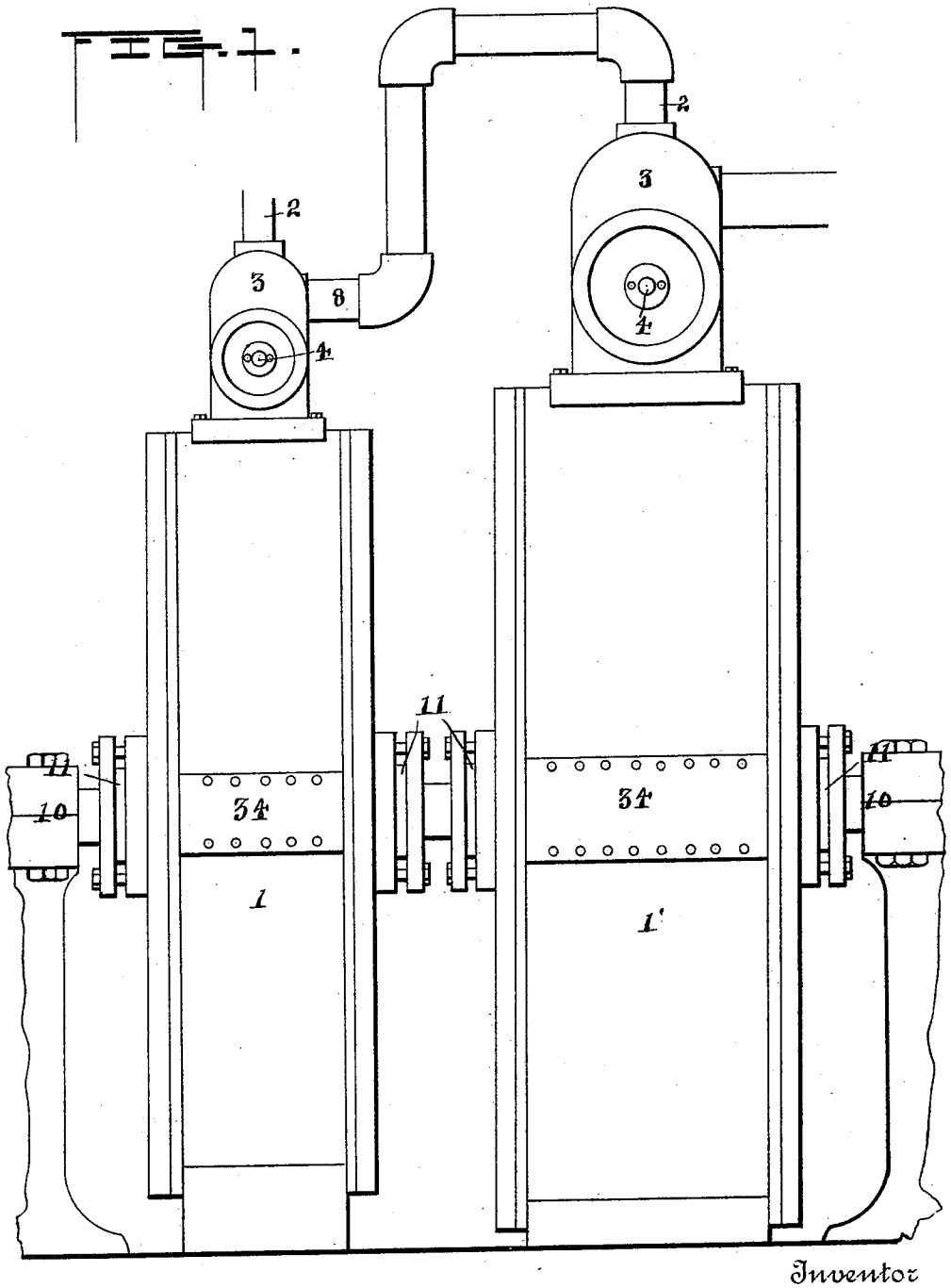
(No Model.)

M. J. BRETHERTON.

4 Sheets—Sheet 1.

ROTARY ENGINE.

No. 460,522. Patented Sept. 29, 1891.



Witnesses
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Montague J. Bretherton
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

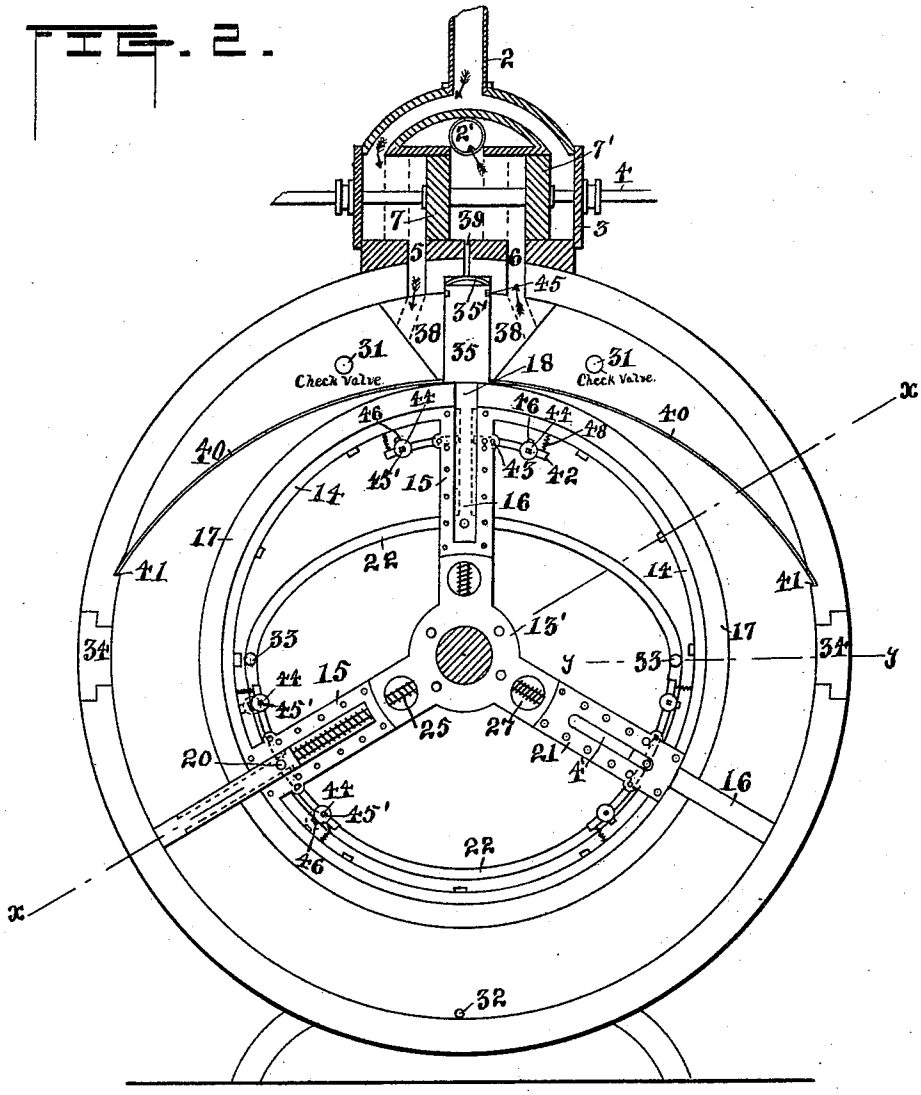
(No Model.) 4 Sheets—Sheet 2.

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FIG. 2.



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FIG. 3.

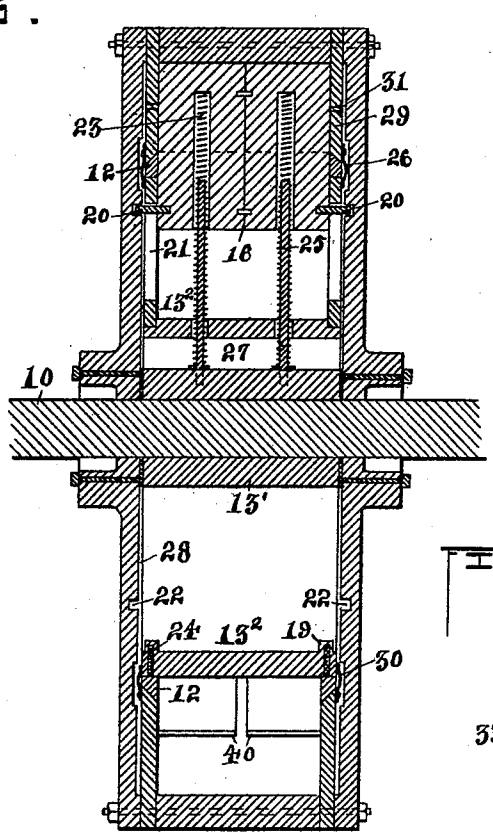


FIG. 10.

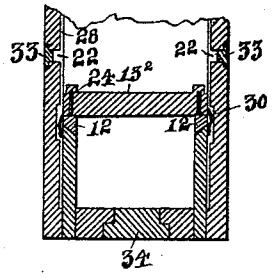
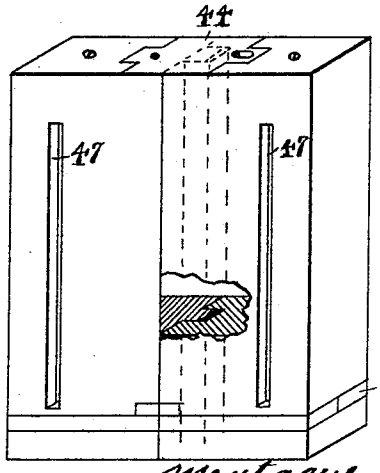


FIG. 9.



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FIG. 5.

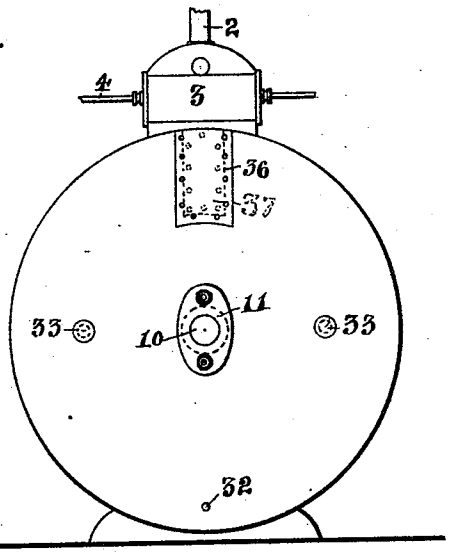


FIG. 6.

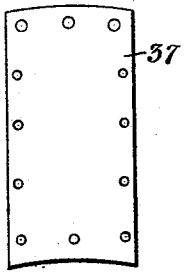


FIG. 7.

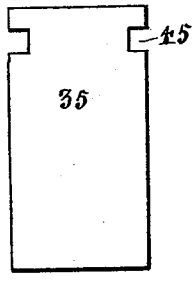


FIG. 8.

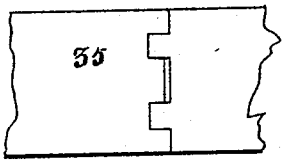
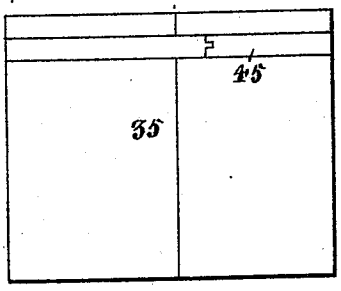


FIG. 9.



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UNITED STATES PATENT OFFICE.

MONTAGUE JAMES BRETHERTON, OF FORT WORTH, TEXAS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 460,522, dated September 29, 1891.

Application filed November 21, 1890. Serial No. 372,137. (No model.)

To all whom it may concern:

Be it known that I, MONTAGUE JAMES BRETHERTON, a resident of Fort Worth, in the county of Tarrant and State of Texas, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

The object of the invention is to provide a reversible rotary steam-engine in which friction shall be reduced to as small an extent as consistent with suitable packing of the joints, the pressure on the piston-wings be practically balanced, compensation made for wear, and other advantages secured; and the invention consists in the construction hereinafter described and particularly pointed out.

In the drawings, Figure 1 is a side elevation of two connected cylinders for working steam expansively. Fig. 2 is an end elevation, partly in section, of a cylinder, piston, and valve-chest, a cylinder-head being removed. Fig. 3 is a section on line *x x* of Fig. 2. Fig. 4 is a perspective of a piston-wing with a part broken out to show joint and spring. Fig. 5 is an end elevation of a cylinder and valve-chest, and Figs. 6, 7, 8, and 9 are views of details. Fig. 10 is a partial section on line *y y* of Fig. 2.

The numerals 1 and 1′ indicate the cylinders.

2 denotes the steam-supply pipe.

3 indicates a valve-chest, and 2′ the outlet for exhaust-steam.

4 denotes a valve-rod, 5 an inlet for live steam to cylinder 1, and 6 an outlet for the exhaust. The valve-rod, which may be moved in any convenient manner, carries the valve 7 7′ to the opposite sides of the ports 5 and 6, as indicated in dotted lines, when it is desired to reverse the engine.

8 indicates a conduit for exhaust from cylinder 1 to cylinder 1′, in which it is further expanded, one or more additional cylinders being employed to fully expand the steam, each cylinder having a rotary piston-wheel and suitable adjuncts. Within each cylinder, which may be supported in any suitable manner, is a piston-wheel or spider made fast to the axis, which is passed through stuffing-boxes 11 in each head. The spider is cast in one piece cored out for the piston-wing recesses and other openings, substantially as shown.

16 indicate piston-wings, and 15 denote the walls of the piston-wing recesses.

17 denotes shoes or sections of tire bolted to the sectional rim 14 of the piston-wheel between the piston recesses or pockets, as indicated at 18.

19 are bosses cast on the rim of the spider and cored out to receive springs 24, which bear upon the movable packing-ring 12.

20 are studs connected to the piston-wings and extending through the slots 4′ of the plates 21 at each edge of said wings and into the grooves 22 in the inner surface of each cylinder-head. These grooves control mainly the radial movements of the wings.

23 are springs extending from hub 13′ into recesses in the wings to take up the play of the studs in the grooves and move said wings out to the periphery of the cylinder when the steam is cut off.

25 are rods screwed into suitably screw-threaded holes in the hub and arranged to guide the springs 23.

21 are covering-plates secured to the edges of the wing-piston recesses of the piston-wheel or spider 15. Two of these are omitted in Fig. 2.

27 are transverse passages in the shoulders or arms 13^2 of the hub for the passage of steam to the inner end of the piston-wing from the steam space or jacket 28, formed in the cylinder-heads. To form these the heads are recessed and the recesses are partially covered by the annular plates 29 and packing-rings 12, which latter extends from the plates 29 to the covering-plate 21, and are each located at the side of a rim 14, being pressed outwardly against the inclined face of the ring or plate 29 by springs 24 in the bosses 19.

26 are thin annular steel plates secured by countersunk screws or otherwise to the plates 29, their purpose being to exclude steam in the steam-jacket from the joints about the packing-ring 12. Annular recesses 30 are formed in the inner faces of the cylinder-heads to furnish spaces for these plates.

31 are check-valves opening from the steam-space of the cylinder into the jackets or spaces between the plates 29 and the recessed cylin-

der-heads. These recesses extend around the inner surface of each head and communicate freely with the passages 27, whereby live steam is admitted to the bottom of the piston-wings through the openings or holes that receive springs 23 and rods 25. By this means steam-pressure on the piston-wings is balanced until the end of a wing is fairly seated against the periphery by the action of the groove 22 upon the studs 20 of the revolving piston-wing, whereupon the steam, acting through opening 27, holds the wings against the periphery of the cylinder. The springs in the wing also act while the steam-pressure is balanced to move them outwardly. During the above-described operation steam is excluded from the sides or flat faces of the wings by the plates 15 and from their edges by the plates 29, packing-rings 12, annular covering-plates 26, and plates 21. It may be noted that steam is excluded from the slots 21′ in the plates 21 by the piston-wing itself until it has been moved outwardly a little. It will also be seen that steam circulates freely about the hub 13.

32 is a cock for drawing off water from the cylinder.

33 are removable plugs in the cylinder-heads placed opposite the groove 22 to permit the removal of the studs 20 when it is desired to remove the piston-wings. The latter can be withdrawn through openings ordinarily filled by the removable plates 34. The abutment 35 can be withdrawn through openings closed by plates 36 in the cylinder-head and plate 37 in the annular plate 29. This abutment is made in sections connected by tongue and groove and provided with packing-bars or plates and springs, the construction being similar to that of the piston-wings.

35′ indicates a spring at the top of the abutment adapted to keep it down upon the piston-wheel.

38 are blocks bolted to the cylinder and provided with continuations of the steam-ports of the valve-chest. They form a way for the abutment and hold it vertical against the steam-pressure, whereby the pressure on it is partially relieved.

40 are a series of steel springs having their ends resting, preferably, in recesses 41, formed in the cylinder periphery and extending over between the abutment and the piston to insure the return of the piston-wings to their receptacles at the moment of passing the abutments. They guard against any contact of the wings and abutment and especially in case the studs of the piston-wings break, and they prevent hammering. The arrangement is such that the wings do not touch the springs until by the revolution of the piston they are brought near the abutment. Preferably there are two of these springs fastened to each block 38 near its outer edge and under the block to just touch the wheel.

The operation of the engine can be readily understood from the foregoing. The valves being in the situation represented in full lines, steam passes constantly through port 5 into the space between the cylinder and the piston, a little of it escaping through check-valve 31 to the steam-jacket, and operating as above explained. The steam acting upon the the piston and against the abutment which it has passed revolves the piston and shaft of the engine by its expansive force. The wing next passing under the abutment is moved outwardly by the cam-groove 22 and the springs until its edge bears on the cylinder-periphery, whereupon it receives the pressure of the steam until another wing is carried past the abutment and moved out to the cylinder-periphery by the cam and springs. The partially-expanded steam is discharged through port 6 and utilized in another cylinder or other cylinders of similar character. The engine can be reversed by shifting the valves 7 and 7′ to the position indicated in dotted lines, whereupon steam will enter port 6 and escape at 5. The check-valve 31 that is adjacent to the exhaust in either case will of course be kept closed by the live steam in the space at its rear. The piston-wings are made in two parts jointed together by a tongue and groove, but forced outwardly by springs to prevent escape of steam between their edges and plates 29.

44 are plates placed at the end of the piston-wings over the grooves, making a full metal bearing.

45 are steel packing-strips inserted in grooves in the wings and intended to be pressed outwardly by springs. They have a tongue-and-groove connection, but not in the same plane with the groove of the wing, and prevent steam passing from the pockets to the exhaust side of the piston.

The abutment is preferably divided and the parts jointed substantially as the piston-wings are. It is also provided with packing-strips of similar character. Springs are admitted in the recess above the abutment to hold it upon the piston-wheel.

Many of the above-described details can be varied by mechanical skill without departure from the invention, provided substantially the same principles of operation and construction are employed.

In Fig. 2 is shown mechanism for counteracting the effect of centrifugal force upon the piston-wings, whereby they are otherwise thrown or pressed against the cylinder-periphery with sufficient force to retard the engine. This mechanism consists of the levers 42, pivoted at 43 in the slots in the walls 15 of the piston-wing pockets. 44 are weights made adjustable on the long arms of the levers, whereby they can be adjusted for different speeds. 45′ are set-screws, and 46 are regulable stops to limit the throw of the weighted levers. The short arm of each lever extends into a slot 47 in the face of the piston-wing, each slot being sufficiently long to allow the piston-wing to retire within its recess, or, on

the other hand, to be moved out against the cylinder periphery without obstruction by a lever 42. When in the latter position, the short arm of the levers should bear or nearly bear upon the inner end of the slot, being held in position by springs 48, which are adapted to oppose extreme movement of the weighted levers in either direction. They prevent violent concussion or hammering against the wheel, and also keep the levers from flying back too far. It will be understood that when the piston-wheel is revolving and the piston-wings are thrown outward by centrifugal force a similar effect is produced upon the weights, whereby the long arms of the levers are moved outwardly and the short arms forced against the bottom of the slots in the piston-wings with the effect to counteract outward movement thereof due to centrifugal action. They are thus kept from producing excessive friction upon the cylinder-periphery.

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

1. In a rotary engine, the cylinder provided with an interiorly-grooved head having removable plugs in the groove, and a piston-wheel provided with wings having removable pins, said cylinder having a removable plate in its peripheral surface, substantially as set forth.

2. In a rotary engine, a steam-cylinder having a steam-inlet and a recessed head or steam-jacket, a plate covering the recess, a check-valve in the plate to admit steam to said recess or steam-jacket, a piston-wheel with movable wings and pockets or ways for the same having steam-inlets near their inner edges, there being free communication between the recesses or steam-jackets in the head and said inlet in the piston-wing pockets, whereby the wings are balanced, substantially as set forth.

3. In a rotary engine, a steam-cylinder having a steam-inlet and a recessed head or steam-jacket, a plate covering the recess, a check-valve in the plate to admit steam to said recess or steam-jacket, a piston-wheel with movable wings and pockets or ways for the same having steam-inlets near their inner edges, there being free communication between the recesses or steam-jacket in the head and said inlet in the piston-wing pockets, whereby the wings are balanced, and springs tending to press the wings outwardly, substantially as set forth.

4. In a rotary engine, a piston-wing made in parts connected by a tongue and groove and provided with a spring in the central groove tending to separate the parts and having transverse and jointed packing-strips situated in grooves in the face of the two-part wing and having the joints at one side of the joint between the parts of the wing to permit the extension of said strips and to prevent steam from passing between the parts, substantially as set forth.

5. In a rotary engine, an abutment made in parts connected by a tongue and a groove and provided with a spring in the central groove and having transverse and jointed packing-strips situated in grooves in the face of the two-part abutment and having the joints at one side of the joint between the parts of the abutment to permit extension of the strips and prevent escape of steam between the parts, substantially as set forth.

6. In a rotary engine, the combination of the cylinder, abutment, and piston with the steam-chest having an inlet and outlet and having two ports communicating with the cylinder, and piston-valve adapted to admit live steam to the cylinder through either port and exhaust through the other, and a steam-jacket or recess in each cylinder-head provided with a check-valve, whereby live steam can be admitted to one recess and behind the piston-wings and exhausted from the other recess, both recesses communicating with the space behind the wings, substantially as set forth.

7. In a rotary engine, the combination of the steam-jackets composed of the recesses in the cylinder-head covered by plates 29, the annular packing located between the piston-wheel rim 14 and the annular plate of the steam-jacket, and the flat steel rings 26, attached to said annular plates 29 and extending over upon the wheel-rim, substantially as set forth.

8. In a rotary engine, the combination of the annular packing-ring having an inclined face located between the piston-wheel rim and the annular plate of the steam-jacket, also having an inclined face, and the flat steel rings attached to said annular plates and extending over upon the wheel-rim, and a spring to press the packing against the plate, substantially as set forth.

9. In a rotary engine, the combination of piston-wings provided with slots in their sides and levers having arms extending through the walls of the piston-wing pockets and normally in contact with the outer end of the slots in the wings when the latter are in contact with the cylinder, said slots being sufficiently long to permit the wings to retire without the withdrawal therefrom of the levers and said levers being adapted under the influence of centrifugal action to oppose the centrifugal action of the wings and to be thrown out of engagement therewith by their inward movement, and regular stops to limit the throw of the levers, substantially as set forth.

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

MONTAGUE JAMES BRETHERTON.

Witnesses:
IRBY DUNKLIN,
O. C. HERRON RIED.