No. 749,742. PATENTED JAN. 19, 1904.

W. L. McLEAN.

STEAM ENGINE FOR CURD CUTTING MACHINES.

APPLICATION FILED SEPT. 2, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

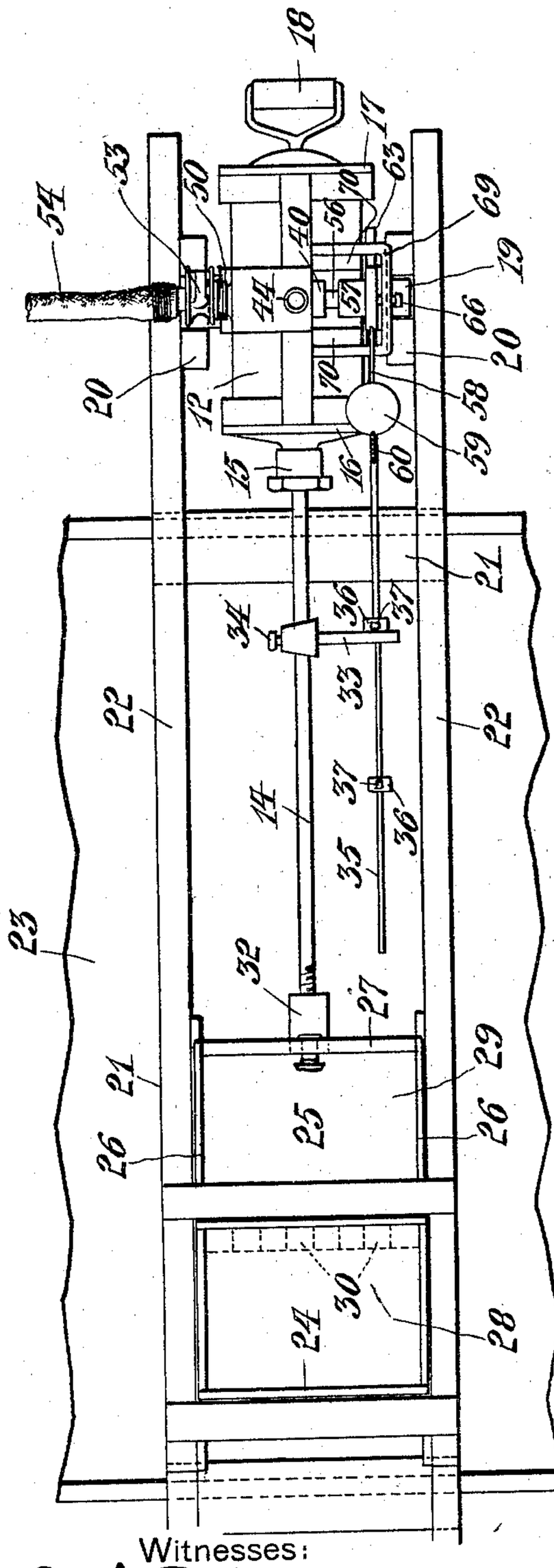

FIG. 1.

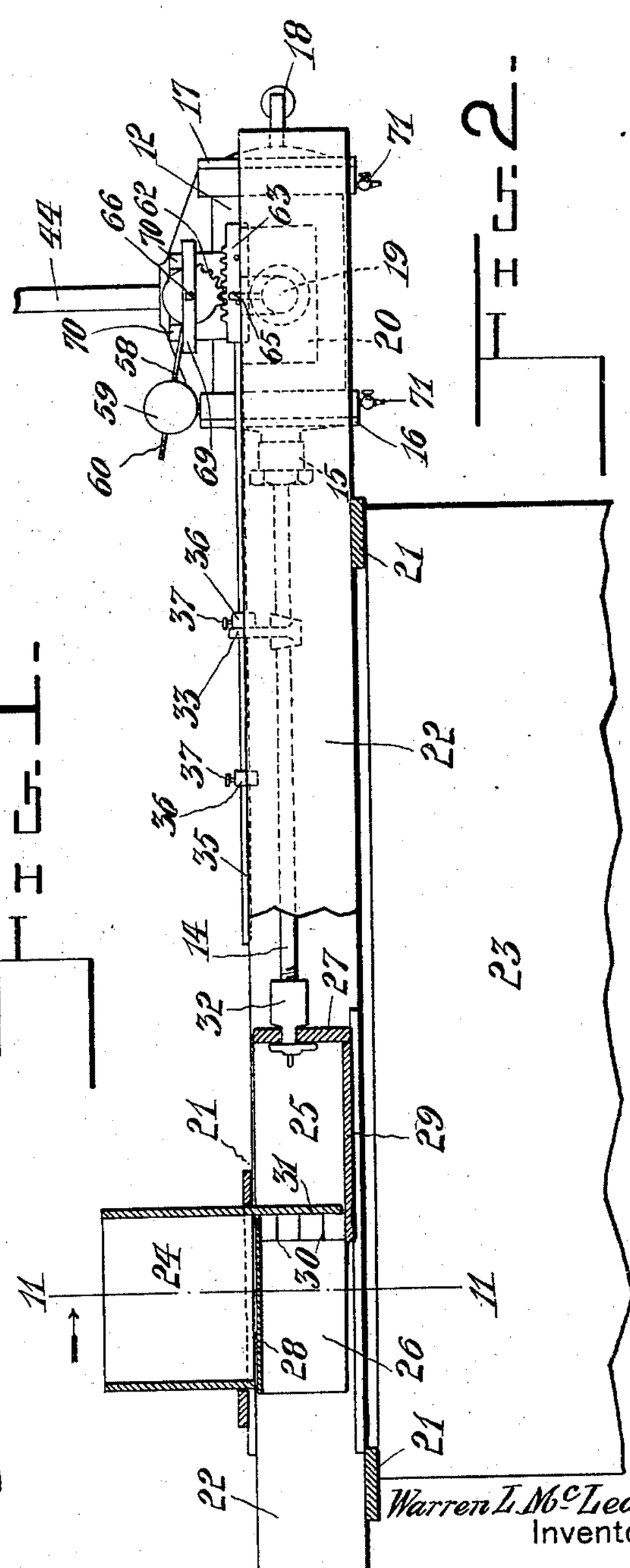

FIG. 2.

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NO MODEL. 3 SHEETS—SHEET 2.

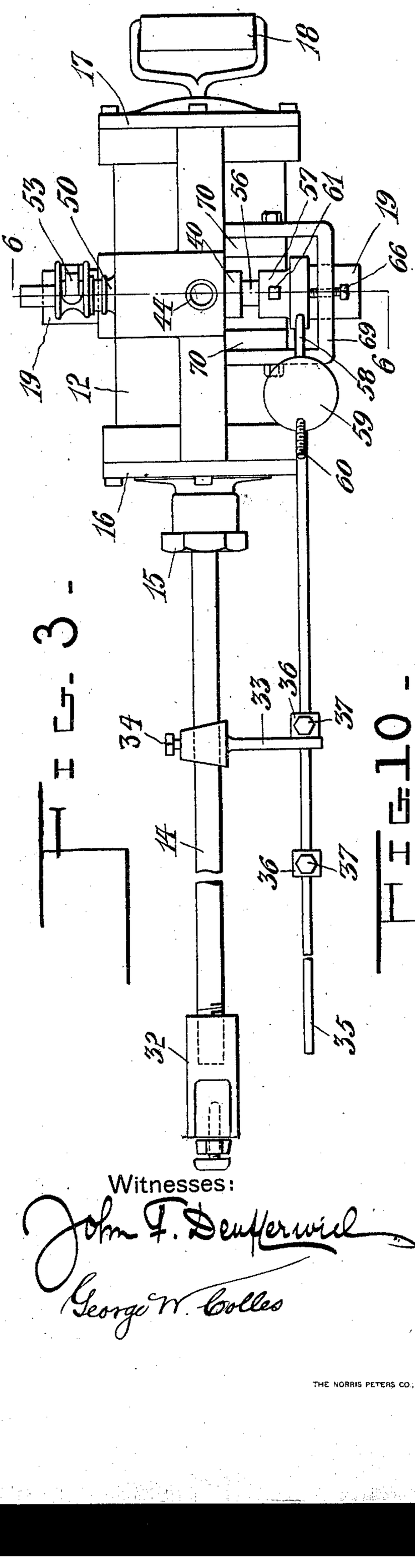

FIG. 3.

FIG. 10.

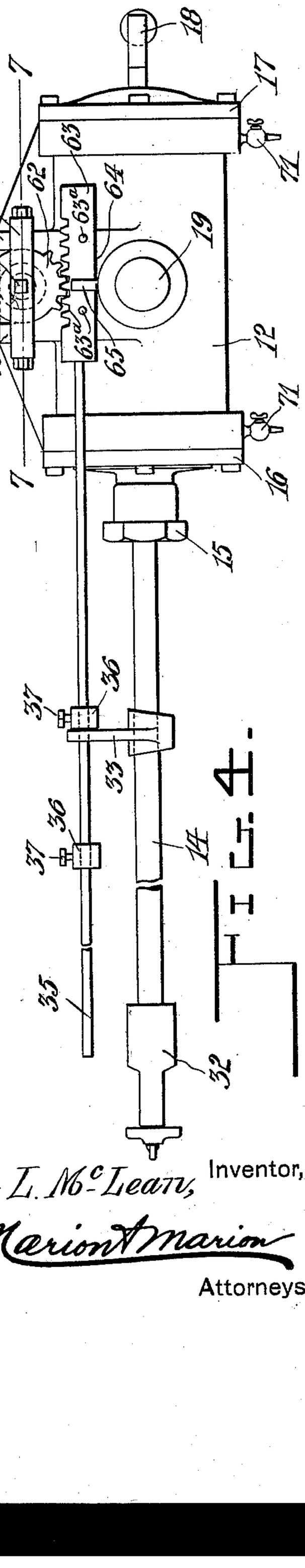

FIG. 4.

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NO MODEL. 3 SHEETS—SHEET 3.

FIG. 5.

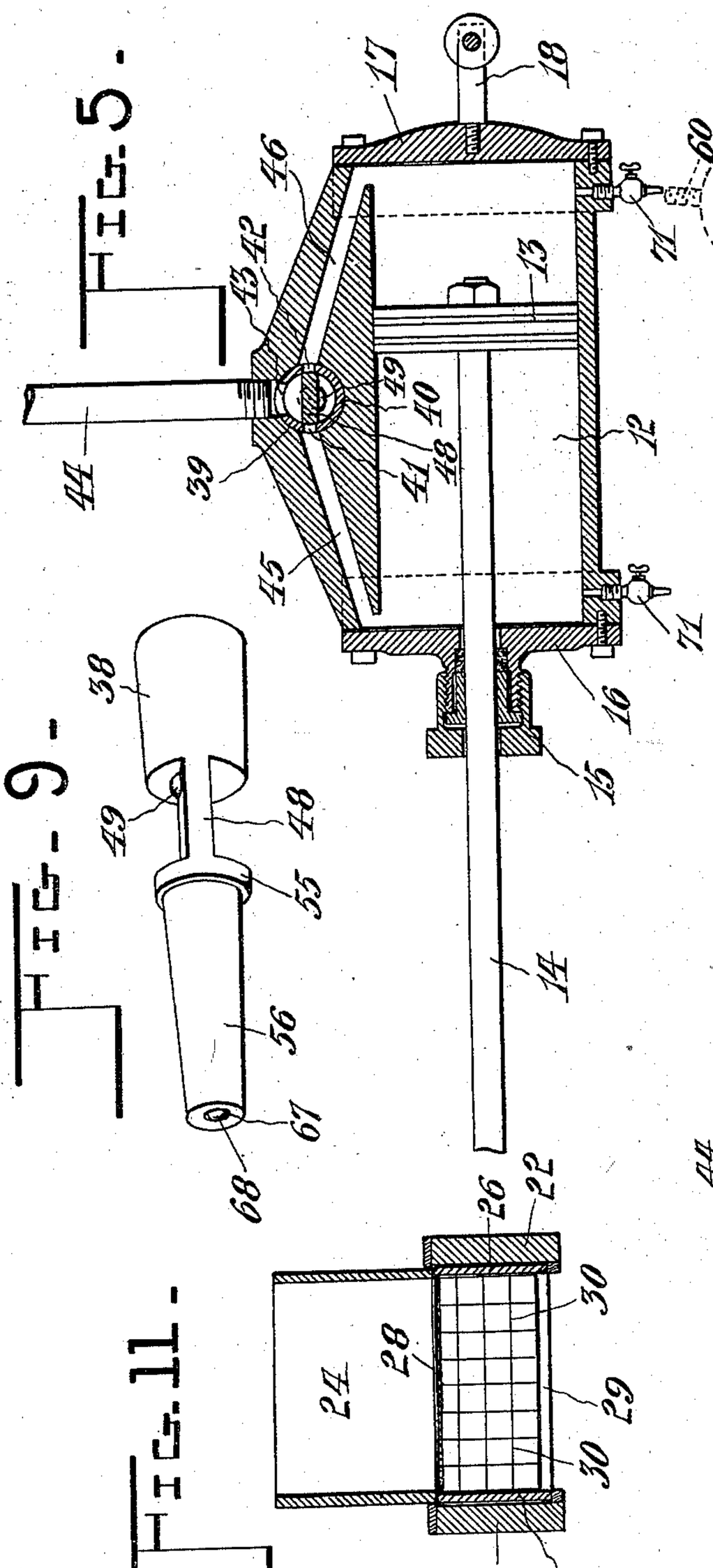

FIG. 8.

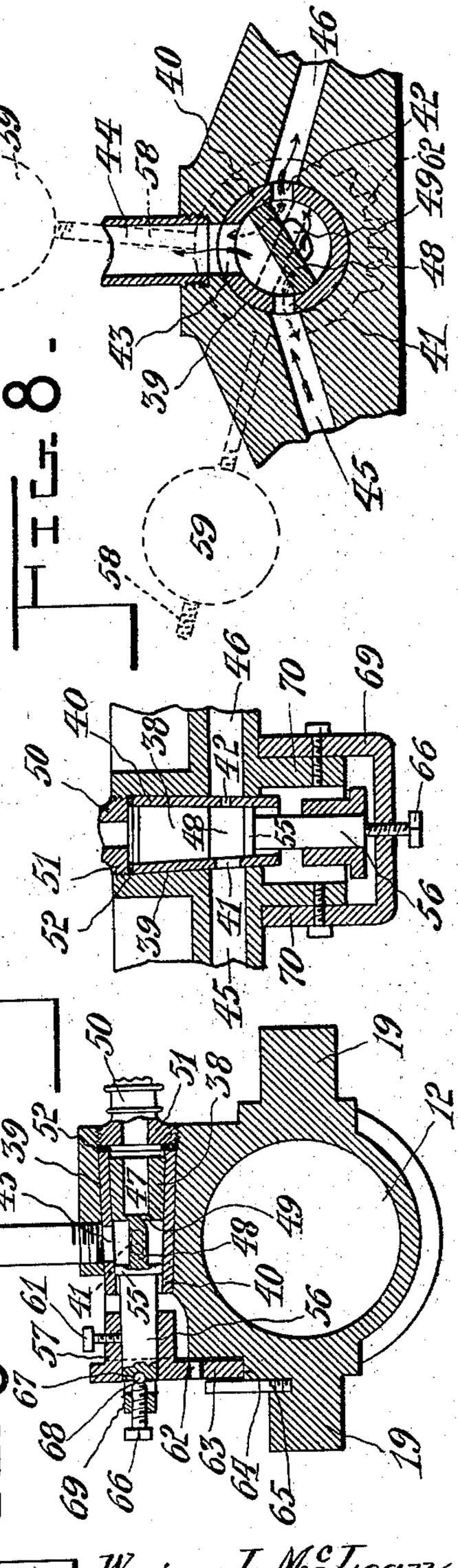

FIG. 9.

FIG. 7.

FIG. 11.

FIG. 6.

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No. 749,742. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

WARREN LYMAN McLEAN, OF YONGE MILLS, CANADA.

STEAM-ENGINE FOR CURD-CUTTING MACHINES.

SPECIFICATION forming part of Letters Patent No. 749,742, dated January 19, 1904.

Application filed September 2, 1902. Serial No. 121,773. (No model.)

To all whom it may concern:

Be it known that I, WARREN LYMAN McLEAN, a subject of the King of Great Britain, residing at Yonge Mills, county of Leeds, Province of Ontario, Canada, have invented certain new and useful Improvements in Steam-Engines for Curd-Cutting Machines; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to small reciprocating steam-motors especially adapted for curd-cutting machines in which the cutting power is applied only in one direction, the return stroke being performed without any cutting or other useful application.

The object of my invention is to produce an engine which shall possess a number of advantages of more or less importance over those now in use, one of which is to enable the full force of the steam to be applied only upon the cutting stroke and only so much steam to be applied on the return stroke as is necessary to effect the latter, whereby the return stroke is effected without danger of knocking out the cylinder-head and without jar or concussion; another to provide for the full port-opening during the entire steam-admission period and a sudden and complete cut-off, whereby to economize steam and increase the general efficiency of the engine; another to provide valve mechanism which shall consume a comparatively insignificant amount of power in its operation in proportion to the total steam used by the engine, a feature which it is difficult to accomplish with small and simple engines, and another to provide for the ready manipulation and removal of the engine bodily when it is desired to repair the same or the curd-cutter to which it is connected or to replace the engine by another one of larger or smaller size.

To these ends my invention consists in a cylinder containing a piston, which cylinder is mounted upon transverse trunnions which rest in suitable bracket-lugs formed on the sides of the frame of the curd-cutter, and the cylinder is provided with a handle at its rear end, whereby it may be readily lifted out from or placed in the curd-cutter frame and connected to the cutting-knife.

A special feature of my invention consists in the valve mechanism, which comprises a tapered valve-spindle arranged to oscillate in a tapered recess forming the interior face of the valve-chest and between which and the spindle is interposed a tapered or conical liner which is provided with the ports through which the steam passes, and these ports are of different size for the two ends of the cylinder, such that the steam in the return-stroke end is withdrawn to a certain extent, thus preventing the employment of an excessive amount of steam for merely returning the piston to the beginning of its cutting stroke and at the same time preventing dangerous jars between the piston and cylinder-head.

Another feature of my invention consists in the means employed by me for suddenly and completely closing the steam-ports at the point of cut-off, which is effected by means of a tumble-bob or weight fixed on an arm radially extending from the axis of the valve and caused to be raised by a dog on the piston-rod, which acts on a rack geared to the tumble-bob, until the said tumble-bob reaches its highest point, when it is overbalanced and falls suddenly to the opposite side.

My invention furthermore consists in the peculiar construction and combination of parts hereinafter described, and more particularly pointed out in the claims following the description.

In the drawings accompanying this specification I have shown the most approved form of my improved steam-engine, and herein—

Figure 1 is a plan view of the engine complete as connected to a curd-cutter. Fig. 2 is a side elevation of the same. Fig. 3 is a plan view of the engine by itself and on a somewhat larger scale than in Fig. 1. Fig. 4 is a side elevation of the same. Fig. 5 is a longitudinal vertical central section through the cylinder and valve-chest of the engine. Fig. 6 is a transverse vertical section taken centrally through the cylinder and valve-chest—that is to say, on the line 6 6 of Fig. 3. Fig. 7 is a plan section taken centrally through the valve-chest—that is to say, on the line 7 7 of

Fig. 4. Fig. 8 is a fragmentary longitudinal vertical central section through the valve-chest on a still larger scale to show the different positions occupied by the valve. Fig. 9 is a perspective view of the valve. Fig. 10 is a similar view of the liner surrounding the valve. Fig. 11 is a transverse vertical section through the curd-cutter shown in Figs. 1 and 2 on the line 11 11 of Fig. 2 to illustrate the character of the mechanism which the engine is employed to drive.

The same numerals of reference denote like parts in each of the several figures of the drawings.

12 designates the cylinder of the engine, 13 the piston, and 14 the piston-rod, which passes through a stuffing-box 15 in the forward end 16 of the cylinder, and to the rear end 17 is fixed a horizontally-projecting handle 18 to enable the engine to be readily raised from its position or lowered thereinto. It will be observed that the sides of the cylinder are provided with trunnions 19, which rest ordinarily in bracket-lugs 20, fixed to the sides of the frame of the curd-cutting machine. This curd-cutting machine, as illustrated in Figs. 1, 2, and 11, comprises a frame 21, consisting principally of a pair of longitudinal beams or joists 22, which extend parallel to each other for a considerable distance to one side of the curd-cutting apparatus proper to form a support for the engine, and they have fixed to their inner faces at the projecting ends the socketed bracket-lugs 20 just referred to. The frame so formed is adapted in the ordinary curd-cutting process to rest upon the upper edge of a curd-vat 23, into which the curd falls as fast as it is cut. The uncut curd is placed in a hopper 24, whose lower side is closed by the frame 25 of the cutting-knife. This frame consists of a trough-shaped box having a pair of sides 26 directly under the sides of the hopper, a transverse board 27 joining the sides 26, a top board 28 immediately under the lower end of the hopper at the upper side of the frame, and a bottom board 29 at its lower side. As will be seen, the top board 28 extends from the rear end of the frame 25 to a point slightly over half-way across the frame and the board 29 extends an equal distance from the front end, both being of suitable dimensions to completely underlie the lower end of the hopper, and between the overlapping ends of the boards 28 and 29 is located a vertical cutting-knife 30, which, as clearly shown in Fig. 11, comprises a vertical and a horizontal series of blades, which intersect so as to form a network, and thus divides the curd into a series of small strips or rods as it passes through it. The forward side of the hopper 24 has an extension 31, which extends adjacent to the upper face of the board 29. When the frame 25 of the cutting-knife is pushed back until the cross-piece 27 abuts against the extension 31 of the hopper, the knife 30 will be under the rear edge of the hopper and the curd will fall from the hopper into the trough-shaped space between the board 27 and knife 30 and will fill the same. Then as the cutter-frame is moved forward the knife will pass through the curd and the cut curd will fall into the vat 23, while the board 28 sustains the curd already in the hopper until the return stroke is completed.

The above description of the curd-cutting machine with which my engine is employed is merely by way of illustration of its use, because the curd-cutting machine of itself is not of my present invention.

The piston-rod 14 of the engine has, as shown, a screw-clamp 32 mounted on its end for securing the cutting-knife thereto. The piston-rod has also adjustably mounted thereon a dog 33, which is fixed thereto by any suitable means, such as a set-screw 34, so that it may be adjusted to the proper position, and this dog is arranged to act upon the valve-rod 35 by means of a pair of collars 36, which are likewise adjustably fixed to the valve-rod by means of set-screws 37.

The valve is of the oscillating type and is, as represented in Fig. 9, in the form of a conical spindle 38, and it is arranged to oscillate about an axis transverse to the axis of the cylinder 12 and over the center of the latter, being set in a tapered aperture 39 in the valve-chest of the engine. Between the valve-spindle 38 and the walls of the valve-chest is located a conical liner 40, which has ports 41 and 42 in its opposite sides, these being of different sizes and employed for the cutting and return strokes, respectively, as will be explained. Intermediate between the ports 41 and 42 and in the same transverse plane therewith is an exhaust-port 43, which communicates with the exhaust-pipe 44, tapped into the upper side of the valve-chest. When the conical liner 40 is driven into place in the valve-chest, the ports 41 and 42 occupy positions at the sides and the port 43 at the top, so that the ports 41 and 42 will register with the steam-passages 45 and 46, which lead to the respective ends of the cylinder.

The valve-spindle 38 is formed to take in steam at its head or larger end through a central longitudinal passage-way 47, and at the point opposite the valve-ports it has a diametrical partition 48, which separates the ports 41 and 42 at all times from each other and by oscillating the valve causes them to be alternately connected with the exhaust-port 43. The lower side of this partition 48 is connected with the central passage-way 47 by an opening 49, so that the lower side of the partition is always connected with the live steam and the upper side with the exhaust, and it will thus be seen that by oscillating the valve into the positions shown in full and dotted lines in Fig. 8 the ends of the cylinder are alternately connected with the steam and exhaust, respectively.

The head end of the valve-chest is closed by a nipple 50, having a threaded flange 51 screwing into the open end of the valve-chest, and the joint is preferably packed by an annular strip of packing 52, which prevents leakage between the steam and exhaust or outer air, and this nipple 50 has on its opposite end a coupling 53, to which may be secured a steam-hose 54, which supplies the engine with steam. The opposite end of the steam-chest is closed by the flange 55, forming the end of the valve-spindle proper. Beyond this end the spindle is prolonged in a conical stud 56, which forms means of attachment for the hub 57 of a tumble-bob comprising a radial arm 58 and a weight 59, adjustably mounted on the threaded end 60 thereof. The tumble-bob is fixed to the stud 56 in the proper position by means of a set-screw 61. The hub 57 of the tumble-bob has formed thereon a gear-segment 62, which intermeshes with a rack 63, mounted on the end of the valve-rod and sliding upon the rest 64, forming the collar of the trunnion 19 and confined against lateral motion by a pin 65. The motion of the rack is limited in both directions by pins 63ª. As the piston approaches one end of its stroke the dog 33, carried by it strikes against one of the collars 36 and moves the valve-rod 35 in the direction in which it is traveling. If, for instance, the piston is on its cutting stroke—that is to say, from left to right, as shown in the drawings—the dog 33 will strike the right-hand collar 36, and the tumble-bob being at the right will be raised until it reaches its vertical position, when it will fall over into the position shown in Fig. 4, thus connecting the left-hand end of the cylinder with the exhaust-pipe and the right-hand end with live steam, which will draw the piston in the opposite direction, and of course the reverse operation will be caused at the end of the return stroke. Up to the time at which the tumble-bob is raised to the vertical position by the dog 33 the valve-port through which steam is admitted and also that through which steam escapes remain open to their full extent, when the fall of the tumble-bob to the opposite side will suddenly reverse both valves, thus causing an instantaneous reversal of the piston. It will be seen, therefore, that the rapidity of the piston is substantially uniform throughout its stroke in either direction and no time is lost in reversing the stroke nor is any overspeed at any point of the stroke necessary, but the cutting of the curd is performed at a uniform rate of speed. Further, it will be seen that the diminished opening of the port 42, which supplies steam to the return stroke, is such as to be just sufficient to draw back the piston without wasting any steam or causing unnecessary jars, as above described, while at the same time full steam is employed on the cutting stroke, in which alone power is required.

The conical form of the valve-spindle substantially prevents leaking; but in order to prevent the pressure of the steam upon the head of the valve from causing the valve-spindle to jam against its seat I provide a step-bearing, which consists of an adjustable bearing-screw 66, mounted coaxially with the valve-spindle and at the end thereof. The end of the stud 56 is spherically recessed, as shown at 67, and the end of the bearing-screw 66 is similarly recessed and an antifriction metal ball 68 is placed between them, upon which the valve-spindle turns. The screw 66 is set in a three-sided bracket 69, which is bolted onto suitable lugs 70, formed on the side of the valve-chest. It will be seen that by properly adjusting the screw 66 the position of the valve-spindle can be regulated until it has just the requisite degree of tightness with the wall of the liner 40 without binding thereon in its movement, and it is of course held in this position by the pressure of the steam on its head end, as above stated. As fast as the adjoining surfaces wear, the wear can be taken up by simply adjusting the screw 66, so that this valve is always tight and can never become leaky or worn out.

On the lower side of the cylinder, at each end thereof, may be provided a water-relief valve 71.

It will be seen that the engine being of small size is readily handled in relation to the curd-cutting apparatus, the whole cutter-frame 22, containing the engine, being removable from the vat whenever desired, while the engine itself may be separately removed by simply disconnecting the clamp 32 and raising it by means of the handle 18 and the piston-rod.

While I have shown in the accompanying drawings the preferred form of my invention, it will be understood that I do not limit myself to the precise form shown, for many of the details may be changed in form or position without affecting the operativeness or utility of my invention, and I therefore reserve the right to make all such modifications as are included within the scope of the following claims or of mechanical equivalents to the structures set forth.

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

1. In a steam-engine, the combination of a valve-chest having a conical inner surface and suitable passage-ways leading to each end of the cylinder at opposite sides thereof and an exhaust passage-way leading from the upper side, a conical liner having ports therein adapted to register with said passage-ways, a conical valve-spindle oscillably mounted within said liner and having its opposite faces recessed opposite said passage-ways so as to form a diametrical partition separating the opposite cylinder-ports, said valve-spindle

having a central steam-opening connecting with the lower side of said diametrical partition, a steam-pipe connection closing the head end of said valve-chest, whereby to admit steam to the central passage-way in the valve-spindle, and an adjustable step-bearing for the opposite end of said valve-spindle, whereby its longitudinal position in the valve-chest is regulated, substantially as described.

2. In a steam-engine, the combination of a valve-chest having a conical inner surface and suitable passage-ways leading to each end of the cylinder at opposite sides thereof and an exhaust passage-way leading from the upper side, a conical liner having ports therein adapted to register with said passage-ways, a conical valve-spindle oscillably mounted within said liner and having its opposite faces recessed opposite said passage-ways so as to form a diametrical partition separating the opposite cylinder-ports, said valve-spindle having a central steam-opening connecting with the lower side of said diametrical partition, a steam-pipe connection closing the head end of said valve-chest, whereby to admit steam to the central passage-way in the valve-spindle, and an adjustable step-bearing for the opposite end of said valve-spindle, whereby its longitudinal position in the valve-chest is regulated, the cylinder-ports in said conical liner being of different size one from the other, whereby more steam is admitted into one side of the engine than the other to permit more power to be exercised upon one stroke than the other, substantially as described.

3. In a steam-engine, the combination of a valve-chest having a conical inner surface and suitable passage-ways leading to each end of the cylinder at opposite sides thereof and an exhaust passage-way leading from the upper side, a conical liner having ports therein adapted to register with said passage-ways, a conical valve-spindle oscillably mounted within said liner and having its opposite faces recessed opposite said passage-ways so as to form a diametrical partition separating the opposite cylinder-ports, said valve-spindle having a central steam-opening connecting with the lower side of said diametrical partition, a steam-pipe connection closing the head end of said valve-chest, whereby to admit steam to the central passage-way in the valve-spindle, an adjustable step-bearing for the opposite end of said valve-spindle, whereby its longitudinal position in the valve-chest is regulated, a reciprocating valve-rod connected with said spindle to oscillate the same, means actuated by the piston of the engine for reciprocating said valve-rod at each end of the stroke, and a tumble-bob mounted on said valve-spindle and adapted to cause the same to be suddenly reversed in position, substantially as described.

4. In a steam-engine, in combination, a rotary valve-spindle, a tumble-bob attached thereto, a segment rigid with said valve-spindle, a rack coöperating with said segment, a dog carried by the piston of said engine, and adapted to reciprocate said rack, and stops adapted to limit the longitudinal movement of said rack.

5. In a steam-engine, in combination, a rotatable valve-spindle, a segment carried thereby, a tumble-bob rigid with said segment, a rack having an extension, collars carried by said extension, a piston for said engine, a dog carried by said piston and adapted to move between said collars, pins carried by said rack, a fixed member lying in the path of said pins, and adapted to limit the movement of said rack.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

WARREN LYMAN McLEAN.

Witnesses:
A. A. Fisher,
Allie Cuthbert.