of recent experiments in Europe, that animal or vegetable oil when mixed with a mineral oil would undergo spontaneous combustion. It was found that cottonseed oil would take fire even when mixed with 25 per cent of petroleum oil. But it was ascertained beyond a doubt that even 10 per cent of mineral oil mixed with an animal or vegetable oil went far to prevent combustion. Professor Ordway described some experiments in other directions, but explained that they would have to be continued before definite deductions could be made. In connection with the tests of the flashing point, experiments had been made with ten specimens of kerosene oil bought at different stores in Boston. The flashing point should be at 130° Fahrenheit. Downer's kerosene was found to be good at 134, but the other specimens flashed respectively at 84, 80, 81, 117, 79, 73, 125, 79, 80, 84 degrees. The professor was of the opinion that it was time for somebody to look after the kerosene oil sold and used in Boston, when out of ten specimens bought at random only one was fit to use with safety. He remarked the fact that oils bought under the same name, from the same manufacturer and at the same price, differed very much in quality. Another remarkable circumstance was that some oils which flashed at a low point were high priced, and *vice versa*. Closing, the professor recommended that manufacturers of oil should be aroused to a greater sense of their responsibility.

HYDRAULIC MOTORS AT THE PARIS EXHIBITION.

M. A. Schmid had at the Paris Exhibition several applications of his patent hydraulic motor or pump, which is figured in *Engineering* as below. Its specialty lies in the manner in which the distribution of the water before and behind the piston is effected by means of the oscillating cylinder. The sectional areas of the inlet and outlet pipes are very large in proportion to the area of the piston, by which means the passage of the water is in no way restricted, and the constant pressure and absence of shock produce a more even action of the engine. It can be applied wherever there is sufficient height of water, or can be driven by steam; can be used as a motor or as a pump, or, as shown in Fig. 2, can be combined into both. When used as a motor the motion is forwards, the admission from either side, and the exit below; as a pump the motion is reversed, the admission of water or suction is from below, and the exit or pressure is on either side. Air vessels are used with the pumps. When this motor is used in the combined form, as a direct acting steam pump, both piston rods are coupled to the same crank axle. In the one exhibited the diameter of the cylinder is 6 inches, and the length of stroke 8 inches, and with a speed of 90 revolutions it delivers 110 gallons per minute. Another application of the same principle of construction is shown as a hydromotor, which consists of two of the hydraulic motors coupled together and driven by the pressure of the fluid passing through them. The oscillating cylinders are kept watertight up to the faces of the valve ports by adjustable screws, whose tension naturally depends on the pressure with which the fluid is actuated. The advantages claimed for the motor are that its speed depends entirely on the quantity of the water passing through it, and that the variations through leakage, etc., are less than in any other, the results given from numerous experiments conducted by Messrs. Sulzer Brothers, of Winterthur, giving an average discrepancy of not more than 1·72 per cent. All the above machines were shown in motion, as well as some well constructed air pumps for compressed air and vacuum, and a small engine on the same principle for working sewing machines.

FIG 1

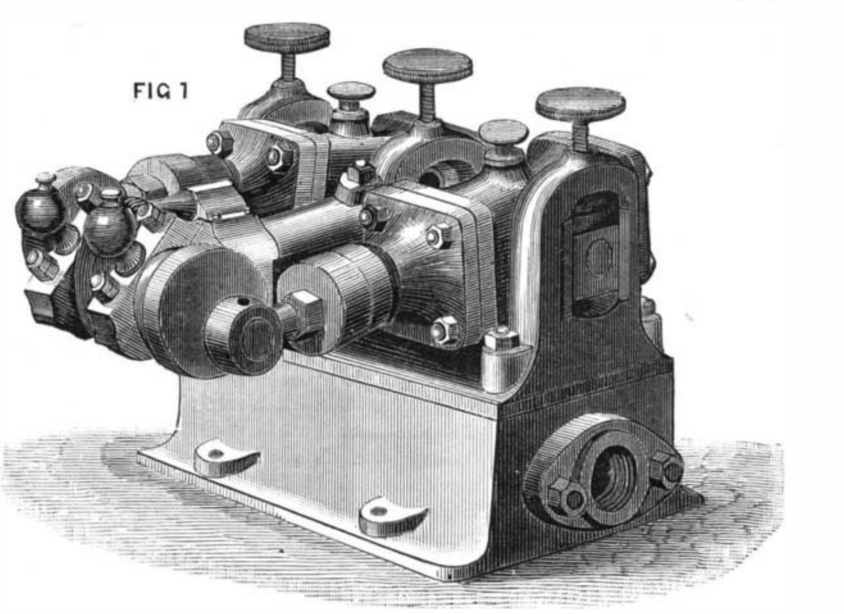
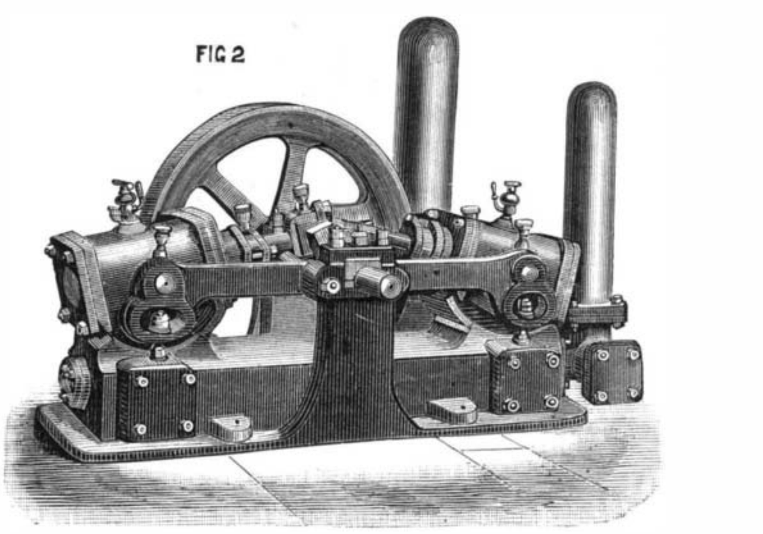


FIG 2



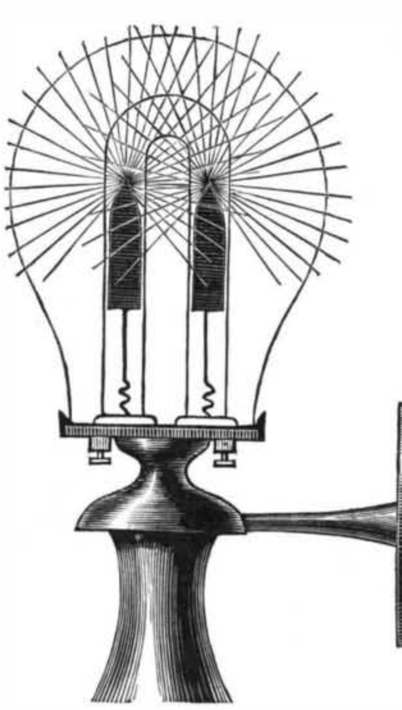
NEW HYDRAULIC MOTOR.

Another Mountain Railroad.

A railway up Vesuvius is to be constructed within the next few months, if the threatened eruption does not interfere with the present plans. A London contemporary states that there will be a double line of rails laid on an iron framework, supported by iron pillars, on which will run eight small carriages, drawn by a wire rope instead of the usual locomotive, and so arranged that four will be making the ascent as the four others descend. These carriages will hold four persons apiece, and will be kept some two hundred yards apart, while strong automatic brakes are to be fitted, so as to stop the carriages immediately if the rope should break. The line will be somewhat over half a mile long, and the gradients very steep—1 in 2.

BURNER FOR ELECTRIC LIGHT.

The annexed engraving shows a sketch of a new burner for the electric light. It consists of a glass tube, one half inch inside and about ten inches long, which is bent to the



FAHRIG'S BURNER FOR ELECTRIC LIGHT.

shape shown, both arms as close as possible together. A small hole is drilled in the top of the bent tube to insert two pieces of wire, No. 30 platinum. Length of platinum wire one inch and three quarters inside each arm of the tube. Two carbon pencils, well fitted to the tube and one inch and a half long, connected on the flat end to a copper wire of No. 12 thickness, are now inserted into the tubes, the points toward the platinum wires, leaving one quarter inch space between the carbon points and the ends of wires. The tube is now warmed, and the air expelled, and quickly sealed and cemented with any fire resisting cement. The two platinum wires are one pole, the two carbon wires the other pole, to be attached to the battery or magneto-machine power. The light so obtained is very brilliant, steady, and clear, having many advantages over the two-point carbon burner, and dispenses with the costly regulator. How far the success of the new burner can be estimated is not known, and must be proved by longer experiments; but as at present it is worthy of adoption and improving in this direction. A bell-shaped globe is better than a round one.—*F. E. Fahrig, in English Mechanic.*

Preservation of Iron.

In 1877 Professor Barff, of London, first reported on some experiments made by him in regard to bronzing iron by the action of steam. The metal is by the process covered with a layer of magnetic oxide, adhering firmly and affording protection against the influences of the atmosphere.

According to M. Krafft, C. E., in *Annales des Ponts*, etc., M. Bourdon, captain of artillery, stationed at the government factories at Tulle, France, has now tried a similar process to bronze all kinds of arms. He inclosed the articles to be bronzed in a cylinder closed at both ends by riveted plates, into one of which the steam supply pipe ended, while the other was supplied with three openings. Into one of the latter a thermometer was fitted; the second one is supplied with a stopcock through which to allow the water condensed to run off. This must be done frequently, as the steam must be as dry as possible. The third opening is taken up by an escape valve for the steam.

The most favorable conditions for success are the following: The pressure must amount to two or two and a half atmospheres, the temperature must be from 330° to 340° C., and five hours of time must be allowed for the completion of the operation. Thus a covering of a greenish black color is obtained which adheres firmly and is perfectly stable.

It must be remarked that the cylinder is placed in a sort of oven, maintaining its shell at 500° C. The thermometer plunged in the steam of the interior with its registered part protruding so as to allow observations, however, only showed 340°. If the current of steam is stopped, the thermometer will almost instantly rise to 500°.

The bronzing was thus a perfect success; care must, however, be taken that no parts of the articles are soldered together by tin solder, as the latter melts at 228° C. Even if the connection remains intact, there will always be a few minute globules of solder detached and stains caused. Copper must be used instead.

In further following up his experiments, Captain Bourdon conceived the idea of replacing the steam by hot air. He proceeded as follows: A coil of pipe communicating at one end with the open air ascends gradually through a reservoir heated to 120° C., from whence it enters the cylinder in which the articles to be operated upon are inclosed. This cylinder is identical with that used for steam. The escape valve leads into a tank with water, permitting a better regulation of the air current. This must pass very slowly. The interior pressure is but a little above one atmosphere, as the apparatus communicates with the open air.

The temperature of the air in the cylinder is 280° C.; the time consumed, five hours. A layer of 0·05mm. thickness was obtained, resisting the action of 00 emery paper and left unaffected by diluted sulphuric acid. The layer possessed a fine greenish black color.

To insure perfect success the articles must be suspended perfectly free. After removing them from the apparatus they are rubbed with a greasy cloth; stains, if any should be present, are removed with emery paper or iron dust.

It has been found that with an elevation of temperature under pressure of one atmosphere a very thick layer is obtained, which, however, scales off easily. The adherence is, therefore, a question of temperature and not of pressure, as was formerly supposed.

Those pieces bronzed by hot air were for one month exposed to the weather without being attacked in the least. On removal of the exterior black rind a gray layer is discovered below the same, which to some extent becomes rusty on exposure. The rust, however, does not adhere as on metallic iron, but is easily removed by scraping with a piece of wood. This fact also applies to articles bronzed by steam.

It will be seen that bronzing by air is applicable to industrial purposes; for instance, to the preservation of the interior surface of marine boilers, steam pipes, etc.

Last June Captain Bourdon tried the process on 400 rifle barrels at once. Similar trials have since been made, showing the practicability of using it on a large scale. The principal point is to obtain a current of air sufficiently abundant to secure a proper thickness of the layer, but of a circulation slow enough to allow the air to act on the iron. The French Government has already adopted the process at some of its arsenal manufactories; for instance, at St. Etienne and Chatelerault.

GUTTA PERCHA cuttings are very useful for the laboratory. By dissolving them in benzole and adding a little carmine or any other pigment, a solution is obtained which when brushed on the cork and neck of a bottle forms a tight fitting cap, impenetrable to air, dampness, alcohol and acids, and can be taken off without difficulty.—*Deutsche Photographen Zeitung.*