No. 891,173.

PATENTED JUNE 16, 1908.

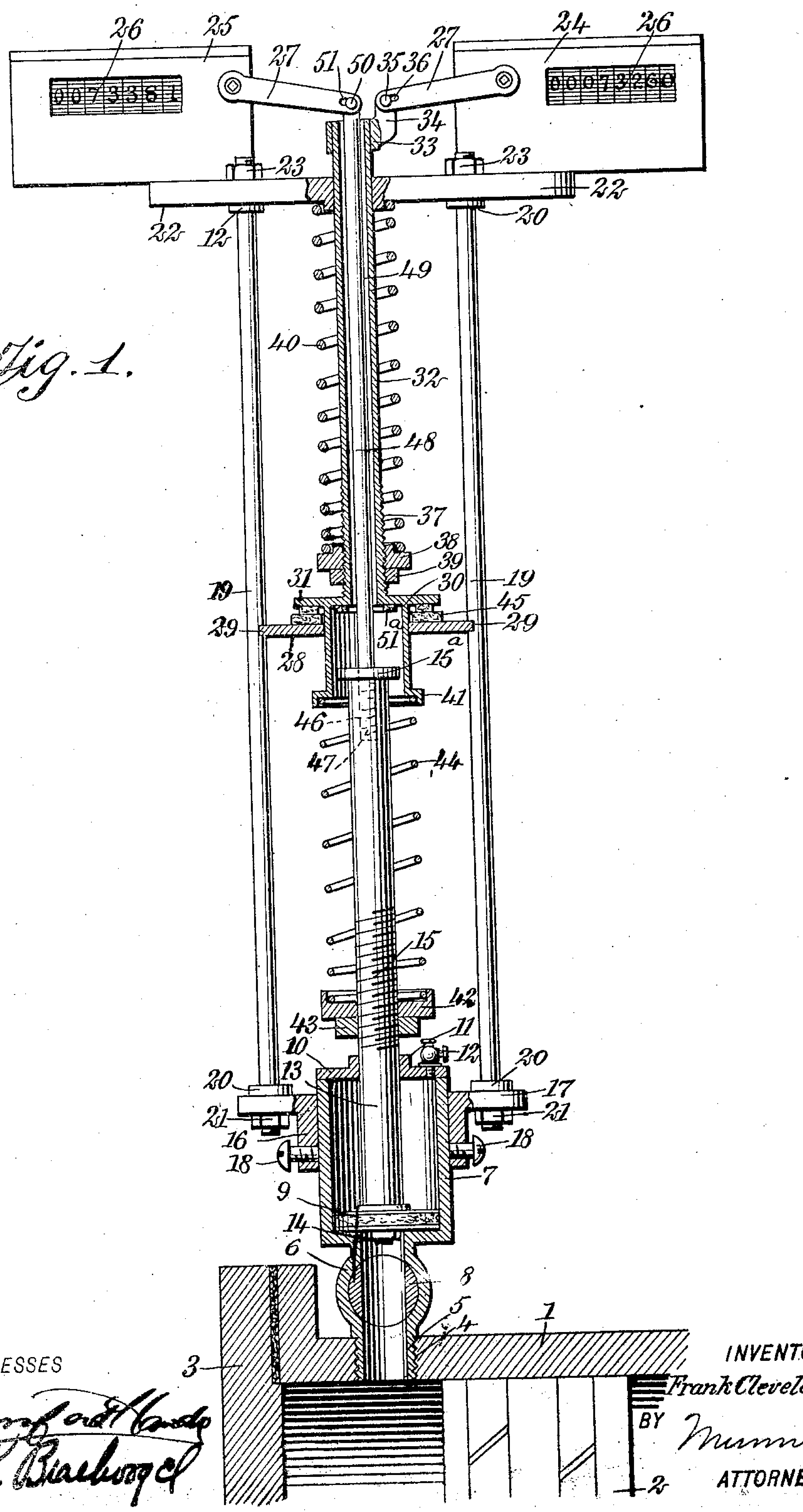
F. C. HOWE.

COUNTER.

APPLICATION FILED JUNE 13, 1907.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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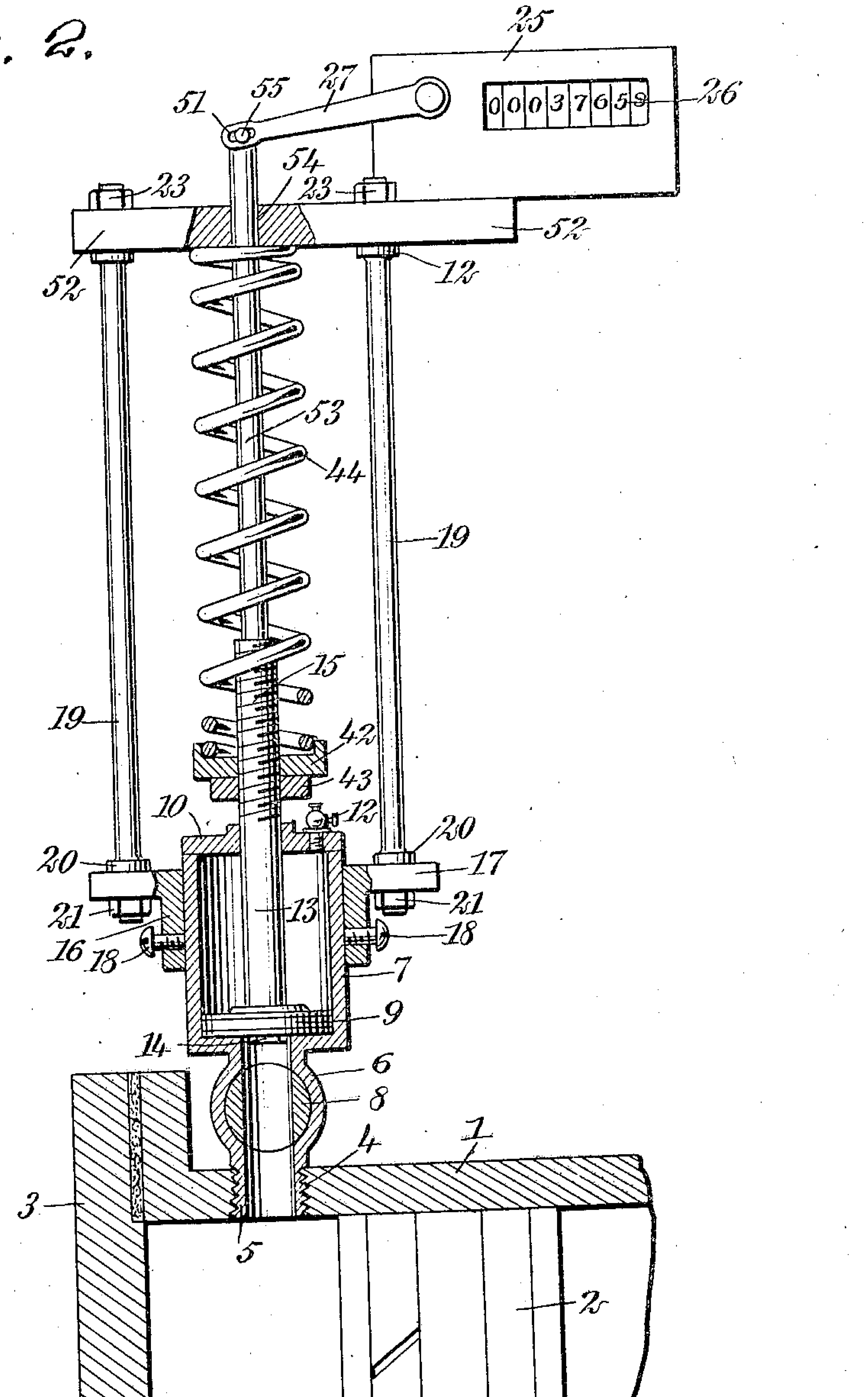
2 SHEETS—SHEET 2.

Fig. 2.



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COUNTER.

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Application filed June 13, 1907. Serial No. 378,796.

To all whom it may concern:

Be it known that I, FRANK CLEVELAND HOWE, a citizen of the United States, and a resident of Globe, in the county of Gila and Territory of Arizona, have invented a new and Improved Counter, of which the following is a full, clear, and exact description.

This invention relates to counters, and more particularly to that class of counters used for ascertaining the piston strokes made by steam or explosive engines, pumps and the like.

The object of the invention is to provide a simple, strong and efficient counter, by means of which the total number of strokes made by a piston can be determined, and by means of which the number of power strokes can likewise be ascertained.

A further object of the invention is to provide a counter actuated by the variations of pressure in the cylinder of an engine or the like, and indicating the number of power strokes made by the piston, and the total number of strokes made by the piston including those during which steam was not admitted to the cylinder, in which the charge was not exploded, or in which the cylinder was performing no work.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference designate corresponding parts in both views.

Figure 1 is a vertical section of the counter, showing the same attached operatively to an engine cylinder: and Fig. 2 is a similar view of a modified form of the counter.

Before proceeding to a more detailed explanation of my invention, it should be understood that the device includes counters *per se*, which may be of any common or preferred type. In the drawing herewith, the counters shown are of the usual type having registering disks carrying indicating numbers and operated by pivoted arms, each movement of the arm about the pivot, adding a unit to the total of the strokes shown by the indicating disks. With this type of counter as well as with the other forms usually employed, the pivoted arm receives its movement from a moving part of the engine, for instance, the cross-head. By means of these counters it is possible to register the total number only, of the strokes of the engine, and this total includes strokes during which no steam was admitted to the cylinder or during which the charge drawn into the cylinder of the engine—in an internal combustion motor—is not exploded. It should be noted that in various tests of engines and the like to determine the efficiency, fuel consumption or other data, it is often of urgent necessity to determine not only the total number of strokes but as well, the actual number of power strokes. By means of my invention, which is operated by the variations in pressure in the engine cylinder—the power strokes are counted as well as the total number of strokes. When no steam is admitted to the engine cylinder or when a charge drawn into the cylinder remains unexploded, a certain compression is caused by the piston which operates a movable member against the tension of a spring, the movable member controlling a counter which thus registers the strokes. When steam is permitted to enter the cylinder, or when a charge is exploded therein, the pressure, greatly in excess of the pressure in the previous case, operates the movable member and registers on the counter mentioned, while at the same time a second member having a resisting spring of greater tension, is operated by the greater pressure and actuates a second independent counter which thus registers the power strokes only.

Referring more particularly to the drawings, 1 represents a cylinder which may constitute that of a steam engine, an internal combustion engine, a pump or other similar mechanism. The cylinder 1 has therein the usual piston 2 and presents a cylinder-head 3. The cylinder 1 is provided with a tapped bore 4 in which is located the threaded end 5 of a valve 6 integral with a case 7, preferably cylindrical in form. A rotatable valve member 8 is provided and serves to cut off communication between the cylinder and the case 7 when the counter is unused. A movable member 9 constituting a piston is slidably arranged within the case 7, the upper end of which is closed by a head 10, having a stuffing-box opening 11 and a petcock 12 by means of which communication between the interior of the case and the outside thereof may be established. The movable member 9 has a rod 13 secured thereto by means of a threaded end and a nut 14. The rod extends through the stuff-

ing-box opening of the head 10 and has a threaded portion 15 and at the extremity an annular shoulder 15ª.

A preferably annular bracket 16 having lateral extensions 17, is removably mounted upon the case 7 by means of set-screws 18. Supporting members 19, comprising rods having threaded ends and adjacent to the threaded ends shoulders 20, are arranged upon the extensions 17 and are secured in suitable openings thereof by means of nuts 21. The members 19 carry at their upper ends, resting upon the shoulders 20, a transverse beam 22 secured in position by means of nuts 23 upon the upper threaded ends of the members 19. Independent counters 24 and 25 are rigidly mounted upon the beam 22 at the opposite extremities thereof, and present the usual indicating disks 26 and the operating arms 27.

At a point substantially mid-way between the extremities of the members 19 a cross-bar 28 is provided, carried in recesses 29 in the side members 19. The cross-bar has an opening therethrough within which is located a slidable, preferably cylindrical bracket 30 having an annular extension 31 and a hollow projecting rod 32 extending towards the cross-beam 22 and passing through a suitable opening therein. At the upper extremity, the hollow rod 32 has a ring 33 rigidly secured thereto and presenting a finger 34 pivoted by means of a pin 35 at a slot 36 in the arm 27 of the counter 24. The rod thus controls the counter 24 and when the rod is slidably moved upward the counter registers once for each movement of the rod. Upon a threaded portion 37 of the rod 32 are adjusting nuts 38 and 39. A helical spring 40 is mounted upon the rod 32 and abuts against the under side of the cross-beam 22 and the nut 38. The nut 38 and the cross-beam 22 are provided with projections engaging the spring and holding the same in proper relative position surrounding the rod. Annular cushions 45 of felt, rubber or the like are arranged between the annular shoulder 31 and the cross-bar 28. At the lower extremity, the cylindrical bracket 30 has an offset portion 41 constituting a shoulder. A recessed nut 42 and a lock-nut 43 are arranged upon the threaded part 15 of the rod 13. A helical spring 44 is mounted upon the rod 13, engaging the shoulder 41 of the bracket and the recessed nut 42. It will be understood that the spring 40 normally forces the rod 32 downward and holds the shoulder 31 in engagement with the cushions 45 upon the cross-bar 28. Similarly, the spring 44 normally forces the rod 13 downward and holds the movable member 9 in position at the lower end of the case 7. At the upper end, the rod 13 has a longitudinally threaded bore 46 in which is mounted a correspondingly-threaded end 47 of a rod 48. The rod 48 extends through the longitudinal opening 49 in the hollow rod 32 and projects thereabove. At the projecting end, the rod 48 presents a pin 50 engaging a slot 51 at the end of the arm 27 of the counter 25.

The arrangement is such that the spring 40 is preferably considerably stronger than the spring 44, and correspondingly more strongly resists the upward movement of the rod 32 than the spring 44 resists the upward movement of the rod 13; thus, when the engine is compressing merely, the compression due to the pressure in the cylinder is sufficient to drive the movable member upward against the tension of the spring 44, the combined resistance of the springs 40 and 44 not being overcome by the pressure in the cylinder, so that the counter 25 only, registers. However, when a power stroke is being made by the piston, the pressure within the cylinder is sufficient to drive the rod 13 upward against the tension of the spring 44 into engagement with the bracket and also to force the rod 32 upward against the tension of the spring 40, so that the counter 24 as well as the counter 25, registers. An annular cushion 51ª of felt, rubber or the like is provided within the bracket and is engaged by the shoulder 16ª of the rod 13 when the latter is forced upwardly. By means of the adjustable nuts upon the rods, the tension of the springs 40 and 44 can be regulated accurately to adapt the counter for use in connection with engines of different kinds and dimensions. It will be clearly understood that with a pressure in the cylinder up to a certain limit, the counter 25 only, registers, the pressure being sufficient to overcome the resistance of the spring 44 but not the combined resistance of the springs 40 and 44. With a pressure exceeding this limit the resistance of both springs is overcome and both counters, consequently, register. Thus, one of the counters registers the total number of strokes performed by the piston, including the power strokes and those in which the cylinder was cut off from the steam supply or in which the explosive charge—in the case of an explosive engine—was compressed and ignited, merely. The other counter registers those strokes only, in which the piston was performing work; that is, when the steam was introduced into the cylinder and the charges were exploded. It should be noted that the counter is applicable also to other types of mechanism, for instance, to pumps. When the pump cylinder is forcing a fluid therethrough the operation corresponds to the power stroke, whereas if a pump piston is merely working idly it corresponds to the operative stroke of the engine.

In the modified form shown in Fig. 2 a single counter only is provided; this counter registers the actual power strokes performed,

or the total number of strokes. The supporting members 19 carry at their upper ends, a transverse beam 52 similar to the beam 22 but extending laterally at one side only of the device. The rod 13 has a threaded portion 15 at its upper extremity and carries an extension rod 53 passing through a suitable opening 54 in the transverse beam 52. At the end above the beam 52, the extension rod 53 has a lateral pin 55 arranged in a slot 51 in the operating arm 27 of the counter 25 which is mounted upon the transverse beam 52. The rod 13 carries the recessed nut 42 and the lock-nut 43 as in the preferred form of the device. A helical spring 44 is mounted upon the rod 15 and the extension rod 53, seating against the recessed nut 42, and engaging the under side of the beam 52, to resist the movement of the rod 13. The operation of the device is similar to that of the parts controlling the counter 25 in the preferred form of the invention. It will be understood that the spring 44 in the modified form may be of such strength or can be so regulated that the counter will register either the actual power strokes only, or the total number of strokes made.

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

1. A device of the class described, comprising a movable member, and a plurality of counters controllable at different stages of the movement of said member.

2. A device of the class described, comprising a plurality of counters, a movable member adapted to be actuated by the variations in pressure, said counters being controllable at different stages of the movement of said member, and means for resiliently resisting the movement of said member.

3. In a device of the class described, in combination, a case adapted to receive a fluid at varying pressures, a movable member in said case, and independent counters, controlled by said member and controllable at different pressures of the fluid in said case.

4. A device of the class described, comprising a counter having an operating arm, a case adapted to receive a fluid at varying pressure, a movable member within said case and controlling said arm, and resilient means resisting the movement of said member.

5. A device of the class described, comprising a counter having a swinging operating arm, a case adapted to receive a fluid at varying pressure, a movable member within said case, means for controlling said operating arm through the movement of said member, and a spring resisting the movement of said member.

6. A device of the class described, comprising independent counters, a movable member controllable by variations in fluid pressure, a controlling member operatively engaging said movable member and one of said counters, means for resiliently resisting the movement of said controlling member, a second controlling member operatively connected to a second counter and adapted to be actuated by said first controlling member, and means for resiliently resisting the movement of said second controlling member.

7. A device of the class described, comprising a movable member controllable by variations in fluid pressure, independent counters, a controlling member operatively connecting said movable member and one of said counters, a second spring resisting the movement of said controlling member, a second controlling member operatively connected to a second counter and having means for engaging said first controlling member when the same is operated, and a second spring resisting the movement of said second controlling member, whereby the resistance of both of said springs must be overcome before said second counter is operated.

8. A device of the class described, comprising a case adapted to receive a fluid at varying pressure, a movable member within said case, a rod operated by said member and having resilient means resisting the movement thereof, a counter controlled by said rod, a second rod controlled by said first rod and having resilient means resisting the movement thereof, and a second counter independent of said first counter and controlled by said second rod.

9. A device of the class described, comprising a case adapted to receive a fluid at varying pressure, a movable member within said case, independent counters, a rod presenting a shoulder and operatively connecting said movable member and one of said counters, an adjustable spring resisting the movement of said rod, a hollow rod arranged upon said first rod and operatively connected to a second counter, said shoulder of said first rod engaging said second rod when said first rod is operated, means for normally holding said second rod from engagement with said shoulder of said first rod, and a second adjustable spring resisting the movement of said second rod.

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

FRANK CLEVELAND HOWE.

Witnesses:

SAM HANMONS,

CALVIN A. WAIRYTON.