(No Model.) 2 Sheets—Sheet 1.

J. CURTIS.

STEAM ENGINE.

No. 409,563. Patented Aug. 20, 1889.

Fig. 1.

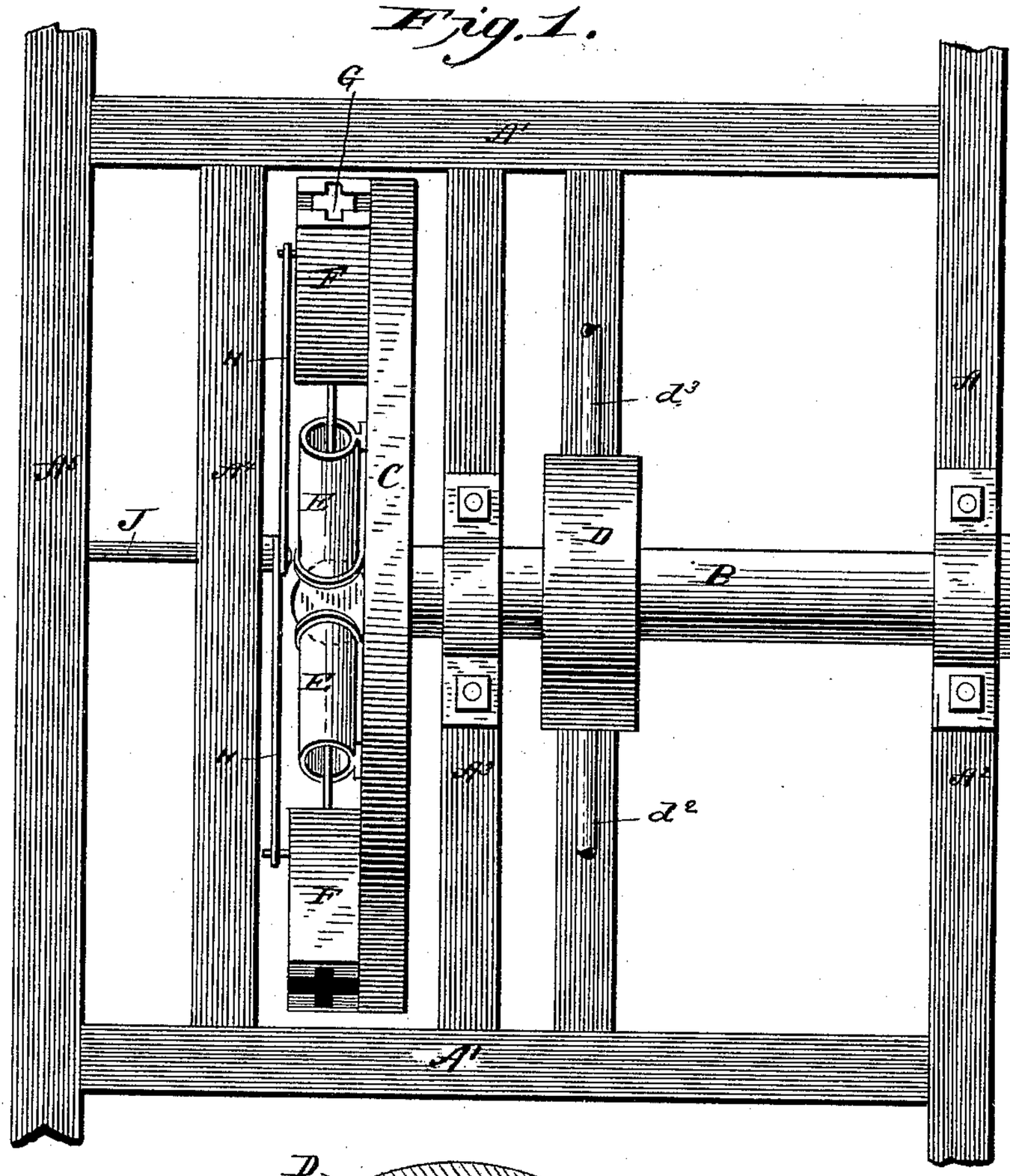
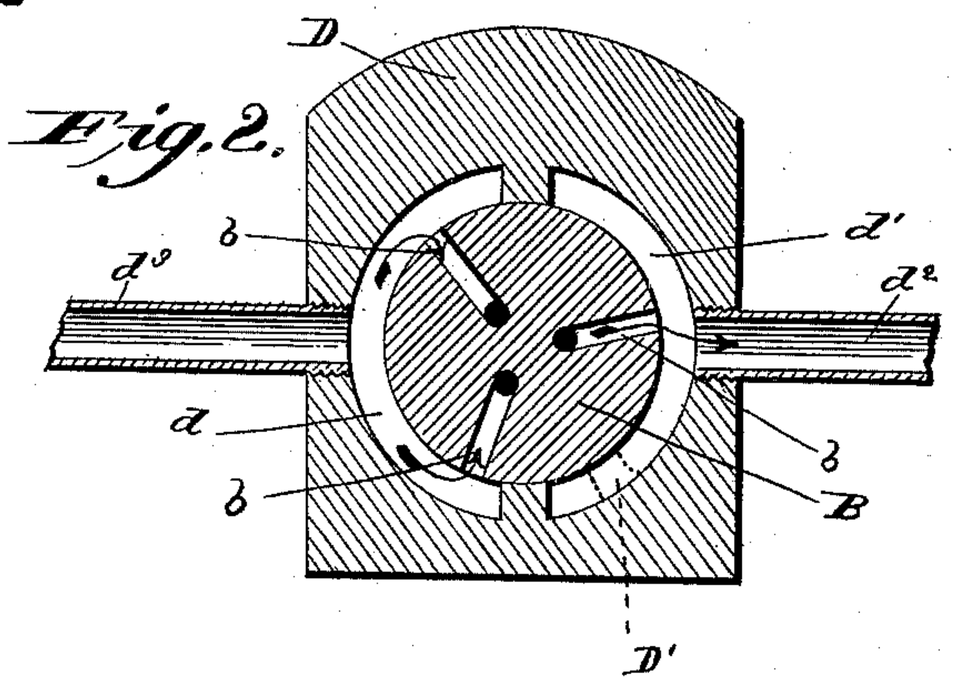


Fig. 2.



WITNESSES

Jno. S. Finch Jr.

C. M. Alexander

INVENTOR

Jno Curtis

By C. M. Alexander

Attorney

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

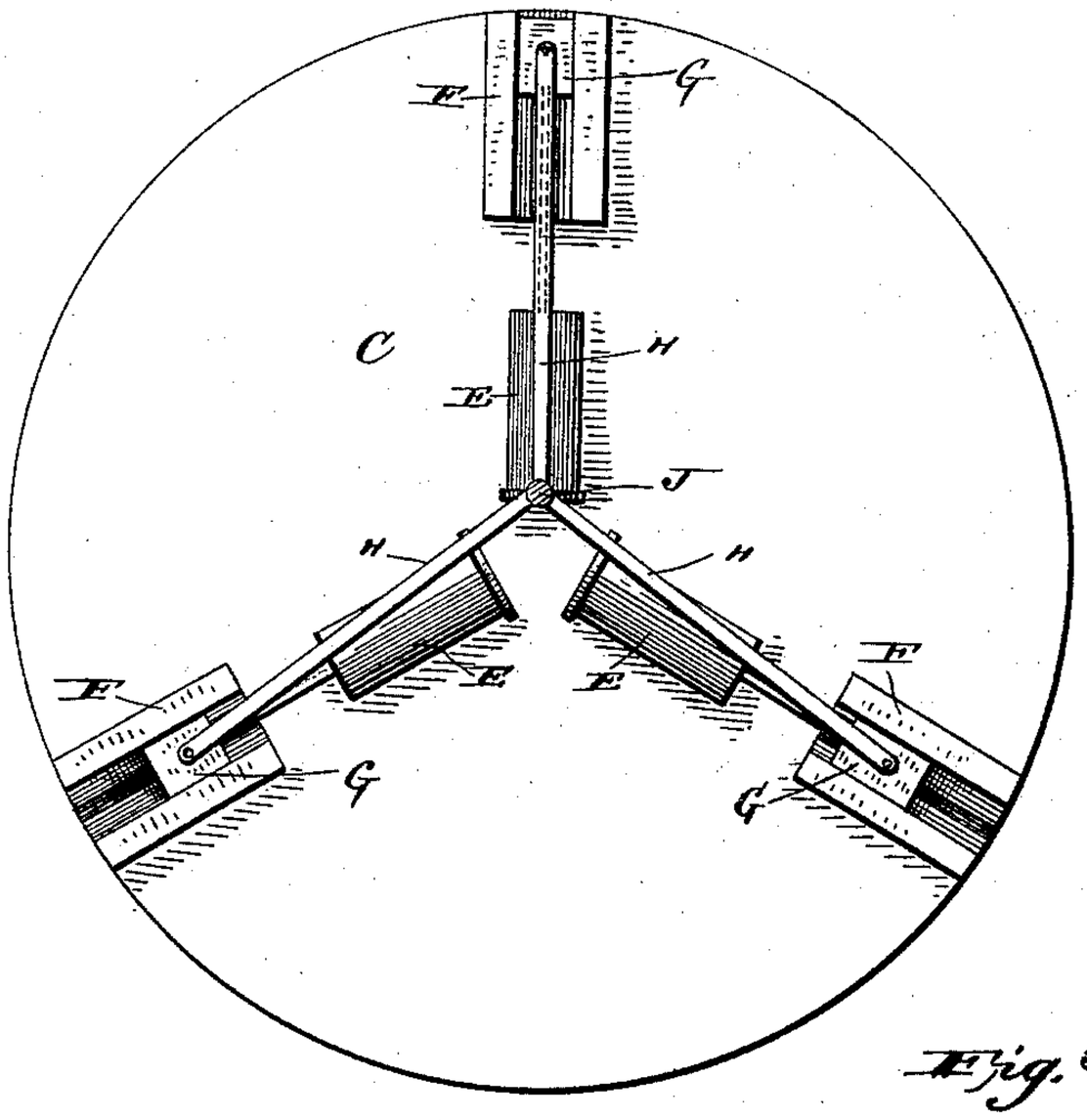
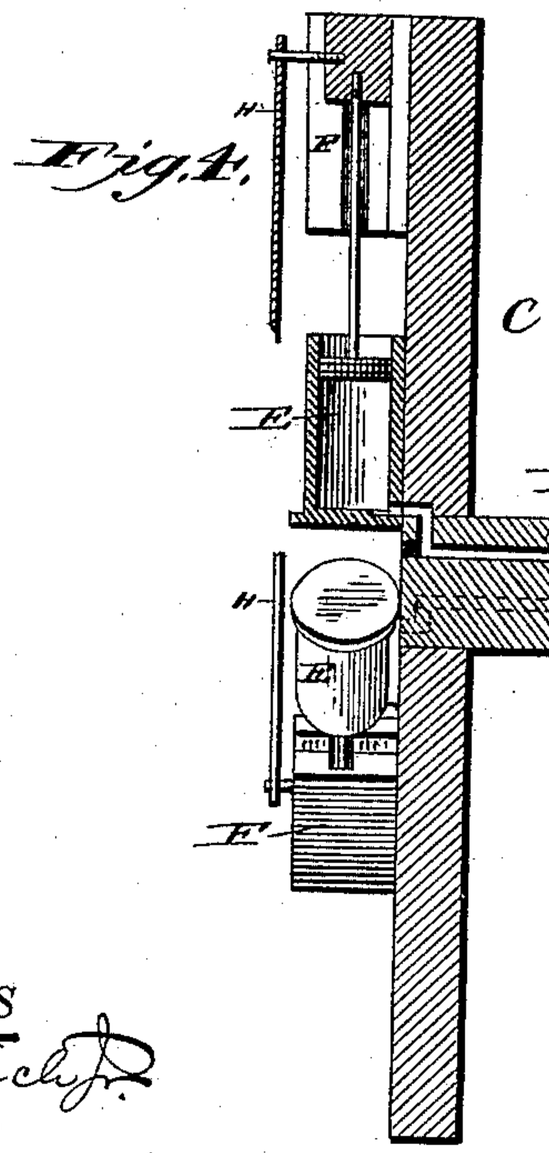
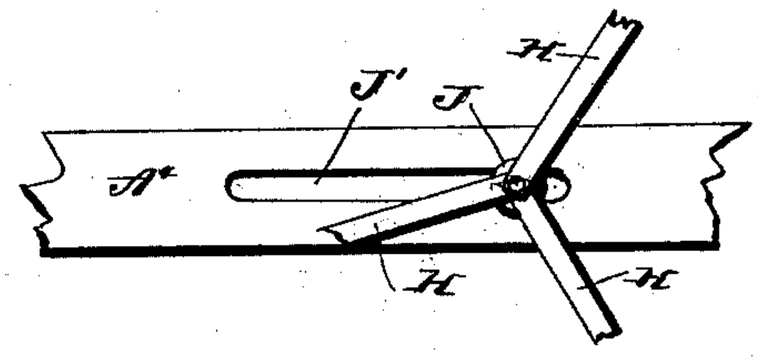


Fig. 5.

Fig. 4.





WITNESSES

Thos. S. Finch Jr.

C. M. C. Davis

INVENTOR

Jno Curtis

By C. M. Alexander

Attorney

UNITED STATES PATENT OFFICE.

JOHN CURTIS, OF NORTH DORSET, VERMONT.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 409,563, dated August 20, 1889.

Application filed June 12, 1888. Serial No. 276,795. (No model.)

To all whom it may concern:

Be it known that I, JOHN CURTIS, a citizen of the United States, residing at North Dorset, in the county of Bennington and State of Vermont, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to that class of steam-engines ordinarily known as "revolving-cylinder" engines; and it consists in certain novel features of construction and arrangement of parts, which will be hereinafter fully explained and specifically claimed.

This invention relates particularly to improvements upon that class of engines covered by a patent (No. 333,060) issued to me on the 22d day of December, 1885; and it has for its object to so improve the construction of such engines that they will be more positive and reliable in operation, and whereby all "dead-centers" and "pounding" will be avoided, as will be more fully hereinafter set forth.

Figure 1 is a plan view of an engine embodying the features of my improvement. Fig. 2 is a transverse sectional representation of the steam-box and shaft, showing the interior arrangement and construction of the same. Fig. 3 is a representation of the revolving disk provided with the cylinders and their connecting parts, and showing their relative arrangement to each other. Fig. 4 is a longitudinal sectional representation of the shaft, the disk, and connecting parts, and more fully illustrating the construction and relation of the same; Fig. 5, a detail view showing one method of reversing the engine by making the eccentric-pin movable.

A, A′, A^2, A^3, A^4, and A^5 is the supporting-frame.

B is the shaft, provided with three distinct ports *b b b*, and having bearings in the supporting-frame A^2 A^3, to which it is suitably secured by the usual journal-caps shown.

D is the steam-box surrounding the shaft B, and secured to the frame part A^2. This box may be provided with suitable stuffing-boxes. The interior of the steam-box is divided by partitions into semicircular recesses as shown in Fig. 2, which act as steam-inlets and exhaust-ports, as hereinafter explained.

d^3 is the steam-pipe, and d^2 is the exhaust.

C is a disk which serves as a bed-plate and fly-wheel, to which the shaft B is suitably secured.

E E E are cylinders set upon the disk on lines radiating from the center of the shaft at points equidistant from each other.

F F F are ways in line with the cylinders E, provided with the usual pistons connected in the ordinary manner with the slides G.

H H H are rods pivotally connected to a rod or pin J, fixed to the frame parts A^4 A^5 in a position eccentric to the center of the shaft B, and thence with pins in the cross-heads G, as shown.

The cylinders E take steam in one end only, and for that reason need but one cylinder-head, which may be made integral with the cylinder.

In operation, steam will enter the semicircular recess *d* in the steam-box, and will pass through the ports *b b* into the inner ends of the cylinders E, in positions corresponding thereto. The cylinders will begin to take steam as the ports *b* pass the lower partition to the steam-box, and will continue to do so until the ports *b* pass the upper partition, when the steam will be cut off and exhausted into the recess and through the pipe d^2. From the relative positions of ports *b* to the steam-box partitions it will be seen that one or two of the cylinders will take the steam all the time, and that the engine will have no dead-centers, but will start at once from any position whatever.

By increasing the thickness of one of the steam-box partitions, or by introducing a movable partition into the recess *d*, the engine can be made to cut off the steam at any desired part of the stroke, as shown in dotted lines at D′ in Fig. 2. The rods H, connecting the cross-heads with the eccentric pivot-rod J, will cause the disk to turn as the pistons move, and will bring the pistons back to the starting-point when the steam is exhausted. By reason of the cylinder, ways, and cross-heads being set at equidistant points on the disk the motion of the latter will be balanced, and the action known as

"pounding," which would otherwise occur, is thus avoided, and a more perfect operation obtained than is otherwise practicable.

One of the main objects of the improvements—*i. e.*, balancing the motion—may be obtained by dispensing with one of the cylinders and its connecting parts and securing the two remaining cylinders and their connecting parts to the disk in line with each other through the center of the shaft B, having two ports correspondingly located to conduct steam into the cylinders as the port-openings pass through the steam-recess of the steam-box. In this arrangement the steam would be admitted to and exhausted from the cylinders alternately, and the piston-force of one cylinder would operate to maintain the motion while the piston-force of the opposite cylinder was inactive. Four cylinders may also be used, in which case it would be necessary to provide the shaft with four corresponding ports, and the cylinders and their connections would have to be located accordingly on the disk. The single pin set eccentric to the center of the machine, for controlling the equal movement of the cross-heads, the movement of the disk with the piston, and the return of the latter, will perform the same office for a two, three, or four cylinder engine, and for this reason I do not confine myself to the use of any special number of cylinders.

This engine can be so made as to be easily and speedily reversed by having the pivot J so arranged as to be movable to a position diametrically opposite to that it originally occupies and by sliding the movable partition D′, if there is one employed, to the other end of the recess in the steam-chest.

One method of making the pin J movable is shown in Fig. 5, where the pin passes through a horizontal slot or opening in the frame-beams A^4 and A^5.

It will be observed that the essential feature of this invention, from which most of the advantages I claim flow, consists in providing the shaft with independent steam-ports and connecting them, respectively, with independent steam-cylinders, the inner ends of the cylinders being closed, as set forth. The special advantage in this construction over the arrangement shown in my former patent lies in the fact that there are always one or more steam-ports taking steam, thus keeping up a rapid and continuous rotary motion of the balancing-disk and shaft.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the shaft provided with independent steam-ports, of a disk secured on the end of this shaft, independent radiating steam-cylinders secured on this disk and connected, respectively, to the said independent steam-ports, pistons and piston-rods working in these cylinders, radiating ways, also secured on the face of the disk in line with the cylinders, cross-heads in these ways connected to the piston-rods, and the rods H, connecting the said cross-heads with a stationary pivot-pin set eccentrically to the said shaft, substantially as described.

2. The combination of the steam-box provided with two recesses, the shaft having independent ports corresponding to the number of cylinders, the disk provided with two or more cylinders having pistons connected in the ordinary manner with cross-heads, the slides secured to the disk in a manner to balance each other, and the rods connecting the cross-heads with the pivot set eccentric to the shaft, substantially as and for the purposes set forth.

3. The combination of a frame, a shaft journaled in the same and provided with two or more independent steam-ports, a balance disk or wheel on the shaft, independent radiating steam-cylinders on this disk, the said independent ports communicating with these independent steam-cylinders, pistons and piston-rods, cross-heads, and radiating slides secured on the disk, substantially as and for the purpose herein described.

4. As an improvement upon my patent numbered 333,060, granted the 22d day of December, 1885, a steam-engine consisting of the following instrumentalities: a suitable frame, a shaft journaled in bearings upon this frame and provided with two or more independent steam-ports, a steam-box surrounding the shaft, a rotating disk secured on one end of this shaft, independent radiating steam-cylinders secured on the face of the said disk, the inner ends of these cylinders being closed and connected, respectively, to the independent steam-ports in the shaft, pistons working in these cylinders, piston rods and slides, and radiating guides secured on the face of the said disk and connecting the said slides with a stationary eccentric-point on the said frame, substantially as and for the purpose herein set forth.

5. The combination of a shaft provided with independent ports, a disk rigidly secured to one end of the shaft, independent radiating cylinders secured to the face of the said disk, the inner ends of the said cylinders being closed and connected, respectively, with the independent steam-ports in the shaft, radiating guides, pistons and piston-rods, cross-heads working in the said guides, radiating independent rods connecting the said cross-heads with a pin J on a stationary beam, said pin, and beam, the said pin being secured in a slot J′ in the said beam, substantially as described.

6. The combination, with a frame, of a drive-shaft journaled upon this frame and provided at one end with a rotating disk, a steam-box embracing this shaft and provided with inlet and exhaust chambers, this steam-box being mounted upon the frame to the rear of the disk on the shaft, radiating steam-cylinders closed at their inner ends and secured on the

face of the said disk, radiating guides upon the face of the disk, pistons in the cylinders, piston-rods connected with slides working in the guides, and independent radiating rods connecting the said slides with a stationary eccentric-pin upon the frame, the said shaft being provided with independent steam-ports connecting the inner closed ends of the cylinders with the steam-box, substantially as herein set forth.

7. The combination, with a frame, of a drive-shaft journaled in the frame, a disk secured on one end of the shaft, radiating independent cylinders and slides upon this disk, pistons and slides, the said shaft being provided with independent ports leading to the cylinders, a stationary adjustable eccentric pin or shaft J upon the frame, and independent radiating rods connecting this adjustable eccentric-pin with the slides working in the guides on the disk, as and for the purposes set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN CURTIS.

Witnesses:

W. N. SEVERANCE,

J. P. BLACK.