(No Model.) 4 Sheets—Sheet 1.

C. E. SCRIBNER.

SPEED REGULATOR FOR DYNAMOS.

No. 563,316. Patented July 7, 1896.

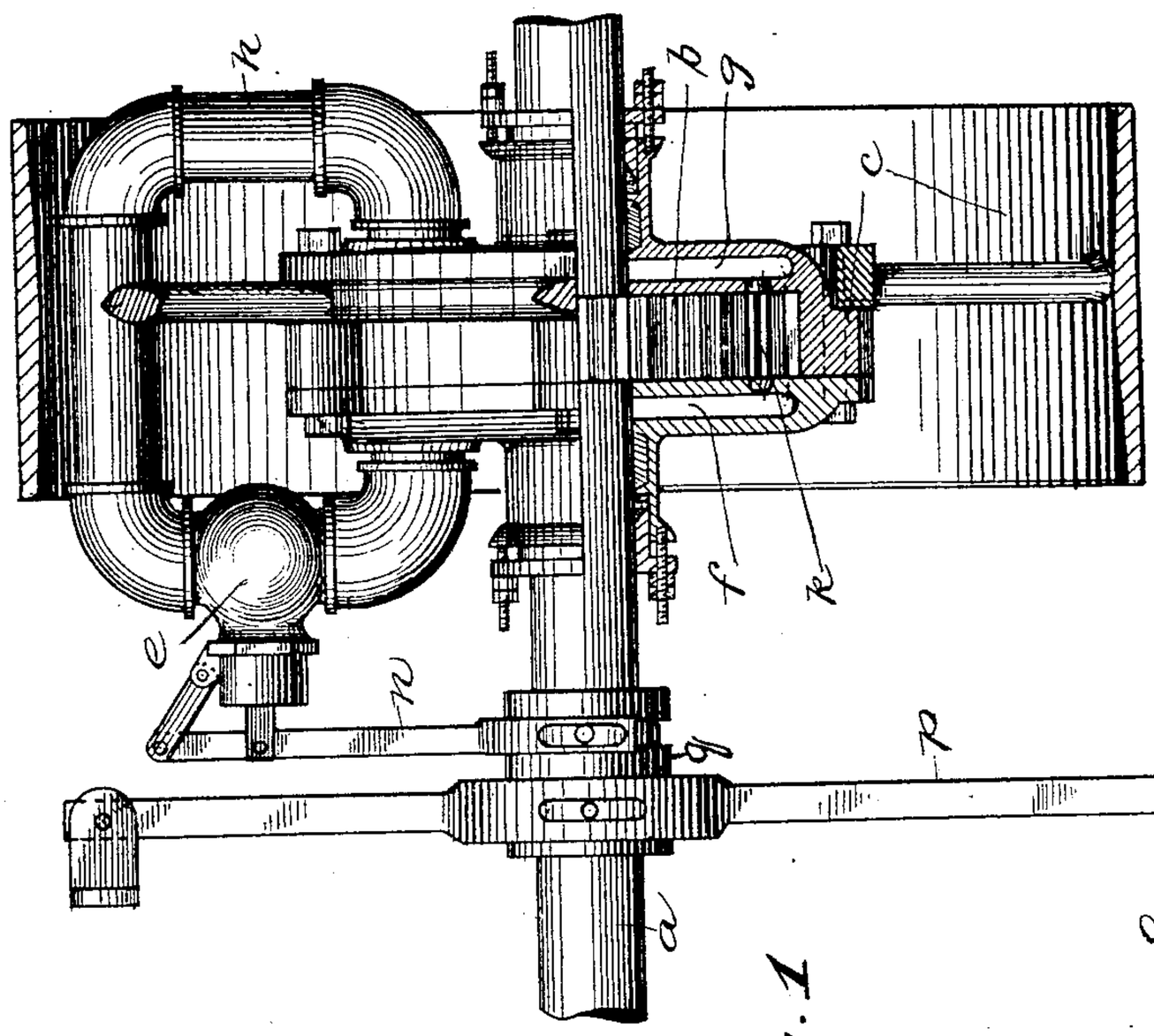


Fig. 1.

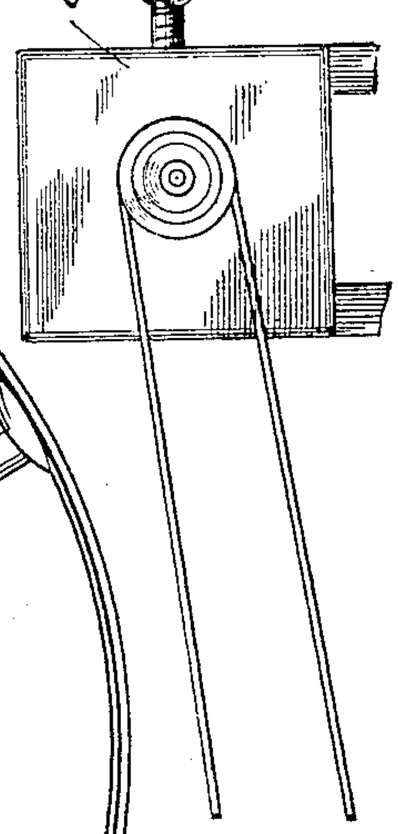
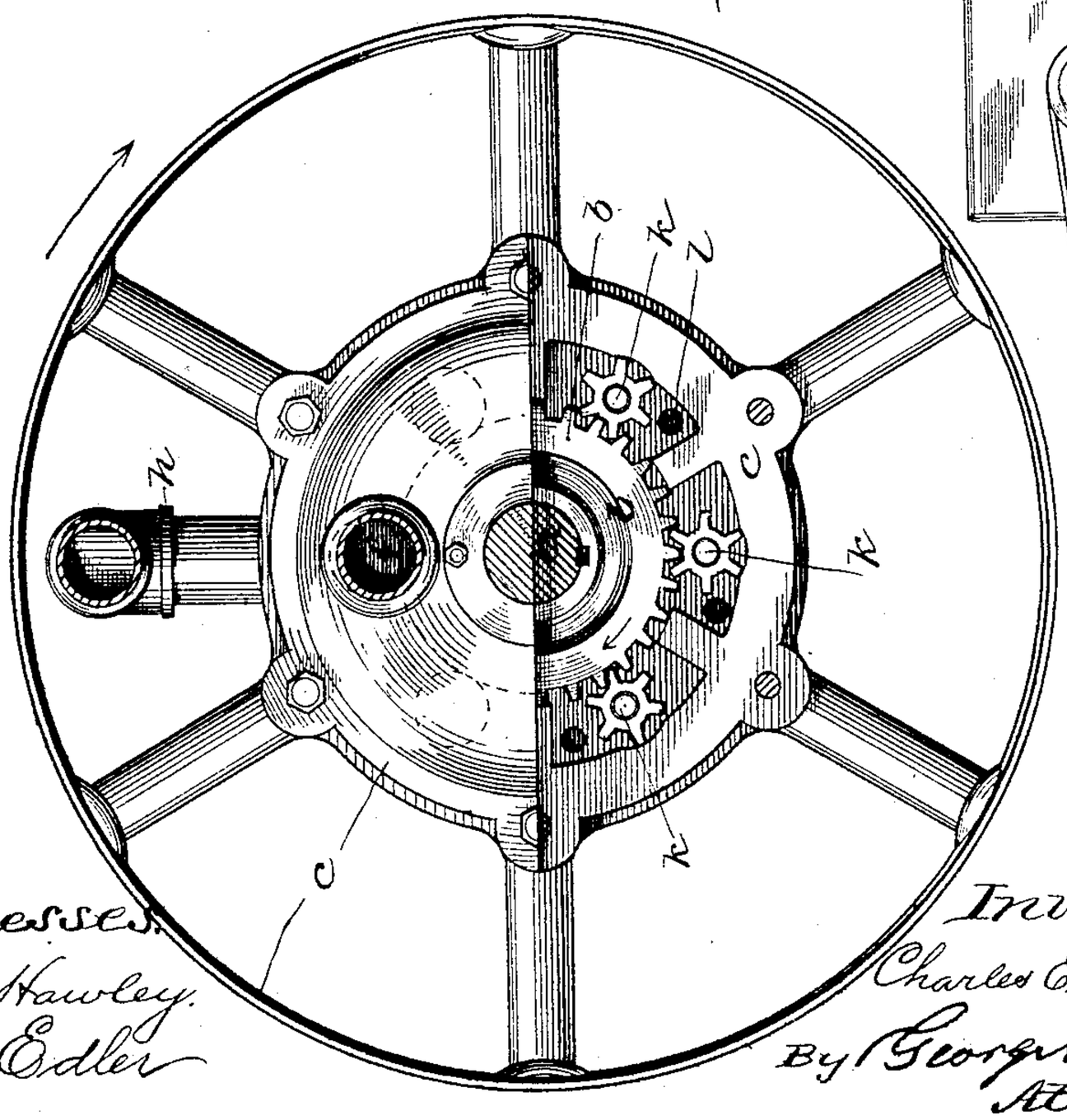


Fig. 2.



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(No Model.) 4 Sheets—Sheet 2.

C. E. SCRIBNER.

SPEED REGULATOR FOR DYNAMOS.

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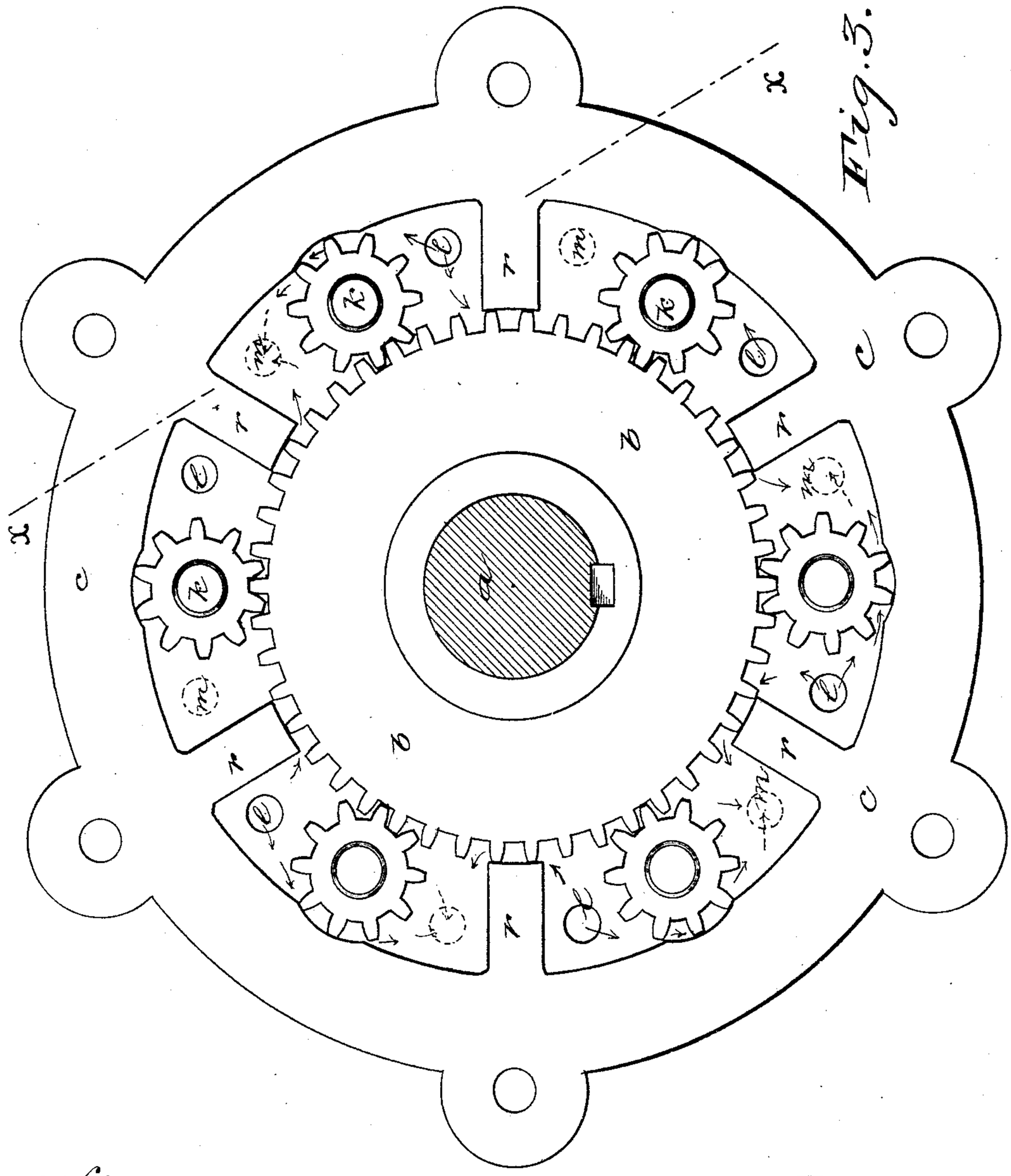

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

C. E. SCRIBNER.

SPEED REGULATOR FOR DYNAMOS.

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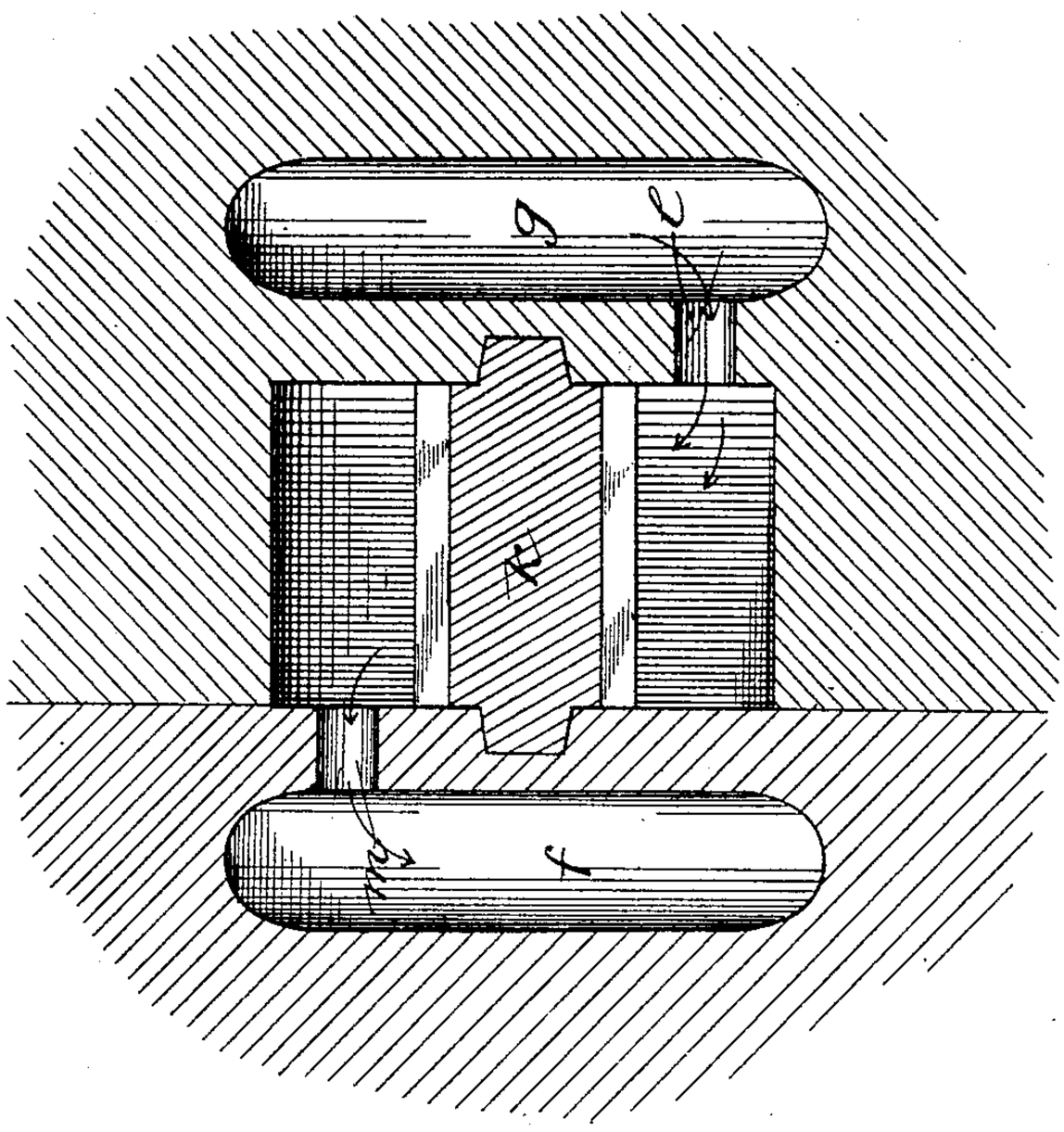

Fig. 4.

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4 Sheets—Sheet 4.

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SPEED REGULATOR FOR DYNAMOS.

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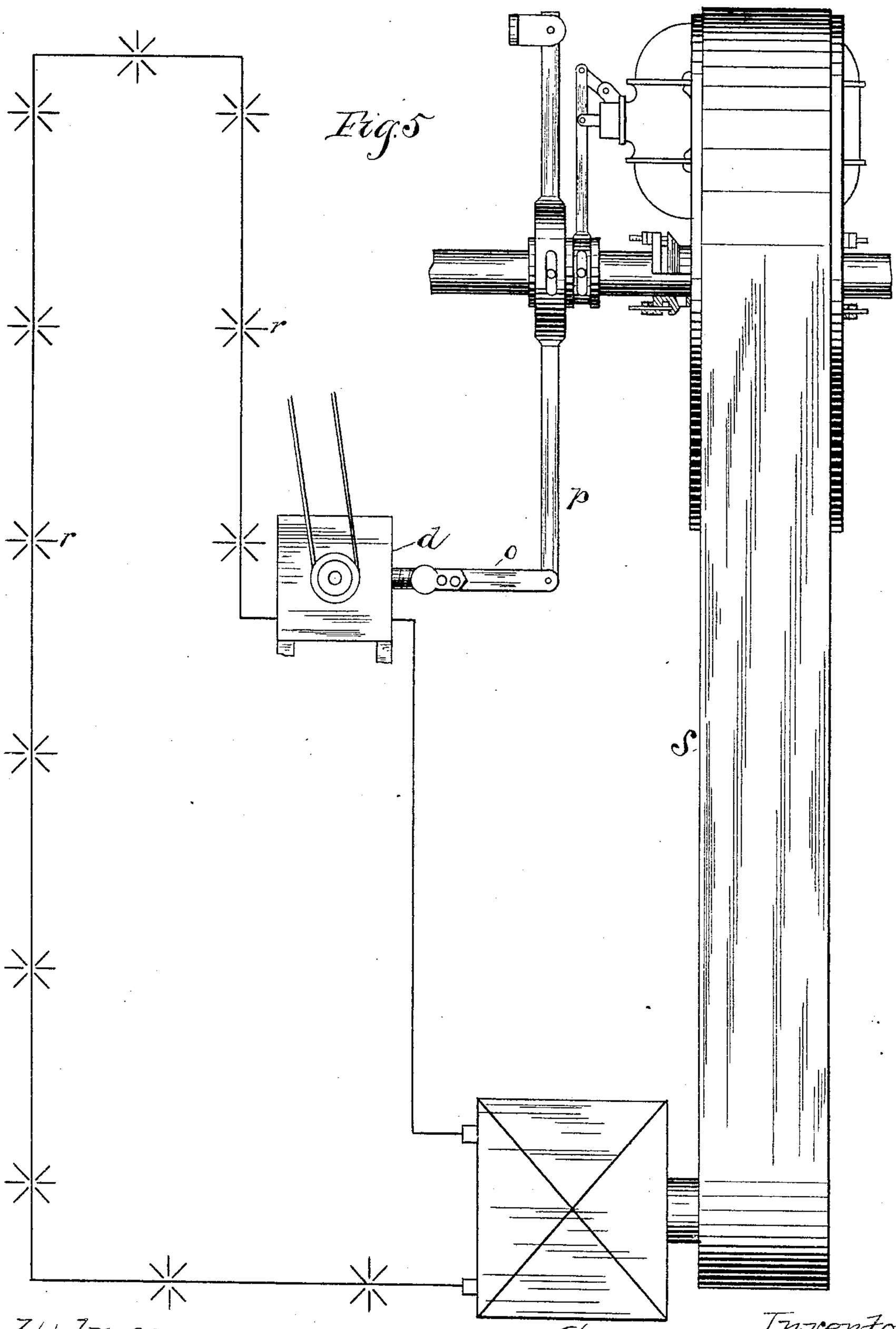
Fig. 5



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UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

SPEED-REGULATOR FOR DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 563,316, dated July 7, 1896.

Application filed December 10, 1888. Serial No. 293,167. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Speed-Regulators for Dynamos, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to current-regulators for dynamo-electric machines. Heretofore regulation of current has been effected in different ways. In one class of machines the current strength of the field-magnets is varied as required to maintain the current strength. In another type of regulators the brushes are moved upon the commutator, the movement being effected by means of an electromagnet included in the main circuit mechanically connected with the brush-carrier.

In my invention herein I provide an electromagnetic device in the main circuit which is adapted, in response to changes in the current, to operate upon the driving-pulley of the machine to change its rate of revolution and thus the rate of revolution of the armature. Thus increase of current strength above the normal operates to reduce the number of revolutions per second of the armature, while decrease of current strength below the normal operates to increase the number of revolutions per second of the armature, in this manner changing the electromotive force without wasteful use of power, so that the power expended may be simply what is required to supply electricity to the lamps or other translating devices included in the circuit, more lamps requiring more power and less lamps less.

One element of my invention herein may be a driven mechanism whose direction of movement is determined by the current passing through an electromagnetic device in the circuit of the machine, current above the normal causing movement in one direction and current below the normal causing movement in the opposite direction. Heretofore I have used a driven mechanism thus controlled, connected with the brush-carrier, as will be seen by reference to my application, Serial No. 194,369, for United States Letters Patent, filed March 8, 1886, for automatic regulators for dynamo-electric machines.

The form of the device for causing power to be exerted by changes in the current strength I do not consider material, since there are other devices well known in the art which might be readily adapted to do this work. I will therefore, without further description, assume that we have a device which is constructed to exert force alternately in opposite directions as the current tends to fluctuate slightly above and below the predetermined normal strength. Such a device may be termed the "responsive" controller, no matter what its form or construction may be.

My invention consists in the combination, with the responsive controller of the driving mechanism of the machine, of a pulley so arranged that the rate of revolution of the armature may be varied automatically to maintain the current at practically the same strength.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of driving mechanism with which the responsive controller is adapted to be connected to vary the speed thereof. Fig. 2 is a front view of the same partially in section and the responsive controller connected therewith. Fig. 3 is a detailed view showing the circulation of the oil, glycerin, or other fluid in the pulley in controlling the movement thereof. Fig. 4 is a detailed sectional view upon line X X of Fig. 3. Fig. 5 is a diagram illustrative of the circuits.

Like parts are indicated by similar letters of reference throughout the different figures.

The main shaft *a* may be driven by any suitable power. Upon this shaft I have provided a gear-wheel *b*, which is keyed to the shaft and adapted to be turned thereby. The pulley *c* proper surrounds the same and is adapted to be driven by the gear-wheel, its rate of movement, however, being determined by the resistance of the liquid contained in the reservoir or chambers surrounding the gear-wheel, this resistance being controlled by a valve. The action of my pulley is analogous to that of a pump.

In case the duct between the opposite chambers is completely closed there is no vent for the liquid, and the liquid, instead of circulating, will resist the movement of the gear-wheel within the reservoir, and thus the pulley will be driven at the same rate as the gear-wheel. If, however, the duct is wide open, the wheel may be driven round and round in the reservoir, pumping the liquid from one chamber to the other without rotating the pulley. The responsive controller *d*, as shown in Fig. 2, is connected with the valve *e* in the duct between the chambers in such manner that increase of current will move the responsive controller in a direction to open the valve until the speed of the pulley is reduced sufficiently to reduce the rate of revolution of the armature of the dynamo-machine, so as to reduce the electromotive force sufficiently to keep the current down at the desired strength.

In case the current falls below the normal the responsive controller is operated to gradually close the valve more and more until the rate of movement of the pulley and that of the armature belted thereto will be increased sufficiently to maintain the current strength.

As shown more clearly in Figs. 2 and 4, the chambers or ports *f g* are provided on opposite sides of the pulley and connected together by the duct or pipe *h*, in which duct is placed a suitable valve *e*. The action of the pump is to force the liquid from chamber *g* to chamber *f*, and thence through the duct *h* back to chamber *g*, thus keeping up the circulation.

The circulation of the liquid is indicated by the arrows in Figs. 3 and 4.

The pinions *k* mesh with the gear-wheel and are turned in the direction indicated whenever there is any movement of the gear-wheel within the pulley, the cogs of the pinions acting to carry the oil from duct *l* on one side of each pinion to duct *m* on the other side, as indicated by the arrows. Thus the liquid tends to circulate from chamber *g* to chamber *f*, passing through the ducts *l*, leading out of chamber *g* to the ducts *m*, leading into chamber *f*, the circulation being completed through the main duct or pipe *h*, which contains the controlling-valve *e*.

The connecting-pipe *h* is revolved with the pulley. The valve-lever *n* is free to revolve about the shaft *a*, and the connecting-rod *o* of the responsive controller is linked to the shifting-rod *p*, which, through the collar *q*, operates the lever *n* as the connecting-rod *o* is moved in one direction or the other. Thus forward movement of the connecting-rod *o* forces the lever *n* inwardly, thus closing the valve *e* enough to obstruct the circulation of the liquid and thereby cause the rate of motion of the pulley to be increased to the extent required to bring the electromotive force up sufficiently to maintain the current strength. Motion of the connecting-rod in the opposite direction serves to open the valve more and more until the circulation of the liquid is made free enough to permit the pulley to slip, as it were, upon the gear-wheel, thus reducing the rate of revolution of the pulley to the extent required to reduce the speed of the armature of the machine and thus prevent the current from becoming stronger than the predetermined normal strength.

It will be observed that each of the pinions is placed between two subports or ducts *l m*. The wings forming the cogs of the pinions are fitted to the interior concave surface of its subchamber, as shown, so that each in its revolution carries the liquid in the direction indicated. The partitions *r* should be of the thickness shown in order that there may be no objectionable leakage between the different subchambers.

The arrangement of electrical connections and of the responsive device to the speed-controlling pulley is shown in Fig. 5, in which the dynamo *q* is shown in a series circuit with the responsive controller *d* and a number of arc-lamps *r r*.

The responsive controller is connected to the liquid pulley-speed controller by the connecting-rod *o* and lever *p*. The dynamo *q* is shown connected by a belt *s* with the liquid pulley-speed controller.

My liquid pulley-speed controller as thus described I have found satisfactory and adapted to do the work required. It is evident, however, that any other controllable yielding connection between the driving-pulley and the driven shaft operated by a responsive controller would be within my invention, considered broadly. I therefore do not limit myself to the details of the constructions shown.

I have described my invention in connection with a regulator for dynamo-electric machines; but the speed-regulator or hydraulic-clutch feature of my invention is applicable for other purposes.

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

1. The combination with a responsive controller for a dynamo-electric machine, of a pulley belted to the armature-shaft for driving said machine, a driven shaft upon which said pulley is mounted, a speed-varying engagement mechanism between said pulley and said driven shaft, said engagement mechanism being connected with the responsive controller whereby the speed of the armature is regulated to maintain a practically uniform current strength; substantially as described.

2. The combination with a responsive controller for a dynamo-electric machine, of a pulley containing a reservoir formed with subchambers, a gear-wheel working within said reservoir, a shaft upon which said gear-wheel is mounted, pumping devices operated by the movement of the gear-wheel to force liquid contained in said reservoir from a

chamber on one side of the pulley to a chamber on the other side thereof, a pipe connecting said chambers, and a valve located in said pipe and operated by said responsive device; substantially as described.

3. The combination with the driven shaft, of the gear-wheel rigidly secured thereto, the pulley surrounding said gear-wheel, the pinions *k*, which mesh with the gear-wheel, the subchambers for the pinions, and the common chambers *f g* on opposite sides of the pulley, the ducts *l* leading out of chamber *g* to the ducts *m* leading into chamber *f*, and the main pipe or duct *h*, which contains the controlling-valve *e*, and the responsive controller connected with said valve, substantially as and for the purpose specified.

4. The combination with a dynamo, of a driving-shaft for rotating the armature thereof, a hydraulic clutch interposed between said driving-shaft and said armature, said clutch comprising two relatively-moving parts, mechanism for controlling a liquid confined between said parts to vary the speed of relative movement of said parts, and a responsive controller for said dynamo for controlling the operation of said mechanism; substantially as described.

5. The combination of a wheel mounted loosely upon a shaft, a fluid-flow-producing means adapted to connect said wheel and shaft, said fluid-flow-producing means being operated by the relative movement of said wheel and shaft, and a controlling device for regulating the fluid flow whereby the wheel and shaft may be driven at the same or different velocities.

6. A clutching device consisting of a cylinder and its inclosed valve-wheel and valves, whereby the application of a liquid shall cause the clutching and unclutching of the driver and the driven parts.

7. The combination, with a driving-shaft, of a pulley loosely supported thereon, and a piston, in a chamber of the pulley, engaged by the shaft and actuated by the rotation thereof to compress a fluid in said chamber against the pulley and thereby form a fluid binding medium between the pulley and the shaft to cause the movement of the shaft to be imparted to the pulley.

8. A clutching device comprising a continuously-moving part, a part movable at will, and mechanism operated to control a liquid confined between the said parts, whereby said parts may be locked and released.

9. The combination of a rotary pump having intercirculatory passages, mechanism which connects the pump-shell with the object to be driven, and means for partially or wholly closing said passages.

10. In a hydraulic clutch, the combination with the two relatively rotatable parts, of intermeshing teeth provided upon said parts, a casing forming with said rotatable parts two chambers, a fluid connection between said parts, and means for controlling the flow of liquid in said connection; substantially as described.

11. In a hydraulic clutch, two or more relatively rotary bodies provided with intermeshing teeth, a casing therefor forming with the said bodies two chambers, a fluid connection between said chambers, and means for controlling the flow of liquid in such connection.

12. The combination with a driving-shaft and a pulley loosely supported thereon, of means for compressing a liquid against the pulley by the rotation of the driving-shaft, thereby to form a liquid binding medium between the shaft and pulley and cause the movement of said shaft to be imparted to the pulley, and a governor operating automatically to control the degree of fluid compression against the pulley and thereby regulate the speed of rotation of the pulley with relation to that of the shaft.

In witness whereof I hereunto subscribe my name this 1st day of December, A. D. 1888.

CHARLES E. SCRIBNER.

Witnesses:
GEORGE P. BARTON,
CHAS. G. HAWLEY.