, and the lovely daffodils, beautiful as they are everywhere, are never more attractive than when seen among the grass along a wood border, or judiciously scattered in irregular locations about a lawn. It is better that they should not be seen in every direction as one looks over a lawn, giving an idea of monotonous planting, but in groups or stretches with intervals or reaches of grass between. Thus scattered they furnish individual flowers for our gratification and make a charming picture in the distance. Some varieties of these flowers will grow persistently and increase from year to year, while almost any of them will bloom for a season or two. They like well-drained meadows which are covered with snow most of the winter. They ripen before the grass is fit for mowing, working trifling harm to the hay crop and yielding a harvest of beauty that is exquisitely satisfying.

A NOVEL CHRONOPHOTOGRAPHIC CAMERA.

Since the introduction of ribbon photography, by means of which successive pictures are rapidly made of moving objects upon a long ribbon or strip of sensitized film, various devices have been invented, some complicated and others very simple, for the production of the pictures and the manipulation of the picture ribbon.

In the large engraving is illustrated quite a novel camera, the invention of G. Francis Jenkins, for making accurately the continuous series of pictures. Instead of using a rotary disk shutter with radial apertures and a fixed lens, this camera has a single opening in the front, the size of the aperture being regulated at its rear end by a diaphragm disk having radial slots cut therein of varying widths. The operator is thereby enabled to govern the amount of light admitted to the lenses according to the subject to be photographed and the length of exposure desired. This disk is rotated by hand on its axis like an ordinary stop in a wide angle lens.

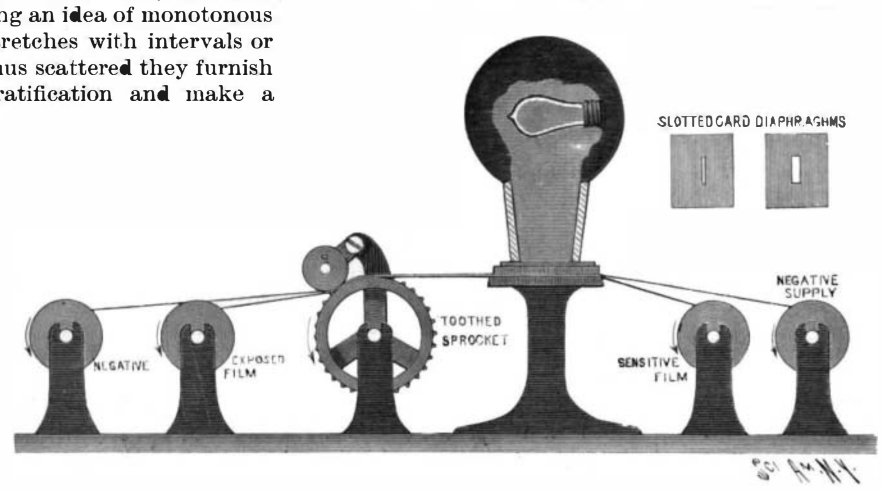
Back of the diaphragm disk is observed the battery of lenses, each of the same focus, arranged in a circle, adjoining each other upon a rotating disk, the axis of which extends rearward, terminating in a bevel gear wheel, which meshes into a side bevel gear wheel, fixed upon the upper shaft, suitably geared to the main driving shaft. The main shaft may be operated by a crank on the outside of the box, by hand or by any suitable motor like a spring. The sensitized celluloid perforated ribbon film will be noticed passing downward near the front end of the camera in front of the exposure tension plate, the square aperture in which is exactly in line with the front aperture in the box. From this point the film, after exposure, passes downward between the sprocket wheel and pressure roller to the winding reel in the rear end of the camera, which is rotated by belt connection to a pulley on the upper shaft, and takes up the film ribbon as rapidly as it is exposed. The feed roll for the supply of fresh film is not shown, but may be located in the rear of the camera over the winding reel.



RIBBON PHOTOGRAPHY—EXPOSING AND PRINTING APPARATUS.

The operation may now be readily understood; to obtain successive pictures of a particular object, the camera is placed on a stand or tripod, the crank on the outside is then rotated, which causes the film to travel downward continuously, with exactly the same speed that the lenses rotate, so that at every fraction of a second that it takes for each lens to pass behind the camera aperture, an impression of light is made on the downwardly moving film, and as they (the lenses and film) both move in unison, it follows that a sharp picture must be the result, while the brilliancy of the illumination is at its maximum. The camera can be carried about as readily as any other camera, and in practice it is found the motion of the hand-operated crank is sufficiently uniform to permit of the proper reproduction of motion by the positive pictures when projected on the screen.

The other illustrations show the method of printing the positive ribbon pictures from the negative by means of artificial light, also designed by Mr. Jenkins. It consists of reels supported on suitable upright standards holding respectively the sensitive ribbon film and the negative film. The film from the negative supply reel is carried along over the sensitive film reel and both pass in contact, in continuous motion, under an exposing chamber illuminated by white light, either incandescent electric light or a Welsbach gas light, thence over the toothed sprocket driving wheel to the winding reels, the exposed film being wound first. It will be noticed that the reels are interchangeable, hence to make duplicate



RIBBON PHOTOGRAPHY—DIAGRAM OF THE PRINTING DEVICE.

copies it is only necessary to remove the negative spool from the winding up end to the supply spool standard of the apparatus and begin over again. The perforations in the edges of the film are of specially square shape and give the square sprocket teeth of the propelling pulley a better pull on the film. The teeth pass through the perforations of both films, causing both to move exactly the same and at all times to keep in perfect register. The speed of the film passing under the exposing chamber must be uniform, and this is obtained by propelling the sprocket wheel by an electric motor or by a spring motor. The electric motor is seen behind the light chamber in the larger of the two engravings. The axle of the motor has worm gear operating a cog wheel on the main shaft. The V shaped elastic band holds the frame (in which is a ground glass) in contact with the films, producing a sort of tension on the film. To the left of the light chamber is a supplementary tension, adjusted by screw nuts, as shown.

Referring to the diagram illustration will be seen two slotted diaphragm cards. These are placed over the ground glass just mentioned, at the bottom of the light chamber, and are for the purpose of regulating the amount of light that acts on the negative. If the negative film, as a whole, should be thin, then the card with the narrow slot is used, which allows a shorter exposure to be made, as the negative and film are passed under it. If the negative is full of density, then the narrow card is removed and the wider slotted card substituted, which allows a larger volume of light to act upon the negative film. The exposed film is wound around large open reels from its spool, and developed by passing through troughs of developer solutions.

The necessity of providing apparatus to quickly reproduce positive impressions from the negative ribbon films is one of the reasons why this simple device was invented, and its novelty consists in the fact that the film moves continuously under a uniform source of light without any intermittent motion or the use of shutters. The operation of exposing the film is carried on in a room illuminated by the usual ruby red light.

National Academy of Sciences.

WASHINGTON MEETING.

BY WILLIAM H. HALE.

The meeting of the National Academy of Sciences, held at the Smithsonian Institution, April 20-22, was attended by over thirty members, or about one-third of the entire membership; the president, Prof. Wolcott Gibbs, in the chair.

The business transacted included the election of Asaph Hall as vice-president, in place of F. A. Walker, deceased; of Ira Remsen as home secretary, in place of Prof. Hall, promoted; and of Alexander Graham Bell as treasurer, in place of Dr. Billings, resigned. Additional members of the council elected were: H. P. Bowditch, G. J. Brush, J. S. Billings, O. C. Marsh, Simon Newcomb and Arnold Hague.

New members elected are: William H. Dall, of Washington; Frank A. Gooch, of New Haven; Charles S. Minot, of Boston; and EdwardW. Morley, of Cleveland.

Only fourteen papers were read, and five of that number were obituaries, viz., of G. Brown Goode, by S. P. Langley; of Thomas L. Casey, by H. P. Abbot; of Charles E. Brown-Sequard, by H. P. Bowditch (read by title); of Hubert A. Newton, by J. W. Gibbs, read in his absence by A. W. Wright; and of George H. Cook, by G. K. Gilbert.

The scientific papers were "The Influence of Environment upon the Biological Processes of the Various Members of the Colon Group of Bacilli," an experimental study by AdelaideWard Peckham, M.D. (presented by J. S. Billings);" On the Energy Involved in Recent Earthquakes," by T. C. Mendenhall; "On a Ring Pendulum for Absolute Determinations of Gravity," by T. C. Mendenhall and A. S. Kimball; "On the Variation of Latitude," by S. C. Chandler; "Variation of Latitude and Constant of Aberration from Observations at Columbia University," by J. K. Rees, H. Jacoby and H. S. Davis (presented by S. C. Chandler); "The Position of the Tarsiids and Relationship to the Phylogeny of Man," by Theodore Gill; "A New Harmonic Analyzer," by A. A. Michelson and S. W. Stratton; "On Recent Borings in Coral Reefs," by Alexander Agassiz; "Notes of Experiments upon the Roentgen Rays," by A. W. Wright.

In the last named paper, Prof. Wright gave results of his experiments which seem to confirm the theory that these rays are not refrangible. By using flat plates of glass instead of prisms, he obviated the effect of the thicker part of the prism on the rays, which, by absorbing them, gives the appearance of a negative index of refraction. Beside the plate of glass he placed a crystal of Iceland spar, without obtaining evidence either of refraction or of polarization. In another series of experiments he employed means to obtain a thin ray and to pass it between the poles of a powerful magnet, and afterward reversed the poles, but without inducing any perceptible change in the direction of the ray. The most interesting point in his experiments has been made within a few days and is not yet fully verified; but in using a screen of platinum wires he observed that the screen caused a faint dark line to appear, which may correspond to the interference lines in the spectrum. If so, this would indicate that these rays can be diffracted, even if they are not capable of refraction.

The next meeting of the Academy will be held at Boston, on November 16 next.

SLOW SPEED CABLE CAR GRIP FOR USE ON CURVES.

The cable car system of traction is at a great disadvantage wherever it is necessary to put in any sharp curves on the line of the road. The construction of the ordinary form of cable car grip is such that, if a stop is made in the middle of a curve, and the cable is released, it will leave the grip and spring toward the center of the curve. Hence, in order to traverse a curve, the gripman takes a firm hold on the cable and swings around on to the next tangent at full speed. That there is danger in such a practice goes without saying, and on such a line as the Broadway cable road, New York, the risk becomes unbearable. The most troublesome curve on this road is one which leads at Fourteenth Street from Broadway into Union Square. Fourteenth Street is one of the busiest thoroughfares in the city, and its proximity to the shopping district causes a large part of the pedestrian traffic to consist of women and children, who are continuously passing across the double tracks of the Broadway cable line at a point near the center of the curve. When it is borne in mind that the cars run under ten seconds' headway in the busiest hours of the day, the danger to pedestrians at this point can be realized.

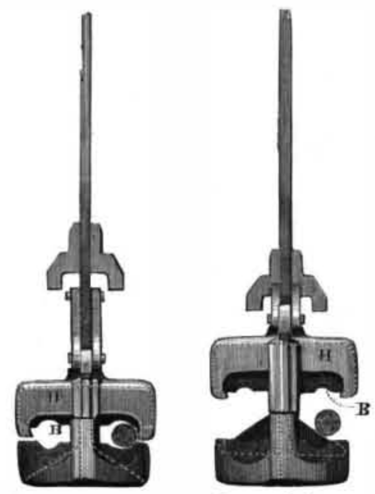


FIG. 1.--Cable released but held in place by hooks. FIG. 2.—"Tripping" the cable.

Various plans have been proposed by which to meet the difficulty, all of which were more or less objectionable, for the reason that they involved either the appropriation or disfigurement of a part of Union Square grounds. It was proposed to carry the tracks directly across the square at street level or beneath it by means of a tunnel. Another suggestion involved cutting off the corner of the block at Fourteenth Street and Broadway, or carrying the tracks through the block by means of an arcade cut bodily out of the buildings. It will be seen that all of these plans aimed at one thing—the elimination of the sharp curve at Fourteenth Street—and that they all took it for granted that the mechanical difficulties connected with the grip and cable were unsurmountable.

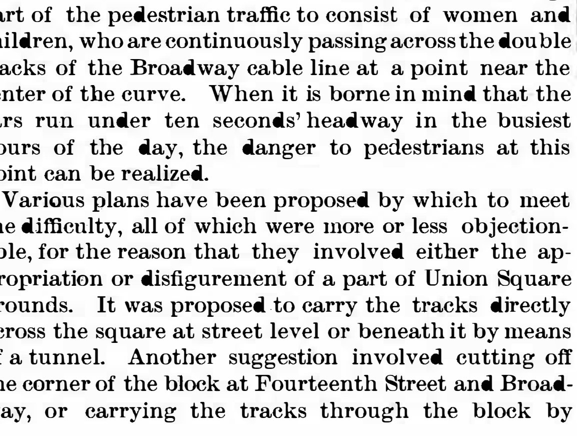


Fig. 3.—PERSPECTIVE VIEW OF GRIP WITH RETAINING HOOKS ATTACHED.

The solution of the difficulty, however, has come in the shape of a very simple mechanical contrivance, which is so easily applied and operated as to cause surprise that it was never thought of when the cable grip was first designed. By reference to the engravings it will be seen to consist of nothing more than a couple of loose hooks, H H, which keep the cable in the grip when the upper jaw, B, is raised to release the cable.

The grip consists of a lower fixed jaw, C, and an upper movable jaw, B. The lower jaw is rigidly attached to a crosshead on the track frame by means of two vertical shanks of plate steel, M M, and is always carried at a fixed level. The upper jaw, B, is carried by a shank, L, which is raised or depressed by the action of levers attached to the crosshead and operated by the gripman. The jaws are each provided with two longitudinal grooves, so that the cable may be taken up on either side of the grip. When the car is stationary the cable runs in the groove in the lower jaw, and the car is started by depressing the upper jaw and gripping the cable, the speed of the car being regulated by the pressure of the grip. At full speed the cable is held perfectly stationary in the grip, and at slower speeds it is allowed to slip somewhat, the car being carried along by the friction between the jaws and the cable.

The cable is thrown out of the grip altogether, or "tripped," by raising a couple of wedges (shown in Fig. 2), which are carried by links, R, bracket, P, and the two plates, E E, and are operated by a separate lever on the car. The plates, E E, are provided with stops which, as the plates are lifted, engage the shank, L, and raise the top jaw, B, to the position shown in Fig. 2.

The trouble with the old form of grip was that when B was raised on a curve the cable would spring out to the inside of the curve and be "lost." To remedy this the hooks, H H, whose cross section conforms to that of the jaw, B, are hung by links, G, to the jaw near its ends, and have a slightly larger vertical movement than the jaw. When the latter is raised sufficiently to release the cable, the hooks, H, remain down in place and keep the cable from springing sideways out of the grooves. This position is shown in Fig. 1. If B be raised still further, as in "tripping" the cable, a swelling upon the jaw just below the link, G, serves to raise the link and carry the hook clear of the cable.

It will thus be seen that this very simple device enables the speed and stopping and starting of the car to be controlled with as much certainty on a sharp curve as on a tangent, and we are informed by Chief Engineer Pearson that the thirty cars which have already been equipped with it are giving the greatest satisfaction.

Artificial Fuel.

Eggette or ovoid fuel, in distinction from briquettes, says the English journal Machinery, may be considered somewhat of a luxury for domestic use, similar to that which anthracite coal bears to bituminous. In Europe, the convenience of the fuel for the furnace was not so much considered as the ability to produce a fuel which was cheapest and best suited for handling, storage, and transportation. Much greater stress than in America was laid on the thorough preparation of the coal, on the quality of the pitch or binding material used, and on the size of the blocks giving the greatest economy in manufacture and handling.

The systems of preparing the coal for coking and briquetting, by washing and jigging, originated in Europe and have there been long practiced to such an extent that almost throughout the whole of the Continent coke can be guaranteed to contain only a certain per cent of ash. This difference in the art of washing fine coals may to some extent account for the slow progress made in the manufacture of briquettes in America.

Statistics show that the production of briquettes in 1893 was as follows:

France	1,750.000	tons.
Belgium	1,200,000	"
England	850,000	"
Austria	250,000	"
Germany	1,230,000	"
Italy	560,000	"
Spain	100,000	"
Russia and Sweden	100,000	"
United States	100,000	"
China, India, and Canada	150,000	"

The proper mechanical preparation of the coal goes far toward making the briquetting of an otherwise waste of coal successful and profitable. That the thorough washing or freeing from all slate and other impurities is one of the chief factors in determining the value of the product is obvious, since the value of the fuel depends mainly on its freedom from ash, or the amount of available combustible matter it contains. This is especially important where the fuel is to be transported and an extra cost is added for handling and transportation.

The Pneumatic Mortar Carriage.

Recent tests of the pneumatic mortar carriage, of which we gave an illustrated description in our issue of January 2, have demonstrated its ability to be fired through an abnormally large arc of elevation. Owing to the fact that the recoil cylinders are at all times in line with the bore of the gun, it can be fired from 2° depression to 75° elevation—a distinct advantage over the common form of hydraulic carriage, which is provided with a fixed recoil cylinder placed at a certain angle, and has a limited range between 48° and 65° of elevation. The construction of the pneumatic carriage allows the gun to be mounted nearer to the surface of the ground than is usual, and its manipulation is rendered proportionately easy.