(No Model.) 7 Sheets—Sheet 1.

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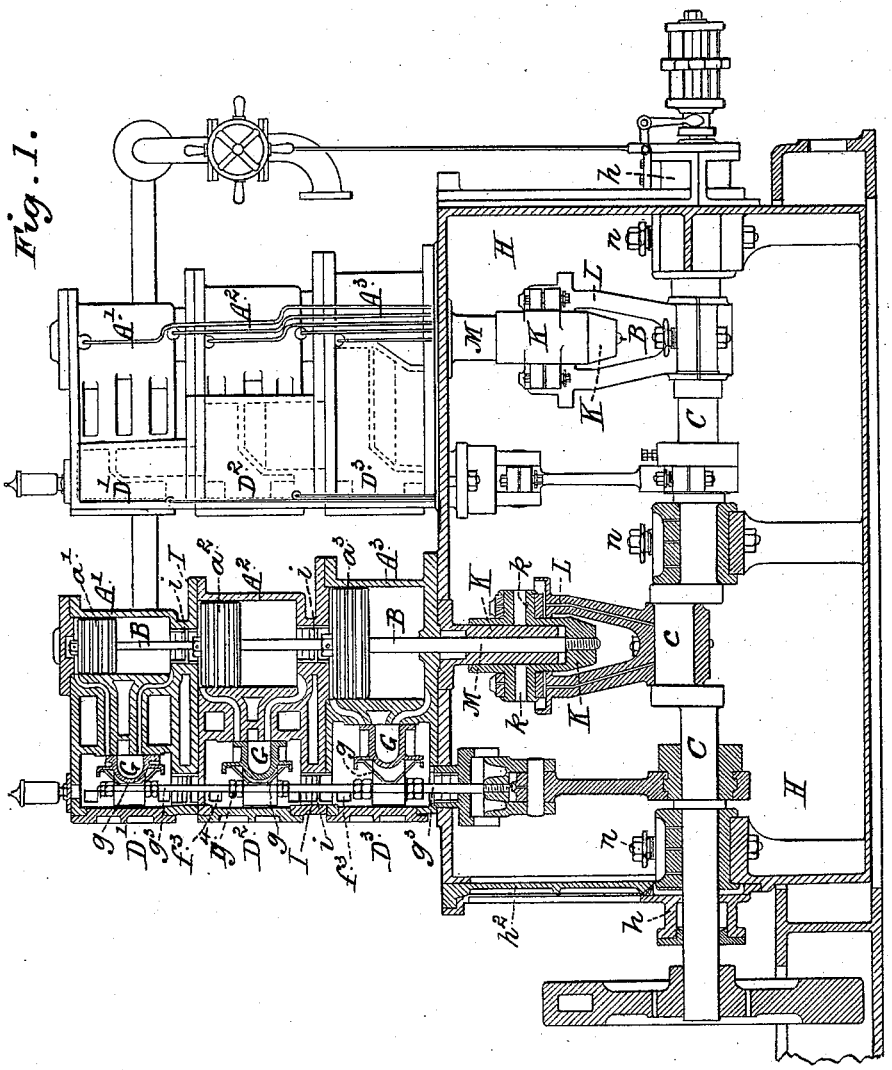
STEAM ENGINE.

No. 491,002. Patented Jan. 31, 1893.

Fig. 1.



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STEAM ENGINE.

No. 491,002. Patented Jan. 31, 1893.

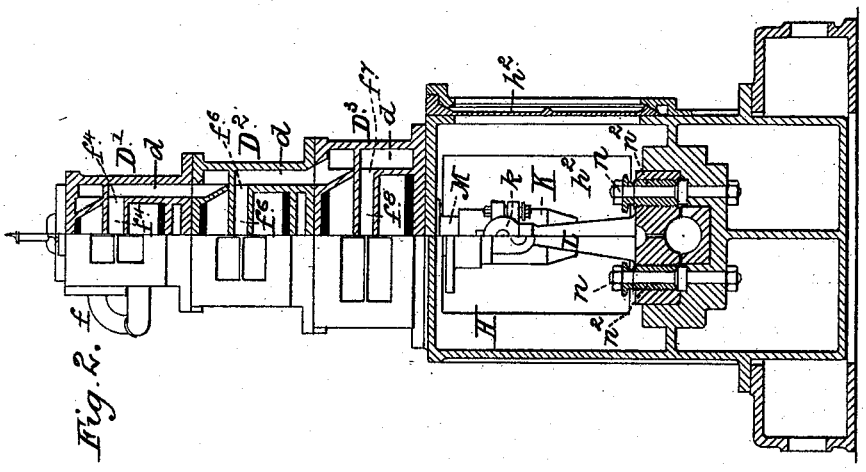

Fig. 2.

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No. 491,002. Patented Jan. 31, 1893.

Fig. 3.

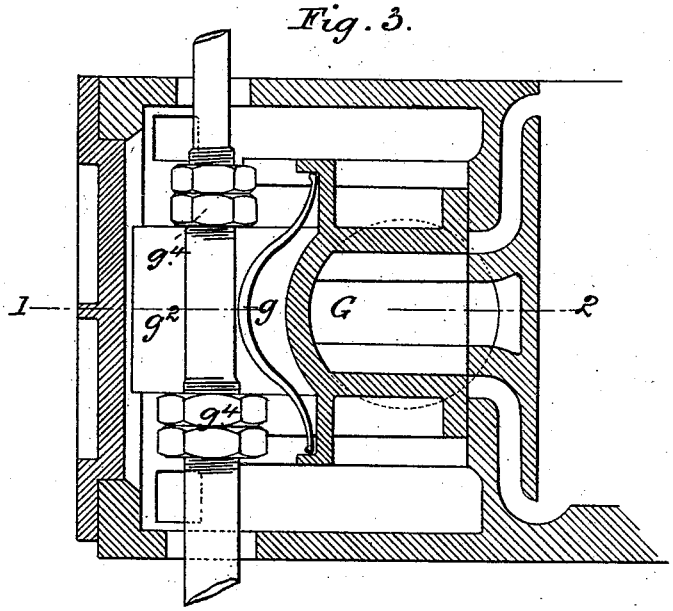
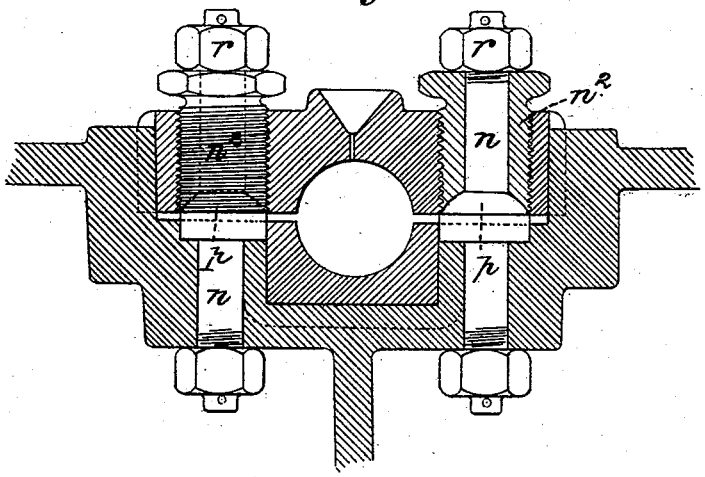


Fig. 6.



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STEAM ENGINE.

No. 491,002. Patented Jan. 31, 1893.

Fig. 4.

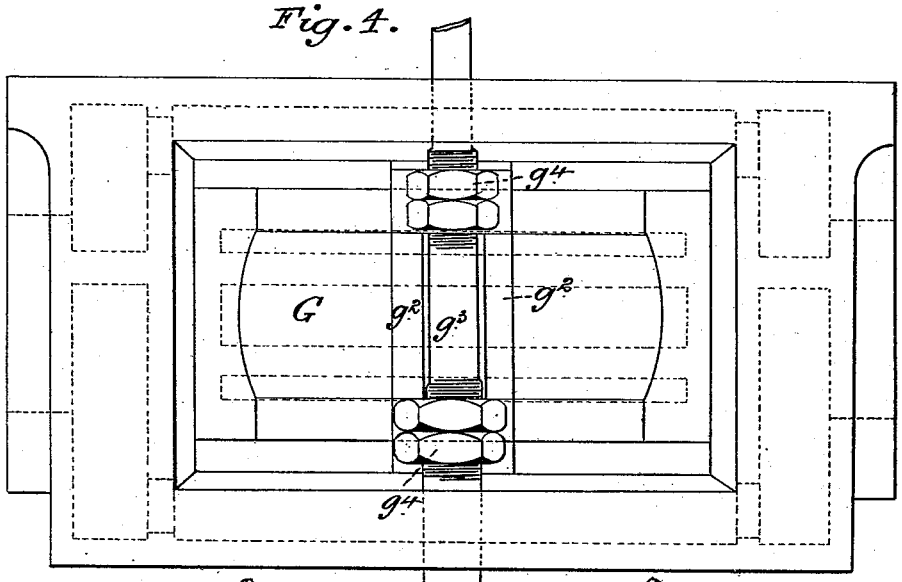
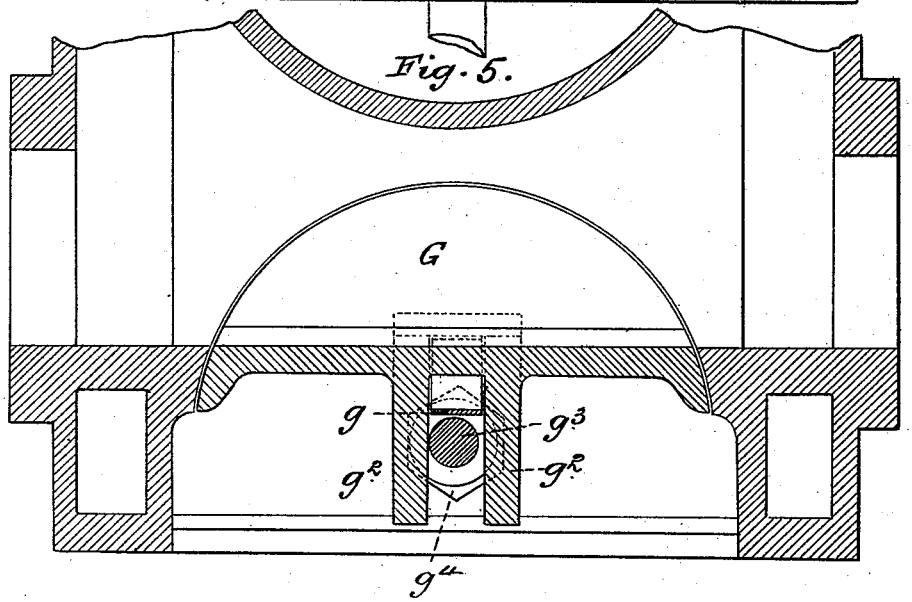


Fig. 5.



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STEAM ENGINE.

No. 491,002. Patented Jan. 31, 1893.

Fig. 8.

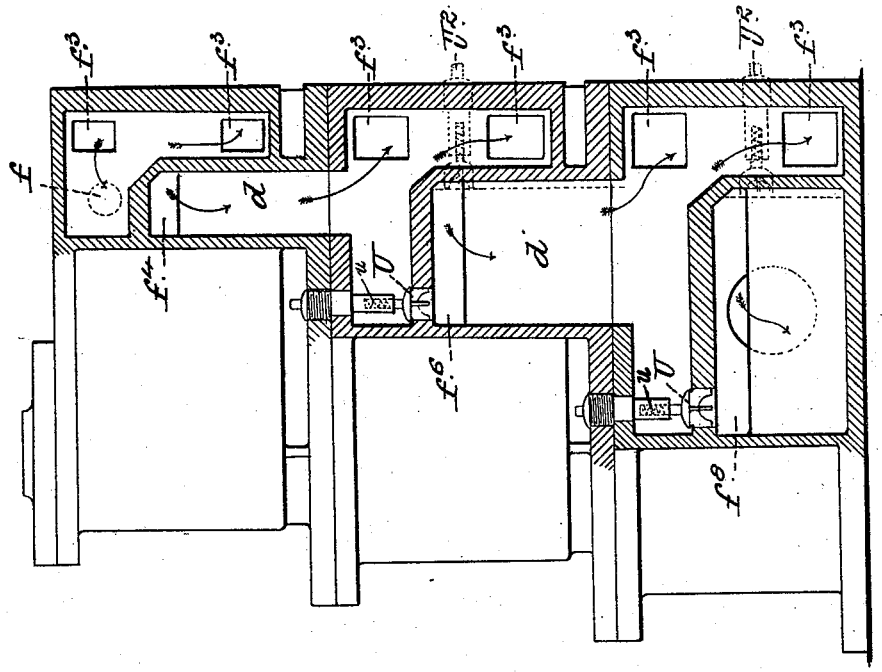
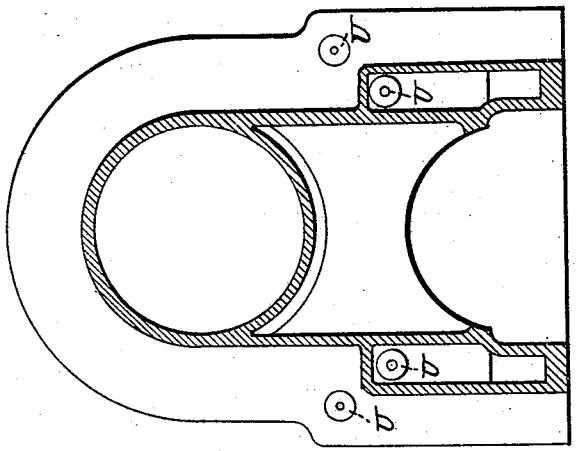


Fig. 7.



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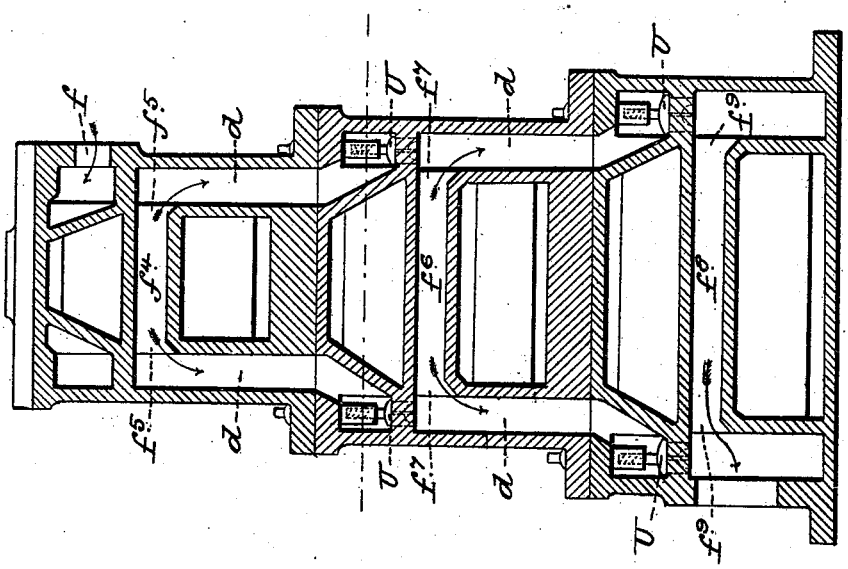
STEAM ENGINE.

No. 491,002. Patented Jan. 31, 1893.

Fig. 9.



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STEAM ENGINE.

No. 491,002. Patented Jan. 31, 1893.

Fig. II.

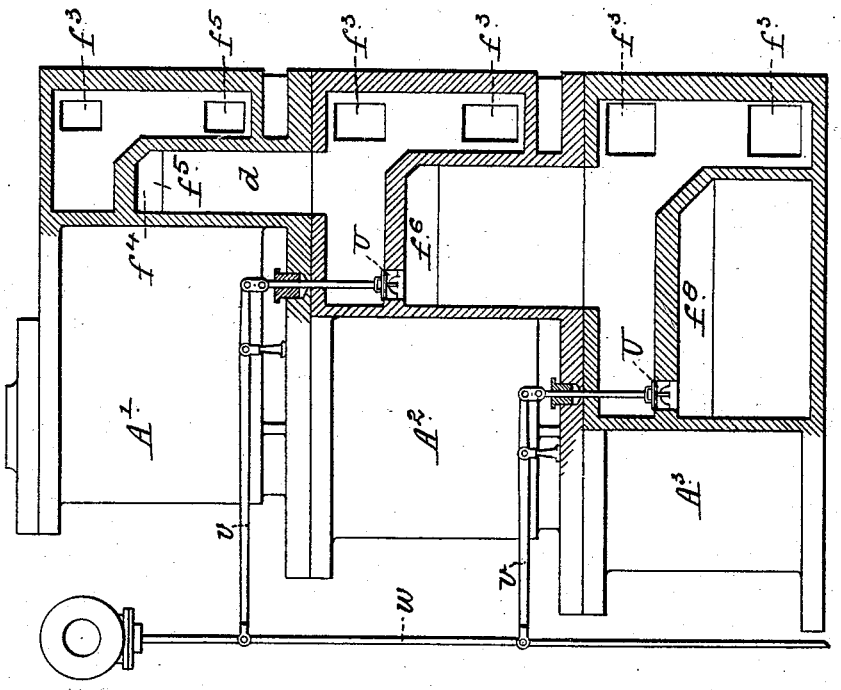
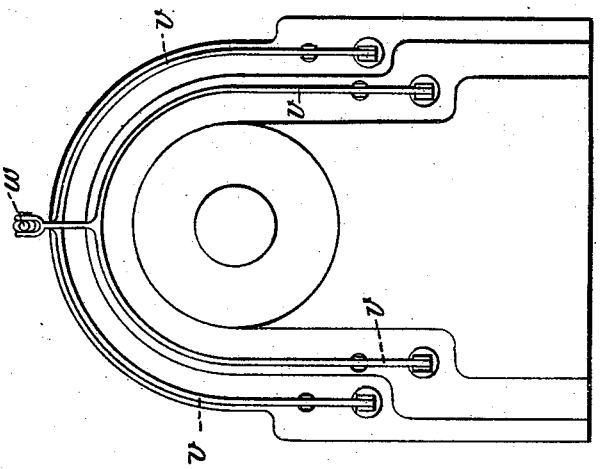


Fig. III.



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UNITED STATES PATENT OFFICE.

JOSEPH WRIGHT, OF LONDON, ENGLAND.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 491,002, dated January 31, 1893.

Application filed July 21, 1892. Serial No. 440,750. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH WRIGHT, mechanical engineer, a subject of the Queen of Great Britain and Ireland, residing at 16 Great George Street, in the city of Westminster, London, England, have invented certain Improvements in Engines Operated by Steam or other Motive Fluid, of which the following is a specification.

My invention has more especial reference to steam engines but is applicable to other engines operated by motive fluid as will be evident from the following description in which I presume steam to be the motive fluid. The engines act on the compound principle and are arranged tandem with the valve boxes so disposed that the pistons and valves can be connected each with a piston rod and valve rod respectively common to all the pistons and all the valves. The valves are made preferably with a bearing face in the arc of a circle struck from their rod and bearing on a similarly formed port face so that either valve can be removed on moving it through half a rotation as hereinafter described. Each cylinder may have a live steam inlet which can be closed (with the exception of course of that to the first cylinder) when all the cylinders are operating or either of which can be opened when it is desired to omit the supply of steam to one or more of the higher pressure cylinders. The springs by which the valves are pressed to the port faces against which they slide are carried by, and move with, the valves themselves so as to avoid wear. The crank shaft and attachments are situated in a tank of oil or other liquid arranged as hereinafter described. The stuffing boxes in which the piston rod and valve rod slide are preferably in one casting between adjacent cylinders. The connecting rod end of the piston rod is connected to the rod by means of pins or trunnions on a tubular piece sliding on a bush or sleeve projecting from the lower stuffing-box. To adjust the bushes and bearing parts which are subject to wear (such for instance as those for the crank shaft the connecting rod ends and the cam strap) and to prevent knocking noises I employ bolts surrounded by partly spherical pieces upon which bear sleeves through which the bolts pass the said sleeves being screwed into the bearing as hereinafter more fully described. Objectionable back pressure or "looping" is obviated by means of valves or cocks between the steam space or passage to, and the exhaust space or passage from, each cylinder which valves or cocks open or are opened when the supply of steam is lessened to such an extent that there is not sufficient steam to fill all the cylinders so that in the low pressure cylinder or cylinders not filled with steam communication is opened between the steam space or passage to, and the exhaust space or passage from, that cylinder, or those cylinders, and the steam spaces are then supplied from the exhaust side to make up deficiency in steam received from the preceding cylinder or cylinders. This may be applied to various kinds of engines subject to considerable variation of load such as dynamo engines, locomotives, rolling mill engines and marine engines whether they be condensing engines or not. And in order that my said invention may be fully understood I shall now proceed to describe the same and for that purpose shall refer to the several figures on the annexed drawings the same letters of reference indicating corresponding parts in all the figures.

Figures 1 and 2 are vertical sections, at right angles to each other, of an engine arranged according to my invention. The arrangement illustrated shows two sets of cylinders, of three each, arranged one above the other, but I do not limit myself to this as there may be one, two, or more, sets of cylinders, with two, three, or more, cylinders in a set. In Fig. 1 one of the sets of cylinders is shown in elevation, and it will only be necessary for me to describe one set, as the other set is arranged in the same manner, and I have marked it with the same letters of reference.

Figs. 3 to 6 are details drawn to a larger scale. Fig. 3 being a section through the valve casing showing the spring carried by the valve. Fig. 4 is a back view of the same the valve casing, cover, or side, being removed. Fig. 5 is a horizontal section through the line 1—2 of Fig. 3, and Fig. 6 shows in section, the arrangement of an adjustable bearing.

Figs. 7 to 11 show the arrangement of valves to prevent objectionable back pressure and "looping" and these figures serve also to show more clearly the arrangement of the passages

for the steam from cylinder to cylinder. A′ A^2 A^3 are the cylinders, arranged tandem, with a piston rod B, common to the pistons a', a^2, a^3, of the said cylinders, and connected to the crank c on the crank shaft C. The passages d, by which the steam exhausts from the several cylinders are made down the sides of the valve casings D′ D^2 D^3, the said passages being divided by the partitions d^2, which separate the exhaust of each cylinder. f, is the live steam inlet to the first cylinder, and f^4 and f^6 are the openings by which the exhaust steam from the cylinders A′ and A^2 leaves the valve casings to pass into the next cylinders A^2, and A^3, respectively by the inlets f^3. When the three cylinders are at work the steam (see Figs. 7 to 11) enters the live steam inlet at f and passes by the inlets f^3 f^3 into the valve chest of the first cylinder from which it exhausts into the central passage f^4 from whence it passes into the first side passages d by the openings f^5 and through the second set of inlets f^3 f^3 into the second cylinder whence it exhausts by the central passage f^6 and passes by the openings f^7 down the second passage d and by the third set of openings f^3 f^3 to the third cylinder from which it exhausts by the central passage f^8 and openings f^9 into the condenser or the atmosphere. On the valves I have shown the improvement in the arrangement of the springs (g) which press the valves on the port face the said springs being carried by the valves themselves so that they move with the valves and so are saved from a considerable amount of wear. This arrangement is shown more clearly in Figs. 3, 4, and 5. The valve G is formed with a slot or horns g^2 g^2 through which the valve rod g^3 passes and the valve is secured by the nuts g^4 to the said rod. The spring g at its mid part presses on the rod g^3, and its ends bear upon the back of the valve G. The valves are shown as being made with a bearing face in the arc of a circle struck from the center of the rod g^3 and bearing on a port face of the same shape so that either valve can be removed by slacking the nuts and turning the valve through half a rotation. H, is a tank, crank chamber, or vessel, through which the crank shaft passes so that the cranks, and their connections, are contained in oil, or other liquid, in the said tank, or vessel, which is provided with packed liquid-tight stuffing boxes h, for the shaft—h^2 are sliding doors capable of being closed liquid tight so that, by opening these access to the parts contained in the said tank, crank chamber, or vessel, can be obtained. The stuffing boxes i, in which the piston rod and the valve rod slide are preferably made with each cylinder and valve casting in one casting I as shown. The port faces in each valve chest are shown as being brought into line so that the one rod g^3, operates all the valves. The connecting rod end of the piston rod, and its connection with the crank, are shown arranged in the following improved manner. The piston rod B is connected to a slide block, or tubular piece, K, carrying the pins k, to which the one end of the connecting rod L, is secured so that it oscillates thereon the other end being connected to the crank as usual. The said tubular piece K, slides upon a bush, or sleeve, M, upon the outside of the lower stuffing box from which the outer end of the piston rod protrudes.

The bushes and bearing parts which are subjected to wear may be arranged as follows:—referring especially to Fig. 6. Bolts n, pass through each side of the block, or other part, carrying the bushes, and through a screwed sleeve n^2, screwed into a hole through one of the parts of the block, or the like. The inner end of the sleeve bears upon a partly spherical part p, surrounding the bolt n. By screwing the sleeve n^2, up or down, the spherical part p, allows for lateral deviation. When the adjustment is made the sleeves n^2, and the nuts r, being screwed up secure the parts firmly in position.

Referring now to Figs. 7 to 11 I will describe the valves arranged for establishing communication between the steam space or passage to, and exhaust space or passage from, the cylinders which valves for simplicity of illustration I have not shown in the preceding figures. Fig. 7 is a sectional plan and Figs. 8 and 9 are vertical sections, at right angles to each other, of so much of an engine as is necessary to show the application of valves operating automatically according to my invention and Figs. 10 and 11 are a sectional plan, and sectional elevation, of an arrangement wherein the valves are opened positively by the operation of the governor. f^3 are the steam passages to the cylinders and f^5 f^7 f^9 are the exhaust passages therefrom. U are the valves which, when closed, cover openings in the division walls between the said passages. When there is not sufficient steam received from a preceding cylinder to fill the next one the valves U, appertaining to that cylinder, open and exhaust steam passes from the exhaust side to make up the deficiency. These valves are normally held seated by suitable springs u, shown in dotted lines in Fig. 9, or by the pressure of steam above the same, and are opened automatically either by back pressure of the exhaust steam in passages d or by mechanical means connected with the governor of the engine.

I do not limit myself to any particular position in which to place the valves U provided they are between the inlet and exhaust passages. In dotted lines at U^2 I have shown, for instance, the valves arranged in another position.

In Figs. 10 and 11 the valves are connected by rods v, with the rod w, of a governor, driven by the engine, so that the valves are controlled by the said governor.

What I claim is:—

1. The combination with the cylinder and valve-rod, of a removable valve formed with a curved bearing face engaging in a corresponding seat, and rotatable in said seat about

the valve rod, and means for clamping the valve rod to the valve, substantially as described.

2. The combination with a series of cylinders, valves therefor and valve casings, said valves having a common valve-rod, and being rotatable in their seats about the same means for clamping the valves to the rod and for removing each or any valve from its casing without disturbing or displacing the rod, substantially as described.

3. In a steam or fluid pressure engine, the combination with the valve rod, of one or more valves each having its face formed in the arc of a circle stricken from the valve rod as a center rotatable about the same and engaging in corresponding seats, and means for engaging said valve or valves with the valve rod, substantially as described.

4. In a fluid pressure or steam engine, the combination with the piston and connecting rods, of a lower stuffing box having a sleeve projecting therefrom through which the piston rod passes, a tubular slide, to which the lower end of the piston rod is secured, engaging about said sleeve and to the lower end of which is pivoted the connecting rod, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH WRIGHT.

Witnesses:
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WM. JOHN WEEKS,
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