

A Cause of Boiler Explosions.

According to M. Treves, some occasionally mysterious explosions of steam boilers, when apparently in good structural and working order, may be thus explained: Supposing that work is to be suspended either for the night or for any long interval, after a stated hour, and that a boiler is commonly driven under an average pressure of 80 pounds or 90 pounds of steam; some time before the hour of closing, the stoker lets his fire slacken, fills up the boiler, and leaves off with perhaps 50 pounds or 60 pounds on the gauge. Next morning, or after the interval, he finds the pressure gauge standing at 20 pounds or 30 pounds, with a good supply of water. Consequently, in order to save the heat stored in the boiler, he begins to fire up, without thinking of the danger which may lurk in the water that has been boiling all night. The stoker never thinks of putting in more water, because the gauge is all right, and thus prepares the essential preliminaries of a "mysterious" explosion.

The water that has been standing above the boiling point for hours has lost its power of ebullition, because the air which it formerly contained has long been driven off; and in this dead condition it is capable of absorbing heat without the power of delivering it up in the form of steam. The water thus becomes superheated, and at the moment of any mechanical agitation—such as the opening of the steam valve, or the introduction of fresh water—it may instantaneously flash into steam with explosive force. It has been abundantly proved that, apart from gross defects of construction, condition, or management, superheating of the water has of late years been the only intelligible cause of the greater number of boiler explosions. The remedy for this danger is fortunately simple, and resides in the employment of any effective means for preventing the "sleep" of water in boilers by keeping up a constant ebullition.

A good device for this purpose is to prolong the water feed pipe by a T; the horizontal branch being about 6 inches above the bottom of the boiler. The under part of this tube is to be provided with open conical nipples ranged along the whole length of the pipe, which will extend from end to end of the boiler. Before firing up, therefore, the stoker should force air through the feed pipe so fitted until a pressure gauge on the pump shows a higher reading than the quiescent steam gauge. The nipples are then full of air, and ready to act as the generating centers of ebullition, whereupon the fire may be pushed as briskly as desired without risk of explosion. This suggestion emanates from MM. Donny and Gernez, and is recommended by M. Treves as an economical embodiment of a universally accepted theory.

A QUADRICYCLE FOR LAND AND WATER.

The accompanying engraving represents an ingenious vehicle for traveling by land or water, recently patented by Mr. H. S. Blanchard, of Cairo, Ill. The inventor has chosen the form of a swan as being the most graceful and appropriate for the purpose, although he does not confine himself to that form. A light frame work of wood or iron is covered with sheet metal, waterproof canvas, or other material. From the body of the vessel arises a standard supporting an awning which, by means of adjustable guys and a ball and socket joint, may be fixed at any angle to be used either as a shelter from the sun or storm, or as a sail.

But the principal means of propulsion are paddles and rotating floats worked by the feet of the rider, who sits on a seat forming a part of the steering lever or helm. From near the top of the standard, curved arms project outside of the vessel, having suspended and supported on the water ellipsoidal floats which steady the vessel on the water and aid in supporting it on the land. As a protection from injury the floats may be surrounded with wire netting, as shown in the engraving. These floats, as well as the vessel itself, are filled with cases of cork or other buoyant material to insure floating even if the outer case is injured.

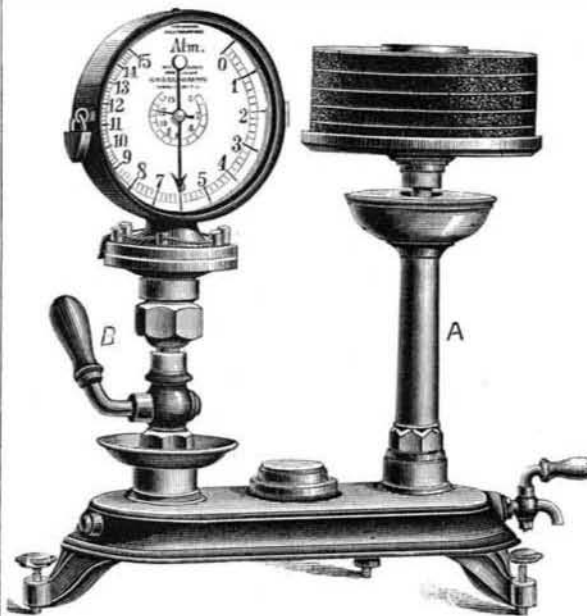
Propulsion is secured by the action of hinged floats connected with a platform treadle which carries cone floats, to the rear ends of which the operating paddles are hinged. As the platform is rocked is one direction the cones are advanced forward, the paddles floating horizontally. By the reverse motion the paddles turn against the broad ends of the cones and present their surfaces to the water. A double crank shaft may also be connected with the foot platform and treadle, so as to rotate floats at either side of the vessel as another means of propulsion.

If the vessel is to be moved on land the buoys may serve as supports and as wheels; or the outer ones may be removed and those connected with the crank shaft be used as a means of propulsion, the buoy in front being used as a guide wheel.

A RAILROAD was opened last month between Tiflis, the capital of Transcaucasia, and Baku, one of the ports on the Caspian Sea. It is intended to connect this last with the Black Sea. This road reduces communication from five days to fifteen hours between Tiflis and Baku. It is the greatest commercial achievement yet of Alexander III.'s reign.

PRESSURE GAUGE TESTING APPARATUS.

The use of standard pressure gauges and pumps for testing and adjusting other gauges and dividing the dials exactly has several inconveniences. Pumps are difficult to keep in good order and to start, if they have been for some time out of use. The standard spring gauges employed for controlling others may become incorrect, and often indicate different pressures when two of them are placed beside each other on the same pipe. Mercurial gauges are certainly the most accurate instruments for measuring pressures, but can-

**PRESSURE GAUGE TESTING APPARATUS.**

not be used for high pressures on account of their very great height. They have become already inconvenient for the present medium pressures, without taking into account that the friction of the mercury, which increases with the pressure, necessitates a calculation in order to obtain the correct indications. These inconveniences have led Mr. Ruchholz to design the testing apparatus represented by the illustration with a view to remedy them. One person is sufficient to work it at any time, while the space occupied is small, and the employment of a standard pressure gauge for the purpose of comparison is avoided, the pressure on the spring of the gauge to be tested being produced by dead weights acting through the medium of a suitable liquid, such as pure glycerine.

The apparatus consists of a base which contains a pipe

**BLANCHARD'S QUADRICYCLE.**

that connects the two uprights which rise from it, and are also hollow. A is a cylinder bored true internally and receiving a steel piston ground to fit. The cock, B, is threaded to receive the gauge to be tested.

The piston carries a tray, on which weights can be placed, and is so proportioned that a pressure of one atmosphere per square inch is given by the piston itself, while each weight represents an additional atmosphere. When used the apparatus is placed upon a firm table and adjusted by the set screws in its feet till the cylinder occupies a perfectly vertical position, which is indicated by the

spirit level fixed upon the middle of the base plate. After taking the piston out, glycerine is poured into the cylinder till the liquid flows out of the upper end of the cock, which is left open, when the gauge to be tested is screwed on, and a further certain quantity of glycerine poured into the cylinder. The apparatus having been thus filled, the piston, which must be kept perfectly clean, is inserted into the cylinder. The pointer of the gauge must then indicate one atmosphere, and maintain its position while the piston is lightly rotated, this rotation being necessary in order to annul the slight friction of the glycerine against the inclosing surfaces. The weights are then gently placed upon the tray, and the latter is each time rotated in order to obtain the exact position of the pointer.

If the piston should come in contact with the bottom of the cylinder after a certain time, or before the desired pressure is obtained, the cock, B, is closed in order to keep the gauge at the pressure prevailing at the time. The weights and piston are then drawn out so that a further sufficient supply of glycerine can be poured into the cylinder. When this is done, the piston is reinserted, and the same number of weights placed on the tray as when the cock was closed. The latter is then opened, and further weights may be placed on the piston. In this way very high pressures can be obtained.

When the testing or dividing of the dial is finished the disks are gradually removed and the piston withdrawn, and when the pointer has arrived at zero the cock is closed and the gauge unscrewed. The glycerine is finally drawn off by means of a small tap placed at one end of the base plate.

Colored Varnishes for Tin.

The *Gewerbeblatt* gives the following: Thirty grammes of acetate of copper are ground to a fine powder in a mortar, then spread out in a thin layer on a porcelain plate and left for a few days in a moderately warm place. By this time the water of crystallization and most of the acetic acid will have escaped. The light brown powder that is left is triturated with some oil of turpentine in a mortar and then stirred into 100 grammes of fine fatty copal varnish warmed to 60° R. (16.7° F.). If the acetate of copper was exceedingly fine, the greater part of it will dissolve by a quarter hour's stirring. The varnish is then put in a glass (bottle) and placed for a few days in a warm place, shaking frequently. The small quantity of acetate of copper that settles can be used in making the next lot.

This varnish is dark green, but when applied to tin it requires four or five coats to get a fine green luster; but two coats are sufficient, if it is heated in a drying closet or on a uniformly heated plate, to produce a great variety of shades of gold. A greenish gold, a yellow or dark yellow gold, then an orange, and finally a reddish brown shade is obtained according to the time and temperature. The colors are superior in brilliancy to those obtained with the English gold varnish, and have the advantage of permanency in the light. If a good copal varnish is used in making this polychromatic varnish, or lac, the tin can be hammered or pressed.

The production of golden colors depends on the reduction of cupric oxide to cuprous oxide (protoxide to suboxide), which, in small quantity, dissolves in the copal varnish with a golden color. The more the heat the greater the reduction, and hence the darker the color. Success depends on applying it evenly and warming uniformly.

Time by Telegraph.

Mr. James Hamblet, Manager of the Telegraphic Time Service in connection with the Western Union Telegraph Company of this city, has patented an improved method of synchronizing clocks, and he is now prepared to furnish clocks with the apparatus included, and correct them each and every hour by signals from the standard clock of the Time Service, from which the signals are transmitted to all the principal watch makers and others in this city.

The problem of correcting clocks throughout cities and towns by electricity has been heretofore supposed to be unattainable; by Mr. Hamblet's system, with a good clock at a central station, provided with the proper mechanism to send a single beat not to exceed one second in duration, exactly at the beginning of each hour, and inexpensive clocks located in places within convenient reach of a local system of telegraph wires, a successful distribution of uniform time may easily and cheaply be maintained.

The clocks that are used for this purpose may independently be regulated to run within a minute or two in a week, and when we remember that the clocks are corrected each hour, making 168 parts into which the two minutes are divided, it will be seen that correct time can easily be assured.

For some time past we have had in operation in the SCIENTIFIC AMERICAN office one of Mr. Hamblet's clocks, which is connected by telegraph as above indicated, and the improvement gives us much satisfaction.

The Italians propose to have a world's fair of their own next year in Rome.