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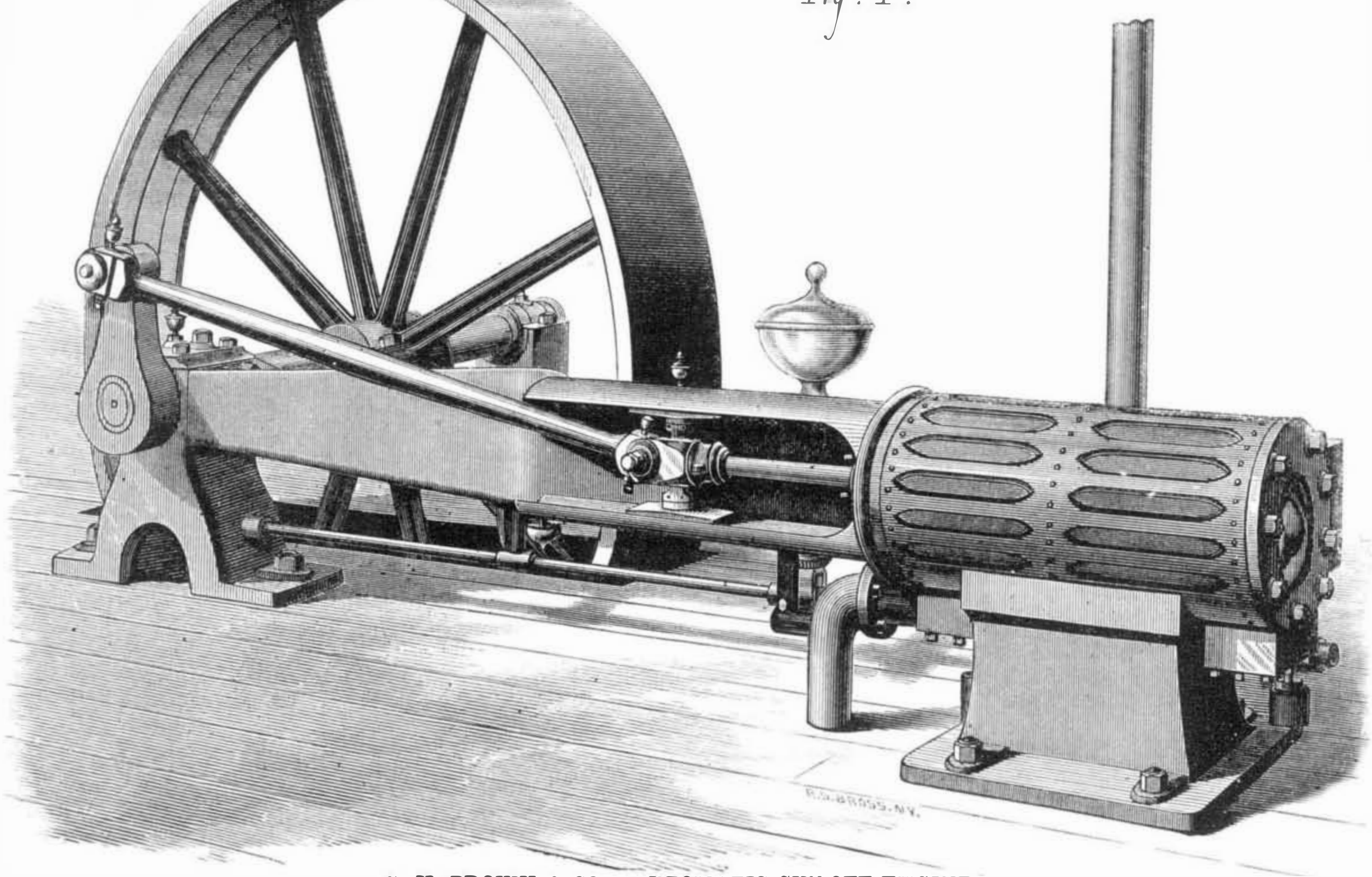
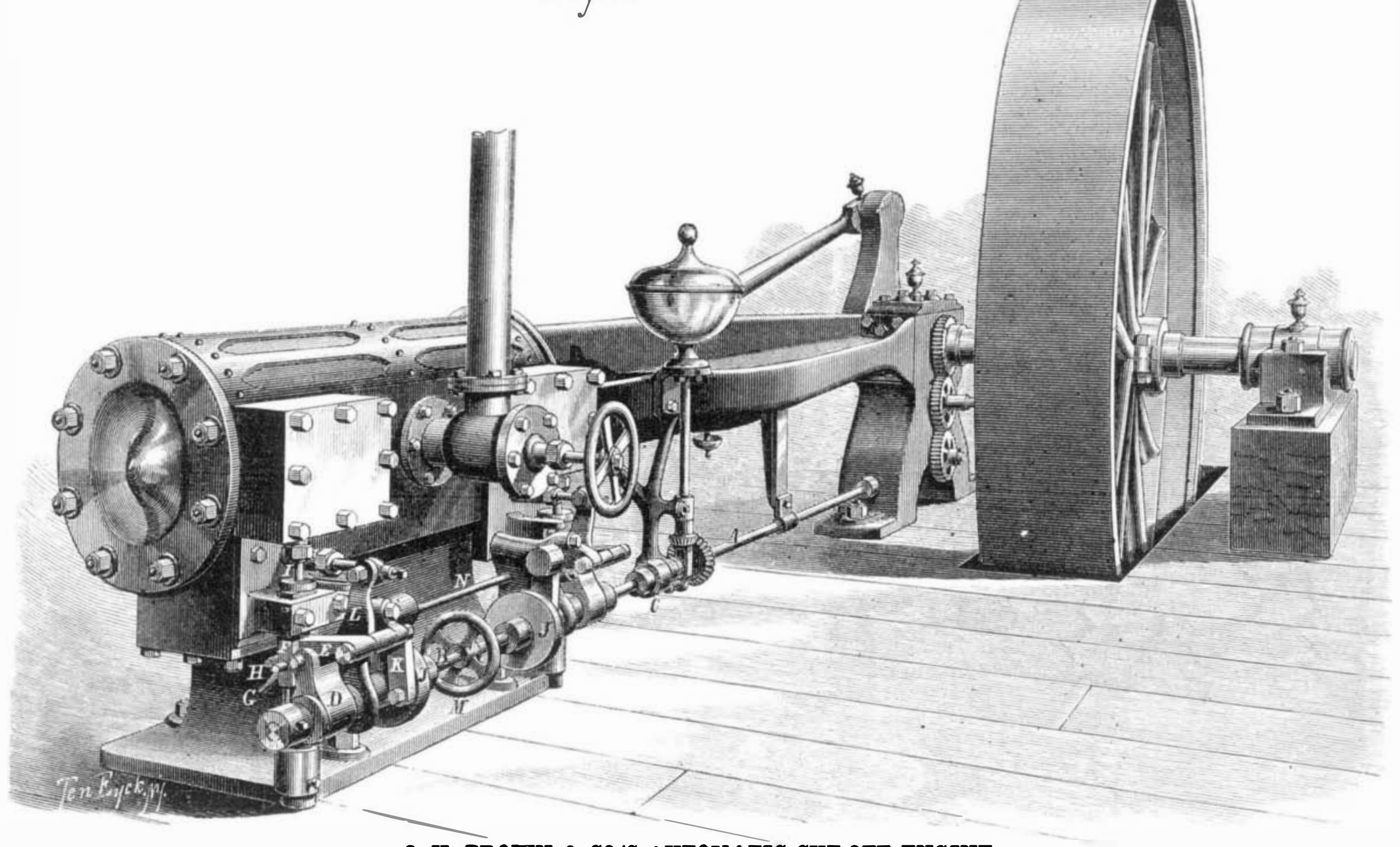
Fig. 1.



C. H. BROWN & CO.'S AUTOMATIC CUT-OFF ENGINE.

Fig. 2



C. H. BROWN & CO.'S AUTOMATIC CUT-OFF ENGINE.

THE BROWN AUTOMATIC CUT-OFF ENGINE.

The modern stationary engine has reached such a degree of excellence that now the whole aim of the more prominent constructors is directed merely to designing simple, durable, and effective mechanical devices by which certain well understood functions may be performed. It appears, in fact, to be determined that we have reached a point of knowledge and mastery of the theory of steam engineering from which further progress is only to be sought by obtaining refinement of action combined with durability and accessibility in the parts. A few years ago, there appeared to be good reason to suppose that economy in the steam engine would be sought in the direction of using steam at much higher pressure than had then (or has since) been employed; and many efforts have, from time to time, been put forth in that direction. The mechanical world seems, however, to have settled down to the conviction that the utmost economy attainable in a high pressure engine is to be reached by establishing, between the duty performed by the engine and the supply of steam to the cylinder, a relation at all times equal, definite, and uniform: and further by avoiding wiredrawing and substituting therefor the using of the steam expansively. It follows then that, to accomplish this end, the action of the

(*Continued on eighth page.*)

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induction valve must, both at the time of opening and closing, be very quick, otherwise wiredrawing inevitably takes place, and this will be evidenced in the rounded corners at each end of the steam line, on the indicator diagram.

It is inherent in simple high pressure steam engines that the power imparted to the driving shaft be variable; because, if we disregard the question of economy, and permit the steam to follow the piston during as large a portion of its stroke as possible, the necessity of having a free exhaust, especially with a high piston speed, demands that the exhaust valve shall open freely before the completion of the piston stroke: while if, on the other hand, we use the steam expansively, the pressure upon the piston (and hence the power communicated by it) decreases from the moment that the induction valve closes until the end of the stroke: in other words, during the whole term of the expansion. It is also found in practice that, even under the most favorable of conditions, the load driven by the engine is variable, and it becomes, therefore, a somewhat complicated problem to devise a mechanical movement that shall sacrifice none of the qualities essential to prevent the wear and tear due to quick motions, that shall establish between the duty and the steam supply to the cylinder are always equal ratio, and which shall, at the same time, maintain a uniformity of engine speed notwithstanding variations in the amount of the duty and in the boiler pressure. In this connection, it may be borne in mind that the variation which may take place in the load of the engine, after the steam supply has been cut off and during the term of expansion, is an element tending to vary the speed of the engine. Nor can this element be counteracted or compensated for, except during the period of admission in the next stroke of the piston. The method which, by common consent, has been adopted to secure economy and regularity of speed, notwithstanding these disturbing elements, is to so attach the governor to the induction valve that the action of the former is communicated instantaneously to the latter, the valve being opened by a positive motion and closed by the action of the governor.

We present in the accompanying engravings views of the Brown engine; and the means by which the before described functions are performed in this engine, may be thus briefly described: In Fig. 2 is shown the valve motion. The steam and exhaust valves are griddle valves, which ensure a large area of opening in proportion to the amount of movement, and give free ingress and egress to the steam; and this it is which, together with the quickness of the valve movement, secures the sharp admission corner and the freedom of exhaust shown in the indicator cards taken from this engine. The valve seats are formed of plates, which may be taken on and off the cylinder; and the part over which the valve travels is raised so that, to true up the seats, the plates may be taken off, and either filed or planed in a few minutes, the operation making no difference to the height of the slide spindles from the seating, thus avoiding a very common defect while simplifying the operation.

The governor is operated by the cut gear wheels shown, which impart a rotary motion to the shaft, A, which operates the governor and communicates rotary motion to the valve shaft, B. Between these two shafts, however, is the friction device, C, which is so constructed as to permit the shaft, B, to be operated by hand independently of the shaft A: and thus the valve motion may be operated by hand independently of the cut gears, which is a great convenience to the engineer in starting the engine. Upon the shaft, B, are the eccentrics, the ends of the straps of which connect with the horizontal lever or arm, E; and the end of the latter extends into the square slot in the slide spindle guide to the catch of the tongue. It is obvious then that, as the shaft, B, revolves, the end of the lever, E, will reciprocate vertically in the said square slot. Turning now to the valve stem and guide, the valve stem is attached to the guide, F, and in the slot shown in the latter is a tongue, G, pivoted by the pin shown in the guide. The upper end of this tongue has a projecting catch upon it; and beneath this catch stands the end of the arm, E. Now the induction valve is closed when at the bottom of its travel, and the weight of the valve and stem and the pressure of the steam (acting on an area equal to the area of the valve stem) are, combined, always acting to keep the valve at the bottom of its travel, that is, in its normal position; and there it remains until lifted for the admission of steam. The manner of effecting this admission is as follows: The end of the arm, E, acting against the catch on the upper end of the tongue contained in the slot shown in the slide spindle guide, F, lifts the valve and holds it open so long as the tongue is not tripped. The instant, however, that the latter action takes place, the valve, from its weight and the action of the steam upon the area above mentioned, closes, the movement being cushioned after the valve is completely closed by means of the small dash-pot shown beneath.

It is evident then that, by regulating the eccentrics, the valve may be given any desired amount of lead, and that the duration of the period of admission may be varied by tripping the tongue before referred to; and this is accomplished by the engine governor in the following manner: The governor acts upon the rod, N, shown in our engraving, the end of the governor spindle being attached to a crank arm attached to the rod, N. Upon this same rod, and immediately behind the induction valve spindle guide, F, is an arm, standing vertically and carrying a pin, H, standing horizontally. Now the tongue, which, at one end, acts as a catch to the eccentric arm at the other end, protrudes from the back of the slide spindle guide, and stands directly beneath the above mentioned pin; so that, when the rod, E, lifts (through the medium of the tongue catch) the induction valve, the latter continues to lift until the tail of the catch, G, contacting with the pin, H, thus tripping the tongue; and the valve instantly closes, returning to its normal position. The action of the governor, then, by controlling the position of the tripping pin, H, controls the period of steam admission, the movement being performed without the interposition of either springs or weights. The exhaust valves lie horizontally, and are operated as follows: Upon the shaft, D, are the discs, J, which are provided with cam grooves. The rocker arm, K, carries a friction roller extending into the cam groove, the upper arm, L, being attached to the exhaust valve spindle. To compensate for the circular motion of the arm, and the vertical movement of the valve spindle, the connection between the two is made by the eye of the spindle, containing a slot, in which is fitted a sliding die to which the pin of the arm is fitted. To regulate the amount of compression, it is merely necessary to adjust the position of the disc. The parts composing the valve motion are simple and plain, involving, it will be seen, no intricacies; and they are easily accessible. The pins and bolts, as also the eyes of all pivoted parts, are made of steel, and are hardened. The rods, A and B, are of steel. The slide spindles and stuffing boxes are of brass, so finely fitted that they are steam tight from the fit without the aid of any steam packing whatever; and it is stated that some of these spindles thus fitted have run a year without requiring any packing. The piston rod and connecting rod are of steel; the crosshead is provided with brass gibs, which are adjustable to take up the wear by means of the check nuts shown. The crank pin and crosshead pin, and all the bolts, nuts, pins, and studs about the engine, are of steel.

The workmanship upon these engines is, both for fit and finish, of the very first order. The joints of parts fitted together cannot be distinguished, nor can the seating of the nuts against the cylinder cover washers be defined by the eye. The whole of the working parts are finished and have a polish upon them equal to silver plating. The governor is of the ordinary fly belt type, and is, for security and safety, enclosed in a polished cast iron casing.

The indicator cards, taken from each end of the cylinder, show the admission and steam lines to be notably perfect, with the corners fully and sharply defined; while the exhaust and air lines are one, at all times when the cut-off takes place so late that the expansion curve does not pass below the atmospheric line.

One of these engines supplied the motive power for the Sawmill Building at the Centennial, and received the highest award in the form of a medal and a special judges' report. Another drove part of the machinery at the recent American Institute Fair, and was awarded the coveted Centennial gold medal. For further particulars, address C. H. Brown & Co., Fitchburgh, Mass.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—Number XVII.

PATTERN MAKING.

We need not dwell upon the half core box, which is necessary for this pattern, if the branch stands at a right angle to the body, or the full one, necessary if it is required to stand obliquely. When the body of the T is much larger in diameter than is the branch, we may joint the two in a simpler way, which, so long as it does not entail a great weakening of the body, will be found more advantageous than the method described. This simpler method is: Having found the amount of the length of the branch necessary to allow for curvature of the body (by the process shown in Fig. 116)

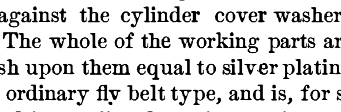


Fig. 124.

we turn upon the branch end an additional projection or stem, as shown in Fig 124, somewhat smaller in diameter than is the branch itself; and we then cut in the body a recess to receive the branch and turned stem or projection, which recess may be either cut out with a gauge or turned out in the lathe, the latter being, for obvious reasons, the best method. For this latter operation, we take a chuck similar to that described in Fig. 58, as a cement chuck;

Fig. 125

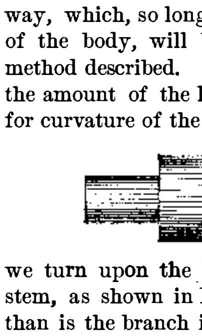
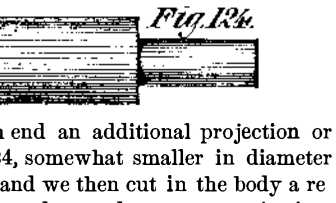
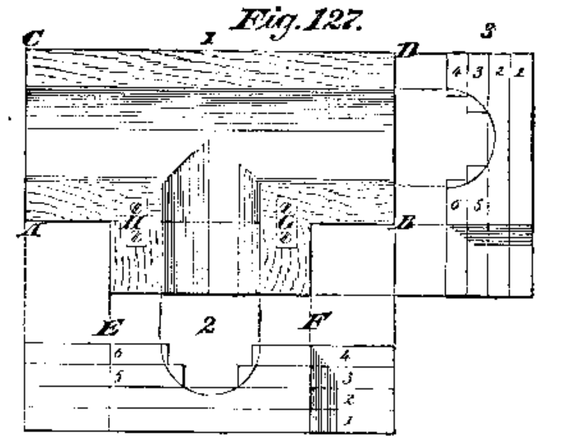


Fig. 126.



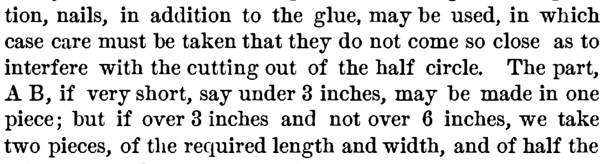
and having verified that the point and the face of the chuck run quite true, we draw a centre line across it, set the apexes of the two V blocks exactly over this line, and then fasten them. Having marked upon the body the centre of the branch, we find a point diametrically opposite to it upon the body, and place the body so that the steel centre point enters the point so found at the same time as the body rests in the V's. We then fix it in this position, by thin straps of hoop-iron, or any other contrivance that will not project so as to prevent the lath rest (or tool rest, as it may be more properly termed) from being brought close to the work. The work must be securely screwed to the chuck, on account of the high velocity of the lathe in turning. To cut out the recess, we commence by placing a centre bit in the back lathe centre, and boring a hole, as large as convenient and very nearly to the required depth. A screw bit is not available for this purpose, for it would in many cases be right through the work before there was time to stop the lathe, which is not usually sufficiently under control. We may next take a turning tool, and turn out the recess to fit the end of the branch; and after taking the job from the lathe, we fasten each half of the branch by glueing and screws. In connection with this method, there is yet another advantage: it is that, by cutting away the body instead of the branch, it renders us indifferent as to whether the shape of the body be spherical, as in a globe valve, or elliptical, or even vase-shaped: because, in this case, the shape adds nothing to the difficulty of the job. Should it occur that one end of the T is larger than the other, we may find the height necessary for each of the V pieces (whereon the body rests during the turning process) as follows: Draw upon a piece of board, the line, A D, in Fig. 126, which will represent the plane of the chuck; and let the point, C, represent the centre point of the lathe. Then, from C, we square up the line D; and we set the compasses to the radius of the body of the pattern at the centre of the place where the branch is to be. We take a radius from C, and about $\frac{1}{16}$ inch up from the line A B, and with this radius, we mark on the line D, the point E. From this point as a centre, we strike the axes, E and F, whose radii correspond to the unequal sizes of the pattern where the V's are required to be. Then we draw tangents to each of these arcs, and complete the forms of the V blocks, as shown in Fig. 127, in which half of each V block is shown.

Fig. 127.



We have now to make a core box for our T; and for clearness of illustration, we will make the drawing somewhat larger than those for the T itself. Fig. 127 represents three views of the core box; that portion which projects below the line, at B, may be made separately, and need not therefore be given any consideration. Having drawn the plan of the box, as shown in Fig. 127 at 1, we draw the end and side views, as shown at 2 and 3, and divide these latter into courses of a thickness to suit the stuff at hand from which the core-box is to be made. The courses may be made of equal or unequal depth. Courses 1 and 2 are got out of the full size of the box, while courses 3 and 4 must be of the length of the box, but their width will differ according to the curvature of the half circle of the core, as shown in Fig. 127, at 2 and 3; 5 and 6 will be similar to 3 and 4, and may be marked from them. All these pieces must be planed to a true surface and glued together, each course being allowed to dry before the next one is put on; but for greater expedition, nails, in addition to the glue, may be used, in which case care must be taken that they do not come so close as to interfere with the cutting out of the half circle. The part, A B, if very short, say under 3 inches, may be made in one piece; but if over 3 inches and not over 6 inches, we take two pieces, of the required length and width, and of half the thickness, and chuck them in the manner previously explained for making flanges in halves; then we place the work in the lathe, and bore a hole for the core, then take them from the chuck and glue them, first together and next to the body of the core box. We next turn the body part of the core to a semi-circle of the required size, and all that will then remain to be cut is that part of the branch that is above the line A B. If, however, the part below A B, in Fig. 127, should be required still longer, then it had better be built up

Fig. 128.



in the same manner as the other part. The lengths of the pieces forming the courses will be the same, and may be measured on Fig. 127, from A B, outwards. The widths will differ and may be measured from E or F, inwards. This separate portion, from the grain of the wood being enduric, cannot be firmly fixed to the main body of the box with glue; we must, therefore, in addition, place battens below the box, and let in pieces of hard wood or metal above, as represented in Fig. 127, at G and H.