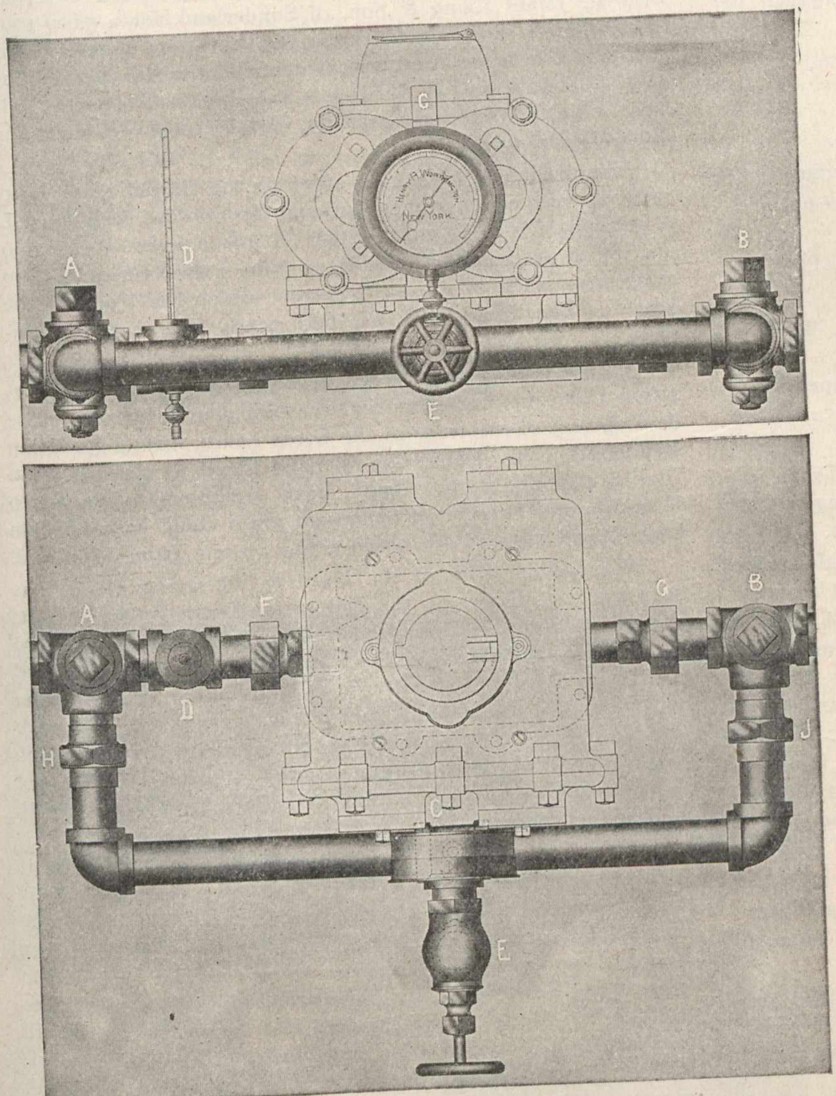
itself from the balance of the plant. This separation shows when the boiler is affected by scale or soot, and determines the most economical fuel, as well as the best method of firing, either by hand or by mechanical stokers. In the past, the customary method of determining the amount of boiler feed water has been by weighing or measuring it. This is a very laborious method, even for short tests, and is utterly impracticable for daily work. The use of the feed water meter, on account of its simplicity, accuracy and reliability in evaporative tests, is now adopted by engineers for daily work, as well as for trial tests.

The most reliable test meters are of the positive displacement type, the duplex pattern of which measures water by means of two chambers alternately filled and emptied by the motion of their pistons. These meters are so constructed that it is impossible to pass water without a corresponding registration, for in order to pass through the meter, the water must be displaced by the motion of the pistons and therefore recorded by the counter attachment. The pistons are closely fitted and move in parallel lines. The design, arrangement and construction of valves and parts is such that the strokes of the two pistons alternate, the valves actuated by one admitting pressure to the other. At end of each motion, the pistons are brought to rest by adjustable buffers which determine the length of the stroke. One of



the pistons is constantly in motion, giving uniform flow of water, free from pulsation or shock. The meters are perfectly noiseless in their performance. These test meters are designed and constructed of materials uniformly affected by expansion and contraction from varying of temperatures, thus further assuring their accuracy as measuring devices.

For an ordinary test, one of these meters was calibrated. By deducting the weight of water, as found by the meter registration from the actual tank weight, the figures showed the meter to be correct to within one-fifth of one per cent. To obtain correct results, these tests meters should be properly applied for operation, the size selected should be ample for the service, insuring slow piston speed, and pipe connection should be made so that at any time the meter can be cut out for examination or repairs without shutting down the boilers.

The accompanying cut shows the plan and elevation of a test meter, by Henry R. Worthington, New York.

A and B are three-way cocks to pass water through the meter and to the boiler, or, for calibration, to allow water to pass by the angle valve "E" to a tank placed on scales for weighing. By this arrangement it is possible to test the meter as frequently as desired. By setting the cocks "A" and "B," and breaking the couplings, "F" and "C," the meter may be removed without interrupting the operation of the boiler plant in any way. "C" is a gauge for indicating pressure; "D" is a thermometer for indicating the temperature of the water; "H" and "J" are pipe couplings. These connections should all be made of brass.

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MACHINE SHOP NOTES FROM THE UNITED STATES.

BY CHAS. S. GINGRICH, M.E.

The writer had an opportunity recently to visit some of the large machine shops in the States and found some very interesting things in the manner in which the work was being done and the rate at which they were doing it. One of the greatest surprises was the milling machine.

The great volume of business that has been coming to machine shops, during the past few years, has been the means of bringing about a more thorough investigation of cost reducing methods than has ever taken place heretofore, and has resulted in the re-designing of machine tools. Space does not permit of going into the details of all the new tools, and we will confine ourselves to the milling machines which we saw and which are doing work in about one-half the time formerly required to do the same work on shapers and small planers. Among the improvements that were made, the most noticeable was the method of driving the feed. The feed belt and feed cones have been superseded by mechanisms which transmit power from the spindle to the table of the machine entirely through gearing. The result is, that there is absolutely no slippage between the spindle and the table of the machine, and instead of limiting the rate of feed to suit the efficiency of the feed belt, these machines are now worked up to the limit of the main driving belt. The result is, that heavier and faster cuts are being taken than were before dreamed possible.

An illustration is here given of one of the Cincinnati Milling Machine Co.'s machines in operation, surfacing cast iron pieces 8¼ in. wide. In manufacturing these pieces it is necessary to take a first roughing cut, and then a finishing cut; whether the work is done on a planer or a miller; and it is, therefore, considered good practice to take the roughing cut by the fastest means possible. It is this roughing cut that is shown in the illustration. The cutter is 4½-in. in diameter, and is of the inserted tooth variety. It takes a cut about ⅛-inch deep so as to get under the scale, and this work, 8¼-in. wide, is actually fed past the cutter at the rate of 8⅛-in. per minute. It might be also of interest to note here that the teeth of the cutter are made of ordinary carbon steel. The writer has data in hand of a similar piece of work having been done on this machine with a cutter having teeth made of "Novo" steel, in which case the rate of feed was 10½-in. per minute. The pieces were finished on this same machine, feeding about 1½-in. per minute, and producing a highly finished surface. We had the privilege of seeing the pieces after the roughing cut had been taken, and were surprised to note that although they were done at the remarkable rate above mentioned, the surface was one