THE MARVIN ELECTRIC ROCK DRILL.

It can no longer be truthfully said that electric engineering is in its infancy. It has arrived at a state of maturity which is marvelous. The introduction of electrical machinery for lighting and power has assumed gigantic proportions, and its extended application in other directions, especially in mining, is increasing at a prodigious rate.

The Marvin electric drill, as at present manufactured by the Marvin Electric Drill Company, of Canastota, N. Y., is one of the finest of recent achievements in electrical engineering. It embodies electrical principles of peculiar merit, and mechanical construction not surpassed by other machines, and a simplicity of operation and construction that is almost ideal.

The early electrical drills, which first made their appearance before the public in 1891, were enthusiastically received, but, owing to faulty design, they soon fell into disuse, and it was not until several years subsequently that the drill was brought to a sufficiently practical state to compete with other drills operated by compressed air or steam. Within the past few years the Marvin drill has undergone still further improvement, and these drills may now be found in successful operation under a wide variety of conditions.

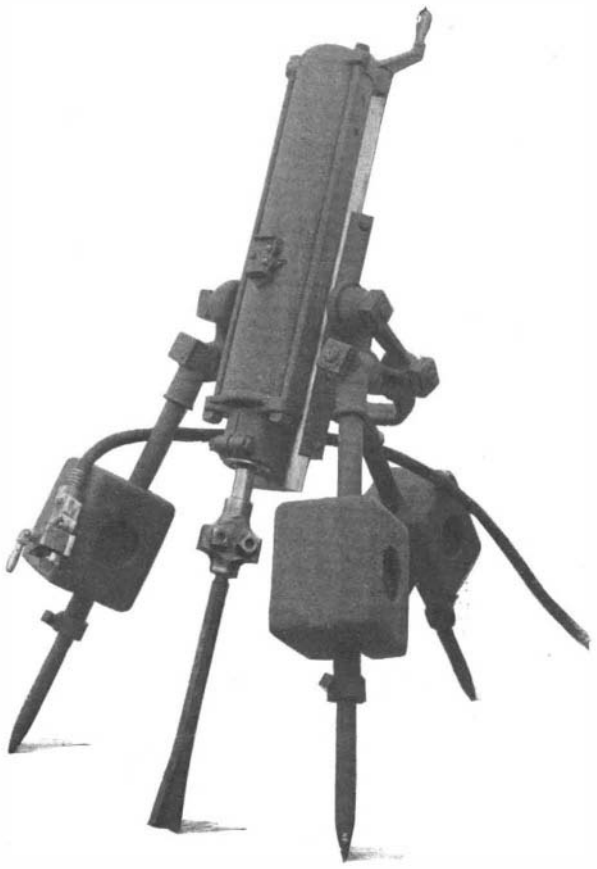


Fig. 1.—THE MARVIN ELECTRIC ROCK DRILL.

In the development of this drill, the inventor, Mr. H. N. Marvin, was confronted on all sides with difficulties, and the limitations prescribed by the exacting conditions necessary to a successful drill rendered the task an extremely difficult one. Those who have had anything to do with mining machinery will appreciate the many obstacles that have been surmounted in the perfecting of this drill.

The general operation of the drill is similar to those operated by steam or compressed air. An idea of the external appearance of the machine may be had by examining Fig. 1, which shows a 7-inch size drill mounted on a tripod. By inspecting Fig. 2, showing the drill in section, its simple and substantial construction will be understood. The different parts of the drill interlock, and are held together by two side bolts and two studs, the latter being integral with the concave slide upon which the parts are held. Referring to Fig. 2, it will be observed that the body of the drill consists mainly of two coils of wire, 3 3, which form a double solenoid. Within this solenoid is developed the magnetic force which drives a soft steel plunger, 1, to and fro, in the same manner that steam actuates the piston in a steam drill. The plunger, which is turned from a solid steel forging, has a reduced section or neck, 4, which passes through a bearing, 11, in the front-head, 5, and terminates in a massive chuck, 6, for holding the drill steel or bit. The other end of the plunger is enlarged to form a magnet, 2. Into the end of the magnet is screwed a rifled nut, through which the rifled bar, 8, passes. On the end of the rifled bar is keyed a ratchet wheel. Pawls (not shown in cut) engage in the teeth of the ratchet wheel and prevent the rifled bar from turning backward. By this arrangement the plunger is rotated through a small arc during every backward stroke. The buffing spring, 7, which closely resembles a car spring, checks the backward stroke of the plunger and returns the energy momentarily stored in the spring to the forward stroke.

The construction of the coils, 3 3, is of particular interest, being peculiar to this machine. They are wound with square copper wire and insulated with pure India mica placed between turns and layers. The absence of organic insulation makes the construction of these coils fireproof, and the square wire tightly pressed into place prevents any disturbance of the insulation by the vibration of the machine. Both coils are wound upon a steel spool and then slipped into a boiler iron tube. The jacket thus formed is hermetically sealed, by calked joints, at the junction of the tube and heads. Electrical connection with the winding of these coils is made with three contact plugs, 10, which press into three metal rings located between the windings. External connection is made with these plugs by means of a connection fitted to the end of a flexible cable.

One of the most noteworthy features of the drill is the entire absence of anything in the nature of a switch or valve, this being unnecessary, as the current is alternately directed into the coils by the generator itself.

The drill generator or dynamo, shown in Fig. 3, is a two-pole machine with a drum armature containing a loop winding embedded in slots, which are disposed over a portion of the periphery, filling opposite arcs. In this a single phase alternating current is generated. Referring to the diagrammatic sketch, Fig. 4, it will be observed that one end of the loop winding terminates in a solid collector ring; the other terminates in a half ring, which alternately shifts the current into the two sides of the drill circuit by means of brushes resting upon the commutator at diametrically opposite points. No appreciable sparking results, as the half ring leaves each brush at the instant when the current wave is zero.

Three wires are required to transmit the current to the drills. Fig. 4 shows the arrangement of the circuits and the path of the current. By tracing the development of the current in the armature and its course through the circuits, it will be noticed that one outside wire receives positive pulsations or waves of current and the other outside wire receives negative pulsations, and that the flow of the current in the drill coils is such as to always magnetize the plunger one way. The magnetism is, in other words, never reversed. Likewise the dynamo field is overcompounded by the coils, *A A*, which receive the current that passes through the drills. The object of the overcompounding is to maintain a uniform pressure of about 135 volts at the drills, whether one or more are working. The middle wire is the common return for both phases of the current. The speed of this machine is usually 380 revolutions per minute. Every revolution of the armature produces one complete stroke of the drill. The field of this machine is excited by coils, *B B*, which receive current from a small exciter, as the generator is not self-exciting. The exciter is belted from a small pulley on the shaft of the drill generator. The exciter usually furnished is capable of supply current sufficient to maintain about fourteen 110 volt incandescent lamps at 16 candle power each, in addition to the current delivered to the field of the generator. In place of the small exciter one of any desired capacity can be used; thus making it possible to operate motors, fans, and other electrical devices from this machine.

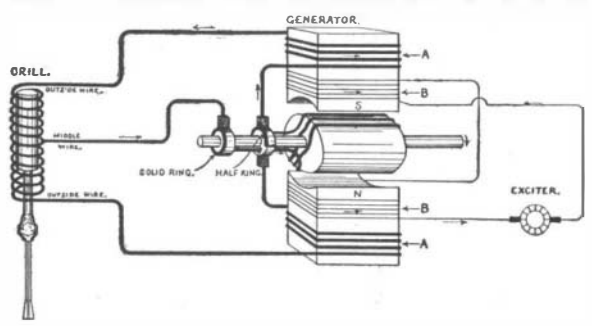


Fig. 4.—DIAGRAM OF THE CIRCUIT.

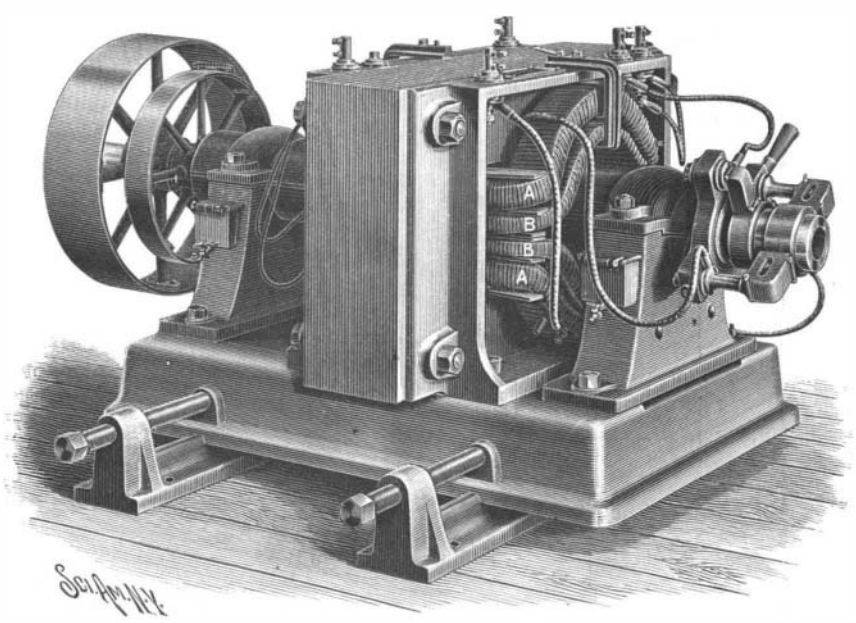


Fig. 3.—THE GENERATOR.

The field of the generator is of rectangular shape and built up entirely of sheet iron punchings. Into side channels in these punchings are laid the field coils, which completely surround the armature. The generator is so constructed that it may be subdivided into small packages for transportation by mule back to localities difficult of access.

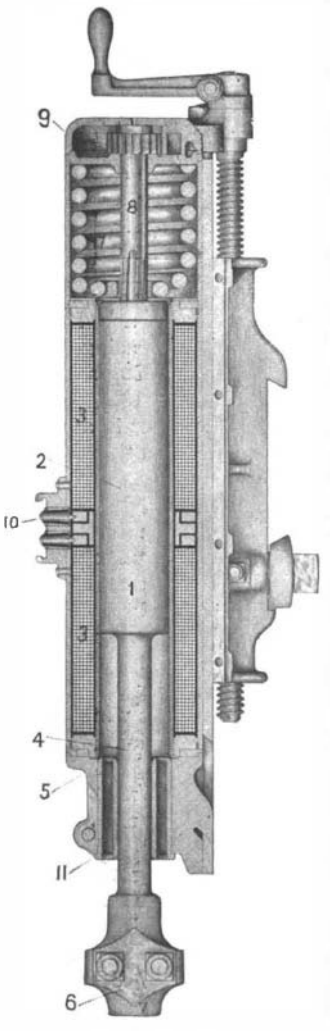


Fig. 2.—LONGITUDINAL SECTION OF THE MARVIN ROCK DRILL.

The electrical features of the system are so extremely simple that no electrician is required to attend to its operation, and the drills themselves may be operated to good advantage by laboring men of ordinary intelligence.

The most striking feature of the Marvin system is its flexibility, of which the plant herein described may serve as a typical illustration. In the fall of 1896 a four-drill plant was installed at Mine la Motte, Mo., for operating four 6-inch Marvin drills in four different underground leads, located a considerable distance from each other. Mine la Motte was discovered by the French, in 1717, and is one of the oldest mines in this country. This mine was once famous for its nickel and cobalt, but of late years, lead is its chief product, of which there seems to be an unlimited supply.

The rock largely encountered in this mine is exceptionally hard dolomite, carrying about 20 per cent of silica. The drills in this mine work to particular advantage, owing to the very large face walls upon which they operate, and which permit of eight-foot holes being drilled and a large amount of rock broken at one time. The wires for conveying the current to the drills are carried along the surface of the ground upon poles in the usual manner and are led down to the mines below through existing prospecting holes. Bare copper wires are used to convey the current above ground and rubber-covered wires protected by several layers of sticky tape are led through the prospecting holes to the drills in the working below. The operation of the four-drill plant was so successful that the owner of the mine, Mr. S. H. Leathe, soon afterward installed an additional generator to operate two drills from wires extending above ground 6,400 feet. When the wires extend underground they are carefully protected from moisture. A separate switchboard is provided for each generator. Each 6-inch drill consumes about 6 horse power delivered to the generator pulley. This is in marked contrast to the power required to operate air or steam drills of similar size. In addition to the economical operation, both as regards drilling, efficiency, and cheap maintenance, may be mentioned the simplicity of the electric generator as compared with an air compressor, which is of complicated construction. There is no deafening exhaust to the electric drills, and they work equally well at all elevations.

In conclusion, it may be said that the Marvin drill possesses many points of superiority not touched upon in this article.

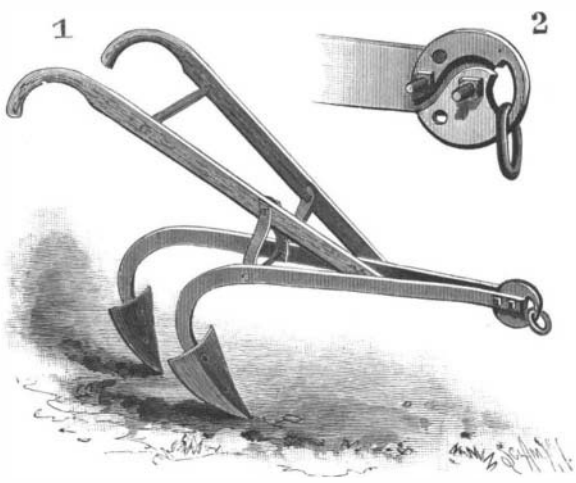
At last bicycle manufacturing has been considered worthy of regular instruction, and a technical class on "Cycle Construction" has been commenced at the Battersea Polytechnic, London. The class meets one evening a week from 7:30 to 9:30. Valuable testing apparatus will be provided and comparative tests will be inaugurated. This will prove of great benefit, as independent tests of parts of materials used in cycle construction have not been made in England.

Effect of Storms on Birds.

The effect of approaching storms upon song birds is the subject of an interesting contribution by Mr. C. E. Linney to The United States Monthly Weather Review. It appears that during the night of August 15–16, 1898, severe electrical, wind, and rain storms prevailed over the northern district of Illinois. An observer in Henry County, Mr. W. W. Warner, noticed that for forty-eight hours before the storm not a sound was heard from the numerous song birds in the district. This observation was so full of interest that Mr. Linney wrote for additional information, with the result that he received numerous letters, some confirming it; others stating that birds sing louder and more persistently before a great storm, and nearly all agreeing that they are more restless than usual at such a time. Mr. Linney has found the following weather proverbs referring to song birds and storms: When birds cease to sing, rain and thunder will probably occur. If birds in general pick their feathers, wash themselves, and fly to their nests, expect rain. Parrots and canaries dress their feathers and are wakeful the evening before a storm. If the peacock cries when he goes to roost, and, indeed, much at any time, it is a sign of rain. Long and loud singing of robins in the morning denotes rain. Robins will perch on the topmost branches of trees and whistle when a storm is approaching. The restlessness of domestic animals and barnyard fowls before an approaching storm is well known, and many of their peculiarities have been noted; but the actions of song birds do not appear to have previously received particular attention.

A CONVERTIBLE PLOW.

A plow has been invented by Willard C. Cousins, of Ferrum, Va., which can be readily converted into an ordinary single-shovel cultivator or double-shovel plow, and which can be easily adjusted to bring the draft at any desired point. Fig. 1 shows the plow arranged as a double-shovel cultivator. Fig. 2 illustrates a peculiar form of clevis employed. The plow is provided with two beams detachably connected by means of bolts. Of these plow-beams, one is somewhat longer than the other; so that one shovel is located in advance of the other, thus forming a double-shovel plow. When it is desired to arrange the parts to form a single-shovel plow, it is necessary merely to detach one plow-beam. The front ends of the beams are held together by two bolts, one of which passes centrally through the clevis-plate and the other eccentrically. At their rear ends the two beams are joined by a transverse screw-rod,



COUSINS' CONVERTIBLE PLOW.

by means of which the distance between the beams and shovels can be regulated. The plow-handles are secured to the longer plow-beams, and, when two shovels are used, are held in position by means of detachable braces.

The clevis, as shown in Fig. 2, is disk-shaped, and is provided with centric and eccentric apertures to receive the two bolts previously mentioned. The eccentric apertures are three in number, and by their means the draught can be brought to any desired point. At its front end the clevis is provided with an opening to receive a solid ring which is designed to engage the whiffletree hook, and which enters the opening by means of a curved slot. The front ends of the beams are recessed to receive the ring. The ring is adapted to be confined at the top, bottom, or center of the beam recesses, depending upon which eccentric perforation in the clevis is used in conjunction with the bolt.

The plow is simple and cheap in construction, is capable of being easily converted into a single or double shovel cultivator, and of being adjusted to vary the draft and bring the ring at the top, bottom, or center of the front ends of the plow-beam.

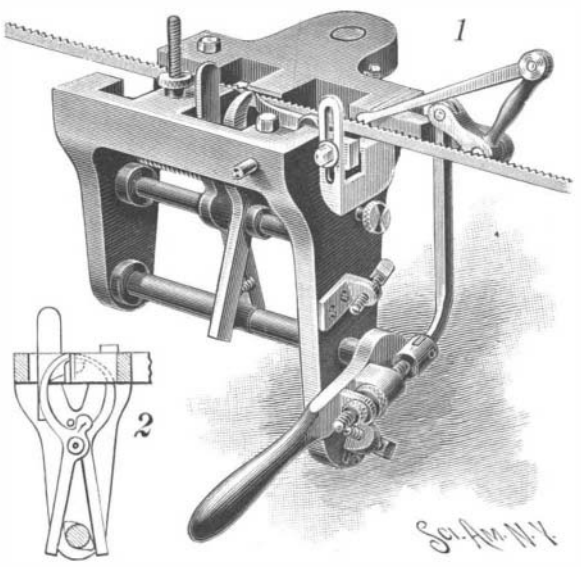
IN the disinfection of stock cars on the Continent it has been found impossible to obtain satisfactory results with either carbolic acid, steam, or formaldehyde. Satisfactory results have, however, been obtained with a five per cent solution of chloride of lime.

AN IMPROVED BAND-SAW-SETTING MACHINE.

A band-saw-setting machine which is constructed to feed the saw forward properly, and to bring the teeth accurately into position for the setting-tools to act on the teeth, has been invented by Pierre Sicotte.

Fig. 1 of our illustrations shows the machine in perspective. Fig. 2 is a transverse section, showing the arrangement of the setting tools.

On the machine-frame vertically adjustable saw-



AN IMPROVED BAND-SAW-SETTING MACHINE.

rests are mounted, one of which is located adjacent to two anvils arranged to face the saw-blade on opposite sides. One of the anvils can be laterally adjusted for saws varying in thickness. On their upper ends the anvils are formed with bevels against which the corresponding saw-teeth are set by longitudinally adjustable setting-tools moving transversely to the saw and to the anvils. These setting-tools, as shown in Fig. 2, are pressed against the saw-teeth by means of cams on a rock-shaft journaled in the lower portion of the frame. To prevent the springing of the saw-blade during the setting, guide-fingers are employed, the free ends of which are arranged opposite the anvils to engage that portion of the blade directly under the tooth to be set at the time.

The saw is fed by means of a pawl which engages the teeth and which is operated by a bell-crank lever connected by a link with an arm which is secured to the rock-shaft previously mentioned, and which, therefore, coacts with the cams operating the setting-tools. An adjusting device is carried on the arm to give any desired throw to the pawl, according to the size of the teeth of the saw to be set, without, however, changing the opening and closing device for the setting-tools. In their normal positions, the setting-tools are out of engagement with the saw, When the arm secured to the rock-shaft is swung down, the cams on the rock-shaft force the setting-tools into engagement with the corresponding teeth of the saw, to set these teeth in opposite directions. Hence, two saw-teeth are set at one operation, without danger of springing the blade, owing to the arrangement of anvils and guide-fingers previously described. Simultaneously with the operation of the arm, the feeding-pawl will be operated through the medium of the connecting link and bell-crank lever, to move the saw forward. From the arrangement described it follows that the setting tools and feeding-device are both actuated by the operation of the arm.

The patents for this machine are controlled by the Helmers Manufacturing Company, of Leavenworth, Kans.

The New French Phosphorus Matches.

In 1895 the outcry against the horrors of phosphorus necrosis induced the French government to appoint a scientific commission under the presidency of Troost, charged with the task of finding, if possible, a substitute for yellow phosphorus. By September, 1897, that commission had almost resolved to report that none of the many preparations examined offered a solution of the problem, when Sévene and Cahen, of the state manufactory, submitted their matches. These matches contain phosphorus sesquisulphide and chlorate of potash. The sesquisulphide is a gray-yellowish substance, which is prepared by heating amorphous, i. e., non-poisonous, phosphorus and sulphur. The substance is very stable. Lemoine, who studied it in 1864, kept it for 15 years exposed to the air without noticing any change. Its latent heat is low; it ignites at 95° C. (203° Fah.), and can therefore be lighted by rubbing like ordinary phosphorus. The mixture with chlorate of potash burns quietly, while the mixture of amorphous phosphorus, which takes fire at 260° C. only, and chlorate of potash is really explosive. For this reason inert substances are added to the chlorate in safety matches; but we still occasionally find safety matches which spit unpleasantly. The new matches are not likely to contain other impurities than amorphous phosphorus and water. They have become popular during the few months they have been obtainable, and are known as the S. C. matches, after the initials of their inventors. The public may hardly have noticed the change, for in their appearance the new matches resemble the old; they may have a faint smell—more a sulphide than a phosphorus smell, however. The sesquisulphide, at any rate, has such a faint smell that the employés in the works are said not to complain about it. The new matches do not phosphoresce even when rubbed energetically, but they are poisonous to a very slight degree. The intending suicide would, however, have to swallow 6,000 matches to put an end to his troubles. We do not think, therefore, that the matches need be labeled "poison." If they can really be manufactured, transported, and stored with safety, and be relied upon to strike, the inventors have claims upon our gratitude. The S. C. matches are manufactured at Trélazé, Begles, and Saintines; no accidents have occurred as yet.—Engineering.

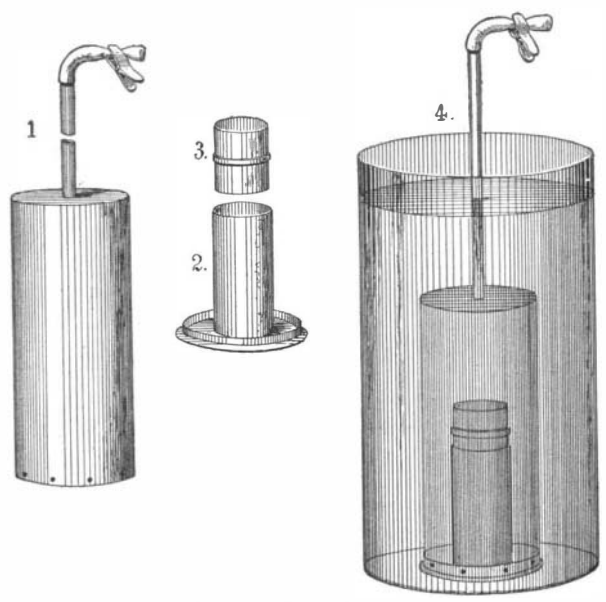
A CHEAP METHOD OF MAKING A CALORIMETER.

A calorimeter for determining approximately the heating value of any combustible solid, as coal, may be made at a cost of one dollar or less. The bomb calorimeters for making absolute calculations cost several hundred dollars; but where results do not need to be absolute and expensive instruments are not to be had, the instrument described below may be used, and with comparatively accurate results.

A sheet of heavy copper is made into a cylinder 7 inches high and 3 inches in diameter, as in Fig. 1. Over one end of the cylinder is soldered a copper cap, from which runs a copper tube perhaps ¼ of an inch in internal diameter. Let the tube be 12 inches high and have a stop-cock at its extremity, or, perhaps, have a few inches of flexible rubber tubing attached which shall have a pinch-cock. To the other end of the cylinder fit a movable cover with an inside, tightly fitting flange, like the cover to any small pail. Within this cover solder a copper cylinder 3 inches high and 1½ inches in diameter, as in Fig. 2. Next make a cup, as in Fig. 3, which is 1½ inches high and a trifle less than that in diameter, placing around it, on its middle line, a flange, so that it may be placed partly in the cylinder of Fig. 2. Obtain a glass jar 6 inches in diameter and 1 foot high, or with about these measurements. The completed calorimeter is shown in Fig. 4. Several holes are punched near the bottom of the outside cylinder to allow the egress of the gases and the ingress of the water from the glass jar.

The British thermal unit is the amount of heat necessary to raise the temperature of one pound of water from 39° F. to 40° F. Hence, if 3 grammes of fuel is burned in the cup and 2,901 cubic centimeters of water is present, the heating value will be as many calories as the temperature of the water is raised in degrees.

A mixture of 3 parts of potassium chlorate and 1 part of potassium nitrate is mixed with the fuel to supply oxygen for the combustion; and, as the nitrate absorbs heat and the chlorate gives off heat upon burning, when mixed as above the effect of each is



A SIMPLE CALORIMETER.

neutralized. After the combustion has taken place the stop-cock is opened, so that the water may fill the apparatus and absorb all the heat that has been evolved.

It is best to test the apparatus first with some fuel, as sugar, whose heating value is known, that the percentage of error may be reckoned in the results obtained with the fuels to be tested.

FRANK F. BRADLEY.

ON Prince Schwarzenberg's game preserves in Bohemia 106,604 wild animals were killed during last season. They include over 200 deer, 250 boars, 27,000 hares, 39,000 grouse, and 6,000 wild geese and ducks.