No. 653,268. Patented July 10, 1900.

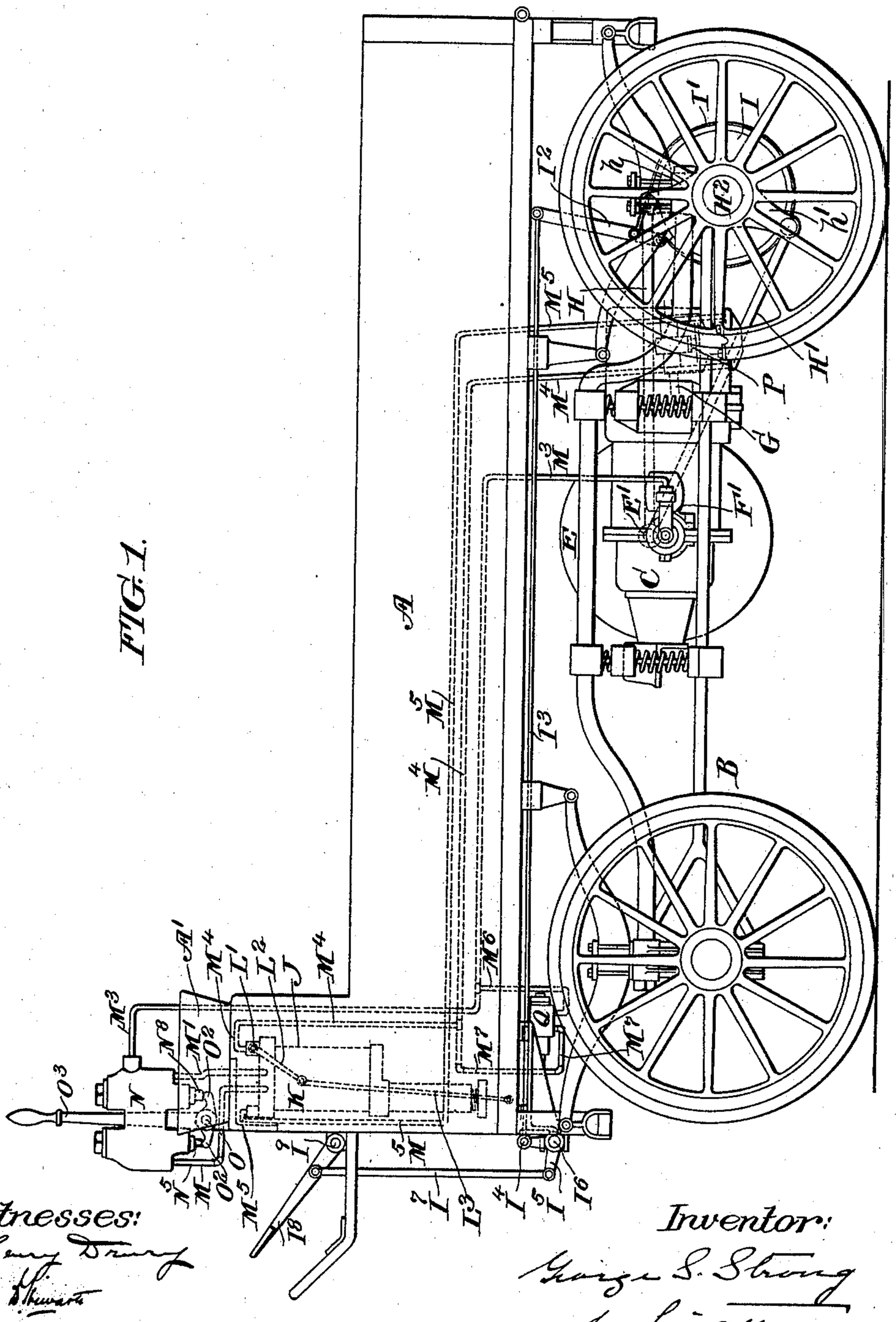
G. S. STRONG.

CONTROLLING MECHANISM FOR ENGINES.

(Application filed Nov. 14, 1899.)

(No Model.) 6 Sheets—Sheet 1.

FIG. 1.



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(No Model.) 6 Sheets—Sheet 2.

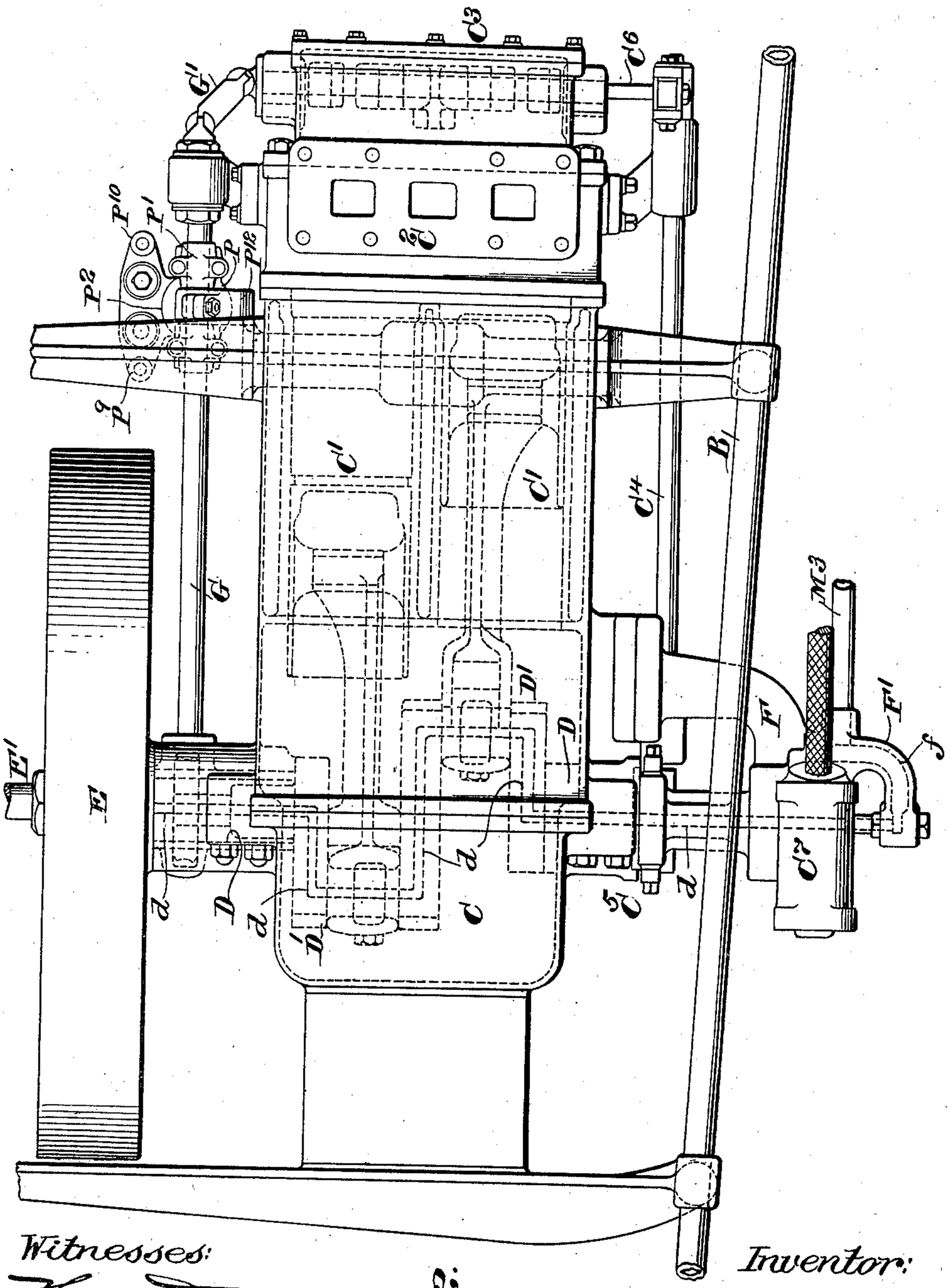

FIG. 2.

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(No Model.) 6 Sheets—Sheet 3.

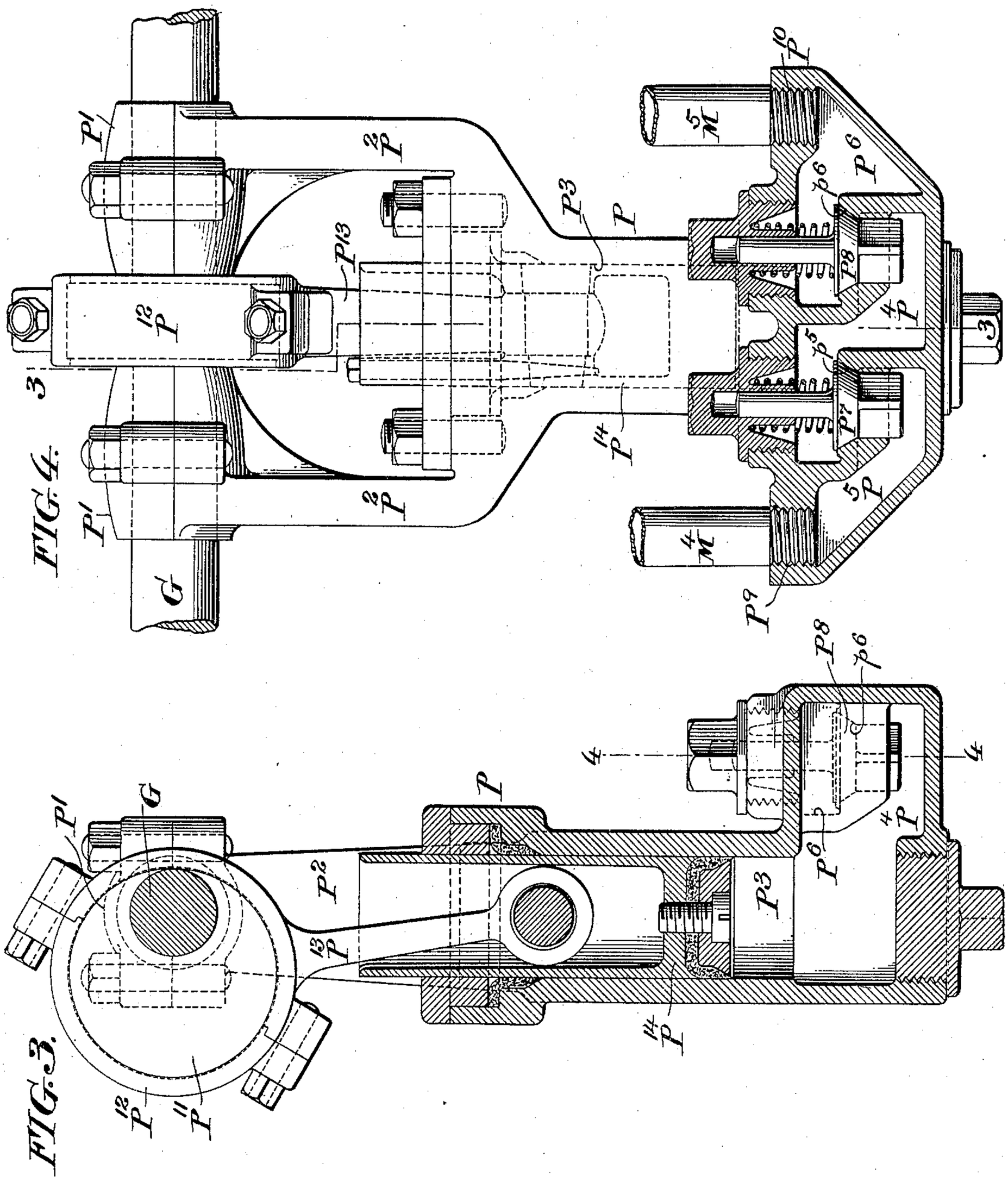

FIG. 4.

FIG. 3.

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FIG. 5.

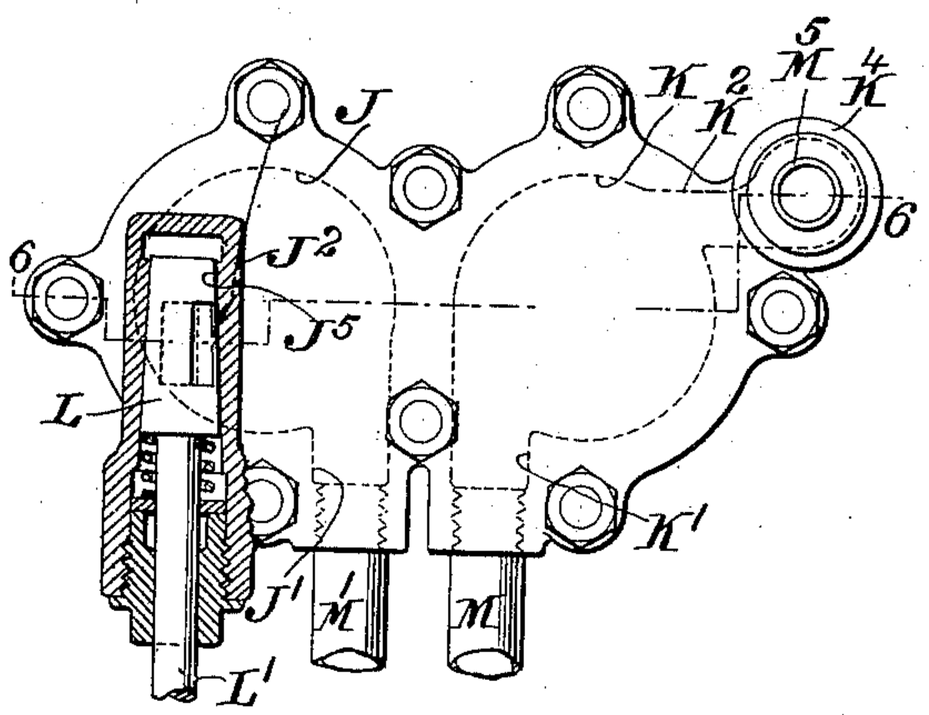

FIG. 6.

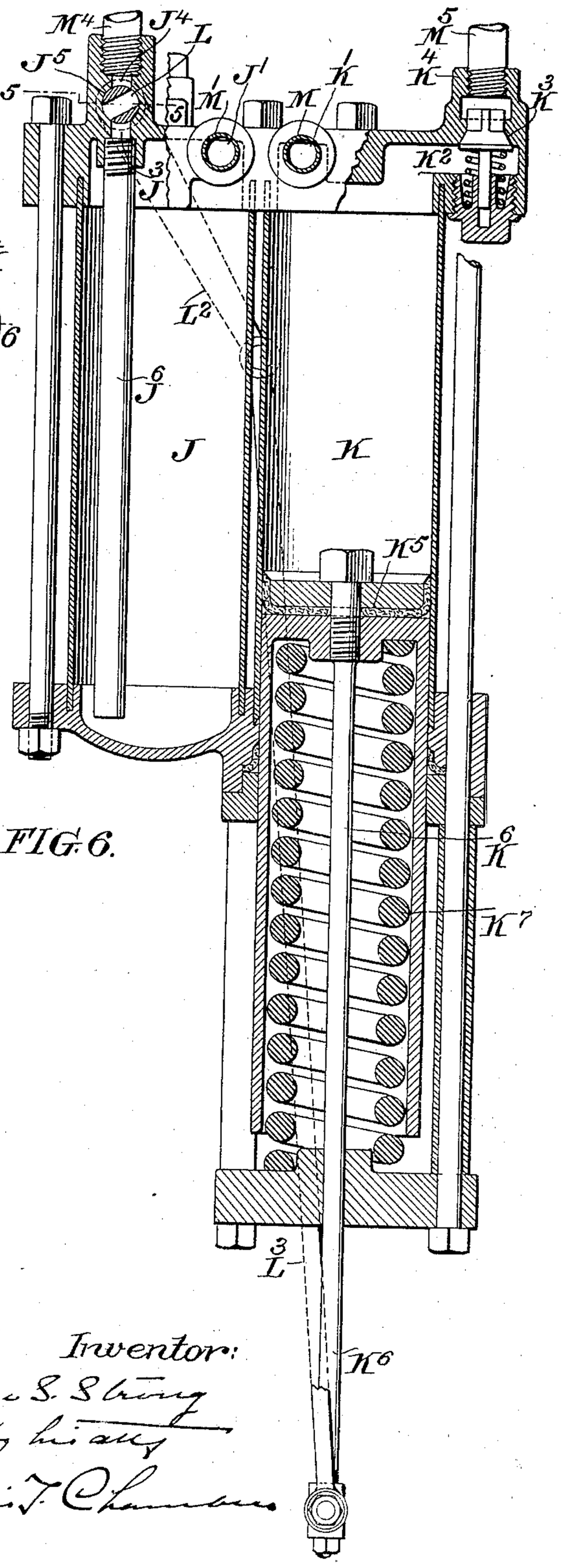

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FIG. 7.

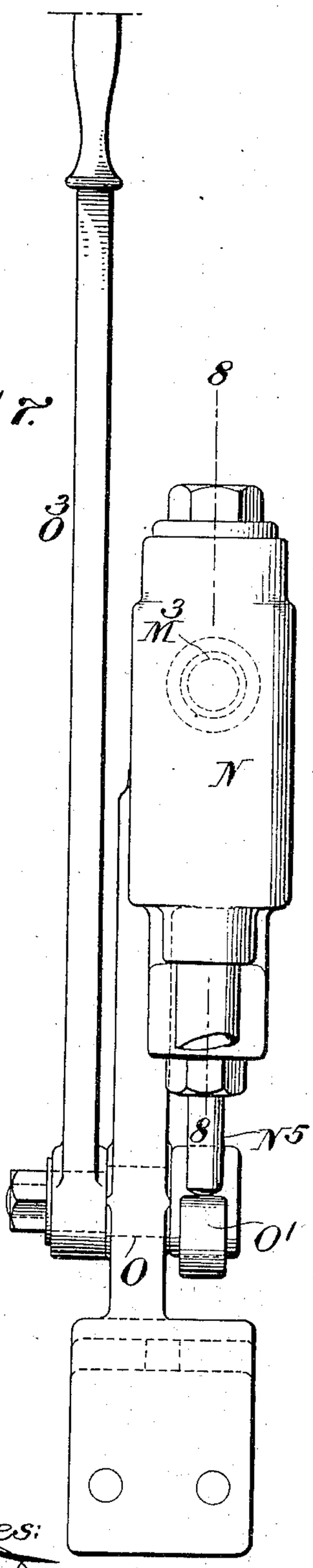

FIG. 9.

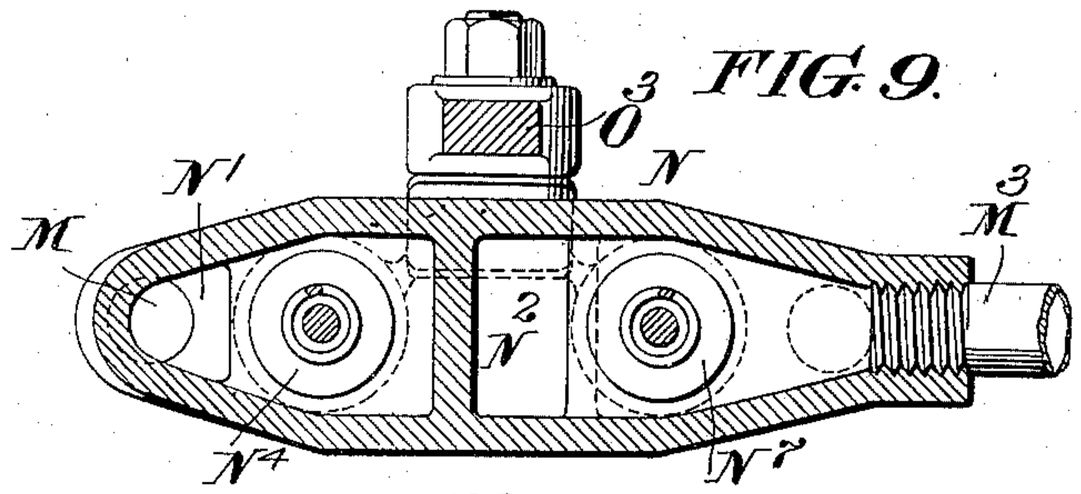

FIG. 8.

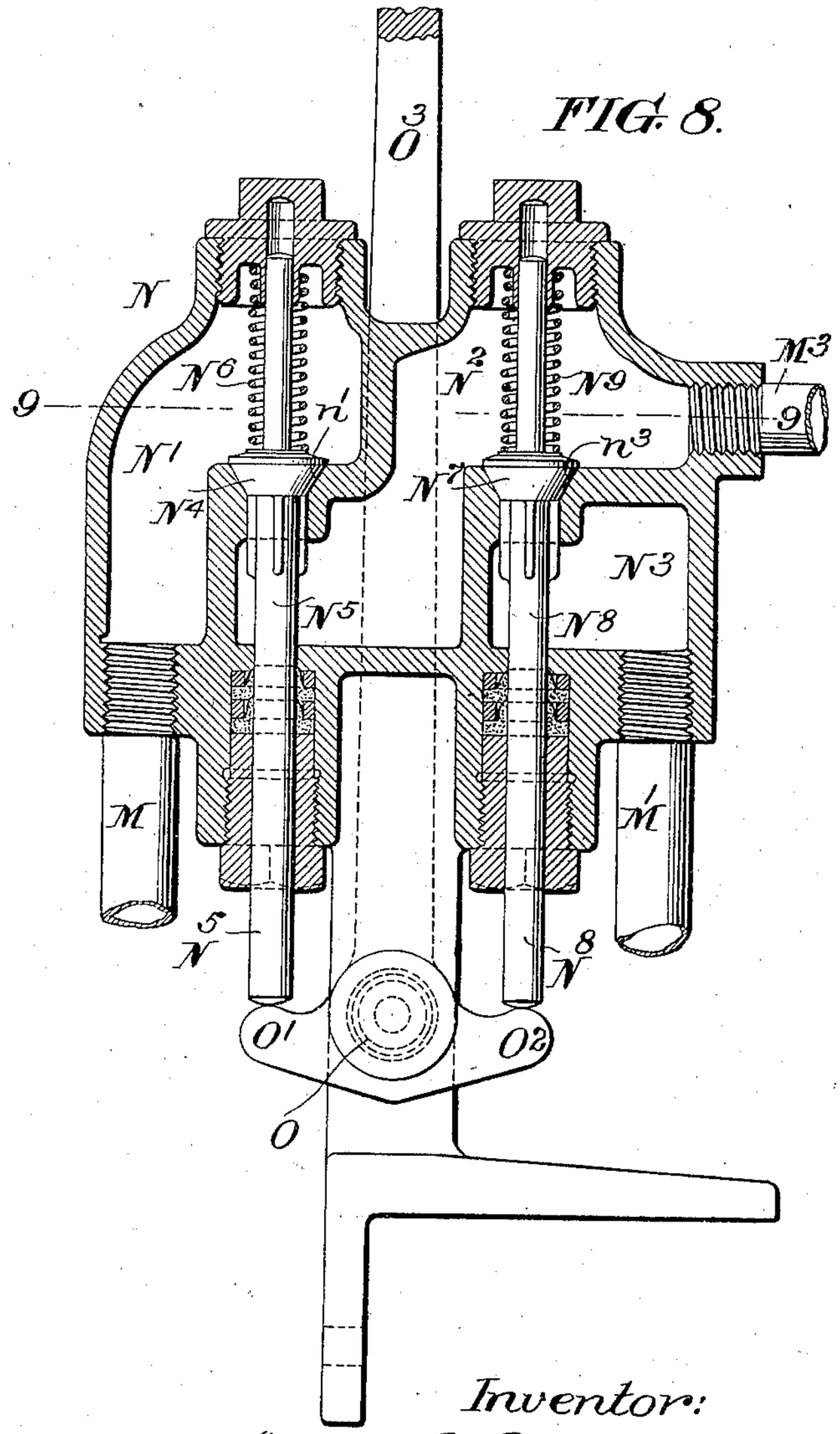

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FIG. 10.

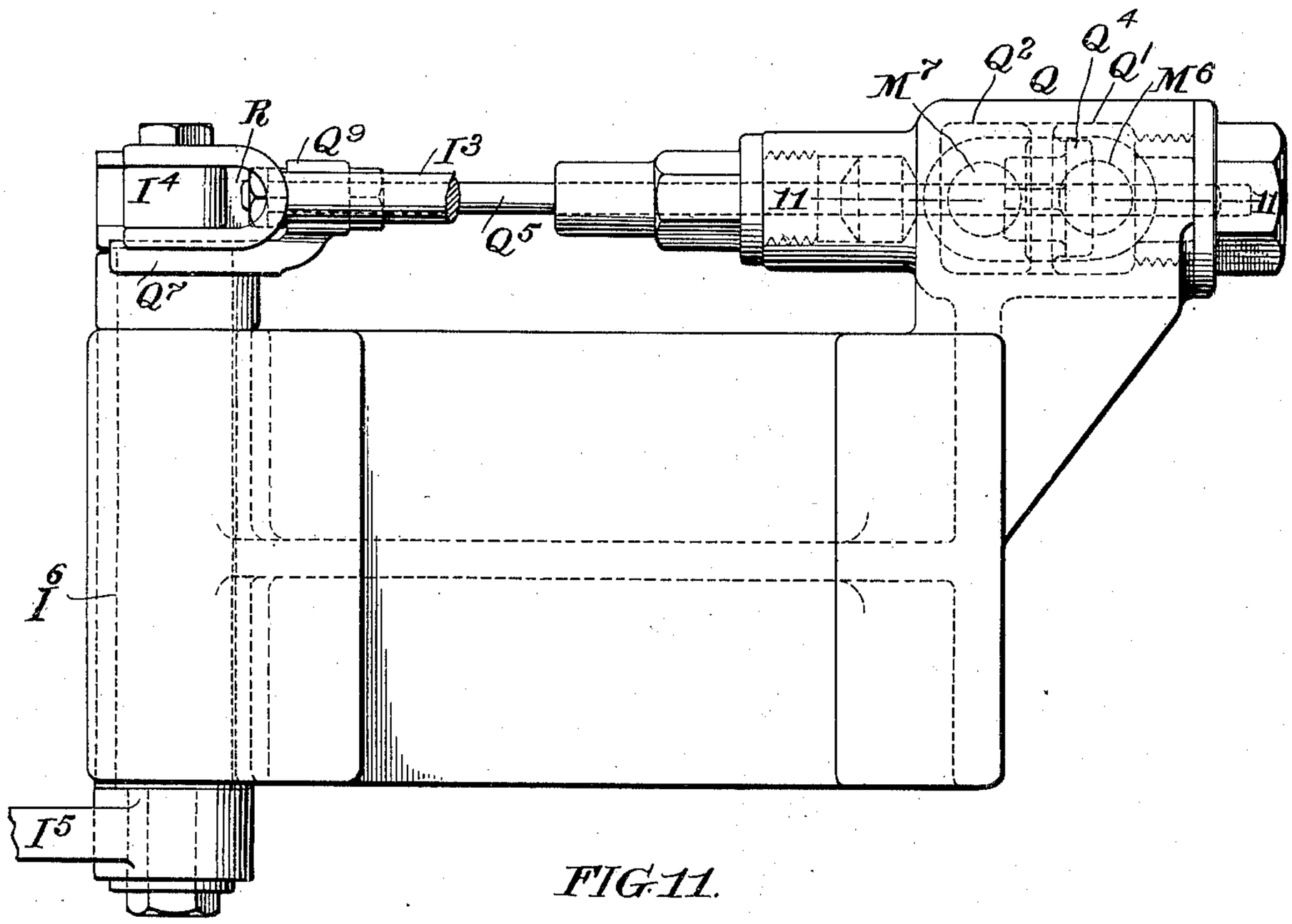
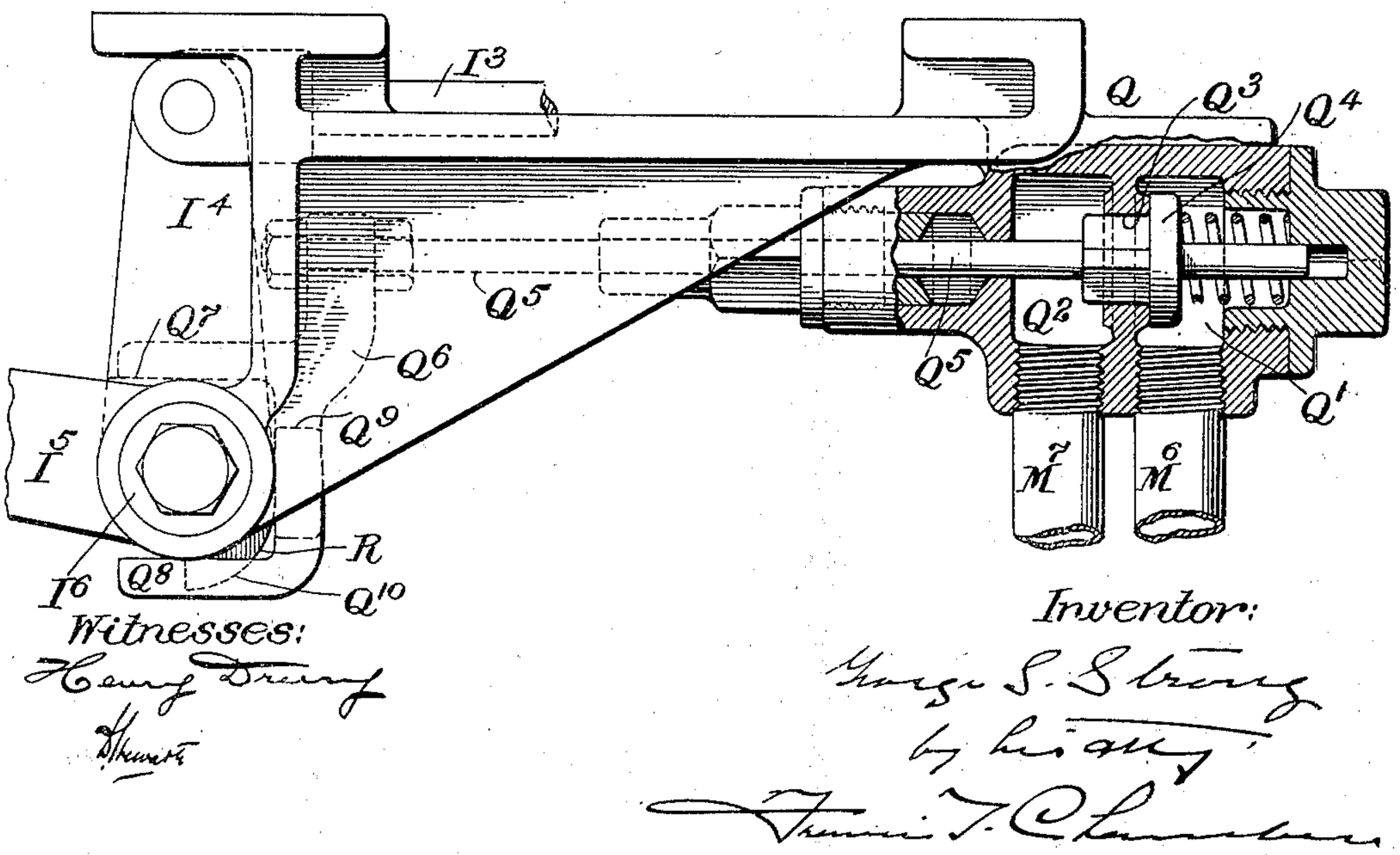


FIG. 11.



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UNITED STATES PATENT OFFICE.

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CONTROLLING MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 653,268, dated July 10, 1900.

Application filed November 14, 1899. Serial No. 736,939. (No model.)

To all whom it may concern:

Be it known that I, GEORGE SIMPSON STRONG, a citizen of the United States of America, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Controlling Mechanism for Engines, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to that class of controlling mechanism for engines in which the control is effected by changing the eccentricity of a crank-pin or eccentric—such, for instance, as described in my patent for power-transmitting mechanism, dated November 21, 1899, No. 637,297.

The object of my invention is to provide a simple and powerful controlling mechanism for shifting the crank-pin; and my invention consists, generally speaking, in providing a pump constantly actuated when the engine is in use and whereby fluid is drawn from a reservoir and stored under pressure in what may be called an "accumulator," the accumulator being connected with the actuating mechanism for the crank-pin, valves being provided whereby connection can be made between such mechanism and the accumulator or between such mechanism and the reservoir.

My invention further contemplates the cutting off of connection between the reservoir and the pump when a determined amount of fluid has been stored under pressure, and also the combination, with the general system indicated, of brake-setting mechanism arranged to establish connection between the pin-actuating mechanism and the reservoir independently of the first-mentioned mechanism accomplishing the same function.

The nature of my improvements will be best understood as described in connection with the drawings in which they are illustrated and in which—

Figure 1 is a side elevation of an automobile vehicle provided with my improved mechanism. Fig. 2 is a plan of the gas-engine used in connection with the automobile vehicle. Fig. 3 is a longitudinal section through the pump and pump-actuating mechanism, taken as on the section-line 3 3 of Fig. 4. Fig. 4 is a front view of the pump, partly in section on the line 4 4 of Fig. 3. Fig. 5 is an end view of the reservoir and accumulator, partly in section on the line 5 5 of Fig. 6. Fig. 6 is a longitudinal sectional view through the reservoir and accumulator, taken as on the irregular section-line 6 6 of Fig. 5. Fig. 7 is a side elevation of the valve-casing forming a part of the conduit connecting the accumulator and the mechanism for actuating the crank-pin, shown together with the valve-actuating levers. Fig. 8 is a sectional view taken on the line 8 8 of Fig. 7. Fig. 9 is a cross-sectional view taken on the line 9 9 of Fig. 8. Fig. 10 is a plan view of the device used for setting the brake and simultaneously opening the connection to the reservoir; and Fig. 11 is a side elevation of the same mechanism, partly in section on the line 11 11 of Fig. 10.

A indicates the body of the automobile vehicle; B, the running-gear; C, the gas-engine supported on the running-gear, preferably by means of springs, as indicated in Fig. 1 of the drawings.

C′ C′ indicate the cylinders of the gas-engine; C^2, the solid casting in which the admission and exhaust ports are formed; C^3, the cam-box in which are situated the cams which operate the valves.

C^4 is a rock-shaft actuated by a governor (indicated at C^5) and operating in sliding rods C^6, which operates to shift the position of the cams actuating the valves.

C^7 is a casing inclosing means for starting the engine.

D indicates the crank-shaft of the engine, the cranks being indicated at D′ D′, *d* indicating the channel or conduit formed through the crank-shaft and cranks and by means of which fluid under pressure is introduced to the mechanism contained in the fly-wheel E and by means of which the eccentricity of the crank-pins (indicated at E′) is changed at will.

F is a bracket having an extension F′, in which is formed a channel *f*, connecting with the channel *d* and with a conduit, (indicated at M^8.)

G is a rotating shaft actuated by the crank-shaft and connecting through a universal

joint G′ with a shaft contained in the box C^3 and to which shaft the valve-actuating cams are attached.

All of the above features are with respect to my present invention old and need not therefore be further shown or described in detail.

H and H′, Fig. 1, indicate connecting-rods extending from the crank-pin E′ on opposite sides of the rear axle H^2 and connecting to the levers *h* and *h′*, with clutch devices acting on the axle H^2.

I indicates a braking-drum secured to the axle H^2; I′, a brake-band placed around said drum and connected, through a lever I^2, connecting-rod I^3, bell-crank lever I^4 I^5, and connecting-rod I^7, to a foot-lever I^8, pivoted as shown at I^9.

J is a reservoir for fluid, having an inlet-opening J′ and outlet-opening J^2, in which outlet-opening is formed a plug-valve casing, (indicated at J^5, J^3, and J^4, indicating the parts on opposite sides of the casing.) From the port J^3, I have indicated a pipe J^6, leading to the bottom of the reservoir, but would mention that this pipe is only necessary because of the position of the reservoir as indicated in the drawings. If the reservoir were reversed in direction or laid on its side instead of supported in an upright position, the pipe J^6 would be omitted.

K is an accumulator-cylinder secured side by side with the reservoir-cylinder. K′ is the outlet-opening leading from said accumulator; K^2, the inlet-opening leading into the accumulator, this inlet-opening having a valve-controlled passage K^3, connecting it with a pipe-coupling chamber K^4, the valve being normally seated by means of a spring, as shown, so as to admit fluid to the accumulator through the passages K^4 K^2, but prevent the exit of fluid through the same passages.

K^5 indicates a piston working in the accumulator-cylinder and normally pressed upward by means of a powerful spring, as indicated at K^7.

K^6 is a rod connected with the piston and extending outside of the accumulator, as shown.

L is a valve-plug working in the casing J^5 and acting to open or close the exit-passage through the ports J^3 and J^4. It is actuated through a spindle L′ (shown in Fig. 5) by a lever L^2, (see Fig. 6,) which by means of a connecting-rod L^3 is coupled to the end of the rod K^6, and it will be obvious that as fluid accumulates in the accumulator K and presses the piston K^5 downward said motion of the piston acting through the connections described will rotate the plug L gradually, cutting off the passage through it until at a determined point the outlet-passage from the reservoir is entirely closed. On the other hand, as fluid is drawn from the accumulator and the piston K^5 moves upward in it the plug-valve will be turned so as to again open the passage leading from the reservoir.

M is a pipe leading from the accumulator and connecting, as shown, with the chamber N′ in the valve-casing N.

M′ is a pipe connecting with the inlet-opening J′ of the reservoir and leading to the chamber N^3 in the casing N.

M^3 is a pipe leading from the chamber N^2 in the casing N and connecting, as indicated in Figs. 1 and 2, with the bracket extension F′ and through its channel *f* with the channel *d*, leading to the crank-pin-actuating mechanism of the fly-wheel E.

M^4 is a pipe connecting with the outlet-opening J^2, leading from the reservoir to the chamber P^5 of the pump P. (See Fig. 4.)

M^5 is a pipe leading from the chamber P^6 of the pump P to the inlet-opening K^4 K^2 of the accumulator.

M^6 is a pipe leading from the pipe M^3 into chamber Q′ of the valve-casing Q, (see Figs. 10 and 11,) and M^7 is a pipe leading from the chamber Q^2 of the casing Q to the pipe M^4, as shown in Fig. 1.

The valve-casing N, referred to above, is shown in detail in Figs. 7, 8, and 9. In it are formed chambers N′ and N^2, which form part of the conduit, comprising also the pipes M and M^3. *n′* indicates a valve-seat in the passage connecting the chambers N′ and N^2, and n^3 a valve seated in the passage connecting the chambers N^2 and N^3. N^4 is a valve normally seated in *n′* and held to its seat by a spring N^6, said valve having a spindle N^5, which extends downward through a stuffing-box and projects beyond the casing N. N^7 is a valve normally seated on the seat n^3, held to its seat by spring N^9 and having a spindle or rod N^8 extending through a stuffing-box to the outside of the casing. O is a pivot-pin, to which are secured on opposite sides the rock-levers O′ and O^2, resting normally in contact, or substantially so, with the valve-spindles N^5 and N^8. O^3 is a valve-lever secured to the pin O and by means of which the rock-levers can be turned in one direction or the other. Normally the valves N^4 and N^7 are seated. When it is desired to open the valve N^4, the lever O^3 is moved toward the right in Fig. 8, pressing the rock-lever O′ upward against the spindle N^5 and raising the valve from its seat, the valve N^7 remaining closed. When, on the other hand, it is desired to open the valve N^7, the lever O^3 is moved toward the left.

P, Figs. 1, 2, 3, and 4, is the pump, the cylinder P^3 of which is connected by arms P^2 P^2 with boxes P′ P′, secured on the shaft G. P^4 is a chamber opening into the bottom of the cylinder P^3 and connecting through valve-seated passages p^5 and p^6 with an inlet-chamber P^5 and an outlet-chamber P^6. The valve-seated passage p^5 is fitted with a valve P^7, which opens inward, but not outward, and the valve-seated passage p^6 with a valve P^8, which opens outward, but not inward. The chambers P^5 and P^6 connect through passages P^9 and P^{10} with the pipes M^4 and M^5. P^{11} is an eccentric secured and turning with the shaft G. P^{12} is an eccentric-strip having attached

to it a connecting-rod P^{13}, which in turn works the plunger P^{14}, operating in the cylinder P^3.

Referring now to Figs. 1, 10, and 11, valve-casing Q is placed in immediate juxtaposition to the rock-shaft I^6, to which are attached the levers I^4 I^5, and which, together with said levers, makes up a bell-crank lever. The casing is divided into chambers Q′ and Q^2, connected by port Q^3 and connecting, respectively, with pipes M^6 and M^7. The port Q^3 is normally closed by a valve Q^4, from which extends a valve-spindle Q^5, having secured to its end a yoke-piece Q^6, the arms Q^7 and Q^8 of which lie, respectively, above and below the rock-shaft I^6. The yoke-piece has also a laterally-projecting arm Q^9, against which rests a cam Q^{10}, secured to the rock-shaft I^6, and which when said rock-shaft is rotated to the left presses against the arm Q^9, pressing it and the rod Q^5 inward and opening the valve Q^4.

The operation of the mechanism may be described as follows: The engine (indicated at C) being in operation, the normal position of the crank-pin E′ is at the center of the fly-wheel E, so that no motion is imparted by it to the connecting-rods H and H′ and the clutches actuated by said rods and by which the rear axle H^2 is turned. The operation of the engine, however, causes the shaft G to revolve, rotating the eccentric P^{11} and operating the plunger of the pump P. The pump being thus in operation, fluid is drawn by it from the reservoir J and forced through the connections already described into the accumulator K, this continuing until the piston in the accumulator has moved through the determined distance at which its connections cut off the connection between the pump and reservoir by means of the plug L. After this is accomplished the pump continues in operation, but no longer draws fluid from the reservoir or forces it into the accumulator. It being desired to start the vehicle in operation, the operator moves the lever O^3 in a direction to open the valve N^4, whereupon the fluid-pressure in the accumulator passes through the pipe M and chambers N′ and N^2 and pipe M^3 into the channel *d*, and thence to the mechanism which forces the pin E′ away from the center of the fly-wheel. The extent to which the pin is moved away from the center is regulated by the length of time during which the valve N^4 is kept open, and when said valve is allowed to close the pressure fluid remaining in the conduits will hold it in the position it has been moved to, subject only to what leakage may occur through the valves and conduits, slight touches of the lever compensating for such leakage. When it is desired to move the crank-pin toward the center, the lever O^3 is moved in the opposite direction, so as to open the valve N^7, whereupon the pressure fluid passes from the chamber N^2 into the chamber N^3 and thence through the pipe M′ into the reservoir, closing it with the valve N^7, checking at once the further movement of the crank-pin toward its center. For emergencies and where it is desired to stop the vehicle with great promptness the operator presses on the foot-lever I^8, applying the brake through the mechanism already described and simultaneously opening the connections M^6 and M^7 between the pipes M^3 and M^4, the by-pass connection opened by the valve Q at once releasing the pressure holding the crank-pin away from its center, permitting the pressure fluid to flow freely to the reservoir.

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

1. Hydraulic mechanism for shifting the position of a crank-pin comprising, in combination, an accumulator and a reservoir for liquid not under pressure, a constantly-running pump arranged to draw liquid from the reservoir and force it into the accumulator, a device operated by the fluid in the accumulator acting to cut off and open the connection between the pump and reservoir as the fluid rises or falls with reference to a determined point, a valve-controlled conduit leading from the accumulator to the mechanism acting directly on the crank-pin, a valve-controlled passage leading from said conduit to the reservoir, and valve-actuating mechanism for opening said valves at will.

2. Hydraulic mechanism for shifting the position of a crank-pin comprising, in combination, an accumulator and a reservoir for liquid not under pressure, a constantly-running pump arranged to draw liquid from the reservoir and force it into the accumulator, a device operated by the fluid in the accumulator acting to cut off and open the connection between the pump and reservoir as the fluid rises or falls with reference to a determined point, a valve-controlled conduit leading from the accumulator to the mechanism acting directly on the crank-pin, a valve-controlled passage leading from said conduit to the reservoir, valve-actuating mechanism for opening said valves at will, a by-pass connecting the suction-pipe of the pump and the pipe leading from the accumulator, a valve in said by-pass, a brake for checking the motion of the mechanism actuated by the crank-pin and brake-actuating mechanism arranged when operated to open said valve.

3. Hydraulic mechanism for shifting the position of a crank-pin comprising in combination an accumulator and a reservoir for liquid not under pressure, a constantly-running pump arranged to draw liquid from the reservoir and force it into the accumulator, a device operated by the fluid in the accumulator acting to cut off and open the connection between the pump and reservoir as the fluid rises or falls with reference to a determined point, a conduit comprising the connected valve-chambers N′ N^2 and the pipe M^3 leading from the accumulator to the mechanism acting directly on the crank-pin, a valve-

controlled port connecting the chambers N′ and N^2 and a similar valve-controlled port, connecting chamber N^2 with the reservoir, normally-seated valves N^4 N^7 for controlling said ports, each having actuating-rods as N^5 N^8, rock-levers O′ O^2 secured together and resting substantially in contact with the rods N^5 N^8 and a lever for actuating the rock-levers and through them the valves N^4 N^7.

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