EFFECTIVE DITCH-DIGGING MACHINE.

Judged by the test that "handsome is that handsome does," the ditch-digging machine which, by the courtesy of John A. McGarry & Company of Chicago, we are herewith enabled to illustrate, is one of the most successful substitutions of hand for machine labor in excavation that have recently appeared. The company mentioned has recently been carrying out improvements on the Evanston Park addition to North Evanston, Ill., which involved the construction of several miles of sewer and water ditches; and in looking around for some more expeditious and less expensive method than that of hand labor in digging these trenches, they authorized Mr. Richard Dalton, of Willmette, to construct a ditch-digging machine for the purpose. Mr. Dalton had been experimenting for a considerable time with a mechanical ditch-digger, and the rough trial machine which was built for the contractors proved so satisfactory that it entirely superseded hand labor in such classes of materials as were suited to its operation. We are informed that, although it was somewhat clumsily built, as is evident from the illustration, the machine proved something of a revelation to the engineers of the city of Evanston, showing unexpected efficiency. The loosening up of the material is performed by a set of plows which are attached to pivoted arms on a heavy wooden wheel, 12 feet in diameter. The wheel is driven by a sprocket chain which is carried around a smaller sprocket wheel, keyed on the shaft of a portable engine which forms part of the machine. The plows referred to extend a little beyond the mouths of a set of buckets, four of which are carried on each side of the wheel. As the wheel rotates the plows loosen up the earth, which falls from the plows into the buckets as they rise from the bottom of the trench.

The buckets are carried at the outer end of the pivoted arms, the inner ends of which are attached near the axle of the wheel. During the part of the travel of the wheel in which the buckets are filling with the loosened material, the arms are locked, but when they reach a point a little above the level of the top of the ditch, the catch releases and they swing out on each side of the machine, and a little later in the revolution of the wheel empty their loads on either side of the trench. Further on in the revolution they are thrown back by their own gravity toward the wheel, and are automatically locked in position, ready to take up another load as they swing through the ditch. The machine is mounted upon low wheels, and it is moved forward as the digging proceeds by means of 300 feet of chain, one end of which is made fast to a post which is driven into the ground for the purpose, the other end being drawn in by means of an arrangement of ratchet wheels and chain pulleys, operated by the engine that drives the excavating wheel.

Provision is made for varying the width of the excavation anywhere between 30 and 72 inches, and this is done by placing liners between the tire of the wheel and the radial arms. By means of a rocker-arm mechanism which is pivoted on the road wheels of the ditcher the trench can be dug to any depth up to 8½ feet with a machine of the size shown in our illustration. Some idea of the remarkable capacity of the excavator may be gathered from the fact that when working in what is designated as a very tough kind of stony hard-pan, it has dug a trench 3 feet wide, 6 feet deep and 460 feet long, in a day of nine hours, only four or five men being required to operate the digger. This, it will be seen, approximates a rate of 1 foot per minute; and that this should be done under the supervision of such a small working force, shows that the machine is a great saver of hand labor. From the end view, showing the excavated trench, it will be seen that the ditch is cut with exact alignment and a fairly regular cross-section.

MACHINE FOR TRENCH AND DITCH EXCAVATION.

THE western oil district at Los Angeles shows a steady output, and we have been favored by a correspondent with an account of the remarkable increase in the wells, following the earthquakes in the vicinity of San Jacinto. The earthquakes occurred at Christmas, and resulted in the disturbance of a considerable area.

Aeronautical Progress in France.

The question of military ballooning has been made the subject of considerable study in the French army, and at the present time a very effective organization of this service has been established, this having been carried out on the lines of previous experience with the balloon in military work. This dates as far back as 1794, when, shortly following the celebrated experiments of Montgolfier, an aerostatic station was established at Mendon, near Paris. This was afterward renewed in 1878, and has now become the central aerostatic station of Calais. Besides this central establishment, a number of sub-stations and magazines have been established throughout the country.

END VIEW SHOWING TRENCH AND SPOIL BANKS.

The captive balloon of the regulation model is of spherical form and is divided into three categories: First, the normal balloon having a volume of 540 cubic meters, capable of carrying two aeronauts, besides ballast and accessories; second, an auxiliary balloon containing about 260 cubic meters, for one aeronaut; lastly, balloon-gasometer, used to carry a reserve of 60 cubic meters of gas. Besides these forms, some of the stations on the frontier are provided with material for making free ascensions, consisting of a balloon of 900 cubic meters, which is inflated with illuminating gas or hydrogen. For the envelope of the captive balloon, the best material has been found to be Chinese pongee silk, which is a tissue both light and flexible; it is made impermeable by a special varnish, this being very adherent and not attacked by the air; it besides does not injure the fabric to any extent.

The sphere of the balloon is made up in the usual way by segments, and at the bottom is a kind of sleeve used in filling it. At the top is placed a valve of special construction, designed by Col. Renard, which permits the areonaut to let the gas escape progressively and in the desired quantity, in the case of a slow descent, or, on the contrary, to rapidly empty the balloon in case a grave accident makes it necessary to descend quickly. The network of cord of the usual form, supports the basket, which is made of osier, well consolidated and made indeformable by a frame work of iron and hardwood. It is arranged for two men, besides the ballast and the different instruments and appliances, among which may be mentioned a combined ladder and anchor. This consists of a metallic folding ladder carrying at intervals a kind of grapnel designed to catch upon the ground. When unfolded, the ladder has a length of 5 meters; it is used especially for landings which are attended with some risk. This event must be provided as the balloon may break its attaching cable and make a free ascension. The cable used is of steel, especially constructed for lightness; it weighs only 115 grammes per meter, and on account of its small weight a height of 1,000 meters may be given the balloon. The cable is rolled upon a revolving drum, operated by a horizontal steam engine which controls the maneuvers of mounting or descent. The drum and engine are installed upon a vehicle adapted for the purpose, and the balloon may be thus towed behind a column of the army on march.

For the inflation hydrogen is usually employed. At the Calais station a process has been designed for its rapid production by passing a current of acidulated water over zinc turnings. Nevertheless, although the process is simple and cheap, it has the great inconvenience, for military use, of requiring an installation which, although portable, must be followed by the necessary supplies of acid, water, metal, etc., and besides, it takes a certain time to produce the gas in this way. This difficulty is avoided by conducting, behind the balloon, the hydrogen compressed in steel tubes provided with a stop-cock, at a pressure of 200 atmospheres. The tubes are carried on a wagon assigned for the purpose, which takes eight tubes as a load. It requires sixteen tubes for the normal charge of a balloon, and to give an idea of the rapidity of this method, the results obtained at the time of the annual maneuvers may be cited. The aerostatic section arrives at the point decided upon for the ascension, the balloon is equipped, inflated, provided with its basket and connected to the windlass upon the vehicle, ready to ascend, all these operations being carried out in half an hour.

The aerostatic equipage designed for use in time of war is placed in the different engineering establishments of the army and at the central post of Calais. It is distributed in a certain number of aerostatic parks, specially equipped for the purpose. A park of this kind includes two balloons of normal type, one auxiliary balloon, a windlass vehicle, a tender for the engine, a wagon for the accessories, and six tube wagons. The personnel consists of a certain number of sections of field aeronauts, each section having three officers and 78 men. The first four regiments of military engineers have each a company of aeronauts, and these are designed to furnish the field sections, as well as those required at the magazine stations, etc. The central establishment of Calais has the general supervision of this department of the army, and is charged with the construction and keeping in order of the balloons, as well as the study and experiment relating to aerial navigation in general. A series of experiments is now being carried on under the supervision of a corps of officers who have made a special study of the question and to whom are due a number of inventions and ingenious dispositions which have contributed to the successful operation of the system.

IN breaking calcium carbide small pieces are apt to fly into the eye. As calcium carbide is decomposed by water it becomes very hot in doing so and yields slaked lime as a product. Should an accident of this kind happen it has been suggested that the eye should be wiped out with oil, or with a solution of sugar. This advice is not particularly good, however, and probably the most efficient means of cleaning the eye is to use large quantities of tepid water. The sufferer should plunge his head into a pail of water and open his eye if necessary, and if the pain is so great that he cannot open it very well, it may be stretched open with the fingers. Absolute cleanliness is very important.

Deep Bore Holes and Shafts.

The deepest oil well which has yet been sunk in this country is about twenty-five miles from Pittsburg in the valley of the Monongahela River. A few months ago the hole had been drilled to a depth of 5,532 feet, and then work was suspended on account of an accident, owing to a break in the rope, a thousand feet of it, with the tools, dropped to the bottom and at last accounts men were at work fishing for the lost supplies, says The New York Sun. It is intended to sink the well to a depth of 6,000 feet. This breakage is the chief difficulty in the way of making deep borings. When the artesian well was dug at Grenelle, Paris, a length of 270 feet of boring rod broke off, and fell to the bottom of the hole after a depth of 1,254 feet had been reached. It required nearly fifteen months of constant labor to pick out the broken parts, and the drilling could not, of course, be resumed until they had been removed. At present there are only two borings in the world, which are any deeper than the Monongahela one and they were both sunk in Germany at the expense of the government to ascertain the thickness of the coal measures, and the greatest depth was obtained at Paruschowitz, in Upper Silesia, where the diamond drill has penetrated to the enormous depth of 6,570 feet, and the second is near Schladebach near Leipsig. The following is a list of the deepest bore holes.

	Feet.
Paruschowitz, Upper Silesia	6,570
Schladebach, near Leipsig	6,265
Monongahela (thus far sunk)	5,532
Wheeling, W. Va.	4,920
Sperenberg (gypsum beds near Berlin)	4,559
Lieth, near Altona	4,388
Eu, near Stassfurt	4,241
Lubthen, in Mecklenburg	3,949
St. Louis, Mo.	3,843
Sennewitz, near Halle	3,644
Inowrazlaw, Posen	3,424
Friedrichsaue, near Aschersleben	3,512

Most of the artesian wells in this country vary from 200 to 1,000 feet in depth, and the average depth of those sunk for irrigation in the western part of the country is 210 feet. When shafts are considered this country has the deepest. One on the Houghton Peninsula was begun in 1895, and will not be completed until 1901. This will be the deepest shaft in the world, and will take that distinction away from the Red Jacket vertical shaft of the Calumet and Hecla mines, which is less than a mile away. This shaft is 4,900 feet deep.

The Solubility of Argon and Helium in Water.

Mr. Estreicher has recently published an account of a series of researches which he has made in order to determine the solubility of argon and helium in water. The value given by Mr. Ramsay, in his preliminary note published in 1895, for the coefficient of solubility of helium, makes this to be 0·0073 at 18°C, showing it to be one of the least soluble of the gases, but as a result of further experiments, Mr. Estreicher considers that this coefficient should be doubled or nearly so. The apparatus he uses is the same in principle to that devised by Ostwald, but has two considerable improvements, one of these consisting in the employment of a glass spiral to unite the recipients of measure and absorbtion, which permits him to make the apparatus entirely of glass, and the whole instrument can be immersed in the water. This envelope of water permits the determination of the exact coefficient of solubility at temperatures varying from 0° to 50° C. He has plotted his results in the form of a series of curves side by side with the curve of nitrogen for comparison. The curve of the solubility of argon is of the usual type, with a decrease as the temperature raises, the value ranging from 0·0578 for 0° C. to 0·02567 for 50° C.

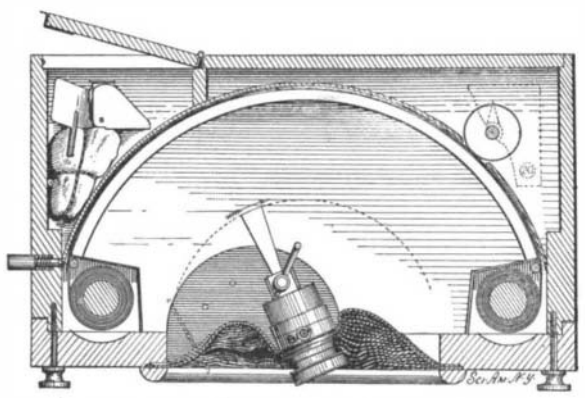
The solubility of helium varies but slightly with the temperature, and the curve shows a minimum near 25° C, the values being 0·015 for 0° C.; 0·01371 for 25°; and 0 01404 for 50° C. The curves of nitrogen and of helium cross at about 30° C, this being the temperature at which they have the same solubility. Above this temperature, nitrogen becomes more soluble than helium.

THE German Archæological Institute at Athens has just celebrated the twenty-fifth anniversary of its foundation, and the celebration was held in the presence of a number of members of the royal family of Greece. Addresses were made by Prof. Dörpfeld, M. Homolle and other archæologists. During the last quarter of a century the German Institute in Athens has rendered immense service to the cause of archæological science conducting researches at Menidi, Tegea, Corinth, Sunium, Thebes, Mitylene, Paros. Athens and Megara, besides participating in important excavations at Olympia, Troy, Tiryns, Orchomenus and elsewhere.

A CONVENIENT PANORAMIC CAMERA.

The amateur photographer, equipped with the ordinary 4 by 5 camera, many times sees, in the course of his excursions, opportunities for securing pictures embracing a wider range of view than his camera permits, and generally arranges the instrument to rotate in such a way as to take a succession of separate views, covering an area of 180 degrees; then, by joining the finished pictures in line together, a panoramic view is obtained. A picture of this kind requires a nicety of manipulation in matching to obtain satisfactory results, otherwise the joints will appear too prominent and render the scene imperfectly.

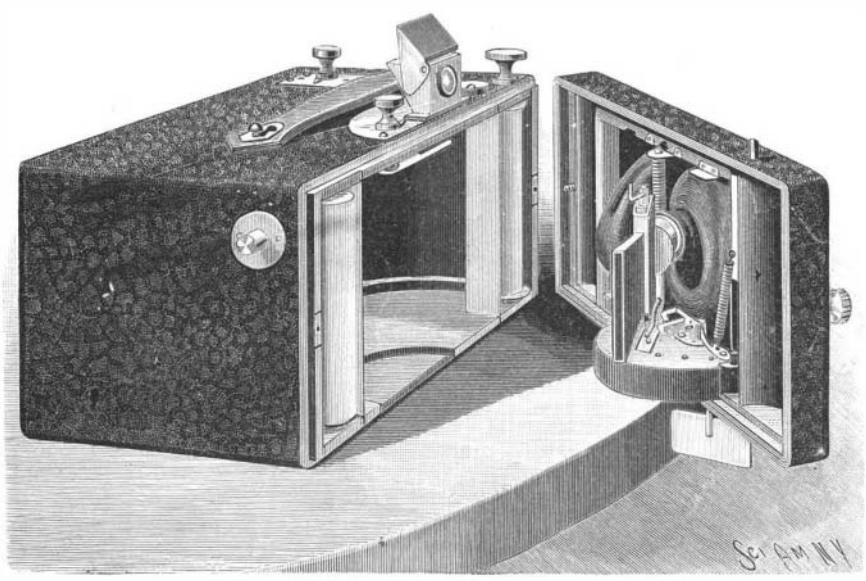
Since the advent of the rollable film and the subsequent improvement known as a daylight cartridge film, different forms of cameras have been devised for making panoramic pictures. Our illustration is a type



SECTIONAL PLAN OF PANORAMIC CAMERA.

of one of the latest styles of a panoramic camera called the "Al-vista," just introduced by the Multiscope and Film Company of Burlington, Wis., embracing several improvements which make it very convenient and adaptable for several purposes; at the same time it can be easily and rapidly operated, loaded and unloaded.

The camera is made in two principal parts: first, the lens board, or front, and lens-moving mechanism; and second, the back or box for holding the film, film spools, film punching and registering device, lens index, stop arm, finder, and level. This construction enables the operator at will to take a picture of a uniform width of 4 inches to 4, 6, 8, 10, or 12 inches long. The lens supplants the ordinary focal plane shutter by itself rotating over a half circle and throwing the image 4 inches wide by 12 inches long upon the semi-circular film in the rear. It is pivoted rigidly midway between the front and rear lenses to a vertical shaft operated by clockwork mechanism observed in a casing below the lens, and is protected by a flexible leather front. A flaring radial rectangular tube about 2 inches long projects rearward from the lens tube and carries the picture rays from the lens in the form of a narrow strip of light, something like the flash of a lighthouse lamp, continuously along the rear circular



A ROLL HOLDER FILM PANORAMIC CAMERA.

sensitized film. So it is only necessary to control the extent of the revolution of the lens to determine the length of the picture desired. To set the lens, the key seen underneath is rotated, which in turn winds up the clock spring and turns the lens in the opposite direction until it is held by the release lever. At the rear of the lens tube is a small shutter whose projecting arm at the top is arranged to impinge against the stop plate arm to be seen just under the center of the top of the film box. This has an index pointer on the outside and can be quickly adjusted by rotating the knob with fingers. If an exposure 6 inches long is desired, the pointer is set at figure 6; when the lens is released, it rotates until the arm of the shutter strikes the stop arm and thus only exposes a 6-inch section of the whole film. The finder is supported upon a revolvable plate, also having an index pointer, and this is set at the figure 6 so that the image viewed in it will be parallel to that covered by the lens. Adjacent to the finder is a circular level. A shaft from the clockwork mechanism projects slightly through the bottom of the lens board, or front, and to this may be attached different sized flat pieces of metals which act as fans and regulate the different speeds at which the lens can be made to rotate. There is also provision made for inserting different sized stops in the lens.

The sensitized film spool is put in the extensible spool holder on the left hand and carried over a guide roller and on through the semi-circular channel to the other end, where it is wound up upon the winding spool, against a suitable tension plate. The thumb screw-head for operating this spool is seen on the right hand end. In its movement the film also operates an index cylinder, which tells at the top the number of inches of film reeled off, then on the left is a punch button for punching a hole through the film after each exposure, as a guide to the separation of the pictures.

The lens front is secured to the film box by two thumb screws, one at each end. Every part is accessible, and the matter of friction in the free movement of the lens is reduced to a minimum. The camera is intended to be supported on a tripod, but is provided with a handle, and in emergencies can be held on the arm during exposures.

In an exposure without any fan attached, the lens rotates from one side to the other in 1½ seconds, causing the image to travel over a space of 12 inches, thereby giving one-sixth of a second stationary exposure. Fans lengthen the exposure ¼, ⅓, ⅜, ½ seconds, according to size used. In the rear is a compartment for holding the finder, fans, stops and extra spools of film.

From what has been said it will be noted that the camera is a very useful instrument, in view of the fact that panoramic or smaller sized pictures, time or instantaneous, can be quickly and easily made, according to circumstances.

A New Ore of Nickel.

A new nickel, believed to be of great commercial value, has been discovered in the copper ore district of Houghton, Mich. It has been named Mohawkite, from the mine in which it was found. It was at first supposed to be a copper sulphide, but chemical examination indicated that it was a new mineral. It possesses a silvery metallic lustre when freshly broken, with very irregular fractures. Chemical analysis shows that it is an arsenide of copper, similar to the domeykite, in connection with which is also found an arsenide of nickel. The possibilities offered by this combination are very great. Copper is more than ever a valuable metal and is now commanding a high price, and nickel is now used in a large number of industries where twenty-five years ago a few tons only were used, in the subsidiary coinage of the United States, so that the discovery of new ores and new bodies of an ore of nickel, may be regarded as of the greatest possible importance. It is, however, in the field of alloys that Mohawkite will probably be more valuable. The assays so far as determined, reveal an almost ideal composition for an alloy of copper and nickel, for which there is already a good demand. The new mineral can also be turned into commercial products from the ore almost without waste.

The International Photographic Congress.

The Committee in charge of the International Photographic Congress which is to be held in Paris, has recently established the following programme of the questions to be considered.

1. Photographic plates, classification and sensibility in various conditions of use. 2. Photometry; the practical study of the subject as applied to photography. 3. Characteristics and classification of optical glass. 4. Lenses and diaphragms; systems of numbering. 5. Questions relating to photographic shutters. 6. Classification of glass plates used in photography as to thickness. 7. Dimensions of cinematograph bands. 8. Expression of photographic formulæ. 9. Project for decimal classification in the bibliography of the subject. 10. Legal protection. 11. Proprietary rights and licenses. 12. Questions relative to photographic documents and archives.

If it is desired to communicate any documents or researches relating to these or like subjects, a resumé should be addressed to the secretary of the committee before the 15th of June in order that it should be admitted to the sessions of the congress. The secretary, M. S. Pector may be addressed at 9 Rue Lincoln, Paris.

AN exhaustive exhibit of United States postage stamps will form a part of the Paris Exhibition. It is said to be one of the most complete ever made, embracing every variety issued since the inauguration of the postal service.