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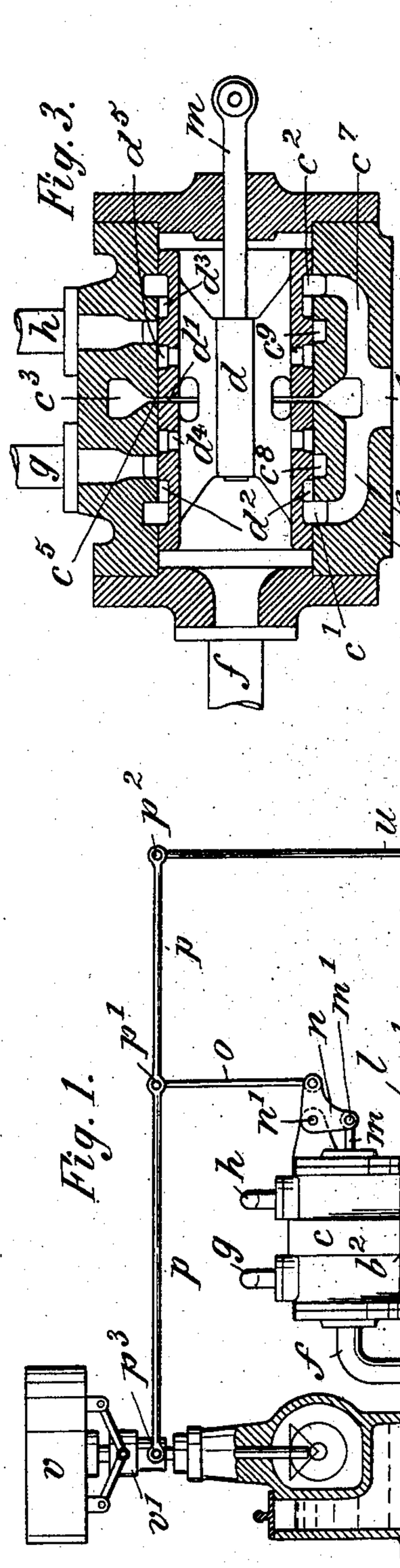
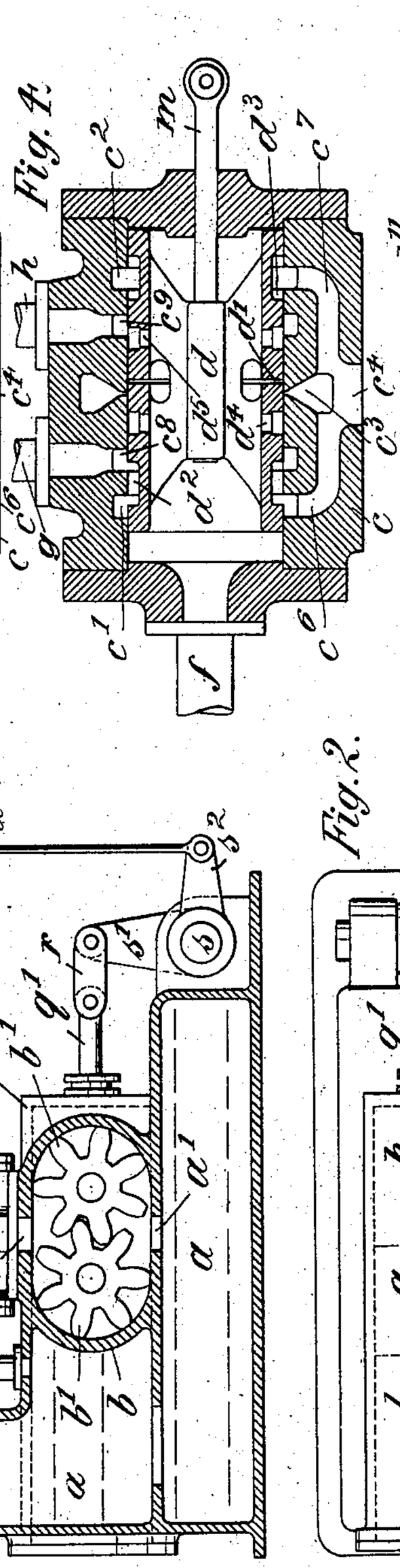
E. MAURER.

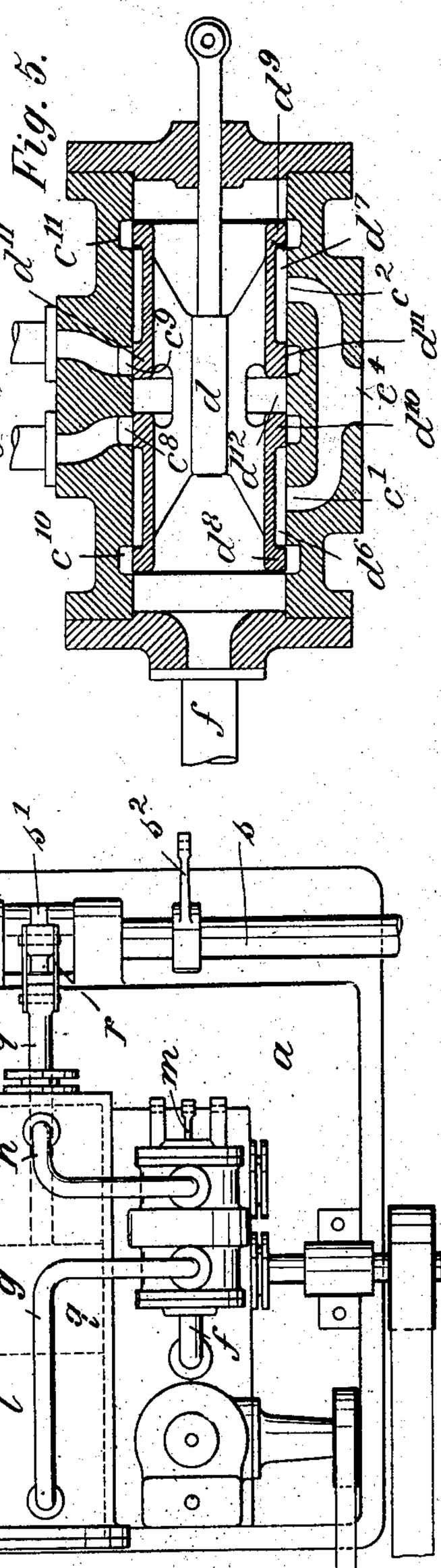
SPEED REGULATOR.

APPLICATION FILED DEC. 11, 1903.

NO MODEL.







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No. 751,319. Patented February 2, 1904.

UNITED STATES PATENT OFFICE.

EMIL MAURER, OF KAROLINENTHAL, AUSTRIA-HUNGARY.

SPEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 751,319, dated February 2, 1904.

Application filed December 11, 1903. Serial No. 184,724. (No model.)

To all whom it may concern:

Be it known that I, EMIL MAURER, a citizen of Switzerland, residing at Karolinenthal, Austria-Hungary, have invented new and useful Improvements in Speed-Regulators, of which the following is a specification.

This invention relates to a speed-regulator for turbines and other hydraulic motors in which an efficient regulation with a minimum expenditure of power is obtained.

In the accompanying drawings, Figure 1 is a front view, partly in section, of my improved speed-regulator; Fig. 2, a plan thereof; Fig. 3, a longitudinal section through the regulating-valve; Fig. 4, a similar section showing the parts in a different position, and Fig. 5 a longitudinal section through a modification of the valve.

The letter a represents a reservoir or chamber containing oil or any other suitable medium for operating the regulator. Chamber a communicates by port a' with the interior of a pump-casing b. The drawings show a rotary pump, the pistons b' of which may be rotated from the power-shaft in suitable manner; but a pump of different construction may be used. The casing b communicates by port b^2 with the port c^4 of a valve-box c, containing a hollow slide-valve d. Valve-box c has two inner circumferential inlet-channels c' c^2, with which port c^4 communicates by ducts c^6 c^7. Intermediate the channels c' c^2 the valve-box c is provided with a central annular channel c^3, which communicates with port c^4. The channel c^3 is provided with a series of central openings or return-ports c^5, that are in alinement with corresponding ports d' of slide-valve d when the latter is in its normal position. The interior of slide-valve d communicates by return-pipe f with chamber a. Intermediate the channel c^3 and the inlet-channels c' c^2, respectively, are arranged the circumferential exit-channels c^8 c^9, that communicate by pipes g and h with the two ends of a working cylinder l. Channels c' c^2 are respectively in permanent communication with two outer circumferential grooves d^2 d^3 of slide-valve d. The width of the groove d^2 is such that if the valve is in its extreme right position, Fig. 4, it establishes communication between left inlet-channel c' and left exit-channel c^8, and consequently between the pump and the left end of cylinder l. In a similar manner the groove d^3 establishes communication between the channels c^2 c^9 when the valve is in its extreme left position.

The valve d is provided with two sets of circumferential perforations d^4 d^5, of which perforations d^5 are adapted to establish communication between the channel c^9 and the interior of valve d when the latter is in its extreme right position, Fig. 4. In similar manner the openings d^4 establish communication between channel c^8 and the interior of valve d when the latter is in its extreme left position. The stem m of valve d engages at m' one arm of a bell-crank n, pivoted at n' to valve-box c. The other arm of bell-crank n is by rod o connected at p' to a lever p.

The piston q of cylinder l has piston-rod q', which is connected by links r to the crank s' of a regulating rock-shaft s. The shaft s is connected in any suitable manner to means (not shown) for setting the blades of the turbine. In order to prevent overregulation, the shaft s carries a second crank s^2, which is connected to one end of a rod u, the other end of which is connected at p^2 to lever p. The lever p is pivoted at p^3 to the sleeve v' of a centrifugal governor v, driven from the power-shaft of the turbine in any suitable manner.

The operation is as follows: Governor v as well as the pistons b' of pump b are rotated by the power-shaft of the turbine. As long as the turbine works with its normal speed governor v is in its normal position, thus holding valve d in its central position. In this position openings c^5 are in communication with openings d', so that the oil delivered by the pump through duct c^4 into central channel c^3 will pass through openings c^5 d' into the interior of valve d, to be thence returned by through pipe f to chamber a. Thus the oil will be freely returned to reservoir a as long as valve d is in its normal position. If, however, the turbine works too fast, governor v will cause sleeve v' to raise, thus tilting lever p upwardly around pivot p^2. The upward movement of lever p will by rod o swing bell-crank n so that valve d will as-

sume the right end position. (Shown in Fig. 4.) In this position openings d' are out of alinement with openings c^5, so that the latter are closed. The channel c' communicates by groove d^2 with channel c^8, while the channel c^9 communicates with interior of valve d through openings d^5. Thus the oil passes through duct c^6, channel c', groove d^2, channel c^8, and pipe g to the left end of cylinder l. The pressure of the oil against left end of piston q will cause the piston to move to the right, which movement will by rod q', links r, and crank s' rock the regulating-shaft s to set the blades of the turbine. The oil contained within the right end of cylinder l will by the piston be forced out through pipe h, channel c^9, openings d^5 into the interior of valve d, whence it will return to reservoir a through pipe f. The rocking movement of shaft s will by crank s^2 pull down rod u, which in turn will cause a downward movement of lever p around pivot p^3. This downward movement will push down rod o and turn bell-crank n, so that the valve d is moved inwardly to reassume its central normal position. If the turbine works too slow, the governor will move the valve d to its left end position. In this position the openings c^5 are again out of alinement with openings d'. The channel c^2 will communicate by groove d^3 with channel c^9, while the channel c^8 will communicate with the interior of valve d through openings d^4. Thus the oil will pass through duct c^7, channel c^2, groove d^3, channel c^9, and pipe h to the right of cylinder l, so as to move the piston q to the left and rock shaft s in the opposite direction. During this movement of the piston the oil will be forced out from the left end of the cylinder through pipe g, channel c^8, openings d^4 into the interior of valve d, and thence back to reservoir a through pipe f.

Fig. 5 illustrates a modification of my regulating-valve, the central annular groove c^3 being replaced by two laterally-arranged inner circumferential return channels or ports c^{10} c^{11}. The valve d has two circumferential grooves or ports d^6 d^7 communicating with channels c^{10} c^{11}, respectively. Between the grooves d^6 d^7 and the ends of the valve there are formed circumferential ribs d^8 d^9, that are of a thickness somewhat less than the width of channels c^{10} c^{11}. It will be seen that in the central position the oil will flow from inlet-channels c' c^2 into grooves d^6 d^7 and thence through channels c^{10} c^{11} around ribs d^8 d^9 to the return-pipe f. Valve d is further provided with two inner ribs d^{10} d^{11}, that slightly overlap the exit-channels c^8 c^9 when the valve is in its central position. Between ribs d^{10} d^{11} valve d has openings d^{12}, that establish a communication between the exit-channels c^8 or c^9 and the interior of valve d when the valve is shifted to the left or right, respectively, the openings d^{12} replacing the two sets of perforations d^4 d^5 of Fig. 1.

It will be seen that in my improved speed-regulator the oil flows without pressure through the pump and valve as long as the governor is in its normal position. Only while the speed of the turbine is being regulated is the oil subjected to pressure. In this way I obtain an efficient regulation with a minimum expenditure of power.

What I claim is—

1. In a speed-regulator, the combination of a reservoir with a pump, a communicating valve-box having inlet-channels and exit-channels, a valve having grooves adapted to connect said channels, a cylinder having a piston, means for connecting the cylinder at opposite sides of the piston to the exit-channels, and a return-pipe connecting the valve-box with the reservoir, substantially as specified.

2. In a speed-regulator, the combination of a reservoir with a pump, a communicating valve-box having inlet-channels and exit-channels, a hollow valve having grooves adapted to connect said channels and perforations adapted to register with the exit-channels, a cylinder having a piston, means for connecting the cylinder at opposite sides of the piston to the exit-channels, and a return-pipe connecting the valve-box with the reservoir, substantially as specified.

3. In a speed-regulator, the combination of a reservoir with a pump, a communicating valve-box having inlet-channels and exit-channels, a valve having grooves adapted to connect said channels, a cylinder having a piston, means for connecting the cylinder at opposite sides of the piston to the exit-channels, a return-pipe connecting the valve-box with the reservoir, a governor controlling the valve, and a regulating-shaft operatively connected to the piston, substantially as specified.

Signed by me at Prague, Bohemia, Austria-Hungary, this 17th day of November, 1903.

EMIL MAURER.

Witnesses:
RUDOLF SIEGMUND,
ADOLPH FISCHER.