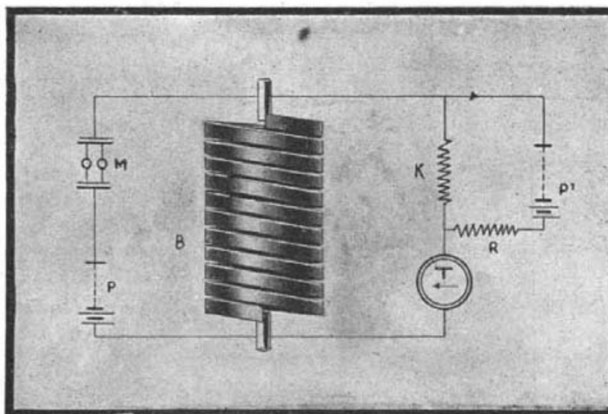
A NEW TYPE OF CLAM-SHELL BUCKET.

Pictured in the accompanying engraving is a new type of clam-shell bucket that has been installed on the Cleveland & Pittsburg ore docks in the old river bed, Cleveland. The bucket has the enormously wide opening of 18 feet 1 inch inside measurement, which is obtained without increasing the height or complexity of the structure. The advantage of this reach in scraping or cleaning up is obvious. The bucket can be operated on any design of unloader using either steam or electricity. Its parts are few and durable and its cost of maintenance is low. The bucket shown in the illustrations has been in operation for over a month, requiring no further attention than lubrication.

Especially advantageous is this bucket in discharging the cargo from a 24-foot center boat with hatch openings running 12 feet fore and aft. It practically eliminates shoveling by hand. Another advantage, appreciated by operators, is in the position of the trays when the grab is open, as the digging edge of the trays comes in contact with the bulkhead or wing of the boat only, while the top of the trays is over 18 inches from either bulkhead, wing or stanch, thus taking the ore perfectly clean from any part of the vessel. When the grab is dropped the entire lower edge of the trays comes in contact with the tank top, obviating any damage to the tank top, which feature is greatly appreciated by vessel owners. The bucket will heel and reach to its full opening by simply placing the heavy scoop on only a half bucket of ore. Operators will appreciate the advantage of this in unloading ore from an adjoining hatch. For instance the operator by leaving some ore in the center of his hatch may lower the grab to the hold of the boat in the closed position and by placing either tray against the ore in the center of the hatch and opening the grab from this point will obtain a reach of 18 feet in either direction. Thus, if one rig should get out of order the two adjoining rigs could unload nearly all the ore from the 24-foot center boat without shifting either the rigs or the boat. The bucket is the invention of Mr. Huntsbery, of Cleveland, Ohio.

SOME INGENIOUS FOREIGN INVENTIONS.

There are European pioneers in many lines of invention who have always been successful in fashioning minor matters which make for usefulness or comfort. Several ingenious notions—as they might almost be termed—are illustrated in La Nature, from whose pages we abstract these descriptions.



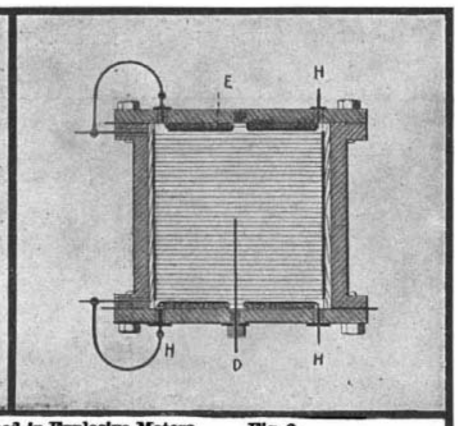
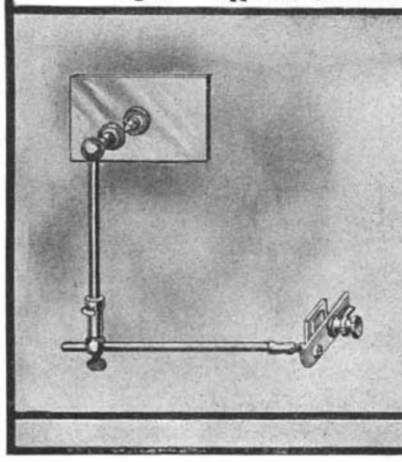
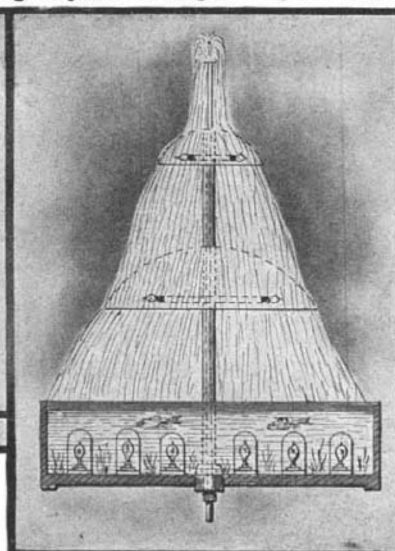


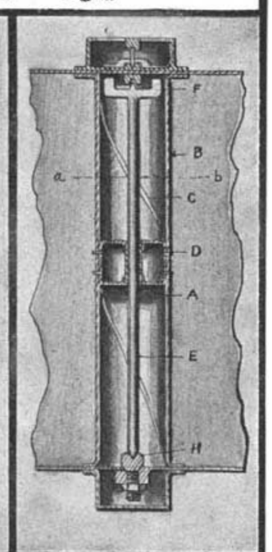
Fig. 1. Apparatus for Measuring Temperature Developed in Explosive Motors. Fig. 2.



A Reflector for Typists.



A Novel Table Decoration.



Magnetic Fuel Gage.

SOME INGENIOUS FOREIGN INVENTIONS.

It is very difficult, in fact almost impossible, to determine the quantity of heat that escapes through the walls of the cylinders of explosion motors, as the calculations are based upon data (including the temperature produced by the explosion) which are yet very imperfectly known.

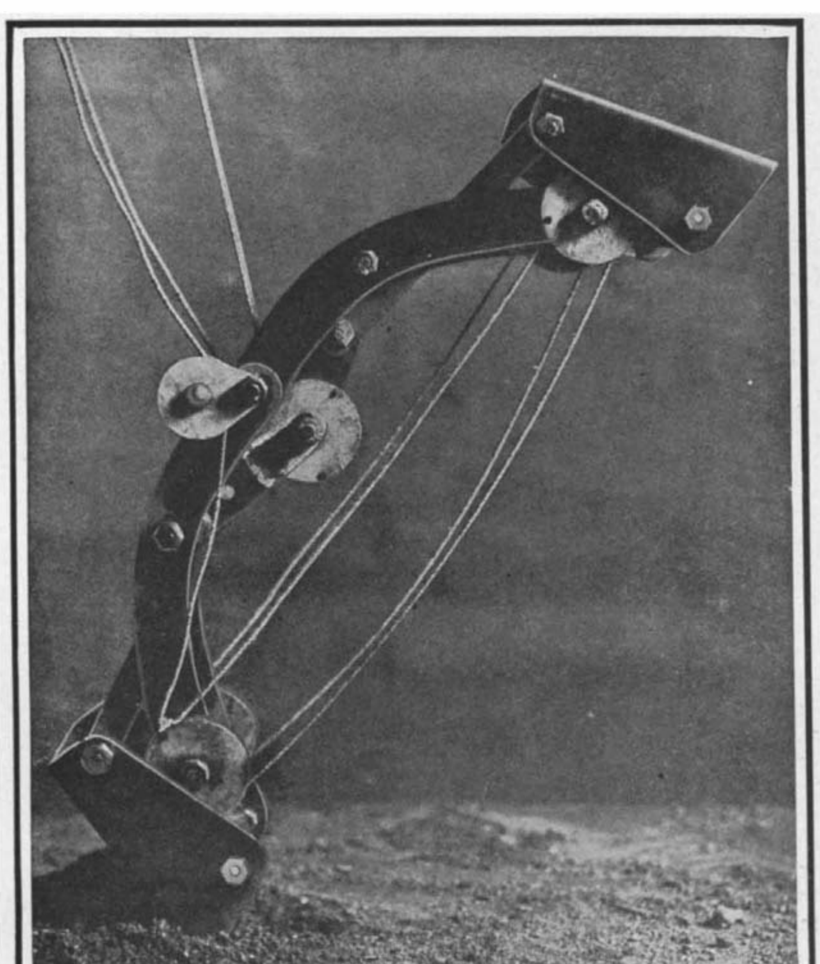
Prof. Hopkinson, of Cambridge University, who has devoted much attention to the theory of explosion motors, has invented a device by which this temperature can be measured directly. The apparatus is based upon the increase of the electrical resistance of copper with increase of temperature. It is a hollow vertical cylinder of cast iron, 12 inches in height and diameter. The interior is lined with wood and the top and bottom are covered with cork. The cylinder contains a ribbon of sheet copper, ¼ inch wide, wound in the form of a helix, with an air space 1/25 inch between the successive turns. The top and bottom of the cylinder are perforated in several places. The central hole in the bottom (*D*, Fig. 2) serves for the introduction of a candle of such length that the wick is at the center of the cylinder. Directly over the candle, in the center of the top, is an opening, *E*, by which the interior of the cylinder is put in communication with a self-registering pressure gage. The remaining apertures, *HHH*, serve for the introduction of strips of copper which are arranged in spirals on the top and bottom of the cylinder and which form one circuit with the central helix. In short, the apparatus constitutes an explosion chamber lined with strips of copper, through which a current can be passed before and during the explosions to furnish data for computing the rise in temperature from the change in resistance.

The cylinder having been filled with an explosive gaseous mixture and this ignited, the change in resistance is measured by means of the apparatus indicated in Fig. 1. The principal circuit comprises the cylinder coil *B*, a battery of fifty accumulators *P* and a group of lamps *M*. Connected as a shunt to the cylinder coil is a second circuit which includes a galvanometer *T* and a resistance of ¼ ohm *K*.

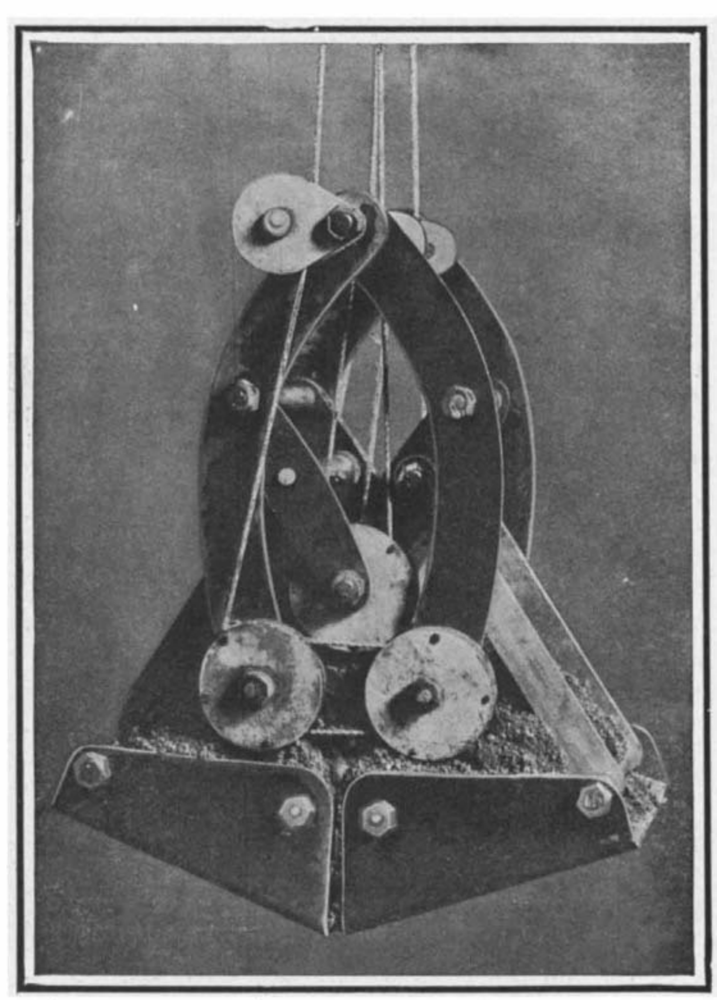
Finally, a third circuit, forming a shunt to the resistance *K*, includes a battery of six accumulators *P'* and a resistance *R*. This resistance and the lamp bank are so adjusted that a current of 8 amperes flows through the lamps and no current flows through the galvanometer *T*. The mixture is then exploded. The small increase of the resistance of the cylinder coil causes a proportionate increase in the difference of potential of its poles and a current through the galvanometer proportional to both of these changes. Hence the temperature produced by the explosion can be determined. The deflections of the galvanometer are recorded by a period of light which is reflected to a sheet of photographic paper by a mirror attached to the galvanometer needle. The pressure at each instant of the explosion is given by the pressure gage.

"Visible writing" typewriters are true to their name only when the light is good and they are advantageously placed with regard to it. In a room lighted by windows on one side only it is often difficult to read the writing on a cloudy day unless the machine faces, or nearly faces, the window, an arrangement which is not always convenient.

This defect is easily remedied by the "Philos," which is simply a small mirror, mounted on a jointed rod, which can be turned so as to reflect the light to the point where the key strikes the paper. The device is made in forms adapted to machines of various makes.



View Showing Enormous Opening of the Bucket, viz., 18 Feet 1 Inch.



The Improved Clam-Shell Bucket in Its Closed Position.

A NEW TYPE OF CLAM-SHELL BUCKET.

A pretty table decoration is easily constructed by anyone who has water and electricity "laid on" in his dining room. In a shallow tank with a wooden bottom and glass sides electric bulbs are mounted under glass globes which are hermetically joined to the bottom of the tank to protect the connections from water. The wires pass through the bottom of the tank, which is also traversed by three concentric tubes, two of which rise to a height of several feet, while the third and largest terminates below the edge of the tank and serves as an efflux pipe. The water enters through the smallest tube and its fall is broken into cascades by two or more flat domes of colored glass which are supported by the intermediate tube. Under these domes are arranged very small electric bulbs of various colors which are fed by wires which pass up the space between the two long tubes. The effect is heightened by placing shells and aquatic plants in the tank.

Automobilists often find it desirable to know the quantity of gasoline on hand at any instant in order to avoid exhausting the supply before reaching the goal and to know whether the speed should be increased or diminished. As the tank is lined with lead an ordinary gage rod can not be used and the glass tube employed in water gages is too fragile. A breakage during the race would be fatal and it is doubtful whether such a device would be accepted by the managers of the trials, who prefer a container of the simplest and most easily examined form and would probably object to the presence of the stuffing box joints which could be so contrived as to make the level of the liquid in the glass tube different from that in the body of the container and thus facilitate and conceal fraud.

The Bayard-Clement firm has devised a magnetic gage which is not open to these objections and indicates the level with great accuracy. It was first used at the recent Grand Prix. The container is traversed from top to bottom by a tube *B*, which bears spiral grooves on its inner surface. Inside the tube is a float *A*, furnished with pegs *D*, which engage in the grooves. The float, therefore, rotates as it descends, making one entire revolution in sinking from the top to the bottom of the tank. The rotation is communicated to a flat vertical rod *E*, which is placed in the axis of the tube and passes through the float. The rod is pivoted at top and bottom and bears at the top a horseshoe magnet *F*, the poles of which revolve with a very small clearance beneath the top of the tank, which is of non-magnetic metal. A magnetized needle mounted on a pivot above the top of the tank follows the rotary movement of the magnet and indicates on a graduated circle the azimuth of the latter. As the float turns with the magnet and sinks as it turns, descending from the top to the bottom of the tank in one revolution, the pointer thus indicates the height of the float and hence that of the liquid.

TESTING FOR HARDNESS.

(*Concluded from page 136.*)

be faultless. But of late years a new product in the form of an air-hardened manganese steel has come into use which product is capable of resisting the file and yet appears to be comparatively softer than the file. In fact, it seems possible that we have here another property of metals which comes to the aid of hardness proper in resisting the abrading action of the file. This property is toughness. Stopping to think, we see that it is quite possible with the slow-moving file that toughness comes in and obscures the test.

Now if this analysis be correct, hardness would appear to be the instantaneous capability of a metal to resist deformation. And differences in hardness we would define as the different degrees of resistant energy of various specimens when the elastic limit is exceeded.

If this description of hardness be correct, then the scleroscope invented by Mr. Albert F. Shore would seem to measure it exactly. The instrument consists essentially of a tiny weight pointed at one end, a piece of glass tubing, and a scale of measurements. The weight fits inside the tube, which serves as a guide. Upon holding the tube upright and allowing the weight to fall, pointed end downward, a sharp blow will be struck upon any specimen placed in position. A scale, graduated from 0 to 140, is placed behind the tube. Upon this scale, the rebound is measured. Referring to Fig. 1, the glass tube may readily be seen held in position by a standard on the left. The rod seen to the right of the tube swings freely from its upper end, and is, in fact, a plumb rod, employed for the purpose of enabling the operator to hold the instrument in a vertical position. The bulb seen at the top is used to exhaust the air from the tube and thus raise the weight. Once in position at the top of the tube the weight is detained by a suitable catch. When it is desired to operate the instrument, the finger hook seen on the left is pressed down and the bulb lying on the table is compressed. The weight is now released and free to fall.

The specimen to be tested should present a horizontal surface at the lower end of the tube. If it is of suitable size and shape it may be held in a clamp. If of irregular form, it may be imbedded in a composition of tar and asphaltum. This material affords in itself an illustration of hardness in reference to a quick blow. For it supports the specimen when subjected to the instantaneous impact with little or no yield, although the specimen may be imbedded in it with no trouble.

If the piece to be tested is large or if it is inconvenient to remove it from its position, the essential part of the instrument may be disengaged from its base, and used separately. This is a matter of great convenience. Thus, by opening a bearing box, both shaft and box may be tested. If the brasses are harder than the steel, it is a combination which may produce trouble; for should the bearing at any time become dry, the shaft would be cut.

By following out the line of procedure suggested by this illustration, a manufacturer will be able to assemble the parts of a machine on the principle of combining with a more expensive piece a softer, less expensive one, so that when wear takes place the less valuable part may be the one to suffer instead of the other. Likewise, the part removable at greater trouble may be associated with a softer and more easily removable piece. These principles are of great value in machine construction, and need only to be mentioned to be understood.

At present, two styles of hammer are used in the scleroscope—one with rather a sharp point, the other somewhat more blunted. The sharp-pointed weight strikes a blow of 75,000 pounds to the square inch. As the weight is quite small, it is necessary, in order to secure this result, that but a very minute area shall be in actual contact. Great difficulty was experienced in securing a material suited for such exacting service. The diamond was tried, but failed. Finally, using the scarcely perfected instrument itself in the effort for success, a method of treating steel was devised which enables the manufacturer to produce a weight capable of withstanding such a tremendous shock upon a very small point. When this hammer, after falling freely for about ten inches, strikes the surface of a fine grade of hardened steel, it rebounds about seven inches. As the scale is divided into 140 parts, such steel registers about 100 points. This rebound is sufficient to enable a distinction to be made between steels differing but slightly in hardness. Thus the fine grades of hardened pure carbon tool-steel range from 90 to 110 points. The same steels, unhardened, disclose a hardness of 40 to 50 points, if unannealed. If annealed properly, the hardness drops to about 31 points. Now the lower carbon steel (as railway rails) annealed show a hardness of about 26 to 30. Brass may be as hard as 30 or it may fall as low as 12. Wrought iron has been found to be 18 hard, while zinc and copper but 8 and 6, respectively. Turning to the alloy-steels, we find manganese self-hardening steel showing a hardness of 60 to 85. High-speed tool-steel, hardened, discloses an instantaneous resistance equal to 100 to 105. This seems to indicate that the finest pure carbon tool steel may be made harder than the alloy steel. But there are so many varieties and grades, and variations in handling, that we must not regard these figures as settling once for all the comparative hardness of these two important kinds of tool steel.

An interesting matter is the effect of compression. This seems, almost without exception, to increase the hardness of the metal. Thus wrought iron increases from 18 when in ordinary condition to 30 when compressed. Lead, which is, of course, very far down in the scale, varies from 2, uncompressed, to 3, compressed. But zinc shows the remarkable variation from 8 to 20—150 per cent increase. Hard brass, 30, may be made still harder by compressing its particles.

This new method of testing comes into direct competition with the Brinell method. The latter proceeds by the slow pressure of a ball upon the surface to be tested. The amount of permanent compression is taken as indicating the lack of hardness—or, expressed differently, as indicating by its reciprocal the degree of hardness. Thus, the deeper the permanent indentation, other things being equal, the softer the metal. It is to be noticed particularly, that it is not the original deformation that is relied on, but the permanent one. These matters of slowness and permanency would appear to be mutually corrective. Thus, by slow compression we should effect a deeper indentation. But, as recovery is allowed, and only the permanent indentation measured, the deformation would have a tendency to recover. At any rate, the Brinell method has proved itself of advantage during a considerable period of trial, and the new method would appear to correspond well with it; for comparative tests have been made, disclosing for the most part a rather striking agreement between the ball method and the drop-hammer procedure. Moreover, the scleroscope would seem to possess a very desirable property in the readiness with which it may be applied.

The Price of Sugar in Olden Times.

Cane sugar was produced by the Chinese at a very remote epoch. In western countries it was a more recent introduction. The Roman writers Pliny, Varro, and Lucian, at the beginning of our era, barely mentioned it. It was then known by the name of Indian salt and honey of Asia, Arabia, or India. In 1090, Crusaders arriving in Syria discovered sugar cane, which became a favorite dainty of the soldiers. During the following centuries the sugar cane was introduced into Cyprus, the Nile Delta, the north coast of Africa as far as Gibraltar, Sicily, and the kingdom of Naples. It reached Spain in the fifteenth century and thence was carried to Madeira and the Canaries. In 1644 the French imported it into Guadeloupe and a little later into Martinique and Louisiana. The Portuguese introduced it into Brazil and the English into Jamaica.

According to the Rivista Scientifico-Industriale, a hundredweight of sugar cost the following amounts in London and Paris, from the middle of the thirteenth to the end of the nineteenth century:

Date.	London.		Paris.	
1260	1,031 francs	= $206	....	....
1300	1,250 "	= 250	....	....
1350	837 "	= 167	....	....
1372	....	....	2,845 francs	= $569
1400	1,156 "	= 231	....	....
1426	....	....	1,441 "	= 288
1450	1,500 "	= 300	....	....
1482	....	....	1,375 "	= 275
1500	267 "	= 53	....	....
1542	....	....	340 "	= 68
1550	458 "	= 92	....	....
1598	....	....	534 "	= 107
1600	397 "	= 79	....	....
1650	402 "	= 80	....	....
1700	266 "	= 53	....	....
1750	103 "	= 20	....	....
1800	191 "	= 38	....	....

In regard to the price of transportation, in 1550 it cost 10 francs, or nearly $2, to send 250 kilogrammes or about 553 pounds of sugar from Antwerp to London, and 24 francs to send 50 kilogrammes by sea from Venice to Antwerp. It is well known that the discovery of the saccharine principle of beet root was made by Olivier de Serres, the gardener of Henri IV, in 1605. The first beet sugar factory was established in 1795, near Berlin, by Achard. In France, at the time of the continental blockade, the increase in price of sugar to 6 francs or $1.20 per pound proved a powerful stimulant to the establishment of beet-sugar factories. On January 2, 1812, Benjamin Delessert, a Paris sugar refiner, presented for the first time specimens of indigenous sugar to Chaptal and declared that the manufacture of beet sugar was in actual operation at Passy.

An Electric Moth Trap.

The Saxony authorities have discovered what would seem to be an excellent way to put an end to the caterpillar plague which is having such a disastrous effect on the local forests. They have discovered a method to catch the brown nun moths that lay the eggs from which the caterpillars come in enormous quantities. They make use of what they call the electric light trap. This consists of two large and powerful reflectors placed over a deep receptacle and powerful exhaust fans. The whole has been erected on top of the municipal electric plant at Zittau. At night two great streams of light are thrown from the reflectors on the wooded mountain sides half a mile distant.

According to the Electrical Review the results have been astonishing. The moths, drawn by the brilliancy, come fluttering in thousands along the broad rays of light: When they get to a certain distance from the reflectors the exhaust fans take up their work and with powerful currents of air swirl them down into the receptacle. On the first night no less than three tons of moths were caught. It has been decided to build another trap on the Rathaus Tower, and the fight with the moths will be continued.

The forests of central Europe have, from time to time, been ravaged by raids of moths from Russia, whose larvæ denude the trees of their foliage. The splendid pines of the Lausitz Mountains are this year threatened with destruction.

Another section of the through railway line from Keelung to Takow was opened to traffic on February 20, 1908. This is the section from Sansaho to Korisho, a distance of nine miles, which has involved some very heavy tunneling and bridging work. There are eight tunnels and three rivers have to be crossed, including the river bed of the Daiankei, which is crossed by a bridge 1,600 feet long and supported by eight spans. Only about four miles of the permanent way remains to be opened, and this, it is expected, will take place this year (1908). Meanwhile the journey from the capital to Tainan has been reduced to 12 hours 13 minutes, the distance being 200 miles.