No. 666,553. Patented Jan. 22, 1901.

E. E. PETTEE & J. J. McCUTCHAN.

MOTOR.

(Application filed May 12, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

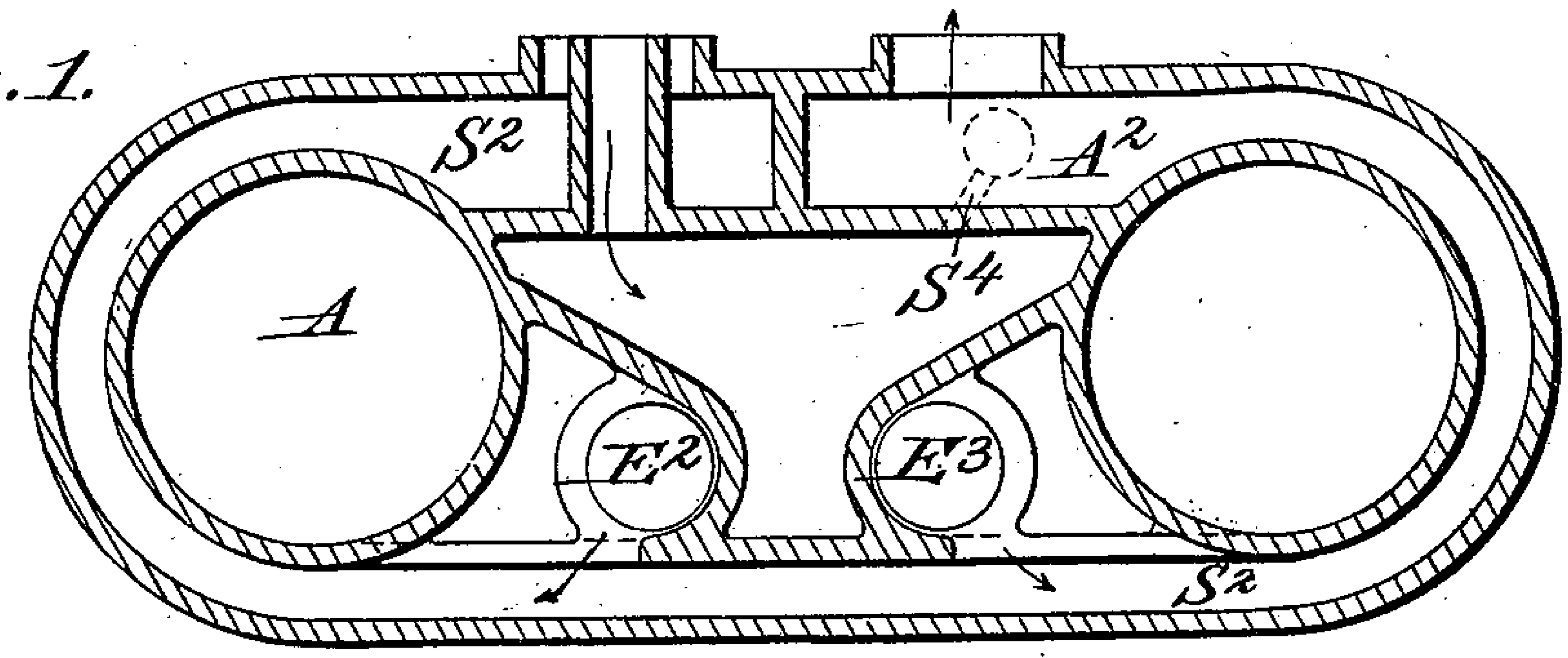
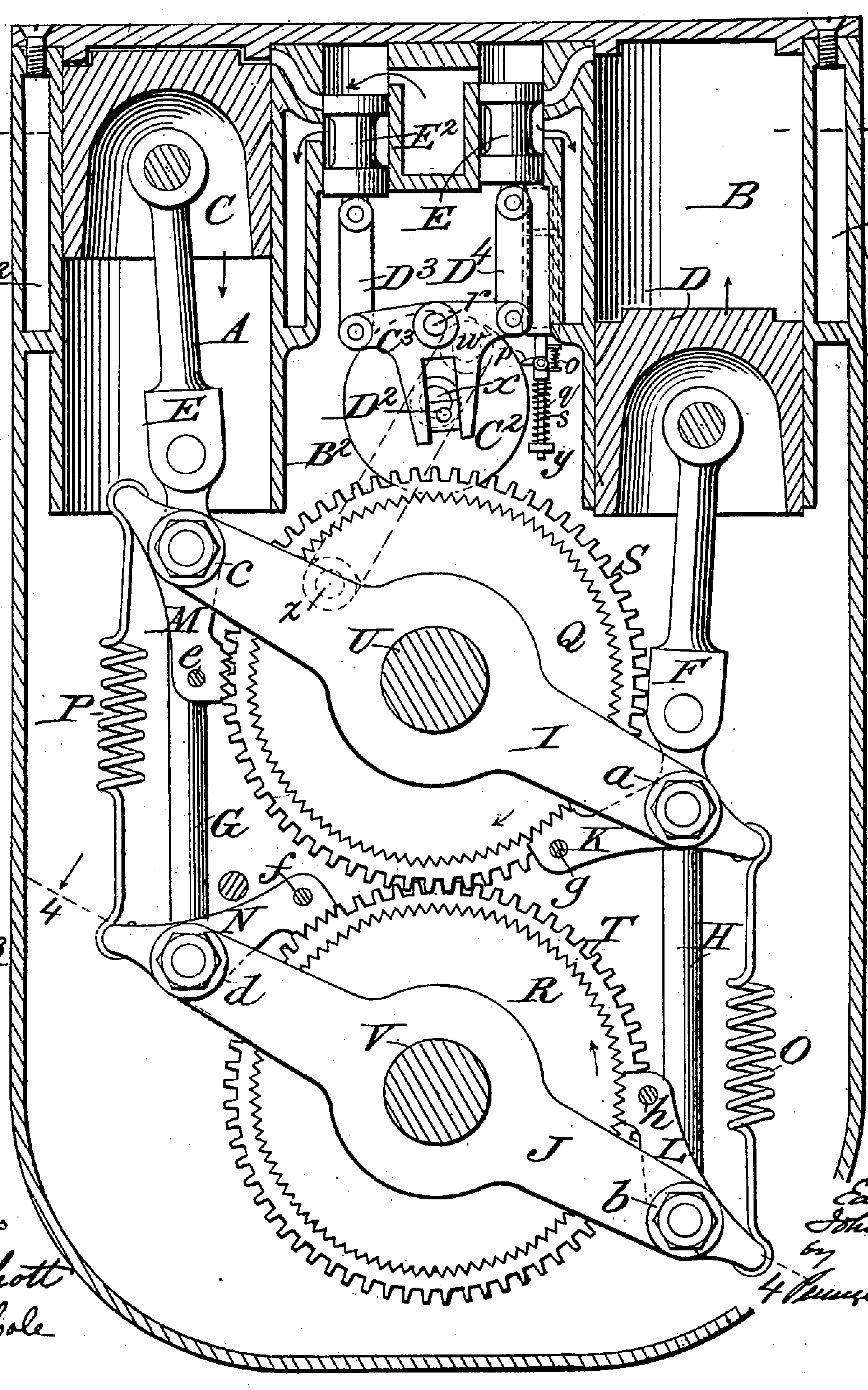


Fig. 2.



Witnesses
F. H. Schott
M. B. Cole

Inventors;
Edw. E. Pettee,
John J. McCutchan
by
Pennie & Goldsborough
Attorneys.

No. 666,553. Patented Jan. 22, 1901.

E. E. PETTEE & J. J. McCUTCHAN.

MOTOR.

(Application filed May 12, 1899.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

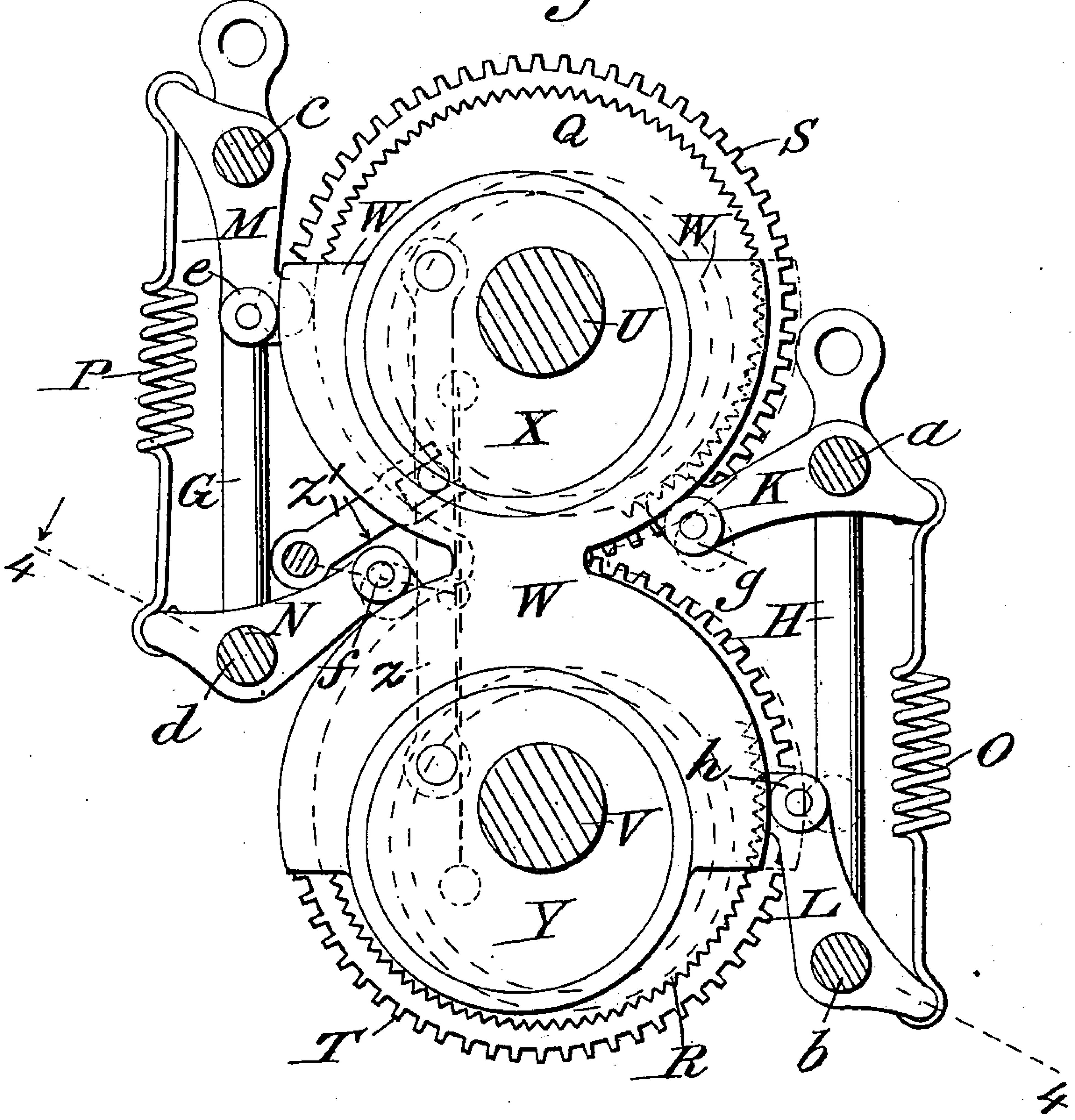
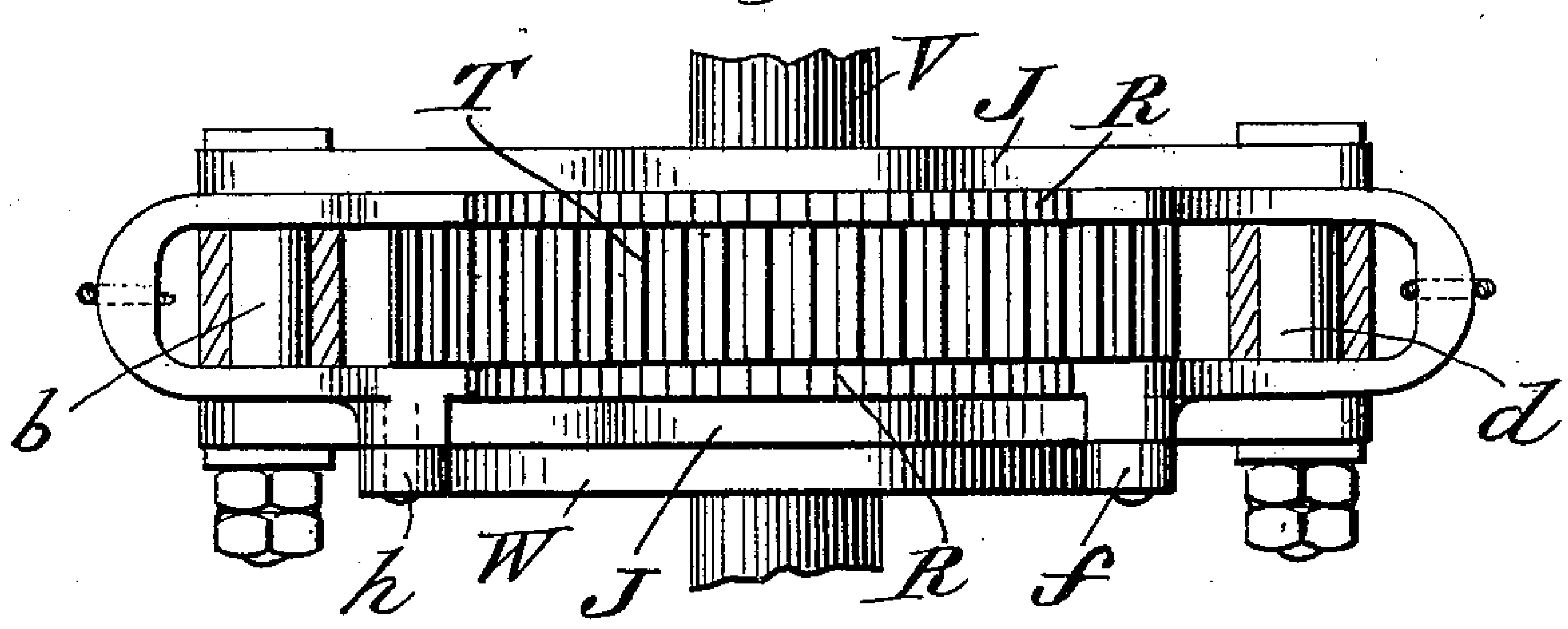


Fig. 4.



Witnesses
H. H. Schott
M. B. Cole

Inventors;
Edw. E. Pettee,
John J. McCutchan,
by Pennie & Goldsborough,
Attorneys.

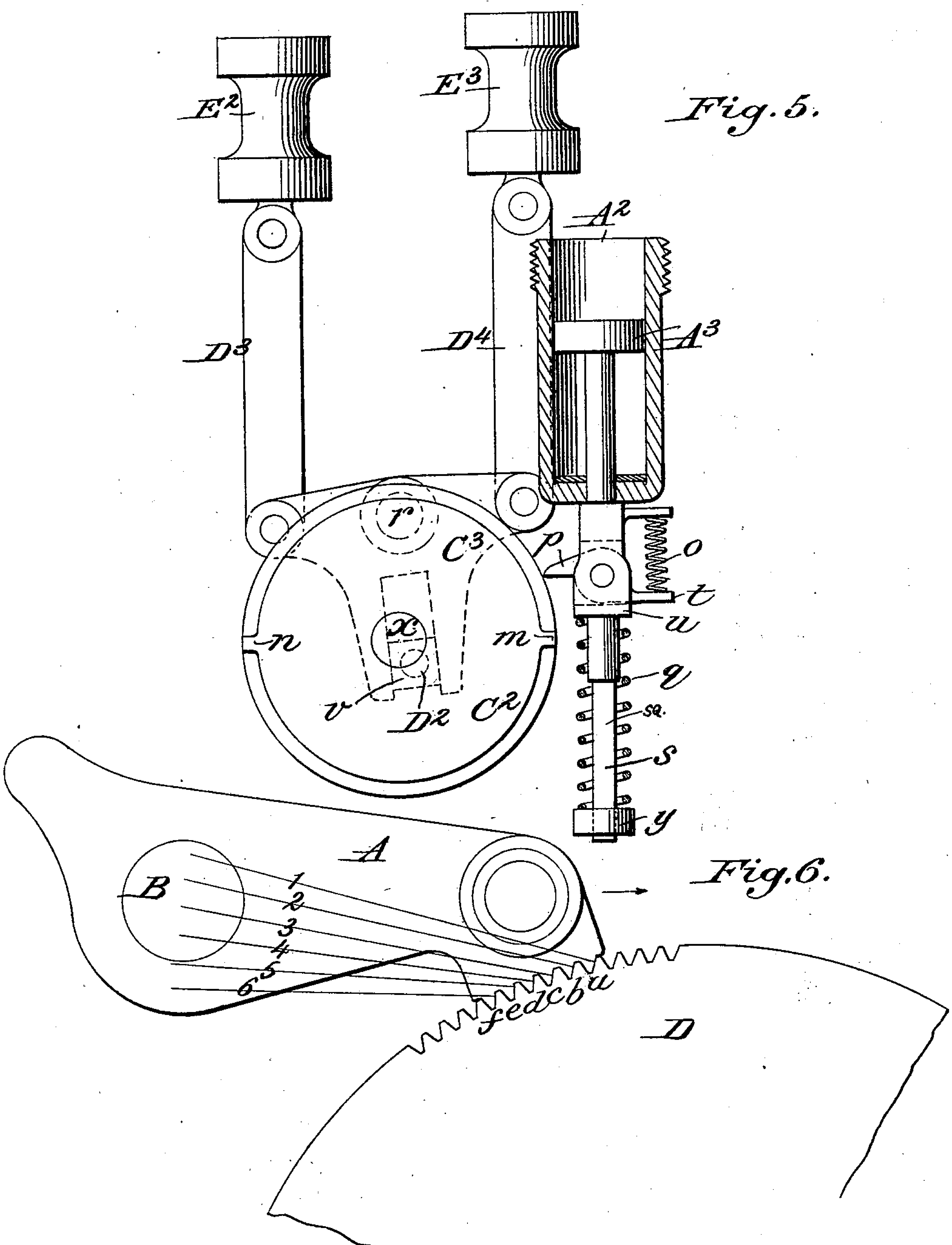
No. 666,553. Patented Jan. 22, 1901.

E. E. PETTEE & J. J. McCUTCHAN.

MOTOR.

(Application filed May 12, 1899.)

(No Model.) 3 Sheets—Sheet 3.



Witnesses
F. H. Schott
M. B. Cole

Inventors;
Edw. E. Pettee,
John J. McCutchan,
by Pennie & Goldsborough,
Attorneys.

UNITED STATES PATENT OFFICE.

EDWARD E. PETTEE AND JOHN J. McCUTCHAN, OF NEW YORK, N. Y., ASSIGNORS, BY MESNE ASSIGNMENTS, TO THE AUTOMATIC AIR CARRIAGE COMPANY, OF NEW YORK.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 666,553, dated January 22, 1901.

Application filed May 12, 1899. Serial No. 716,537. (No model.)

To all whom it may concern:

Be it known that we, EDWARD E. PETTEE and JOHN J. McCUTCHAN, citizens of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Motors; and we 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 appertains to make and use the same.

This invention relates to improvements in engines or motors designed primarily to be operated by expanding gases; and the object of our invention is to provide an engine or motor in which the reciprocating action of the pistons is transformed into a continuous rotary motion. Provision is also made for reversing the revolution of the shaft at will without altering the valve mechanism or stopping the motion of the pistons. Furthermore, the wear of the essential parts is automatically taken up, thereby avoiding the necessity for the attendance of an experienced operator, and in addition the construction chosen is compact and light, certain and efficient in its operation, and easy to control.

In the accompanying drawings, Figure 1 represents a sectional view, on the line 1 1 of Fig. 2, of a double-cylinder engine provided with our improvements. Fig. 2 represents a vertical sectional elevation thereof. Fig. 3 represents an end elevation of the shaft-revolving mechanism. Fig. 4 represents a view thereof, partly in plan and partly in section, on the line 4 4 of Fig. 2. Fig. 5 represents, partly in elevation and partly in section, an auxiliary cylinder and its appurtenances, constituting one of the details of the invention. Fig. 6 represents, on a larger scale, one of the actuating-pawls and its ratchet.

Similar characters of reference indicate similar parts throughout the several views.

The engine, as shown in Fig. 2, comprises two cylinders A B, each having a piston C D connected to the rods E F. The pistons are set at different radial lines to accord with the usual alternating operations of two-piston engines. To the rods E F are attached the rods G H, which are pivoted to the two arms I J at the points *a b c d*. At these points *a b c d* are likewise pivoted the pawls K L M N, which are connected by the springs O P with a tension that forces the pawls against the notched wheels Q R to cause the teeth or notches of the pawls to mesh with the notches upon the wheels. The wheels Q R are rigidly attached to the gear-wheels S T, which mesh together and revolve with the shafts U V. Upon the shafts U V are pivoted the arms I J in such manner that the movements of the pistons rock these arms back and forth upon the shafts U V and move the pawls with them.

The piston D is shown at its extreme downstroke. If now the piston C moves downward, the piston D will move upward and the rods G H will rock the arms I J upon the shafts U V. As these arms move they carry with them the pawls K L M N, and as the pawls M N are held away from the wheels Q R by means hereinafter explained, the pawls K L being in contact with the notched wheels Q R, the pawl L will push the wheel R in an upward direction and will cause the wheel T to move with it and revolve the intermeshing wheel S in an opposite direction, and the pawl K will slip over the teeth or notches of the wheel Q. When the piston D moves downward, the arms I J are moved in an opposite direction by the rods G H, and the pawl K will mesh with the wheel Q and push this wheel in a downward direction, while the pawl L will slip over the teeth or notches of the wheel R. By this means the pistons C D cause the wheels S T to revolve first by means of the pawl K meshing with the wheel Q and then by the pawl L meshing with the wheel R, thereby maintaining a uniform direction of revolution for each wheel. It will be seen that while one pawl is forcing its wheel in one direction the other pawl is slipping over the notches of the other wheel with a backward motion, and when the rods G H reverse their directions of movement the slipping pawl will mesh with its wheel and cause it to revolve in an opposite direction to that of the other wheel, while the first pawl will slip over the notches of its wheel. As the two wheels S T intermesh, this opposite rotation of each wheel causes a continuous rotation of the shafts U V.

Each of the pawls K L M N has attached to it a friction-roller *e f g h*, which bears upon the curved edges of the plate W, as shown in Fig. 3, when this plate is moved to the right or left. The curved plate W is attached to the two shafts U V by the eccentrics X Y in such manner that the movements of these eccentrics by the lever Z, operated by the yoke Z', throws the plate W to one side or the other. As the pawls K L M N bear upon the curved edges of this plate, one direction of movement of the eccentrics will carry one set of pawls away from the wheels Q R and allow the other set to mesh with the wheels, while the opposite direction of movement will bring the idle pawls into contact with the wheels and remove the others. If the plate W is placed in a neutral position, both sets of pawls are raised from the wheels Q R, and the pawls do not mesh with their wheels, but move back and forth upon the curved edges of the plate W, and the shafts U V come to a standstill, while the engine or motor may continue in operation. By this means either set of pawls may be brought into contact with the wheels Q and R at will, one set revolving the shafts U V in one direction and the other set revolving these shafts in an opposite direction. As will be seen, the pawl M will push the wheel Q in an opposite direction to that of pawl K, and pawl N will push the wheel R in an opposite direction to that of pawl L. The curved edges of the plate W are so formed that the pawls may move over the curved surfaces upon their rollers, and only one set of pawls can at any time mesh with the wheels Q and R, as one set is raised away from the wheels before the other set makes a contact.

As will readily be seen, we are enabled to reverse the direction of rotation of the shafts U V at will without stopping the engine or altering the valve mechanism by simply throwing into action one or the other set of pawls by means of the plate W, as shown by dotted lines in Fig. 3.

In the view represented in Fig. 4 are clearly shown the ratchet-wheels R R, attached to the gear-wheel T, the curved plate W, with the pawl N raised from the notched wheel R R and the pawl L in contact therewith. The roller f bears upon the edge of the plate W, while the roller h does not touch the plate W, thus allowing the pawl L to mesh with the notches of the wheel R R and vibrate upon its pin d during its backward movement.

The springs O P, Figs. 2 and 3, draw the pawls M N K L and the arms I J together with a tension that tends to cause the pawls to mesh with the notches of the wheels, and yet allow one pawl of each set to slip over these notches during its backward motion. This continual tension of the springs O P upon the arms I J and pawls M N K L takes up the wear of the pawls upon their pins and the wear of the arms I J upon their bearings on the shafts U V and at the points a b c d, which support the pawls and rods G H.

In the enlarged view, Fig. 5, is shown the auxiliary cylinder A^2, as indicated in dotted lines in Figs. 1 and 2, together with mechanism for operating the valves E^2 and E^3. The cylinder A^2 has a piston A^3, whose rod is prolonged and fits over a square guide-rod s, attached to the engine-frame at y. This square rod prevents the piston A^3 and its rod from turning and is inclosed in a coil-spring q, which tends to force the piston within the cylinder. Attached to the piston-rod is a pawl p, with a tension-spring o pressing upon it in such manner as to hold the heel t upon the seat u. When the piston A^3 is depressed, the pawl p moves downward in a straight line and will contact with any obstruction within its path, with a tendency to push the obstruction out of the way. The fly-wheel C^2 is revolved upon its bearing x by the connecting-rod B^2, as shown in dotted lines in Fig. 2, which rod is connected to the arm corresponding to I upon the back of the wheel S at the bearing z. This fly-wheel has formed upon its periphery the two lugs m n, which project into the path of the pawl p when the wheel revolves. To the fly-wheel C^2 is rigidly attached the pin D^2 at a point without the center of the wheel. Consequently when the wheel revolves the pin travels in a circle about the center of revolution in manner similar to an eccentric. The pin D^2 revolves within a block v, and this block slides within a slot cut in the yoke C^3, as shown in dotted lines. The yoke C^3 is pivoted to the engine-frame at r, and its two arms are attached to the links D^3 and D^4, which move the valves E^3 and E^2. As the fly-wheel is revolved by the connecting-rod B^2 in Fig. 1 the pin D^2 moves with it in a circular path, and being within the block v this block is carried with the pin up and down the slot in the yoke C^3 and forces the yoke first to one side and then to the other, thus raising one valve and lowering the other to allow the steam or other actuating fluid to enter the cylinders A and B at the proper time.

If at any time the fly-wheel C^2 should stop in such manner that the bearings w, x, and z are in line, the piston C or D would be unable to descend on account of the rigid position of the connecting-rod B^2. To provide against this contingency, we introduce the auxiliary cylinder A^2, as shown in dotted lines in Figs. 1 and 2 and enlarged in Fig. 5. As stated above, the fly-wheel C^2 is formed with the lugs m and n on its periphery. These lugs are so located that should the wheel stop and bring the bearings w x z in line one of the lugs will be in the path of the pawl p. Consequently when the throttle-valve is opened the fluid will pass to the valve-chest and then into the cylinder A^2 and will press down the piston A^3 and hold it down as long as there is pressure in the valve-chest. As the piston A^3 descends the pawl p comes into contact with the lug m or n and moves it along in its path, thus revolving the fly-wheel

C^2 sufficiently to throw the bearings *w*, *x*, and *z* out of line and allow the piston C or D to descend and perform its duty. When fluid is shut off from the valve-chest and the pressure upon the piston A^3 is removed, the tension of the spring *q* raises the piston within the cylinder A^2 and places the pawl *p* in readiness to repeat the operation. In the upward movement of the pawl *p* should it meet one of the lugs *m* or *n* the spring *o* will be depressed and allow the pawl to slip over the lug, and when away from the lug the spring *o* will force the heel *t* against the seat *u* and maintain it in position for operating the fly-wheel. It will be seen that the operation of the piston A^3 is automatic, as the cylinder A^2 is in direct connection with the valve-chest by the passage S^4, Fig. 1. Whenever fluid is admitted to the valve-chest it also enters the cylinder A^3. Consequently if the fly-wheel C^2 has stopped, so that one of the lugs *m* or *n* is in the path of the pawl *p*, the fly-wheel is turned off of the center and the engine may perform its duty.

The cylinders A and B are jacketed by the spaces S^2, as shown in Figs. 1 and 2, in order to pass hot gases about the cylinders, and the whole mechanism is inclosed by the casing S^3.

In Fig. 6 is shown one of the pawls meshing with one of the toothed wheels. D is the toothed wheel, and A is the pawl, with its bearing at B. The lines 1, 2, 3, 4, 5, and 6 are drawn perpendicular to the faces of the teeth *a*, *b*, *c*, *d*, *e*, and *f* and show that the majority of these lines pass below the center of the bearing B, showing that those teeth whose perpendicular lines 3, 4, 5, and 6 are below the center of B will tend to force the pawl A against the wheel D and prevent its rising from or slipping out of the notches or teeth of the wheel D when the pawl is moved in the direction of the arrow to rotate the wheel. It will also be noted that when the pawl A is moved backward in an opposite direction to the arrow and the wheel D continues to revolve in the direction of the arrow the teeth of the pawl will rise upon the inclined planes of the teeth upon the wheel and allow the pawl to slip over the periphery of the wheel until the pawl again moves in the direction of the arrow and again meshes with the teeth of the wheel to continue its rotation.

The pawl-and-ratchet mechanism for converting motion is not claimed in this application, but forms the subject-matter of a separate application, filed July 11, 1899, Serial No. 723,481.

Having thus described our invention, what we claim is—

1. In an engine, the combination with the valve-gear, of an automatic shifter including means in communication with the steam or fluid supply for automatically moving the parts of the engine off the dead-center independently of the engine-piston.

2. In an engine, the combination with the valve-gear, of a shifter-piston subject to the fluid-pressure on the engine side of the throttle, when the throttle is open, and operating on the gear to shift the distribution-valve into receiving position, independent of the action on the gear by the engine-piston, whereby the engine may always be started by opening the throttle-valve; substantially as described.

3. In an engine, valve-shifting mechanism comprising a rotary disk or fly-wheel driven from the engine and carrying a crank-pin and an oscillating yoke within which said crank-pin travels, said yoke being operatively connected with the valves, and means in communication with the fluid-supply and operative upon the fly-wheel for throwing the parts off the dead-center, substantially as described.

4. In an engine, valve-shifting mechanism, comprising a rotatory disk or fly-wheel, a driver-arm for rotating the disk, a crank-pin carried by the disk, an oscillating yoke within which the crank-pin travels, said yoke being operatively connected with the valves, and a cylinder-piston in communication with the fluid-supply and adapted to carry the driver-arm past the dead-center should occasion require; substantially as described.

5. In an engine, valve-shifting mechanism, comprising a rotatory disk or fly-wheel, a driver-arm for rotating the disk, a crank-pin carried by the disk, an oscillating yoke within which the crank-pin travels, said yoke being operatively connected with the valves, and a cylinder-piston adapted to carry the driver-arm past the dead-center should occasion require, said piston being spring-seated, and carrying a spring-pawl, adapted to engage with an abutment upon the disk; substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

EDWARD E. PETTEE.
JOHN J. McCUTCHAN.

Witnesses:
CHAS. J. HENSLEY,
M. WILSON.