

(No Model.)

2 Sheets—Sheet 1.

J. E. SCHUMACHER.
HYDRAULIC OR OTHER ENGINE.

No. 571,129.

Patented Nov. 10, 1896.

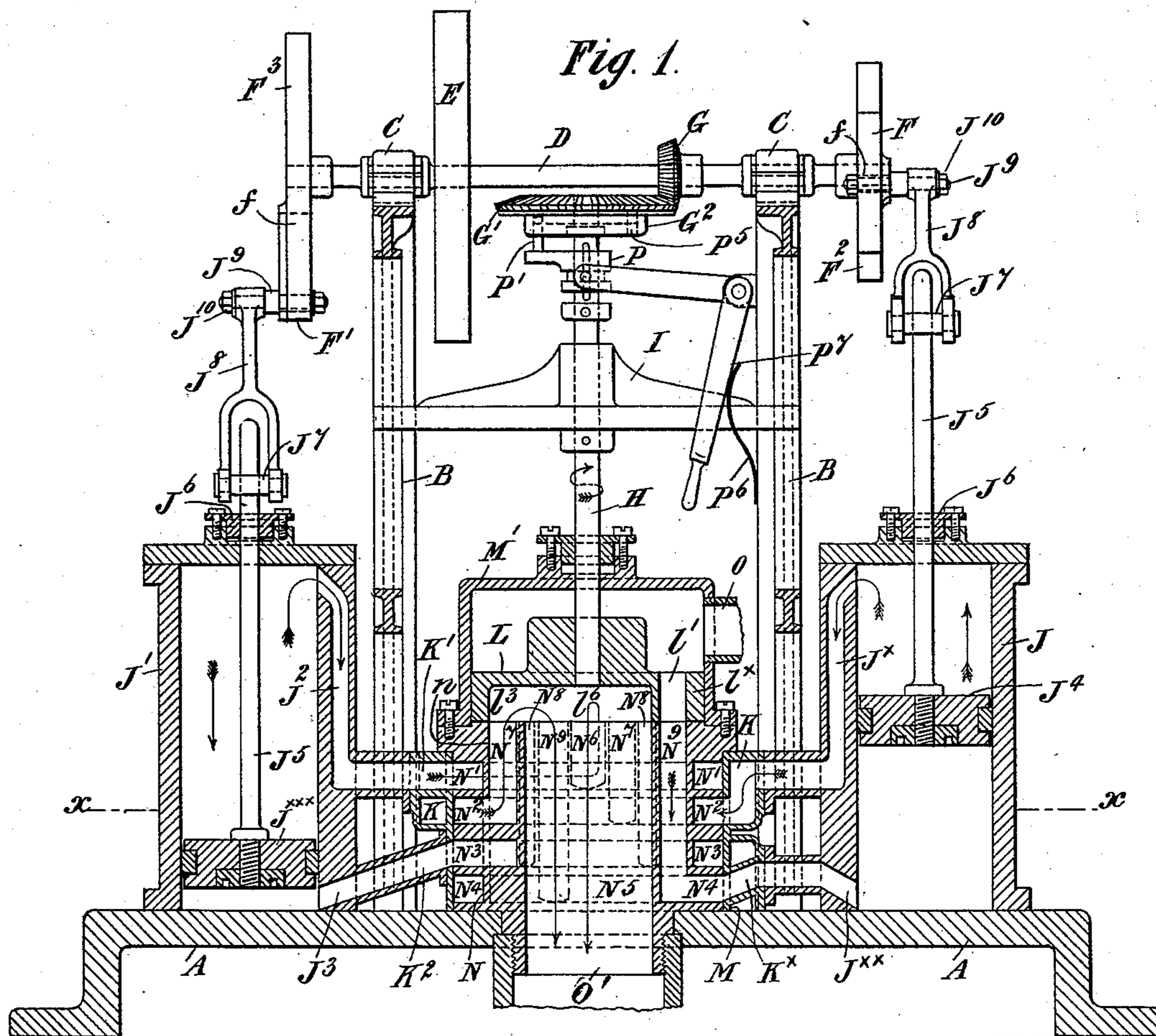
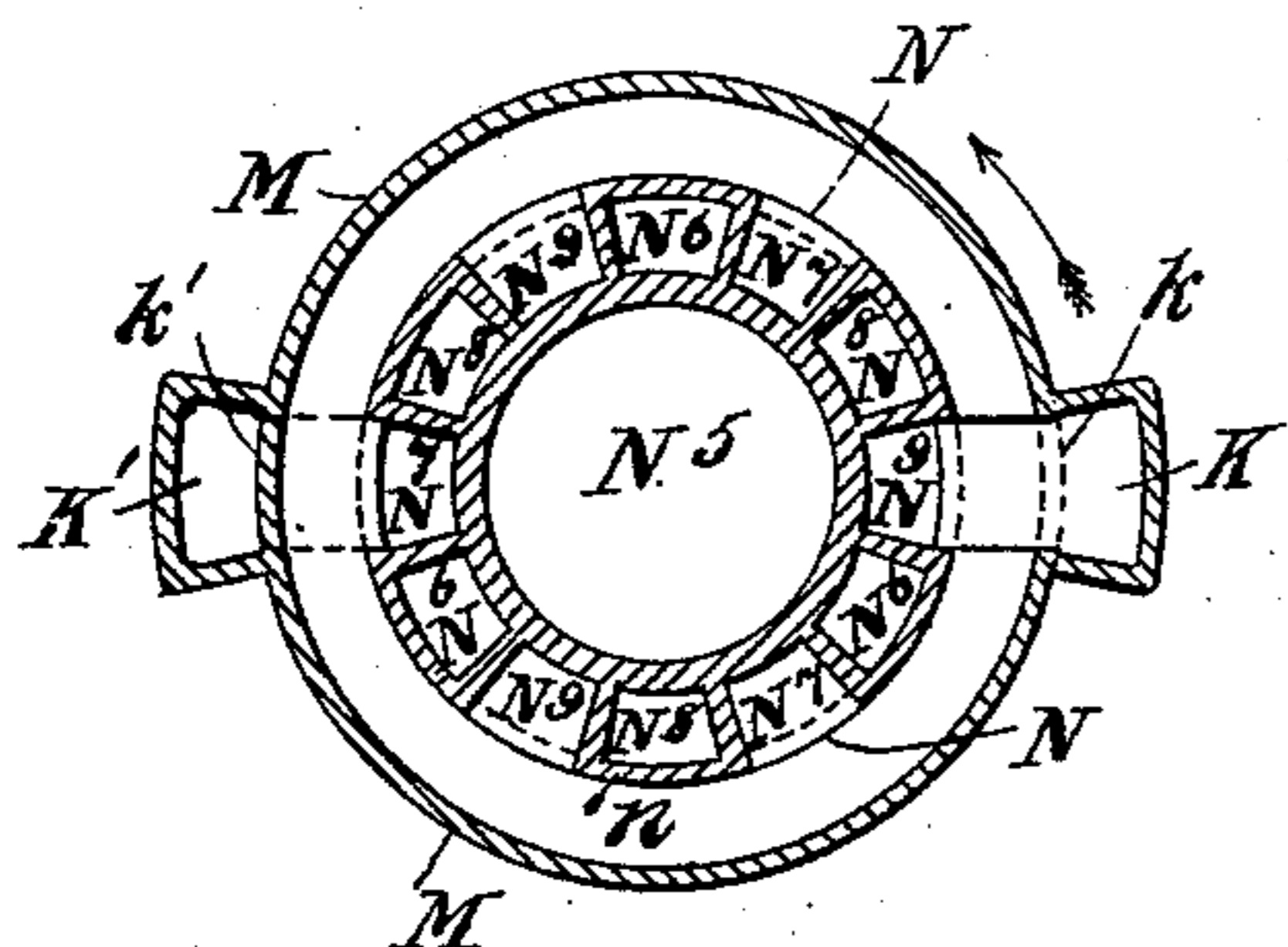


Fig. 3.



Witnesses:

J. B. McGirr.
H. L. Dyer

Fig. 6.

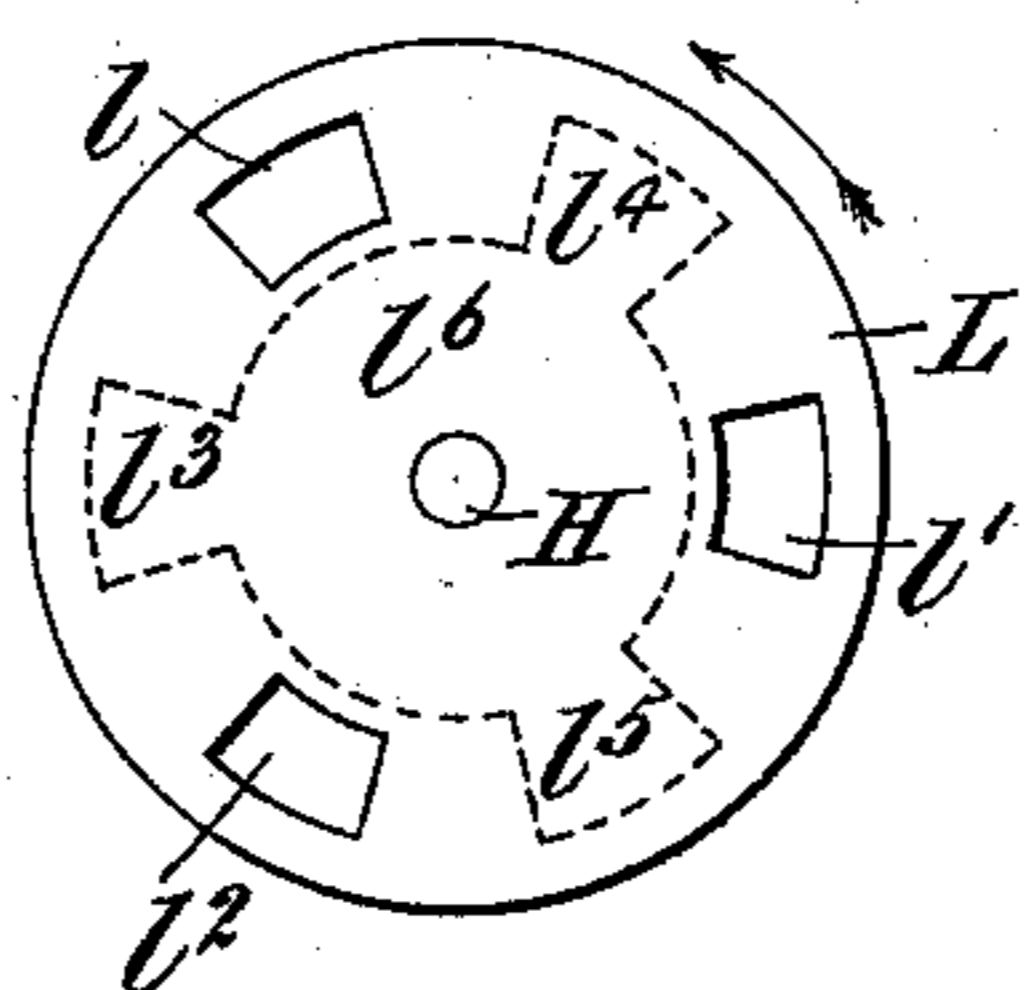
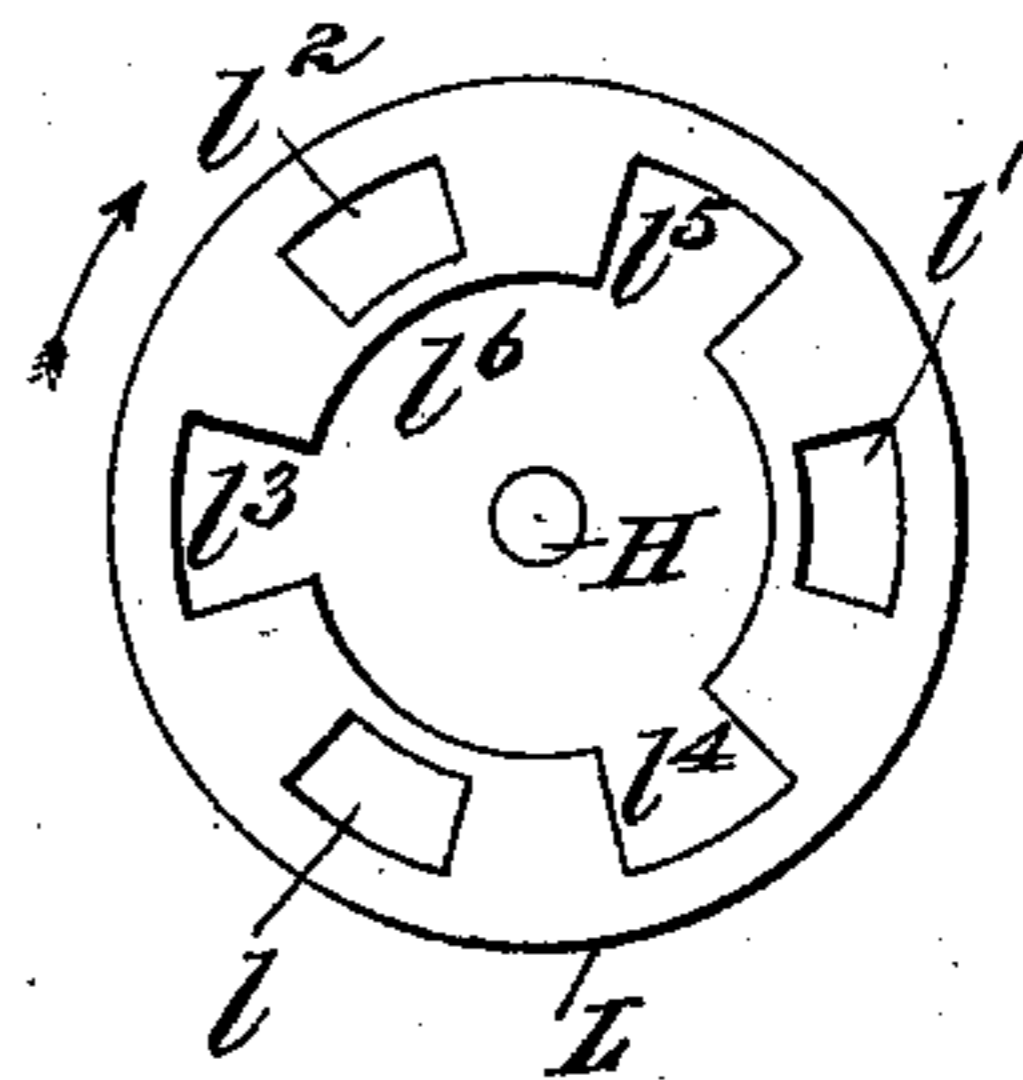


Fig. 7.



Inventor.

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By Howard H. Dyer. Atty.

2 Sheets—Sheet 2.

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Fig. 9.

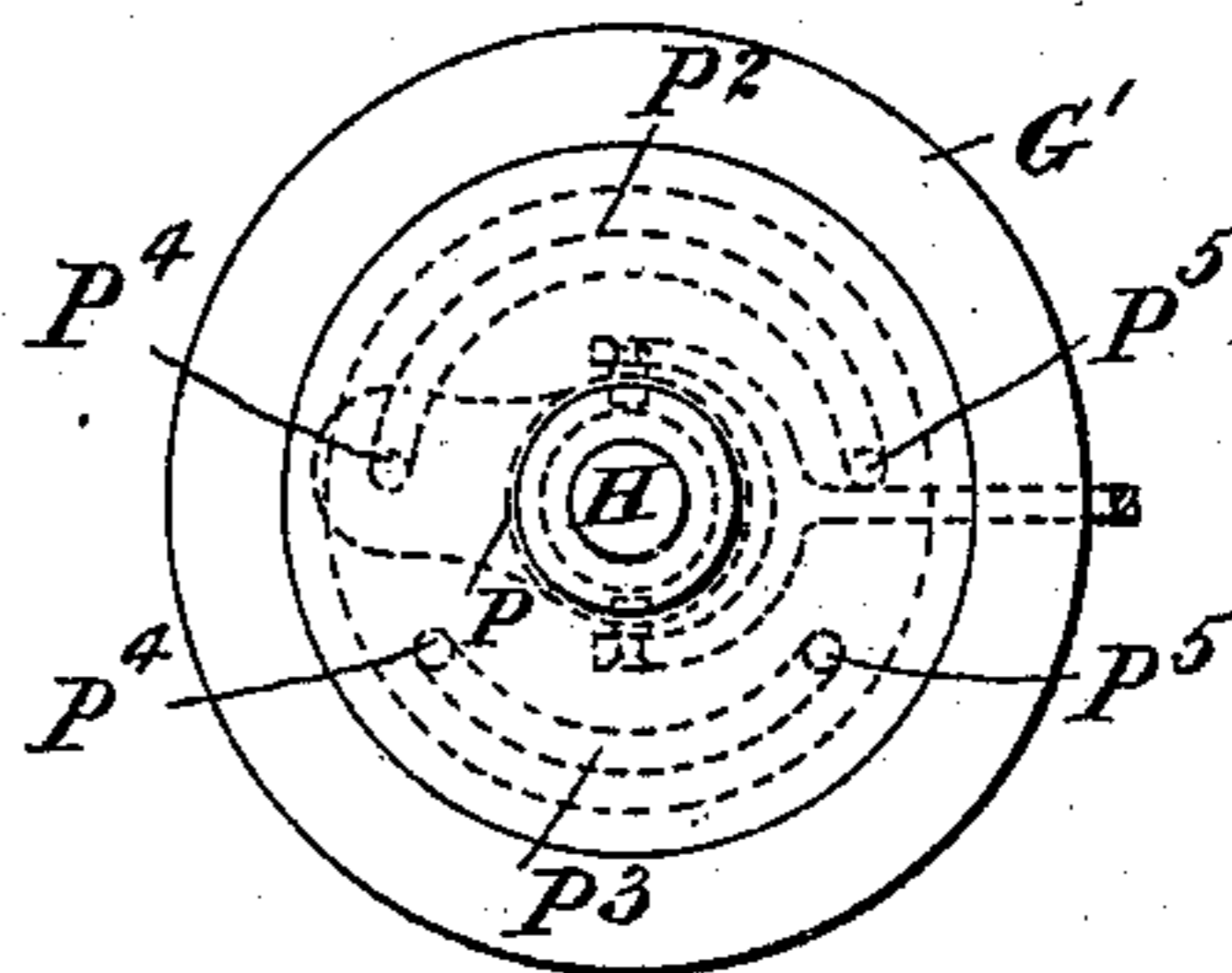


Fig. 2.

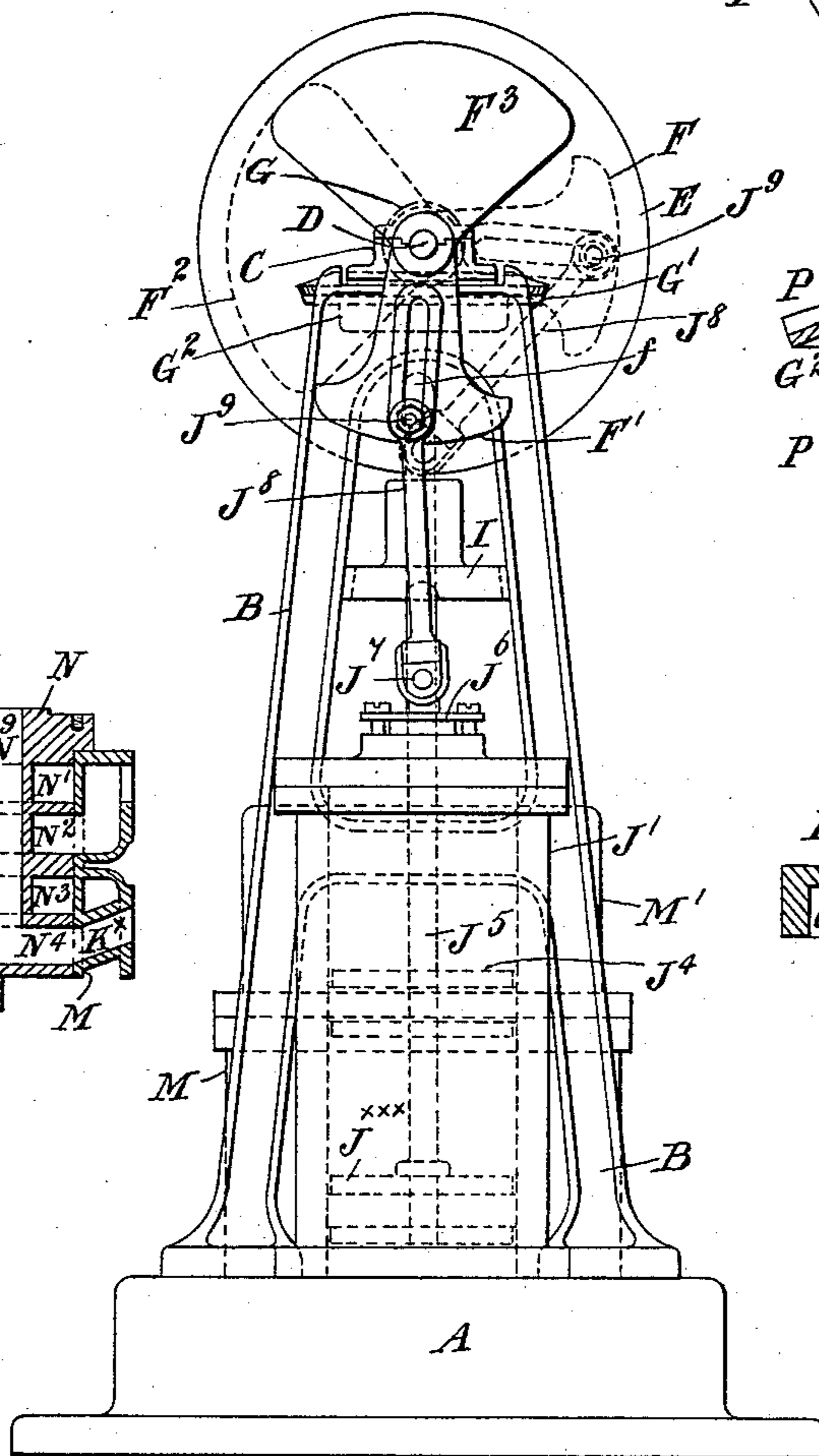


Fig. 8.

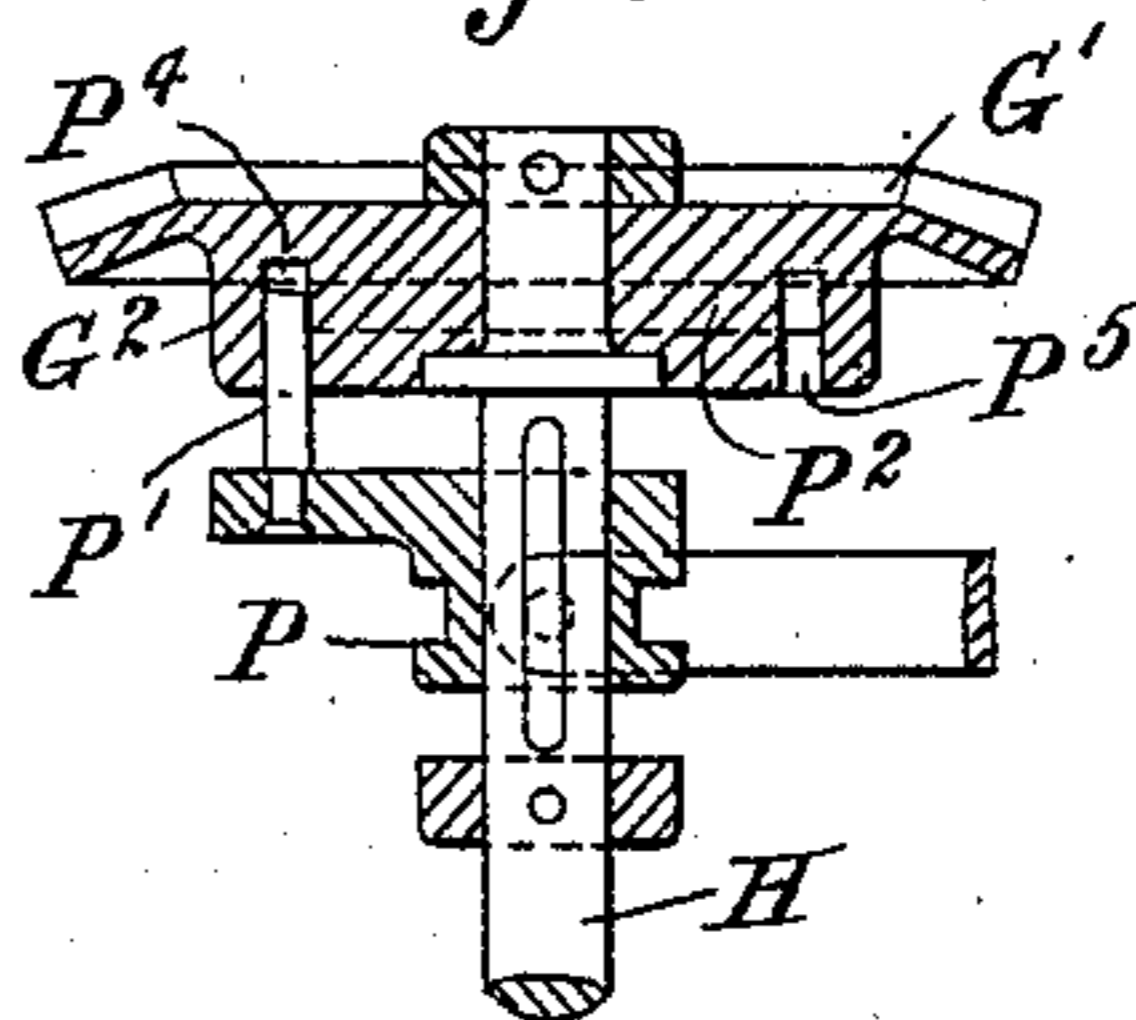


Fig. 5.

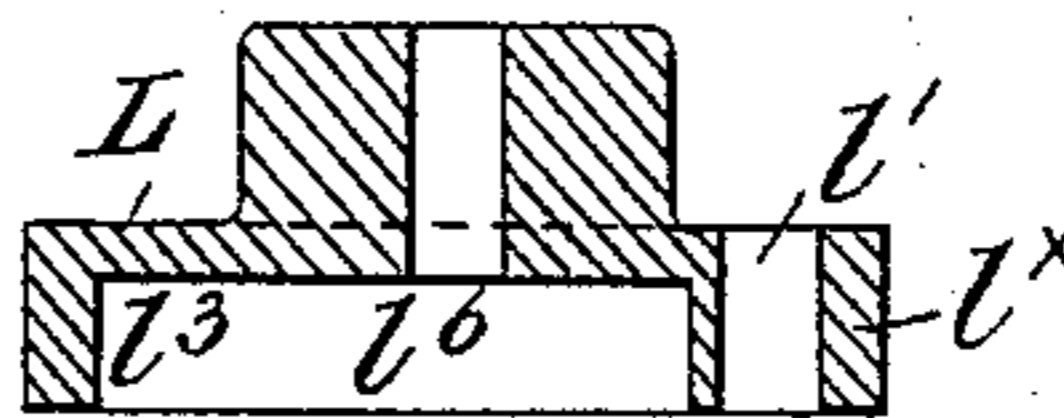
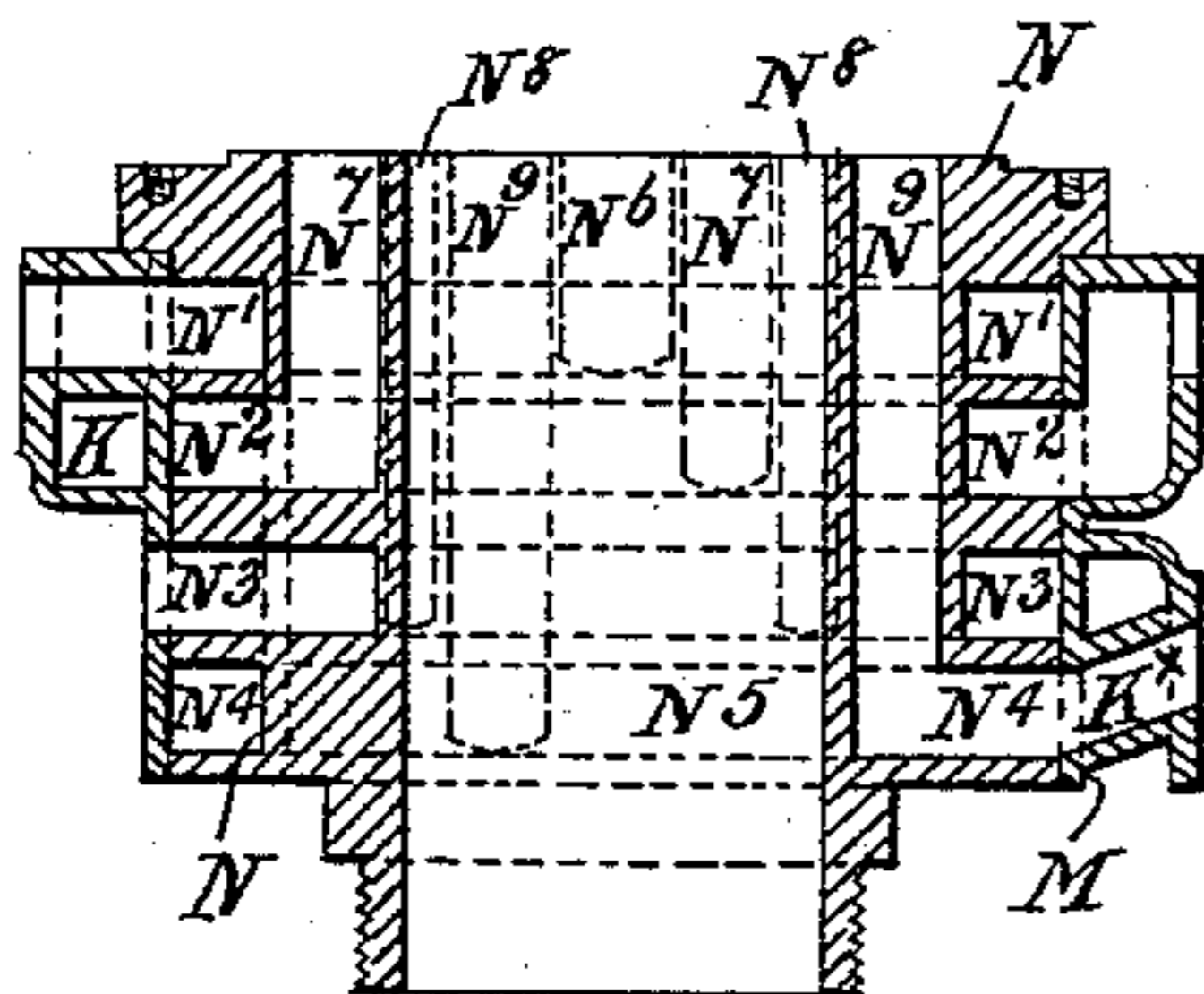


Fig. 4.



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Atty

UNITED STATES PATENT OFFICE.

JAMES EDWARD SCHUMACHER, OF YORK, ENGLAND.

HYDRAULIC OR OTHER ENGINE.

SPECIFICATION forming part of Letters Patent No. 571,129, dated November 10, 1896.

Application filed September 24, 1894. Serial No. 524,010. (No model.)

To all whom it may concern:

Be it known that I, JAMES EDWARD SCHUMACHER, a subject of the King of Prussia, Emperor of Germany, residing in the city and county of York, England, have invented new and useful Improvements in or Relating to Hydraulic or other Engines, of which the following is a specification.

This invention relates to improvements in hydraulic and other engines; and the objects of my improvements are, first, to provide a continuous revolving valve making, say, one revolution to three strokes of the piston or pistons; second, to afford facilities for the proper adjustment of the stroke of each piston, whereby when, say, two cylinders and pistons are controlled by the same valve the stroke may, if desired, be slightly varied; third, to enable the engine to be readily reversed. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a sectional elevation of a vertical engine provided with two cylinders controlled by one valve; Fig. 2, a front elevation of the same; Fig. 3, a sectional plan of the valve-seat on line $x\ x$, Fig. 1. Fig. 4 is a sectional elevation of the valve-seat; Fig. 5, a sectional elevation of the valve. Figs. 6 and 7 are plans of the top and bottom faces of the valve. Figs. 8 and 9 are respectively a sectional elevation and end elevation of reversing-gear.

Like parts in all the views are marked with similar letters of reference.

A is the bed-plate, and B are the standards. These constitute the framework of the engine and may be of any suitable and ordinary construction. On the top of the standards B are fixed the pedestals C, which form the bearings of the fly-wheel shaft D, on which is mounted the fly-wheel E, slotted cranks $F\ F'$, weighted at $F^2\ F^3$, to be hereinafter described, and bevel-pinion G, gearing with bevel-wheel G' , mounted on the valve-shaft H, which is supported by bearings I, fixed to the standards B.

All the above parts, with the exception of the cranks $F\ F'$, may be of ordinary and well-known construction.

On the bed-plate A are bolted or otherwise fixed one or more double-acting cylinders J

J' , somewhat similar in construction to that of a steam-cylinder. The top of the bed-plate A is preferably, though not necessarily, so arranged to form the bottom cover for each of the cylinders. In each cylinder are provided two ports $J^x\ J^{xx}$ or $J^2\ J^3$, communicating, respectively, with the ends of each of their cylinders and connected by suitable pipes or passages $K\ K'\ K^x\ K^2$ with a valve-box M, to be hereinafter described. In each of the cylinders J J' reciprocates a piston $J^4\ J^{xx}$ of ordinary construction, mounted on a piston-rod J^5 , working through the gland J^6 and connected to the weighted slotted cranks $F\ F'$ by cross-heads J^7 , forked or other rods J^8 , and pins J^9 , capable of adjustment in the slots f of the cranks. According to the position of the crank-pins J^9 in the slots f will the stroke of the pistons $J^4\ J^{xx}$ be increased or diminished. The crank-pins are retained in position in the said slots by nuts J^{10} or their equivalents.

The circular valve L, mounted on shaft H, and its case M, fixed to the bed-plate A, are constructed as follows: Within a metal casing or ring, hereinafter termed the "outer" casing M, is inclosed a tube or ring N, hereinafter termed the "valve-seat," of any suitable diameter, length, and thickness. In the periphery of the valve-seat N are cut or otherwise formed any desired number of circumferential grooves or recesses, say, for example, four, $N^1\ N^2\ N^3\ N^4$; but I distinctly wish it to be understood that I do not limit myself to this or any other number hereinafter mentioned. In the thickness or ring portion n of the said valve-seat N and around its central orifice N^5 are also provided a number of vertical holes or apertures, hereinafter termed "valve-ports," communicating with the said circumferential grooves, say, for example, three ports to each circumferential groove. That is to say, valve-ports N^6 communicate with circumferential groove N^1 and port J^2 of cylinder J' ; valve-ports N^7 with circumferential groove N^2 and port J^x of cylinder J; valve-ports N^8 with circumferential groove N^3 and port J^3 of cylinder J' ; valve-ports N^9 with circumferential groove N^4 and port J^{xx} of cylinder J. The whole of the valve-ports $N^6\ N^7\ N^8\ N^9$ are arranged at or about a right angle to the circumferential grooves $N^1\ N^2\ N^3\ N^4$ and

are open to the action of the valve L. The outer casing M is fixed around the periphery of the valve-seat N, so as to be water or fluid tight, for preventing the water or other fluid passing from one circumferential groove to another. In the periphery of the outer casing are provided a number of openings k k' , corresponding with the number of circumferential grooves, that is to say, one opening for each groove, which is connected by a pipe or passage with one of the ports in each cylinder as follows: passages K K^x, respectively, with circumferential grooves N² N⁴ and ports J^x J^{xx}; passages K' K², respectively, with circumferential grooves N' N³ and ports J² J³. On the top of these valve-ports N⁶ N⁷ N⁸ N⁹ is arranged to rotate within the outer casing M a circular disk or valve proper, L, in which are provided a number of vertical openings or orifices corresponding in number with the number of ports communicating with each circumferential groove. That is to say, if there are three valve-ports, as shown in the drawings, communicating with each circumferential groove, then there will be three vertical openings l l' l^2 , arranged to perforate the flange or disk portion l^x of the valve L. These openings or orifices l l' l^2 are of slightly larger area than that of the valve-ports N⁶ N⁷ N⁸ N⁹. On the inner face of the disk or flange l^x are also formed or provided a number of apertures or recesses l^3 l^4 l^5 , (of the same number as the ports communicating with each circumferential groove,) arranged to communicate with a central circular or other recess l^6 , formed in the under face of the said disk or flange l^x and about the same (or nearly so) diameter, and immediately over the central orifice N⁵ of the valve-seat.

It will be readily understood if, say, two cylinders, such as J J', each having a port, such as J^x J^{xx} J² J³, communicating with each end of the cylinder, are connected with the circular valve-disk, such as L, and its casing, such as M, four circumferential grooves would preferably be provided in the outer casing M, and, say, twelve ports, such as N⁶ N⁷ N⁸ N⁹, would be provided in the valve-seat N and the four perforations, such as k k' , in the outer casing M would be connected, respectively, by four pipes, such as K K^x K' K², with the four ports, such as J^x J^{xx} J² J³, in the cylinders, one pipe for each port.

The herein-described ports J^x J^{xx} J² J³ in the cylinders J J' and valve-ports N⁶ N⁷ N⁸ N⁹ are alternately employed for inlet and exhaust purposes. The inlet water or fluid may be arranged to enter the hood or valve-covering M', which forms a part of the outer case M at O, above the circular valve-disk L, and passes through the vertical holes or apertures l l' l^2 therein to the valve-ports and circumferential grooves in the valve-seats, and from thence to the ports in the cylinder, that is to say, when the valve L is in the position shown in the drawings the inlet-water passes into the hood M', through openings l' ,

into valve-ports N⁹, thence into circumferential groove N⁴, passage K^x, port J^{xx}, to bottom of cylinder J for raising piston J⁴ to the top of its stroke, while the exhaust is forced by the descent of piston J^{xx} from the cylinder J' into the circumferential groove N⁸ and up the valve-ports N⁷ into the recesses l^3 l^4 l^5 and central circular recess l^6 , formed in the inner face of the circular valve-disk, by which it is directed to the central orifice N⁵ in the valve-seat for conveyance away by a pipe O' or its equivalent.

The circular valve is caused to rotate continuously by gearing mounted, say, on the shafts D and H or other equivalent means for gradually opening and closing the valve-ports; but the rotation of the circular valve L is slower than the traverse of the pistons, that is to say, the pistons J⁴ J^{xx} may be arranged to make, say, three strokes to one revolution of the valve.

To reverse the action of the valve and of the engine, one of the gear-wheels, say wheel G', is arranged to revolve loosely on its shaft H, and on the same shaft is mounted, so as to slide freely on a square portion or key, a clutch P, armed with one or more pins P'. In the boss G² or other portion of the gear-wheel is or are provided one or more grooves, say two grooves P² P³, of the same or varying lengths, as shown in the drawings. At the ends of each groove is a hole P⁴ and P⁵, into which the pin P', or one of the pins when more than one pin is employed, enters when the clutch is meshed with the gear-wheel. During the time the pin is traveling in the groove P² or P³ of the wheel no motion is transmitted to the circular valve. A suitable spring P⁶ and lever P⁷ or equivalent mechanism may be employed for meshing and unmeshing the clutch.

To reverse the engine, the pin P' is withdrawn from the hole, say P⁴, and the action of the engine is immediately stopped. On rotating the pin to place it in the hole P⁵ the position of the valve over the ports will be changed and thus causing a reversing action to take place.

It will be readily understood that when required the cylinders, valves, and valve-seat may be arranged in a horizontal position; also that instead of arranging the valve to work in the horizontal position, as shown in the drawings, it may be arranged to work in a vertical position, that is, with its shaft or spindle H in a horizontal instead of the vertical position illustrated.

One or more cylinders may be operated from one valve and its seats, two circumferential grooves and any desired number of valve-ports—say three for each groove—being required for each cylinder.

The above-described engine may be operated by gas, compressed air, steam, water, and other fluid, preferably water, and may be applied for a great variety of purposes.

The action of the engine is as follows: Com-

mencing with the admission of water to cylinder J to raise piston J⁴ to, say, its half-upstroke, water or other fluid under pressure enters the hood M', through the pipe O, above the valve L, from any suitable source—such as, say, the water mains or reservoir—and passes through the openings *l l'* ² to the valve-ports—say to the three valve-ports N⁹ N⁹ N⁹—to circumferential groove N⁴, and from thence through passage K^x for imparting the full power or pressure to piston J⁴ for its upstroke. At the same time port J^x, passage K, circumferential groove N² and valve-ports N⁷, and covered recesses *l*³ *l*⁴ *l*⁵ *l*⁶ will be in communication with the central orifice N⁵ for conveying away the exhaust from cylinder J. At the commencement of the action in cylinder J, that is, when the piston is in the position shown in Fig. 1, the valve-ports N⁶ and N⁸ are closed by the solid or faced portions of the under side of flange *l*^x of the valve L against the admission of water to the cylinder J'. At the commencement of the action in cylinder J' the exhaust from below the piston will have passed out through port J³, passage K², to circumferential groove N³, valve-port N⁸, recessed portions *l*³ *l*⁴ *l*⁵ *l*⁶, to central orifice N⁵, it being understood that the valve would not have reached the position illustrated until the piston J^x had reached the bottom of its cylinder. When, say, the half-upstroke of the piston J⁴ in cylinder J is reached, and continuing to admit the water to said cylinder J through openings *l l'* ², valve-ports N⁹, and circumferential groove N⁴, none of the valve-ports will then be practically closed, as valve-ports N⁷ will be then partially and decreasingly closed to the exhaust from cylinder J, while the valve-ports N⁶ will be partially and increasingly opened to the exhaust from cylinder J'. When this stage is reached that both of the pistons J⁴ and J^x are rising in their respective cylinders, it will be readily understood that the admission of water through the openings *l l'* ² of the rotating valve L to valve-ports N⁹ and circumferential grooves N⁴ will gradually decrease, while the admission to valve-ports N⁸ and circumferential groove N³ will be simultaneously and correspondingly increased. On the completion of the stroke of piston J⁴ in the upper half of the piston J and when the piston J^x is, say, at its half-stroke in cylinder J' valve-ports N⁷ and N⁹ are closed, and the valve-ports N³ communicating with circumferential groove N³ are fully opened to cylinder J', and at the same time valve-ports N⁶, communicating with circumferential groove N⁴, are fully opened to the exhaust from that cylinder; but when the piston J^x has passed over, say, its half-stroke and is continuing its motion upward at the same time piston J⁴ is descending, say, to its half-stroke valve-ports N⁸ will be closing decreasingly to pressure at the same time that valve-ports N⁶ are being closed decreasingly to the

exhaust from cylinder J'. Simultaneously therewith valve-ports N⁷ will increasingly open to pressure, and N⁹ will also be increasingly opened to the exhaust from cylinder J. On the completion of the stroke of the piston J^x and when the piston J⁴ is at, say, its half-downstroke in cylinder J valve-ports N⁶ and N⁸ will be closed, thereby completely shutting off the pressure and exhaust to and from cylinder J'. At the same time valve-ports N⁷ and N⁹ will be fully opened for respectively imparting pressure to the piston J⁴ and receiving the exhaust from cylinder J; but by the continued descent of the piston J⁴, say, from its half-stroke to the bottom of cylinder J, valve-ports N⁶ will be increasingly opened for admitting pressure to the top of cylinder J', and valve-ports N⁸ will open increasingly for receiving the exhaust from the cylinder J'. Simultaneously therewith valve-ports N⁷ will be closed decreasingly to pressure in cylinder J and valve-ports N⁹ closed decreasingly to the exhaust from the same cylinder.

By the continuous rotation of the valve, before comparatively any pressure is obtained in the closed valve-ports which would tend to lift or force the valve from its seat, the valve will have been moved partially over the adjoining valve-ports, say, for instance, N⁶ and N⁸, gradually opening them and closing the previously-opened ones, so that when the openings *l l'* ² and recesses *l*³ *l*⁴ *l*⁵ are respectively midway between two sets of valve-ports, say, for example, between N⁹ N⁶ and N⁷ N⁸, water or other fluid for completing the upward stroke of piston J⁴ and downward stroke of piston J^x would be able to pass simultaneously through openings *l l'* ² to valve-ports N⁹ N⁶. At the same time the water above piston J⁴ and below piston J^x will respectively be forced, say, through ports J^x J³ of cylinders J J', along passages, say, K K², up valve-ports, say, N⁷ N⁸, and conveyed by recesses *l*³ *l*⁴ *l*⁵ to central recess *l*⁶ and thence down exhaust N⁵ and away through pipe O'.

It will thus be seen that on water or other fluid pressure being admitted to the hood M' above the valve L it will find, as described, three supply valve-ports fully open to pressure and which communicate with the ports in the cylinder J, (while the valve-ports of cylinder J' are closed,) whereby the piston J⁴ is caused to reciprocate in its cylinder, and in so doing and by the connection of the pistons with the shaft D, by means of piston-rods J⁵, cross-heads J⁷, connecting-rods J⁸, crank-pins J⁹, and cranks F F', a rotary motion is imparted to the said shaft and by it transmitted through gear-wheels G G', boss G², clutch P, sliding on valve shaft or spindle H, to valve L, causing it to rotate and thus changing the position of the valve for operating both pistons simultaneously, as described, thereby permitting of another set of three valve-ports being opened to the exhaust. By the gradual simultaneous opening and clos-

ing of the inlet and exhaust valve-ports an easy and uniform motion is imparted to the moving parts of the engine.

5 Having now particularly described the nature of my invention, what I claim, and desire to be secured by Letters Patent, is—

1. In an engine, the combination with a bed-plate, cylinders mounted on said bed-plate, a valve-case arranged adjacent to said cylinders, and communicating therewith, a valve-seat within the casing, circumferential grooves formed on the valve-seat, each groove communicating with a single port of one cylinder, and with one or more openings in the face of the valve-seat, a hood covering the face of the valve-seat a rotating valve mounted within the hood, perforations within the valve connecting the hood and circumferential grooves, and recesses on the face of the valve, connecting the grooves with the central orifice, substantially as set forth.

2. In an engine such as described the com-

bination of the outer casing M perforated as described, the valve-seat N fitted within said outer casing having a number of circumferential grooves N¹ N² N³ N⁴ cut in its periphery, valve-ports N⁶ N⁷ N⁸ N⁹ communicating with said circumferential grooves as described, an orifice N⁵ in the center of said valve-seat, a valve L working in the hood M' and upon the valve-seat N, and having a number of openings l¹ l² l³ for inlet purposes, and recesses l⁴ l⁵ communicating with a central circular recess l⁶ over the central orifice N⁵ for exhaust, said valve receiving a continuous rotary motion through gear-wheels G, G', and shaft H from the fly-wheel shaft D as set forth.

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

JAMES EDWARD SCHUMACHER.

Witnesses:

ELIZABETH SCHUMACHER,
W. FAIRBURN HART.