

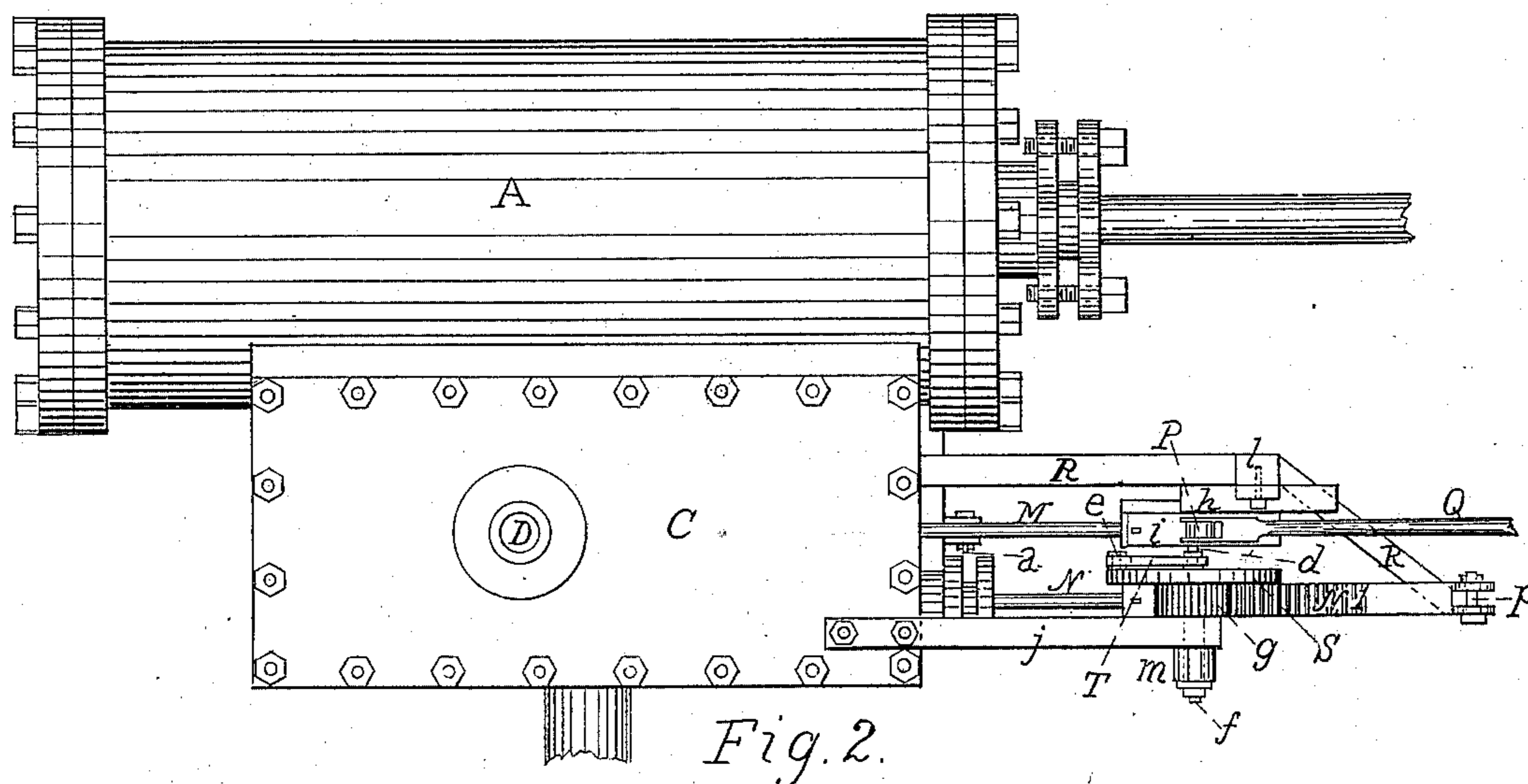
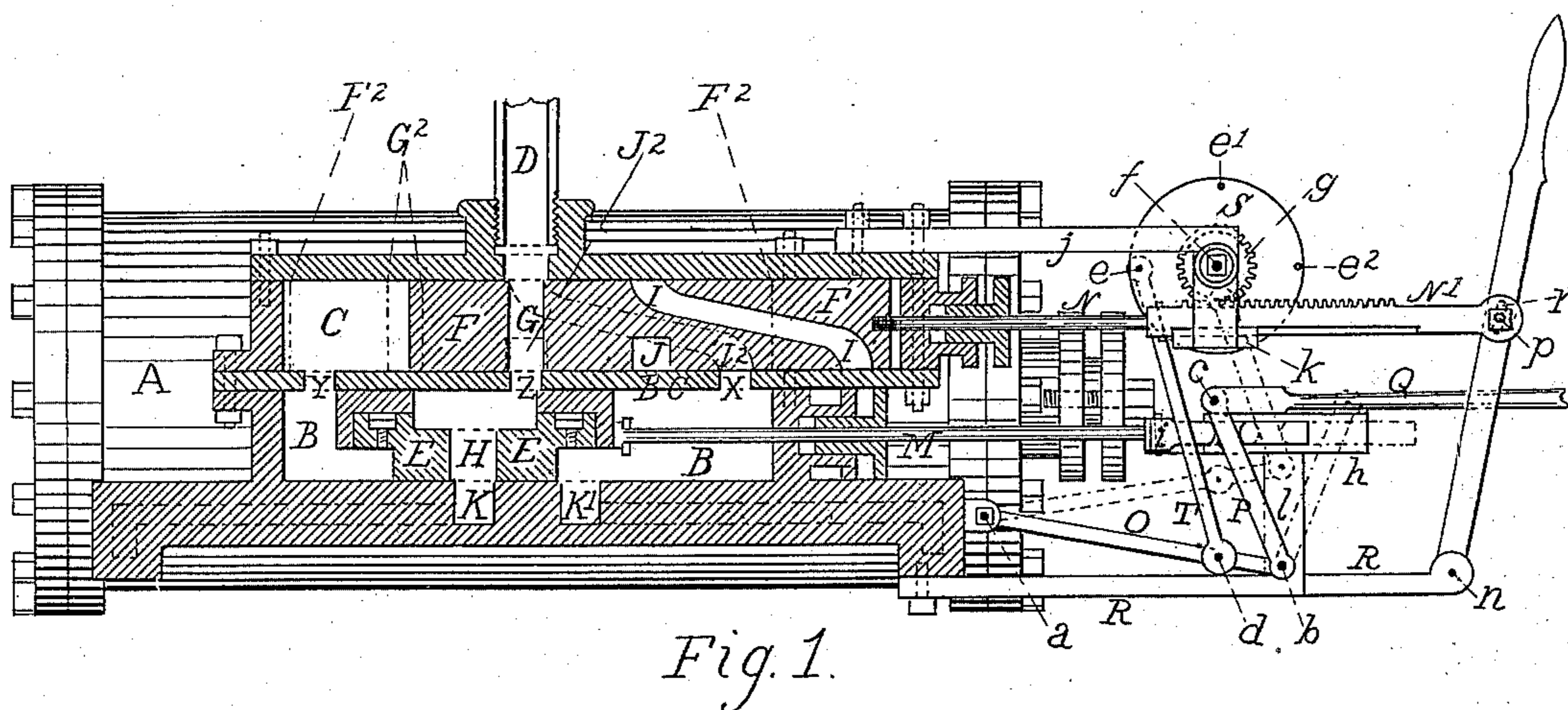
(No Model.)

A. FREEMAN.

REVERSING VALVE FOR STEAM ENGINES.

No. 311,890.

Patented Feb. 10, 1885.



Witnesses:
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UNITED STATES PATENT OFFICE.

ALONZO FREEMAN, OF CONCORD, MASSACHUSETTS.

REVERSING-VALVE FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 311,890, dated February 10, 1885.

Application filed June 16, 1884. (No model.)

To all whom it may concern:

Be it known that I, ALONZO FREEMAN, a citizen of the United States, residing at Concord, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Reversing-Valves for Steam-Engines, of which the following is a specification.

My invention consists in providing the valve-chest of a steam-engine with a main valve having an opening through it for the passage of steam, and adding thereto an adjoining and communicating valve-chest containing a reversing-valve having two passages for steam, so arranged in connection with the main valve and the main valve-chest that by a movement of said reversing-valve relative to the main valve and its chest-ports either end of the cylinder will take the working-steam, said steam passing through one passage in the reversing-valve to operate the engine one way, and through the other passage to operate the engine the other way.

In the use of the word "steam" as applied to an engine in the following specification and claims, I mean it to designate an engine propelled by steam, gas, compressed air, or other motive agent.

It also consists in combining with the valve-stem operating said reversing-valve a mechanism for shortening the stroke of the main valve, thus cutting off the supply of working-steam, while the reversing-valve by its movement is changing the direction of the steam and reversing the movement of the engine.

The construction and operation of my invention are illustrated in the accompanying drawings, of which—

Figure 1 is a vertical elevation of my invention, except that the valve-chests and valves are in section, in order to show their ports and steam-ducts, the valve-chests being located on the side of the cylinder. Fig. 2 is a top view of the same, (the reversing-lever U omitted,) showing the horizontal relation of the several parts vertically shown in Fig. 1.

Similar letters refer to similar parts in each drawing, as follows:

A is the engine steam-cylinder. B is the main valve-chest; C, the reversing valve-chest.

BC is the partition separating the two chests B and C; D, the working-steam inlet. The exhaust-steam may pass out through an opening in any convenient part of the side of the valve-chest C.

E is the main valve; F, the reversing-valve. G is a port extending through the same, conveying direct or working steam through port Z into port H in valve E, and thence into either cylinder-port K and K' alternately when the engine is working in one direction.

Y is the port through which the exhaust-steam enters the valve-chest C from chest B when the engine is working directly, the steam passing readily to said opening Y from the cylinder exhaust-duct K' by a space between the sides of the main valve E and the sides of the chest B.

I is a port running obliquely through the reversing-valve F and through which the direct or working steam passes into the valve-chest B by opening X and into either cylinder-port K and K' when the engine is reversed.

J is a channel cut entirely across the reversing-valve F, and which conveys the exhaust-steam into valve-chest C from the ports Z in the partition BC, and from port H in the main valve E in its passage from the cylinder-ducts K and K' alternately when the engine is reversed, the exhaust-steam passing readily out of said channel J into valve-chest C by a space between the sides of the reversing-valve F and the sides of the valve-chest C.

M is the main valve-stem. N is the reversing-valve stem.

O is a hinged fulcrum-bar, hinged at its inner end to some suitable point below the line of the valve-stem M, its outer end supporting the lower end of the hinged lever P, which lever passes through an eye in the sliding piece i, (which is an extension of the valve-stem M,) which slides in the slide-groove h.

l is an upright piece, which extends upward from the horizontal supporting-bar R and secures the piece with the slide-groove h.

c is a pin passing through the upper end of the lever P and engaging the eccentric-rod Q with said lever P by a hinge-joint on pin c.

S is a semi-rotating plate secured to and operating with the cog-wheel g and shaft f,

which latter moves in the journal-bearing *m*. An arm secured to and projecting radially from the cog-wheel *g* may be substituted for the plate *S* with like operative results.

5 *T* is a rod connecting the plate *S* with the fulcrum-bar *O*, being pinned to each at each end by the pins *d* and *e*.

U is a reversing-lever, having its fulcrum at the bottom on the pin *n*, and operating the
10 reversing-valve *F* by means of the bar *N'* and valve-stem *N*, said lever being engaged to the bar *N'* by the pin *p* passing through the slot *r* and the bifurcated end of the bar *N'*. The said bar has a rack of teeth on its upper side
15 which engage with the teeth on the cog-wheel *g*, the lower side of said bar resting and sliding on the piece *k*.

Now, having anticipated the operation of my invention in the definition of its descriptive letters, I concisely and further state its operation as follows: When the working-steam enters the port *G* in the reversing-valve *F*, the engine is working directly, or the first way. The steam thence passes through the
25 port *Z* in the partition-plate *BC*, port *H* in the main valve *E*, and alternately into each end of the cylinder through steam-ducts *K* and *K'*, which steam-ducts serve as ports for working and exhaust steam alternately as the main valve slides back and forth in the valve-chest, and the port *H* communicates alternately with the entrance-ports to the steam-ducts *K* and *K'*. The exhaust-steam passes freely to any part of the valve-chest *B* around the main valve *E* and
35 makes its exit therefrom into the valve-chest *C* through port *Y*, and out of said chest *C* through an opening in any convenient part of said chest *C*, passing freely around the reversing-valve *F*. When the engine is reversed
40 the lever *U* is pushed toward the valve-chests, moving the bar *N'* and valve-stem *N* in the same direction. This carries the reversing-valve *F* to the position shown by the broken lines of said valve, as indicated by a figure 2
45 added to its letter of designation, and closes the port *Y* between the valve-chests *B* and *C*. This position allows the working-steam to pass obliquely through the reversing-valve *F* by the port *I*² (shown in broken lines) into the
50 main valve-chest *B*, through port *X* in the partition-plate *BC*, thence into the cylinder through the steam-ducts *K* and *K'* alternately, while the exhaust-steam passes through the main valve *E* by the port *H*, and into the valve-chest *C* by the port *Z*, and thence through the
55 channel *J*, across the reversing-valve *F*, into the valve-chest *C*. While the bar *N'* is moving toward the valve-chest in the operation of reversing the engine, the plate *S* makes a
60 quarter-revolution, carrying the pivot *e*, with its attached connecting-rod *T*, to the highest point in the revolution, (marked *e'*), thus lifting the fulcrum-bar *O* by the pin *d*, lever *P* by the pin *b*, and the eccentric-rod *Q* by the
65 pin *c*, to its maximum height, and changing

the leverage of the lever *P* in its relation to the eye in the piece *i* of the main valve-stem *M*, and thus shortening the stroke of the main valve *E* at the half-way point in the movement of the reversing-valve *F*. This reduces the
70 supply of working-steam taken into the cylinder while the engine is moving directly or the first way, so that the reversed movement of the engine will meet with less resistance of direct-working steam, while the reversing-
75 valve *F* is reversing the movement of the engine. When the pin *e* is carried by a half-revolution to the other lower point, (marked *e'*), and with it the connecting-rod *T*, the fulcrum-bar *O*, the lever *P*, and the eccentric-rod *Q*, the
80 full stroke of the main valve *E* is again made on the reverse movement, and a full head of working-steam is obtained by a restoration of the mechanical relation of the lever *P* with
85 the eye in the piece *i* of the main valve-stem *M*. The reversing-valve *F* may be packed at its bearing against either the upper or under surface of the valve-chest *C* with any suitable elastic packing. A wedge-shaped enlargement of the lever *P*, near its point of contact
90 with the bearing-surfaces of the eye in the piece *i*, through which it passes, takes up and prevents any loss of reciprocal motion when the said lever *P* stands perpendicular to the
95 piece *i*.

The advantages of my invention are obvious in the simplicity of construction and the ease with which the reversing movement can be made.

In the drawings, the valve-chest is located
100 at the side of the cylinder, the valves having horizontal bearings against the steam-ports. This is a novel arrangement, and is an advantage in locomotive construction, as it permits the use of a horizontal straight-line eccentric-
105 rod from the eccentric-disk on the axle of the driving-wheels.

I claim—

1. In a steam-engine, the combination of the cylinder *A*, valve-chests *B* and *C*, and valves
110 *E* and *F*, with the ports and passages *G*, *H*, *I*, *J*, *X*, *Y*, *Z*, *K*, and *K'*, and openings for the inlet of working-steam and exit of exhaust-steam, as described, and for the purpose or
115 purposes specified.

2. In a steam-engine, the reversing mechanism consisting of the valve-stem *N* and bar
120 *N'*, gear *g*, and plate *S*, connecting-rod *T*, fulcrum-bar *O*, lever *P*, valve-stem *M*, sliding pieces *i* and *h*, and eccentric-rod *Q*, with all their bearings, connections, and attachments, substantially as described, and operated by the lever *U*, as and for the purpose or purposes specified.

3. In a steam-engine, the reversing-valve *F*,
125 with its ports *G*, *I*, and *J*, communicating with valve-chests *B* and *C*, and main valve *E*, and operating substantially as described, and for the purpose or purposes specified.

4. In a steam-engine, the cylinder *A*, valve-
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5 chests B and C, valves E and F, with their several ports communicating with the ports X, Y, and Z, and ports to steam-ducts K and K', in combination with the direct-acting and reversing mechanism, consisting of the valve-stems N and M, bar N', gear *g*, plate S, connecting-rod T, fulcrum-bar O, lever P, slide-pieces *i* and *h*, and eccentric-rod Q, all with their

bearings, connections, and attachments, substantially as described, and for the purpose or to purposes specified.

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