

permitted to fall below the top of the opening in the tail rod, when the piston must be refilled at once. A great drawback incident to the use of some hydro-pneumatic tools, is thus entirely eliminated. In the construction of some parts, an alloy of aluminum is used to secure lightness.



### FOR THE STEAM ENGINEER.

The Montupet water-tube boilers have been subjected to tests on French warships. It is found that the tubes can be very quickly removed and replaced. In one of the trials, which lasted four hours, the fires were reduced, the steam pressure lessened, the boilers emptied, and a tube removed—all in the space of 15 minutes. The tube was then replaced and the steam pressure immediately restored. The total interruption to the proper working of the boiler lasted 40 minutes, and of this only eight to ten minutes were employed in removing and replacing the tube. Later, when the fires were out and the boiler had cooled, 32 tubes were removed in one hour and twenty minutes. All the tubes were found to be in good condition.

The use of zinc to prevent the oxidation of the iron and the incrustation in steam boilers has greatly increased during recent years. Heretofore, zinc has been employed for this purpose only in the shape of raw pigs, but after many experiments made by the society of "Mines et Fonderies de Zinc de la Vieille Montagne," which have since been confirmed by the British Admiralty, by the national French marine, and many great maritime companies, it has been established that compressed laminated zinc made in the form of thick plates for application as an inside boiler lining is greatly superior to the old method. In fact, the galvanic current developed transforms the pig of raw zinc into a more porous substance, in which the metallic molecules are insulated one from the other by the corrosion which is quickly produced, resulting in this, that the intimate metallic contact, which causes the generation of the electric current, is eliminated. Compressed laminated zinc, on the contrary, resists the spongy internal corrosion, as it corrodes only on the surface, thus being very slowly consumed and being capable of conducting the current as long as a metallic nucleus remains. The application of the laminated plates is very simple. They are applied to the walls of the boilers by means of strips and are so distributed that the galvanic action is exercised in an even way, when possible, over the entire surface of the iron. When oxidation is produced in any part of the boiler, it is because the nearest zinc plate is too far away. By this employment of pressed zinc the incrustation of the boilers is avoided, and at small cost.

The methods of disposing of city refuse are costly and wasteful. There is an immense amount of power in the refuse which might be turned to account if proper methods were employed. In Great Britain, by the use of what are called destructors, the stuff is converted into fuel at such a high temperature that no gases escape to infect the surrounding air, and everything is consumed but a small residuum that has in some cases been used as a filtering material. The temperature is carried as high as 2,000 degrees Fahrenheit. The bulk of the fuel is the refuse itself, and the heat is converted into power, just as coal might be, to run pumping engines and electrical plants for lighting and traction. These destructors are of various types and their use is rapidly extending.

It is the custom of some engineers to shut all of the valves in their plants at night, while others only close those that are absolutely necessary. Some close all valves on their lubricators, others only shut off the supply of oil. Both think they are right, but the one who shuts all never regrets his action, while he who does not sometimes finds a glass broken, and damage done by hot oil thrown around promiscuously. One experience of this kind usually is sufficient to show him the error of his ways. The same difference in practice is found about shutting off water columns when leaving them at night, for while one engineer will carefully shut them off every night, another leaves them just as they are used. After a man has come into his boiler room in the morning and found that a broken gauge glass has

allowed water and steam to be blown into it during the greater part of the night, he usually decides that it is a good plan to shut the valves before he goes away. This certainly is the safest way, and the only objection to it that we have heard of is that he may forget to open them in the morning and find out where his water-level is.

As a rule, the cross compound engine is more desirable than the tandem where uniform speed is essential because it has two cranks set at right angles, therefore the force is supplied to the crank shaft in a nearly uniform manner, which prevents the changes which are inseparable from a tandem compound or a simple engine, where the whole of it is applied to one crank.

### WHAT CONSTITUTES A GOOD BOILER FURNACE?

In order to burn the fuel as most firemen like to see it burn, the total air space of the grate must be as large as possible, while the metal is reduced to the smallest size consistent with ample strength. The surface of the grate will be smooth, offering no obstructions to the use of the slice bar and rake. A furnace in which a long time is required for the perfect combustion of the fuel will be made larger, as well as the combustion chamber and flue. Where a high temperature is desired, sufficient air must be supplied, and to realize this, both time and space become important factors if thorough combustion is had. The walls of the furnace will have very few openings, such as doors and vents, because every break in the solid wall increases the tendency toward cracks, which can seldom be avoided entirely, and which cause air leaks that interfere with economy. The walls will be built double with an air space of ample size between them, so that any air that may leak through the outer half of the wall will become more or less heated before reaching the furnace, and will thus tend to aid rather than hinder combustion. The furnace will be lined with a quality of fire-brick combining great refractory power with hardness, and a degree of toughness sufficient to resist the abrasion due to the fire tools and the clinker. The lining of fire-brick will extend from two to four feet beyond the bridge wall, depending upon the size of the boiler and furnace, beyond which ordinary brick will be used. The walls will be firmly held together by suitable anchor bolts because neither fire-clay nor mortar is entirely reliable for binding the brick together and especially when subjected to the high temperatures of the furnace. All joints between the boiler and the walls will be kept tight—as nearly air tight as possible—by means of a properly built wall and suitable filling material between the constantly moving shell and the walls, and lastly, the space back of the bridge-wall and the floor of the ashpit will be paved, which not only makes the furnace work better, but enables the fireman to work better also.



### THE HOT WATER METER FOR BOILER EVAPORATIVE TESTS.

BY JOHN A. DREW.

Every engineer, who has control of a boiler plant, must feel the necessity of having some simple device by which the amount of water fed to the boiler can be accurately measured. With such an appliance, it is easy to test the evaporative values of various coals.

There was a time when it was not necessary to keep a close record of the cost of operation of large power plants, but now the ever-increasing competition and the necessity of lowering the cost of production demand the very closest scrutiny into every possible source of economy. With the introduction of electricity and the consequent installation of large central power stations, and in large manufacturing establishments, where the cost of power is an important item in cost of the product, a very careful record should be kept of the performance of the boiler plant, and there are but few, if any, plants to-day that do not keep a close record of the coal consumption. But while this is valuable information in itself, it is only part of the data that should be obtained. If the amount of water evaporated is not known, there is no way of separating the performance of the boiler