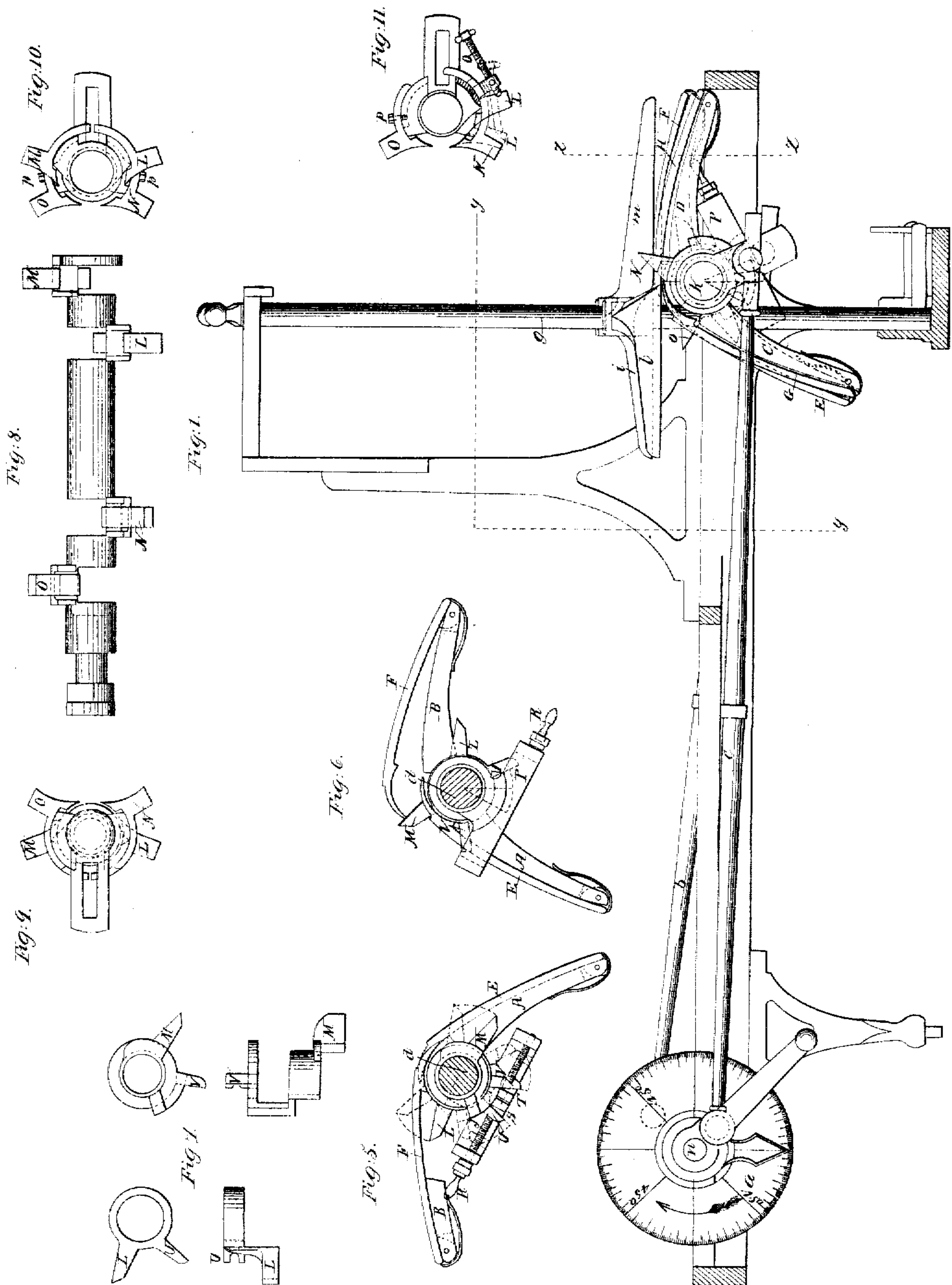


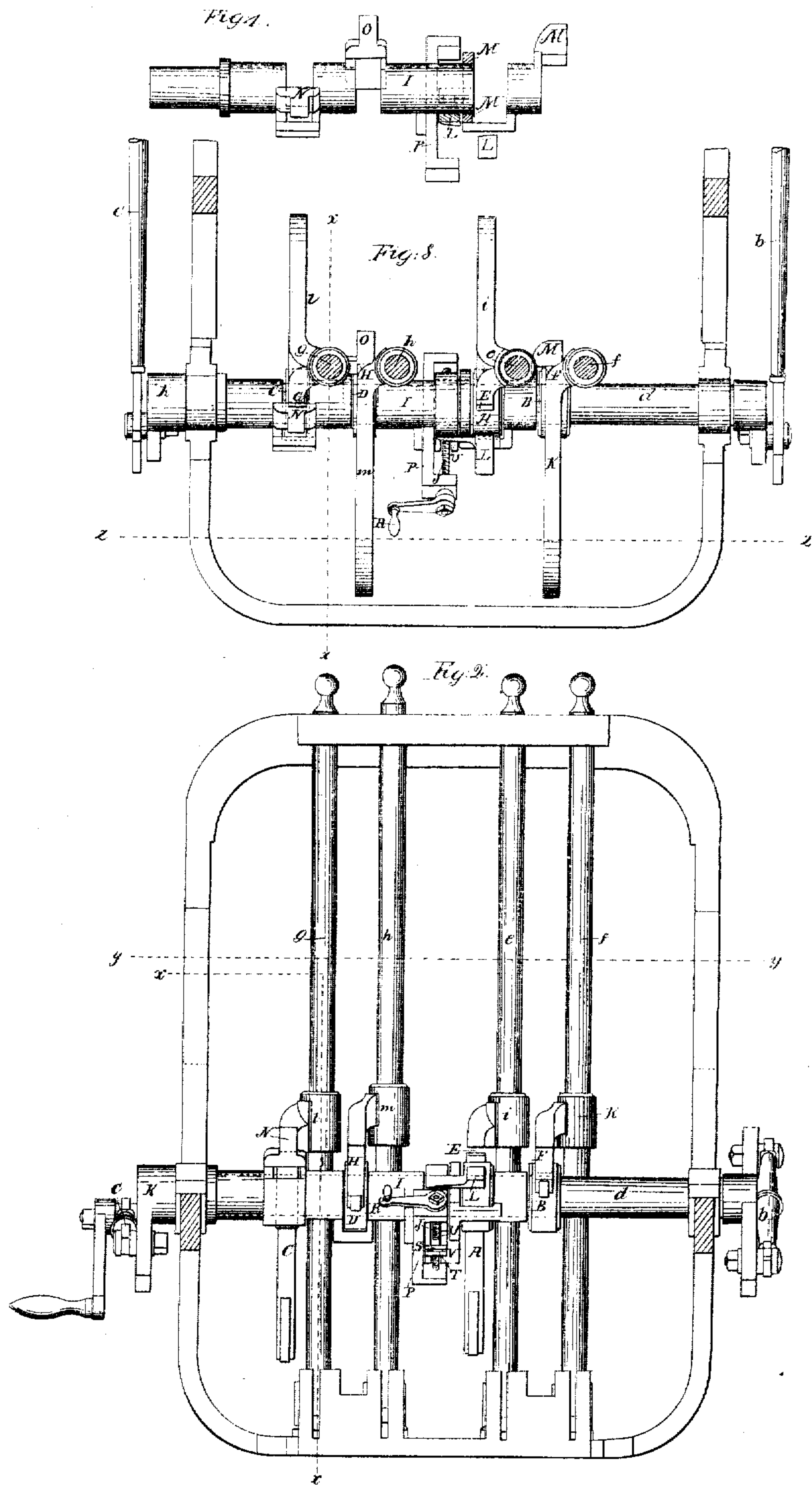
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Steam-Engine Valve-Gear.

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UNITED STATES PATENT OFFICE.

FRANCIS B. STEVENS, OF WEEHAWKEN, NEW JERSEY.

IMPROVEMENT ON CUT-OFF-VALVE MOTION.

Specification forming part of Letters Patent No. 33,855, dated December 3, 1861.

To all whom it may concern:

Be it known that I, FRANCIS B. STEVENS, of Weehawken, in the county of Hudson and State of New Jersey, have invented an Improvement on Stevens's Cut-Off; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in certain additions to the valve-motion patented by Robert L. and Francis B. Stevens on the 25th day of January, A. D. 1841.

The object of these additions is, first, to raise the eduction-valves more rapidly than they are commonly raised; secondly, to produce the same effect that the addition to Stevens's cut-off known as the "gags" produces. These objects I produce by keying or attaching the two eduction-tappets on the same shaft to which the tappets (or, as they are usually called, the "long toes") of Stevens's cut-off are attached, and I make these eduction-tappets the same length that the induction-tappets are, and I attach them to the rock-shaft at the same angle, so that if working without any other addition the induction and eduction valves would have the same motion, and the eduction-valves, after being raised up as rapidly as the induction-valves are raised, would then cut off the exhaust in the same manner that the induction-valves cut off the steam. Now, to prevent this action of cutting off by the eduction-valve and to keep the eduction-valve from closing until the end or nearly the end of the stroke, I place a hinge-piece on the top of the tappets, this hinge-piece being hinged at the end of the tappets farthest from the shaft and raised and lowered at the part nearest the shaft by small tappets attached to a hollow rock-shaft placed over the main rock-shaft and worked with a vibratory motion by the eccentric that works the eduction-valves in Stevens's cut-off. These small tappets raise the hinge-pieces and keep the eduction-valves open until the end of the stroke. I thus raise the eduction-valves more rapidly than they are commonly raised, and by as quick a motion as the induction-valves of Stevens's cut-off are raised, and still keep

them open the requisite time. I produce the second effect above named—that is to say, the effect produced by the gags—by also placing hinge-pieces on the top of the tappets that work the induction-valves, these hinge-pieces being worked by small tappets placed on the above-mentioned hollow rock-shaft; but I attach these small tappets to the hollow rock-shaft in such manner that their position on the hollow rock-shaft can be altered from a point where no motion is communicated by them to the hinge-pieces to a point where the valve is kept open until the end of the stroke, or to any point intermediate between these two. Thus, when the small tappets are so set that no motion is communicated by them to the hinge-pieces the steam will be cut off at the point at which Stevens's cut-off is set, and when they are so set that any motion will be communicated by them to the hinge-pieces then the steam will be cut off at some longer portion of the stroke.

I will now proceed to describe my invention with the aid of a reference to drawings.

Figure I is a side elevation of Stevens's cut-off with my additions attached. Fig. II is a front elevation of the same. Fig. III is a horizontal view of the same. Fig. I is sectioned to the red lines *x x* of Figs. II and III. Fig. II is sectioned to the red lines *z z* of Figs. I and III. Fig. III is sectioned to the red lines *y y* of Figs. I and II. Fig. IV is a horizontal view of the hollow rock-shaft and of the four small tappets that work the ends of the four hinge-pieces. Fig. V is a side view of the long steam-tappets, the hinge-pieces on the same, the hollow rock-shaft, the small induction-tappets on the hollow rock-shaft, and the screw that elevates and depresses the small tappets on the hollow rock-shaft. Fig. VI is Fig. V, but viewed on the reverse side. Fig. VII is a view of the small tappets that work the hinges on the two steam-tappets. Fig. VIII is a horizontal view of the hollow rock-shaft, showing a different method of altering the position of the small tappets that work the hinge-pieces, the hollow rock-shaft being made all in one piece. Fig. IX is an elevation of Fig. VIII. Fig. X is an elevation of Fig. VIII, taken on the reverse side of

Fig. IX. Fig. XI is the same as Fig. X, showing the method of altering the small tappets.

a is the index, showing the position of the main crank of the engine.

b is the eccentric-rod that works the rock-shaft to which the four long tappets are attached.

c is the eccentric-rod that works the hollow rock-shaft.

d is the rock-shaft to which the four long tappets A, B, C, and D are keyed or attached permanently.

e and *f* are the induction-valve lifting-rods.

i and *k* are the feet attached to the induction-valve lifting-rods.

l and *m* are the feet attached to the eduction-valve lifting-rods.

n is the main shaft of the engine.

A and B are the two long induction-tappets of Stevens's cut-off.

C and D are the two similar tappets that work the eduction-valves.

E and F are the hinge-pieces placed on top of the tappets A and B.

G and H are the hinge-pieces placed on the top of the tappets C and D.

I is the hollow rock-shaft that works over the rock-shaft *d*.

K is the arm attached to the hollow rock-shaft and worked by the eccentric-rod *c*.

L and M are the small tappets that work the hinge-pieces on the induction-tappets A and B.

N and O are the small tappets that work the hinge-pieces on the eduction-tappets C and D.

P is the frame-piece attached to the hollow rock-shaft I for the purpose of holding the screw J.

J is a screw, on one half of which a right-handed thread is cut and on the other half a left-handed thread is cut, and which when turned by the handle R brings together or spreads apart the nuts S and T.

U and V are projections attached to the small steam-tappets L and M, and against which the nuts S and T act for the purpose of altering the position of the tappets L and M on the hollow rock-shaft.

p p are small screw-bolts that secure the small tappets N and O to the hollow rock-shaft in the method shown in Figs. VIII, IX, X, and XI.

o is a screw (shown in Fig. XI) for the purpose of altering the position on the hollow rock-shaft of the small tappet L in the method shown in Figs. VIII, IX, X, and XI, the tappet M being altered by a similar screw. The small tappet L is drawn showing its position when cutting off full stroke, and is drawn in the red or dotted lines in its position when leaving Stevens's cut-off unaltered.

The operation is as follows: Supposing, in the first place, that the small tappets L, M, N, and O were all removed, then it is evident that the hinge-pieces E, F, G, and H would

lie quietly on the tappets A, B, C, and D, and that both induction and eduction valves would be raised and lowered by Stevens's cut-off and that their motions would be identical, the machinery for working the eduction-valves being merely a duplication of that working the induction-valves. Now when the small tappets N and O are attached to the hollow rock-shaft I, as shown in Figs. I, II, III, and IV, the small tappets work the hinge-pieces in the same manner that the tappets of the ordinary exhaust-motion work the lifters. Thus the tappets *n* and *o* vibrate backward and forward, and alternately raise and lower the hinge-pieces G and H, and, as the hinge-piece H lowers the foot *g* in its seat just as the hinge-piece G commences to lift the foot *h*, it is evident that the eduction-valve attached to the rod *g* will thus be kept from closing until (or nearly until) the other eduction-valve attached to the rod *h* begins to raise, and thus the eduction-valves will be raised by the long tappets C and D as quickly as the induction-valves are raised by Stevens's cut-off, and will then be held up to the completion of the stroke by the small tappets N and O. If the small tappets L and M are attached to the hollow rock-shaft I at the same angle that the small tappets N and O are attached, as shown by the red or dotted lines in Fig. V, then the induction-valves will have the same motion the eduction-valves have and will remain open to the end of the stroke; but if they are depressed to the position shown in Fig. V, and also the dotted lines in Fig. I, then the small tappets L and M will not work the hollow rock-shaft pieces E and F, and the induction-valves will be closed at the point at which Stevens's cut-off is set. These small tappets are elevated and depressed, as shown in Fig. V, by the right and left handed nuts S and T approaching or receding from each other as the screw Q is turned by the handle R, for the projections U and V of the tappets L and M, by the action of the weight of these tappets, which are loose on the shaft-press and bear against these nuts. In Fig. V the small tappets L and M, the projections U and V, and the nuts S and T are shown when the small tappets are depressed and where the steam is cut off at the point at which Stevens's cut-off is set. The red or dotted lines represent the same pieces when these tappets are elevated and where the steam is cut off at full stroke. In Fig. VIII the small tappets that work the induction-valve hinge-pieces are attached to the hollow rock-shaft in the same manner that those that work the eduction-valves are, and are shifted on the hollow rock-shaft to the proper angle of elevation or depression by the small screw-bolts *p p* or by the screw *o*.

What I claim as my invention is—

1. Setting the tappets that work the eduction-valves on the same shaft and at or near the same angle of depression that the tappets of Stevens's cut-off are set, so that the eduction-

tion-valves can be lifted at the same speed that the induction-valves are lifted by Stevens's cut-off.

2. The hinge-pieces E, F, G, and H, hinged at the ends of the tappets A, B, C, and D and raised and lowered by the small tappets I, M, N, and O, these small tappets being attached to the hollow rock-shaft I, placed

over the rock-shaft *d* and worked by the eccentric motion that works the eduction-valves in Stevens's cut-off as commonly constructed.

FRANCIS B. STEVENS.

Witnesses:

CORNELIUS CREEDON,

JULIUS HORNIG.