PRACTICAL MECHANISM.

NUMBER X.

BY JOSHUA ROSE.

FITTING CYLINDERS.

To fit the cylinder cover joint, put marking on the joint face of the cover; put the cover into its place on the cylinder face; then, in order to discover how much the faces are out of true, strike the outside of the cover on one side of its diameter, and then the other, alternately, with the hands; and if the faces at any point are open, they will strike each other with a blow, the sound of which will clearly indicate to what extent they are out of true: if much, the cover may be removed and the high parts rough filed to the extent the judgment may indicate; if, however, when the cover is struck, the faces give no sound of striking, smooth filing will answer. When the faces mark nearly all over, the high spots may be eased with the scraper until the surfaces are sufficiently close that a light coating of marking will mark them allover, when they may be ground together as follows: Place on the cylinder face grain emery and oil, and then put the cover on. Fasten to the cover a lever, and then place sufficient weight upon the cover to leave it capable of being conveniently moved by means of the lever (which should project on both sides of the cover). The cover must not be revolved all in one direction, or the emery will cut grooves in the face, but must be moved back and forth while it is being revolved. When the grinding has proceeded until the cover moves smoothly upon the cylinder face, indicating that the emery has worn down and worked out (as it will do) from between the faces, the cover may be removed; and if the grinding appears equal and of one shade of color all over the faces, the emery may be wiped off them, and the cover replaced and revolved back and forth as before, which will cause the faces to polish each other, removing all traces of the emery, and showing plainly the slightest defect in the surfaces. If, however, the first grinding is not sufficient (as is generally the case), oil and emery must be again supplied, and the grinding continued as in the first instance. The cover of an 18 inch cylinder, even if it is much out, may be made of a steamtight fit by this process in about half an hour.

It is obvious that, in the case of a large cylinder cover, such as are used for marine purposes, the hand will not strike a sufficient blow to indicate how much the faces, before fitting, are out of true, and a block of wood and a hammer must be employed instead.

The next operation is to cut out the cylinder ports to their requisite dimensions.

In facing up the valve faces, the surface plate may, in like manner, be struck on its opposite corners, or a pressure may be placed on them by the hands to ascertain if the surface plate will rock, and to what extent. If it rocks at all, a rough file should be employed to file away the high parts of the face; if it does not rock, a smooth file should be employed to take out the tool marks, the filing being continued until a light coat of marking on the surface plate will mark the cylinder face all over, when the scraper may be applied to finish it. The slide valve itself may then be surfaced and scraped to the surface plate, and then placed upon the cylinder face, and the valve and cylinder face scraped together.

The joint of the steam chest may be made by filing the planed surfaces to a straight edge, and placing between the chest, and its seat, on the one hand, and the cover and the chest, on the other hand, a lining of very thin softened sheet copper, which plan is generally adopted on cylinders for locomotives.

In cases where a number of cylinders of similar sizes are made, the whole of the marking off, and much other work, may be saved by the employment of gages, etc.

For drilling the cylinder covers and the tapping holes in the cylinder, the following system is probably the most advantageous: The flanges of the cylinder covers are turned all of one diameter, and a ring is made, the inside diameter of which is, say, an inch smaller than the bore of the cylinder; and its outside diameter is, say, an inch larger than the diameter of the cover. On the outside of the ring is a projecting flange which fits on the cover, as in Fig. L, *a* being the cylinder cover, and *b b* a section of the ring, which is provided with holes, the positions in the ring of which correspond with the required positions of the holes in the cover and cylinder; the diameter of these holes (in the ring, or template, as it is termed) is at least one quarter inch larger than the clearing holes in the cylinder are required to be. Into the holes of the template are fitted two bushes, one having in its center a hole of the size necessary for the tapping drill, the other a hole the size of the clearing drill; both these bushes are provided with a handle by which to lift them in and out of the template, as shown in Fig. M, and both are hardened to prevent the drill from cutting them, or the borings of the drill from gradually wearing their holes larger. The operation is to place the cover on the cylinder and the template upon the cover, and to clamp them together, taking care that both cover and template are in their proper positions, the latter having a flat place or deep line across a segment of its circumference, which is placed in line with the part cut away on the inside of the cover to give free ingress to the steam, and the cover being placed in the cylinder, so that the part so cut away will be opposite to the port in the cylinder, by which means the holes in the covers will all stand in the same relative position to any definite part of the cylinder, as, say, to the top or bottom, or to the steam port, which is sometimes of great importance (so as to enable the wrench to be applied to some particular nut, and prevent the latter from coming into contact with a projecting part of the frame or other obstacle): the positions of the cylinder, cover, template, and bush. when placed as described, being such as shown in Fig. N, *a a a* being the cylinder, *b* the steam port,

Fig. L.

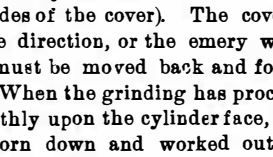


Fig. M.

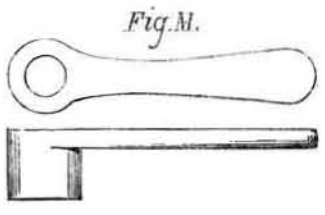
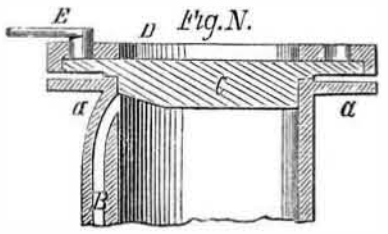
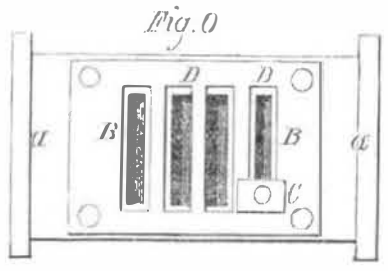


Fig. N.



c the cylinder cover, D the template, and E the bush placed in position. The bush, E, having a hole in it of the size of the clearance hole, is the one first used, the drill (the clearance size) is passed through the bush, which guides it while it drills through the cover, and the point cuts a countersink in the cylinder face. The clearing holes are drilled all round the cover, and the bush, having the tapping size hole in it, is then brought into requisition, the tapping drill being placed in the drilling machine, and the tapping holes drilled in the cylinder flange, the bush serving as a guide to the drill, as shown in Fig. N, thus causing the holes in the cover and those in the cylinder to be quite true with each other. A similar template and bush is provided for drilling the holes in the steam chest face on the cylinder, and in the steam chest itself. While, however, the cylinder is in position to have the holes for the steam chest studs drilled, the cylinder ports may be cut as follows, which method was introduced in 1867, with marked success, by Mr. John Nichols, who was then manager of the Grant Locomotive Works, at Paterson, N. J.: The holes in the steam chest face of the cylinder being drilled and tapped, a false face or plate is bolted thereon, which plate is provided with false ports or slots, about three eighths of an inch wider and three fourths of an inch longer than the finished width and length of the steam ports in the cylinder (which excess in width and length is to allow for the thickness of the die). Into these false ports or slots is fitted a die, to slide (a good fit) from end to end of the slots. Through this die is a hole the diameter of which is that of the required finished width of the steam ports of the cylinder; the whole appliance, when in position to commence the operation of cutting out the cylinder ports, being as illustrated in Fig O, *a a* being the cylinder, B B the false plate, C the sliding

Fig. O



die, and D D the slots or false ports into which the die, C, fits. Into the hole of the die, C, is fitted a reamer, with cutting edges on its end face and running about an inch up its sides, terminating in the plain round parallel body of the reamer, whose length is rather more than the depth of the die, C. The operation is to place the reamer in the drilling machine, taking care that it runs true, place the die in one end of the port, as shown in Fig. O, and then wind the reamer down through the die so that it will cut its way through the port of the cylinder at one end; the spindle driving the drill is then wound along. The reamer thus carries the die with it, the slot in the false face acting as a guide to the die.

In the case of the exhaust port, only one side is cut out at a time. It is obvious that, in order to perform the above operation, the drilling machine must either have a sliding head or a sliding table, the sliding head being preferable.

The end of the slot at which the die must be placed when the reamer is wound down through the die and cylinder port, that is to say, the end of the port at which the operation of cutting it must be commenced, depends solely on which side of the port in the cylinder requires most metal to be cut off, since the reamer or cutter, as it may be more properly termed, must cut underneath the heaviest cut, so that the heaviest cut will be forcing the reamer back, as shown in Fig. P, *a* being a sectional view of the cutter, B the hole cast in the cylinder for the port, C the side of the port having the most cut taken off, D the direction in which the cutter, *a*, revolves, and the arrow, E, the direction in which the cutter, *a*, is traveling up to its cut. If the side, F, of the port were the one requiring the most to be cut off, the cutter, *a*, would require to commence at the end, F, and to then travel in the direction of the arrow, G. The reason for the necessity of observing these conditions, as to the depth of cut and direction of cutter travel, is that the pressure of the cut upon the reamer is in a direction to force the reamer fowrard and into its cut on one side, and backward and away from its cut on the other side the side having the most cut exeting the most pressure. If, therefore, the cutter is fed in such a direction that this pressure is the one tending to force the cutter forward, the cutter will spring forward a trifle, the teeth of the cutter taking, in consequence, a deep cut, and, springing more as the cut deepens, terminate in a pressure which breaks the teeth out of the cutter. If, however, the side exerting the most pressure upon the reamer is always made the one forcing the cutter back, as shown in Fig. P, by reason of the direction in which the cutter is traveled to iss cut, the reamer, in springing away from the undue pressure, will also spring away from its cut, and will not, therefore, rip in or break, as in the former case.

In cutting out the exhaust port, only one side, in consequence of its extreme width, may be cut at one operation; hence there are two of the slots, D, Fig., O, provided in the false plate or template for the exhaust port. The cutter, *a*, must, in this case, perform its cut so that the pressure of the cut is in a direction to force the cutter backwards from its cut. The time required to cut out the ports of an ordinary locomotive cylinder, by the above appliance, is thirty minutes, the operation making them as true, parallel, and square as can possibly be desired.

In order to tap the holes in the cylinder heads and steam chest seat on the cylinder true, without requiring the workman to apply the square, a long tap and a guide is employed as shown in Fig. Q, *a* being a section of the cylinder end face, B the guide for the tap, C the tap itself, and D a bolt

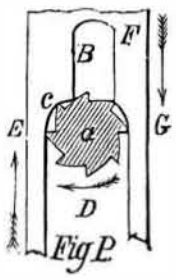
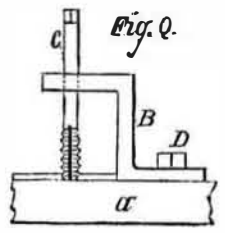


Fig. P.

Fig. Q.



for holding the guide to the cylinder face. If the end cylinder faces have a projecting ring on them (so as to leave a small surface to make the joint), the guide may be cut away on its bottom face to fit the projection, so that, if the guide is held against the projection, while the guide is bolted fast, the hole in the guide through which the tap passes will stand true (both ways) of itself, to the hole to be tapped in the cylinder. In the case, however, of there being no projection of the kind mentioned, as, for instance, when tapping the holes in the seat for the steam chest, the guide will require adjusting, sideways, by the eye. The distance, however, of the holes in the guide, being the same from center to center as the distance from center to center of the holes to be tapped, insures, without any setting, that the holes tapped are true with each other one way.

The saving of time and labor effected by means of the employment of this system and its appliances is much greater than might be supposed at first sight; it may, however, be appreciated when it is stated that, under it, three pairs of locomotive cylinders have been fitted up in seven and a half days, the work done to each pair being the holes, amounting to 200, drilled, and those for the cylinder covers, cylinder cocks, steam chests, steam pipes, and exhaust pipes, tapped; the steam and exhaust ports cut out, and the faces and those of the slide valves scraped up, the cylinder end and cover faces filed, scraped, and ground up steamtight, the steam chest seat faces filed up true to a straight edge, the seat for the steam and exhaust ports faced out with the cutter, all necessary bolts and studs put in, the cylinders bolted together, their bores being set true with each other, and the whole turned out so that the cylinders were complete and ready to bolt to the engine frames.

Rapid Transit in New York.

The American Society of Civil Engineers has appointed a committee, consisting of O. Chanute, M. N. Forney, Isaac C. Buckhout, Charles K. Graham, and Francis Collingwood, to investigate the necessary conditions of success, and to recommend plans as to the best means of rapid transit for passengers, and the best and cheapest methods of delivering, storing, and distributing goods and freight in and about the city of New York. Investigations of this kind by the committees of the Legislature, of the Common Council, and of private citizens have been annually made, in New York, during the past twenty years. There are any quantity of plans. The only thing lacking is the money to build with. If the present committee can solve that problem, they will render valuable service, and do something that the wealthiest capitalists of the city have not yet been able to accomplish.

Death of Judge Benjamin R. Curtis.

We regret to announce the death of this eminent jurist, which took place on September 16. Born in Watertown, N Y., on November 4, 1809, he graduated at Harvard in 1829; and three years afterwards he commenced legal practice. From this date his career was one continued success, gaining him fame as a lawyer, an orator, and a logician. In 1851, he was appointed Judge of the Supreme Court of the United States, and here he delivered his celebrated decision in the Dred Scott case. He resigned his seat in 1857, and resumed his practice. He defended President Johnson before the Court of Impeachment.

Judge Curtis' learning and high personal character gave great value to his writings and his judicial decisions. His return to the bench was looked for when his death occurred.