

and blowing off until leaving two solid gauges. This valve, and its connection up to the boiler, should be carefully inspected every week; and it should be placed where it will not be damaged from the strongest part of the flame—say at any spot most convenient between the middle and back end of the boiler—where any sediment left after blowing off, will not injure the shell, as it would do if placed where the flame is strongest.

#### Stop or Steam Valve.

The stop valve is generally placed near the middle of the boiler, and if on a steam dome (or drum) so much the better. The modern globe form of valve is that most generally used both for this, the blow-off, and surface blow-off valves.

#### Surface Blow-Off Valve.

The surface blow-off valve should be used once in every hour, unless where the water is very pure and every way suitable for making steam. In cases where the water is muddy, frequent blowing off at the surface, besides lessening the deposit in the boiler, prevents foaming.

#### Getting up Steam.

In getting up steam in a boiler for the first time there is in most cases a good deal of trouble from the boiler foaming, sometimes in consequence of impurities in the water, but oftener with a new or newly repaired boiler from the oil that has been used by the boilermaker, inside the boiler, or from some other greasy matter on the tubes or plates.

To get over this difficulty, when very bad, it is advisable not to attempt to run the engine for any other purpose than working the pump, until it is stopped, which can be done by moving in the ball on the lever of the safety valve as far as it will go, and arranging the lever so that it will not rise more than four inches at the outer end at the most, and keep the pump at the boiler until the foaming ceases, which will in a new boiler probably continue for half a day. In filling the boiler it should have three solid gauges, and this should be ascertained by the party himself, to whom the attendant is responsible, by trying the gauges before the fire is started. We have known of several cases in which the boiler was fired up without any water in it, thereby damaging both the shell and the tubes.

#### Donkey Engines.

A donkey engine or steam pump is a very useful auxiliary to the pump attached to or in connection with the engine, for the purpose of putting water in the boiler when the engine is at rest, as may be required; and also to use in the event of the other pump getting deranged, which is a common occur-

rence, and the cause of much loss of time. The pump being the next thing in importance to the safety valve, requires close attention, from chips or other substances getting stuck in the valve seats, and causing the covers to be taken off to get them cleared out. It sometimes occurs that there will be no water found in the suction branch at all, when tried at the pet-cock, causing much annoyance; and when the cause has been found out, it may be a frog or a fish has been drawn in and stuck in one of the elbows of the pipe, showing the necessity of having a fine strainer on the mouth of the suction pipe. The proper way is to pump first up into a cistern ten feet or so above the engine or donkey pump, and have a fine strainer both before entering and before leaving the cistern. Numerous casualties can be traced to the defective state of the pump, it having become deranged while the attendant supposed all was right, and consequently neglected too long to see to its condition—some other more trifling matter probably having occupied his attention at the time. When the damage is done, the usual report first put out is, "Plenty of water in the boiler; he had tried the gauge cocks a short time before, when there were nearly two gauges."

#### Cleaning the Boilers.

When the boiler is to be cleaned, the first thing to be done is to draw out the fire; then to take the pressure gradually off the boiler by moving in the ball on the lever, finally tying up the lever, and then lifting the dampers. Three or four hours after this, take off the manhole cover, and run out the water. The boiler will be cool enough next morning for getting inside. The cleaning should be done every week in some localities (this, however, depends somewhat on the water used for steam, and the number of hours the engine is at work during the day); in other situations, once in two weeks; but never to exceed a month without cleaning, even with the best water—although in some places it is not done oftener than once in three months; but this is a bad and slovenly practice, and soon wears out the boiler by its getting burned below, from the mud laying on the opposite side of the plate. Even with good water for steam, the boiler should be cleaned at the end of every two weeks. "If it requires little, it will be the easier done;" and as every boiler should be inspected at the end of two weeks, the cleaning is necessary to get this done. The cleaning should be performed as follows: There must be at command a plentiful supply of water, under a good pressure. If in a city, this can be obtained from the water works, and in the most unfavorable localities a small hand fire engine is amply sufficient for this purpose.