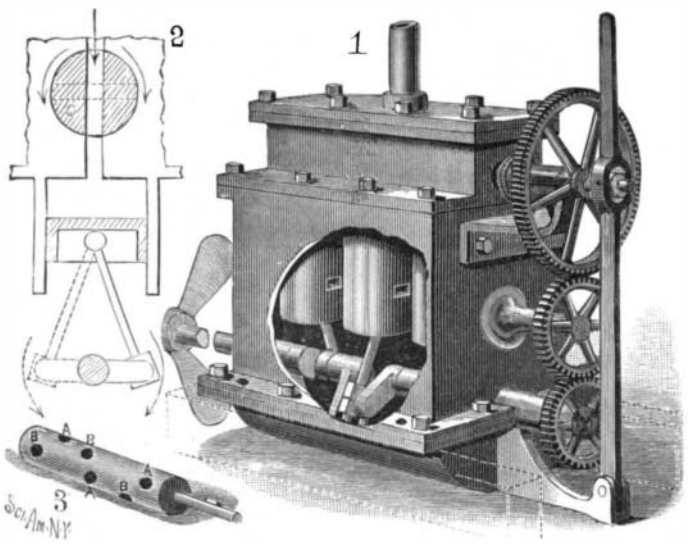
A REVERSIBLE ENGINE OF NOVEL FORM.

The problem of supplying a simple reversible petroleum-engine for automobiles and launches has evidently proved an inexhaustible source of perplexity to inventors, if the many motor appliances which have been devised for the purpose of dispensing with the awkward reversing-gears commonly employed be any criterion. An invention has, however, been recently



A NOVEL REVERSIBLE ENGINE.

patented by Mr. Herman B. Ogden, of 204 Carroll Street, Brooklyn, New York city, which seems to have overcome the difficulty encountered, by the provision of a simple and ingenious rotary valve. Our illustrations picture Mr. Ogden's invention applied to a three-cylinder engine in which the exhaust ports are opened and closed by reciprocating pistons, and in which the inlets are controlled by the novel valve referred to.

The inlets in question are located at the tops of the cylinders so that they can be placed in communication with a valve chamber, containing a valve, *C*, shown sectionally in Fig. 2 and in perspective in Fig. 3. The valve, it will be observed, is a cylinder formed with two sets of ports, *A* and *B*, arranged in a double spiral. When the ports are in register with the cylinder inlets, the motive agent enters the cylinders. The angles between the ports correspond with the angles at which the cranks are set, so that the cylinders are successively placed in register with a valve-port. In order to secure this successive registration, the valve is constantly turned by means of gearing (shown in Fig. 1) driven from the crank-shaft. The gearing is so arranged that the valve turns at half the speed of the crank-shaft, thereby reducing the wear.

The valve is arranged not only to rotate, but also to slide; and by means of this sliding movement the engine can be reversed. When it is desired to change the direction of the engine's motion, a shifting lever connected with the valve stem is swung over, so as to move one set of ports (*A*, for example) out of register with the cylinder-inlets, and the other set of ports (*B*) into register with the inlets, thereby causing the motive agent to act upon the crank-shaft in the opposite direction, as shown by the dotted and full lines of Fig. 2.

The inventor states that the engine is reversible at any point without danger, even though running at full speed. The motive agent may be steam, gas or compressed air. Although designed primarily for small vessels, the engine can also be used on larger ships, since any number of cylinders can be used. Since the reversing mechanism is so simple and so easily operated, the engine could be used as a steam steering-gear in larger ships and could be controlled, when thus employed, by a wheel in the pilot house. This rotary valve has a decided advantage over slide valves; for it cannot bind or clog and enables the engine to develop more power with less friction.

ELECTRIC LOCOMOTIVE AT THE PARIS EXHIBITION.

We illustrate an electric locomotive, intended for working a rack railway, as well as on smooth rails, shown at Paris by the makers, La Société Suisse, of Winterthur. The engine has been constructed for the Jourvière et Ouest-Lyonnais Railway, Lyons.

The firm has been occupied for many years in the construction of rack-railway locomotives, and has probably made the greater number of all such engines in service; they have also studied electric locomotives, and availing themselves of their experience in steam rack traction, they have already built a considerable number of electric locomotives, working on the Gornergrat, Stanstad-Engelberg, Jungfrau, Bex-Ville, and Aigle-Leysen Railways. The electric mechanism of these engines has for the most part been supplied by Brown, Boverie & Company, of Baden, Switzerland.

The engine we illustrate is one of several constructed to work the traffic of the Western Lyons Tramway Company on the steep inclines between the city and the plain of St. Just. The engine must be able to haul 28 tons up an incline of 1 in 5·2 at a minimum speed of five miles an hour. The rack is on the Abt system; current is supplied at 500 volts.

The rack mechanism is worked by a motor of 150 horse power running at 700 revolutions per minute. The motor, by means of two pinions and two spur wheels on two counter-shafts, acts on the two axles of the rack wheels. For working on the level, the carrying wheels are driven direct by two 25 horse power motors. On the rack portion of the line all three motors are worked; on the level the rack gear is, of course, thrown out of use.

The locomotive is fitted with very powerful brakes. There are first two screw brakes independent of each other, which act on the toothed driving wheels; secondly, a similar brake acting on the carrying wheels; and, lastly, an automatic brake, which is thrown into action whenever the maximum speed allowed is exceeded, or whenever the electric current is broken by any cause whatever. The square tank, seen above the engine, is intended to carry water to keep the brakes cool.

The principal dimensions of the locomotive are as follows:

Gage	3 feet 3¼ inches.
Diameter of rack driving wheels	1 " 10½ "
Carrying driving wheels	2 " 9½ "
Speed, miles per hour	5½
Weight of engine	12 tons.
Total of base	28 "
Revolutions per minute of adhesion motors,	300

The mechanism is inclosed in a wooden case, not seen in our engraving, provided with plate glass panes, so that the driver can at all times see it at work. The two motors for the carrying wheels are of the usual four-pole type, series-wound. They are placed between the wheels. They develop together 50 horse power when the machine is running at 9 kilometers per hour, and the torque is then not sufficient to slip the wheels.

The principal motor will work up to 200 horse power. It is shunt-wound. The armature is of copper bars, connected in series, carried in notched soft iron plates. To provide for the rough usage and high speed, the bars are very carefully secured by means of wedges of insulating material, which serve to interlock the bars with the iron plates. The motor is placed inside the vehicle, but it is not covered up, because it was deemed necessary to keep it cool, so that it has been left as open to the air as possible.

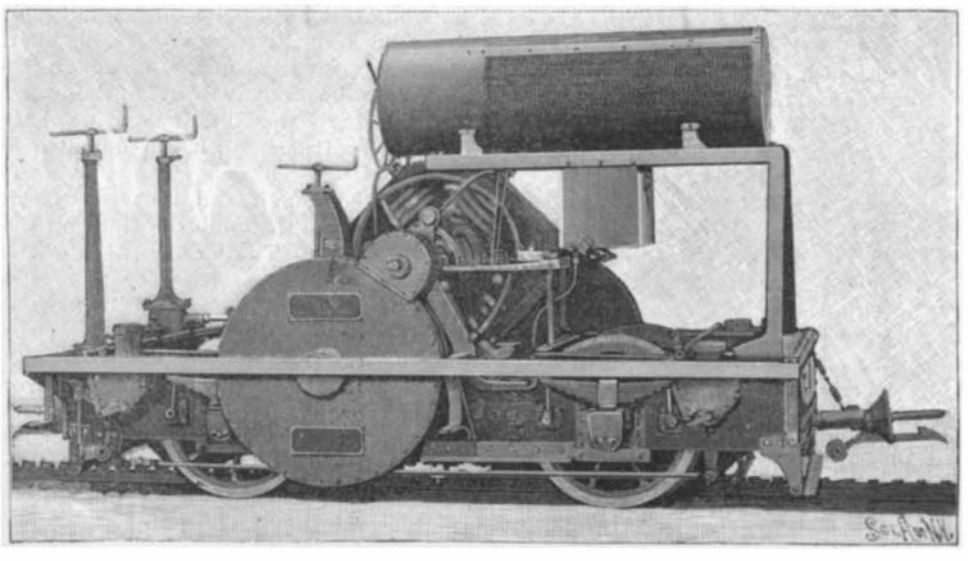
When the train is descending the incline, the motor acts as a dynamo, generating current; this is not wasted in a resistance, but is thrown into the main circuit. In order that the tension may be raised sufficiently, more current is thrown through the shunt into the field magnets. In order that the heavy current generated may not overheat the machine, great care has been taken to maintain efficient ventilation. As the motor is shunt-wound, it automatically adjusts the current to the speed, and the speed to the current, so that the velocity of descent is very little affected by variations in the angle of inclination of the incline.

The starting and stopping arrangements are very simple. The former is effected with minimum current; all variations of speed are obtained by altering the resistance in the shunt. One small handle suffices for everything but reversing, for which a special lever is provided; this last is so connected with the regulator handle, as we may call it, that the driver can make no mistakes.

Current is taken by three "archets," or trolleys of special construction, which work when nearly horizontal or nearly vertical. This is rendered necessary by the circumstance that out in the open the line wires are some 19 feet above the level of the rails, while in the tunnels they are close to the roof of the vehicles.

The locomotive is furnished with various pieces of apparatus, such as a lightning arrester, fuses, and volt and ampere meters. A safety apparatus is provided which consists of a solenoid which carries an armature of soft iron; when this drops through failure of current, the brakes are applied and at the same time the safety switch is thrown, so that should there be a sudden return of current in the circuit, no damage may be caused by what has been termed electric momentum, which, as is but too well known, throws up the voltage enormously for a moment.

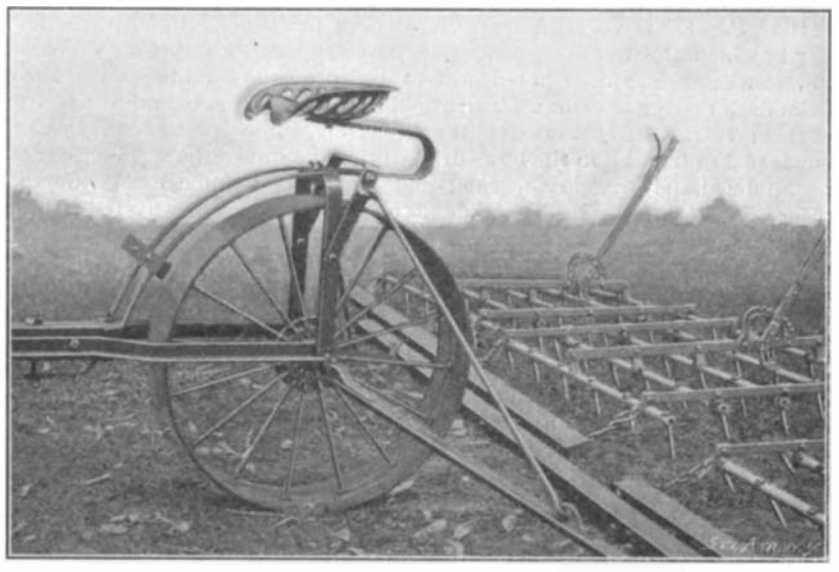
The lighting of the train is, of course, electrical.—The Engineer.



THE PARIS EXHIBITION—ELECTRIC LOCOMOTIVE.

A SIMPLE SULKY ATTACHMENT FOR HARROWS.

A sulky attachment for harrows so constructed that it can be turned from side to side, as occasion may demand, without influencing the harrow is a new invention, for which patents, controlled by the Howard & Waite Company of Blunt, South Dakota, have been taken out.



THE HOWARD-WAITE SULKY ATTACHMENT FOR HARROWS.

The attachment consists of a single broad-tired wheel held in a U-hanger, to the upper portion of which a yoke is pivoted. To the lower ends of the hanger connecting-rods are pivoted which are also pivotally secured to the harrow. Braces pivotally join the connecting-rods with the yoke. It is evident that by reason of this construction the wheel can be turned to the right or to the left without moving the harrow, and that the pivotal connection of the rocking yoke with the hanger and with the connecting-rods and braces permits the harrow to ride over uneven places without interrupting the continuous action of the harrow-teeth.

The driver of the harrow takes his position over the wheel in a spring-seat. The implement can be drawn either by a team or by a single horse, with slight modifications in the structure of the forward portion of the attachment. It is evident that the invention can be applied to any harrow.

Spontaneous Combustion of Hay.

The question of the spontaneous combustion of hay has recently been investigated by one of the officials of the Weather Bureau, who states that fermentation within moist hay may raise the temperature to 374° F., at which temperature clover hay will ignite. The best preventive to spontaneous combustion is a rapid and complete ventilation by which the oxidization and fermenting substances are kept cooled down below the point of ignition.