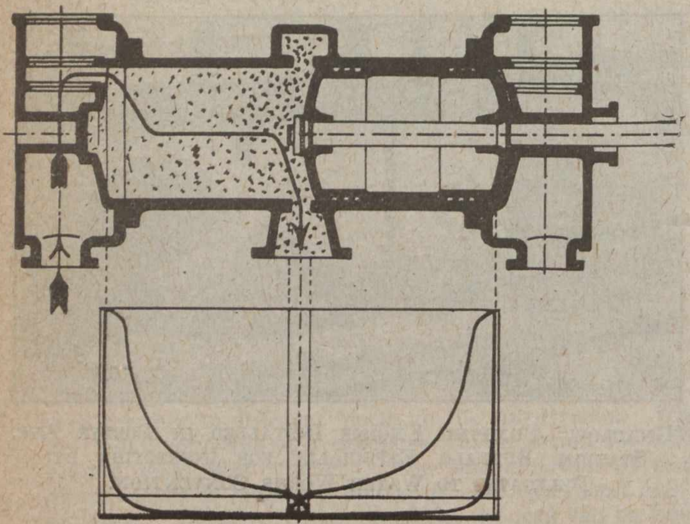
steam remaining in the clearance is heated by compression to a temperature above the temperature of the initial steam; when the valve is opened to start the next stroke the live steam rushing in goes into a clearance space in which the steam entrapped is hotter than the entering steam, hence no initial condensation. Owing to the complete removal of all of the mixture on each stroke, the well-known heat losses caused by the presence of water in counter-flow engines are avoided.

Eliminating initial condensation permits an economical high ratio of expansion in one cylinder. For normal working conditions about sixteen expansions have been found to give best results.

It is also evident with the use of exhaust ports in the cylinder instead of the usual exhaust valves, leakage losses at the exhaust valves and all of the added clearance space and surfaces which necessarily follow from the use of a special exhaust valve, are eliminated. It has been found practical to reduce the clearance space in condensing engines to three per cent. of the swept volume of the piston.

Some of our manufacturers of "Unaflow" steam power engines have guaranteed as low as ten pounds of steam per indicated horse-power per hour, and some of the tests of European built engines have shown well under nine pounds.



Typical "Unaflow" Steam Cylinder and Indicator Cards

Taking into consideration its simplicity, for with a single cylinder substantially the same economy is obtained as with the best types of compound or triple expansion steam engines, the "Unaflow" engine marks a distinct step in advance of the other types of reciprocating engines.

The advantageous features have attracted attention to its desirability as a motive power for reciprocating pumping engines.

To develop a pump that could be combined with and utilize the advantageous features of the "Unaflow" engine requires that due consideration be given to proper channels for passing the desired amount of water to and through the pump with the least practicable amount of deflection and disturbance of the flow. This can be attained by incorporating the "Unaflow" principle in so far as it will apply to a pump. The pump should be provided with passages ample and direct so there will be no reversal of flow, with plungers properly proportioned and formed to cause a minimum disturbance, with suitable suction and discharge air chambers properly located with pump valves that will deflect the direction of flow as little as possible, that will operate quickly and quietly at all pressures and economic speeds of the engine, and furthermore, that will be durable and lasting in operation.

The engine illustrated is of the horizontal extended type (so-called), having one steam cylinder and one double acting plunger pump; its normal working water pressure is 100 pounds per square inch; the suction lift is approximately fifteen feet plus the friction in about sixty feet of suction pipe; these are not particularly favorable working conditions, rather the reverse; it (the engine) may be duplex or triplex which would double or triple its capacity, it also may be of the opposed or interposed types, horizontal or vertical.

The normal steam pressure at the Porter Avenue Station is 325 pounds per square inch with 100 degrees Fah. superheat.

The outstanding features of the "Unaflow" pumping engine are:—

Simplicity of construction; low cost of production as compared with compound and triple expansion reciprocating pumping engines; high duty or economy in the use of steam, not only in the large, but in the small units. For instance, the three million gallon unit above mentioned is expected to develop a duty of one hundred and eighty million foot pounds per 1,000 pounds of steam, and to maintain this duty more nearly under variable loads than any other known type.

FLANGES FOR LIGHT CAST IRON PIPE*

By John Knickerbocker
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THE question of flanges for light cast-iron pipe has come up for discussion at different times, but up to now no final action has been taken.

The American Society of Mechanical Engineers, at its meeting December 3rd to 6th, 1918, received a report from its committee on light flanges, in which report a "Proposed Low-Pressure Standard for End Flanges, Bolting and Body Thicknesses, 50 lb. Working Pressure," is given.

The flanges proposed for 50 pounds working pressure by the American Society of Mechanical Engineers are of the same thicknesses and diameters and have the same diameters of bolt circles, and the same number of bolts, as the American standard flanges for 125 pounds steam working pressure; but the bolts are of smaller diameters than the sizes used in the American standard flanges for 125 pounds steam working pressure.

The American standard for flanges for 125 pounds working pressure became effective January 1st, 1914, through the recommendation of the American Society of Mechanical Engineers.

It is surely desirable to arrive at some standard or standards as soon as possible for light flanges, provided the standard or standards would meet with the approval of the engineers, the users and the manufacturers of cast-iron pipe, valves and fittings.

It is a serious question whether the standard flange suggested by the American Society of Mechanical Engineers for pipe for 50 pounds working pressure is not too heavy and will not cause casting strains and shrinkage where the flange meets the pipe.

Take for example the 30-in. pipe. The class A, American Water Works Association pipe measures 88/100 in. thick. Would it be good foundry practice to cast a flange measuring 2⅛ in. thick to this thin pipe, and if the pipe were increased in thickness about ⅛ in. to 1 in. thick, the thickness proposed by the American Society of Mechanical Engineers for 50 pounds working pressure, would not the flanges 2⅛ in. thick be too heavy for the pipe?

The American Gas Institute pipe thickness for 30-in. pipe is 85/100 in. Taking the inside diameter of the flange at 31.7 ins. on this 30-in. pipe, as 31.7 ins. is the outside diameter of the pipe, the weight of the American Gas Institute flange is 102.4 pounds and the flange proposed by the American Society of Mechanical Engineers for light pipe is 215.5 pounds, which is over twice as much as the American Gas Institute 30-in. flange. If the American Gas Institute flange is heavy enough for class A pipe, then for each

*Paper read at the 39th Annual Convention of American Water Works Association, June 9th to 13th, at Buffalo, N.Y.