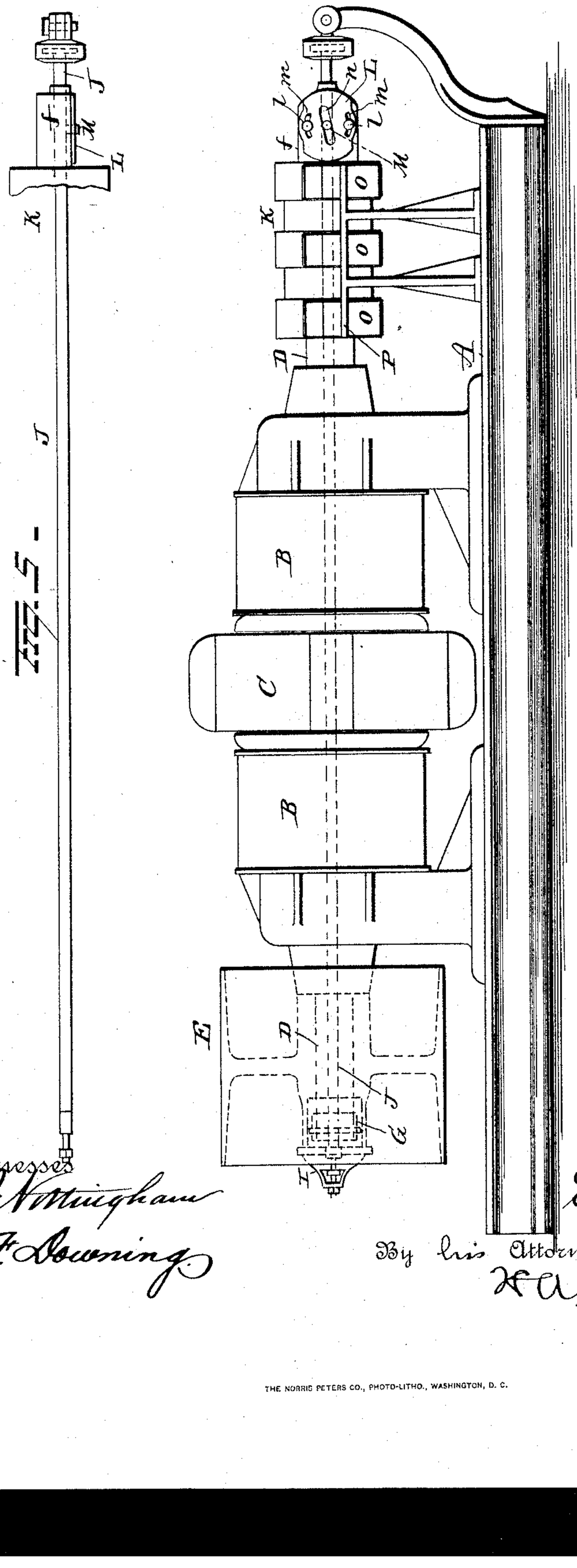
(No Model.) 3 Sheets—Sheet 1.

G. PFANNKUCHE.

REGULATOR FOR ELECTRIC CURRENT GENERATORS.

No. 428,317. Patented May 20, 1890.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

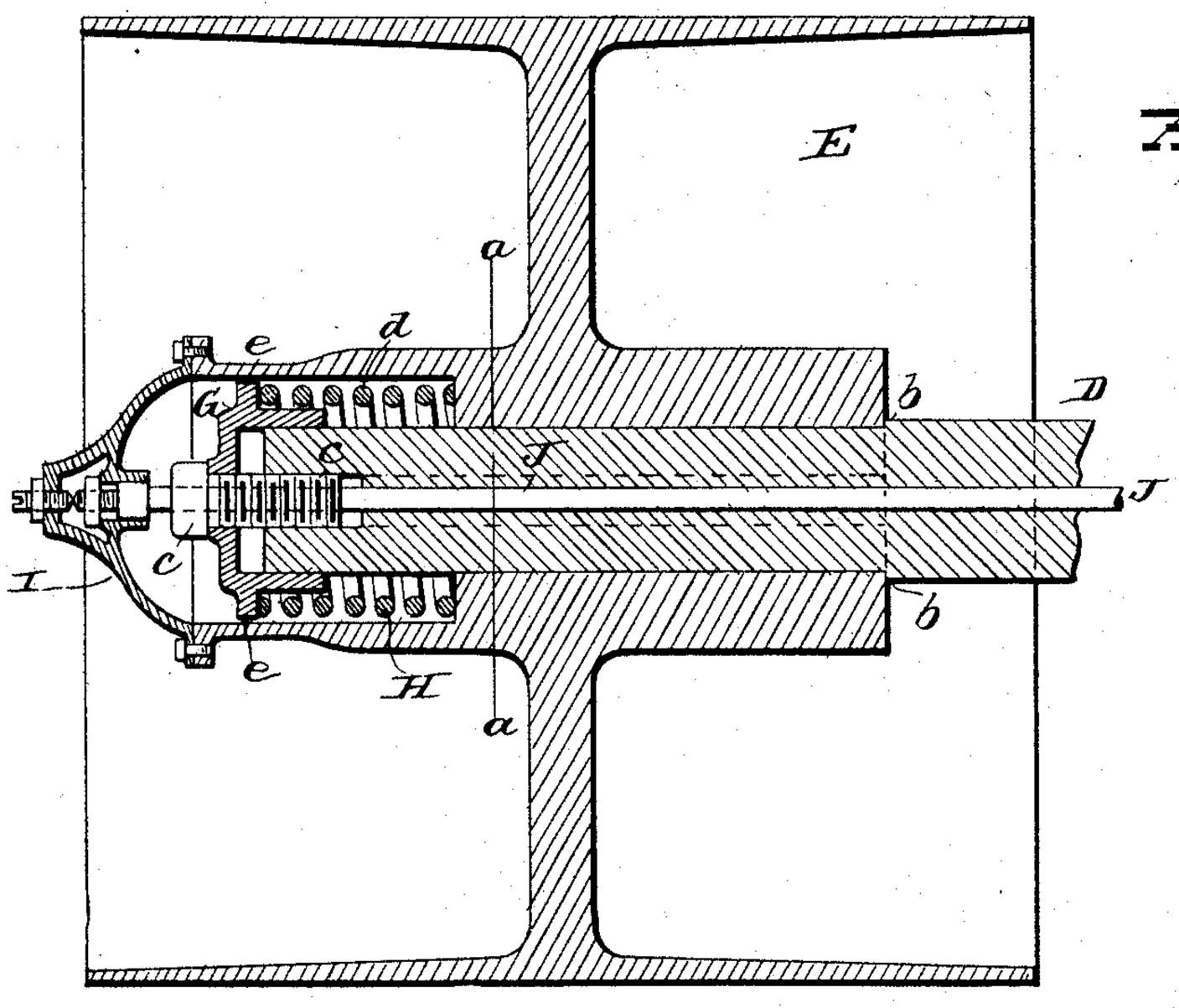
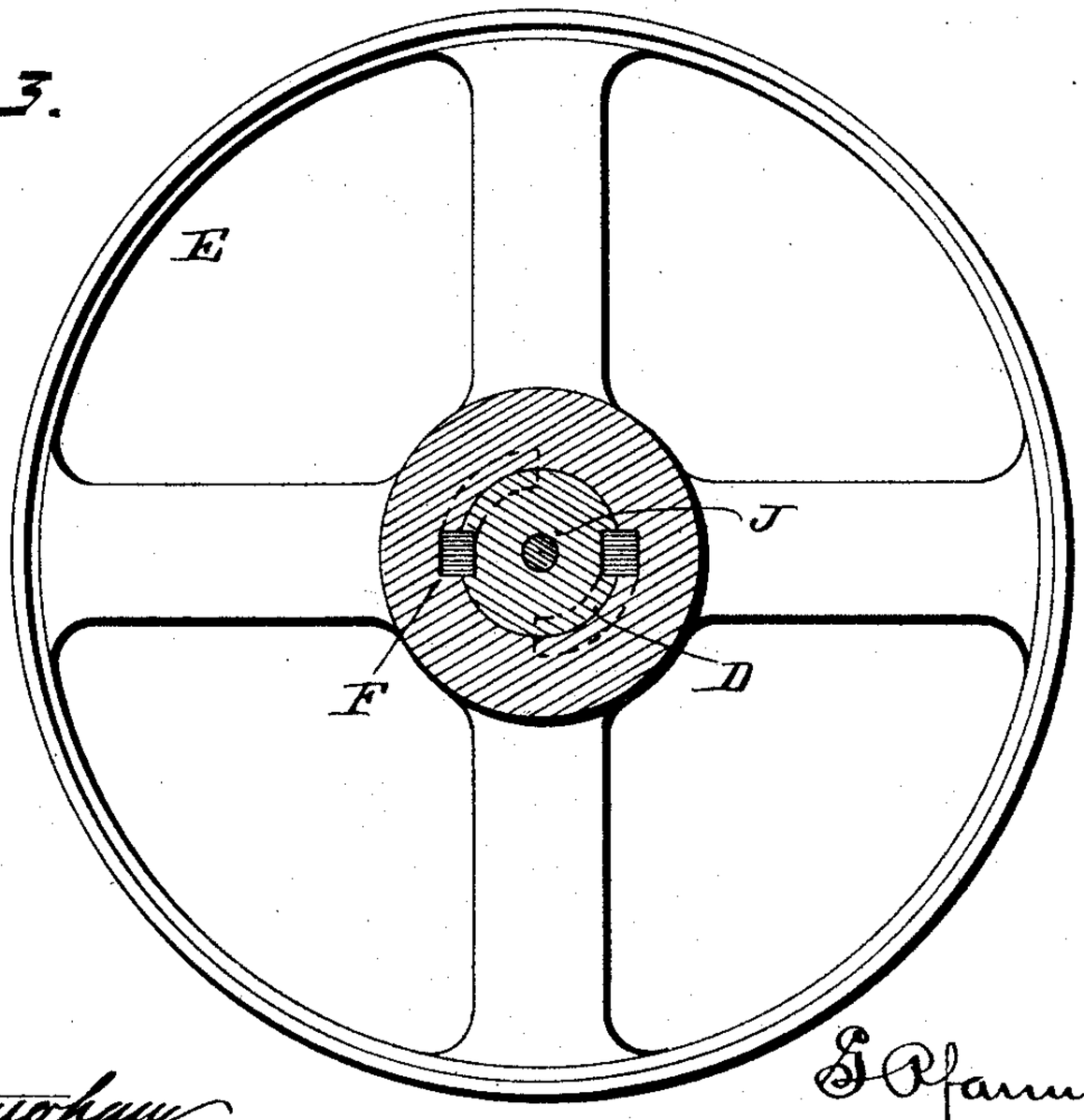


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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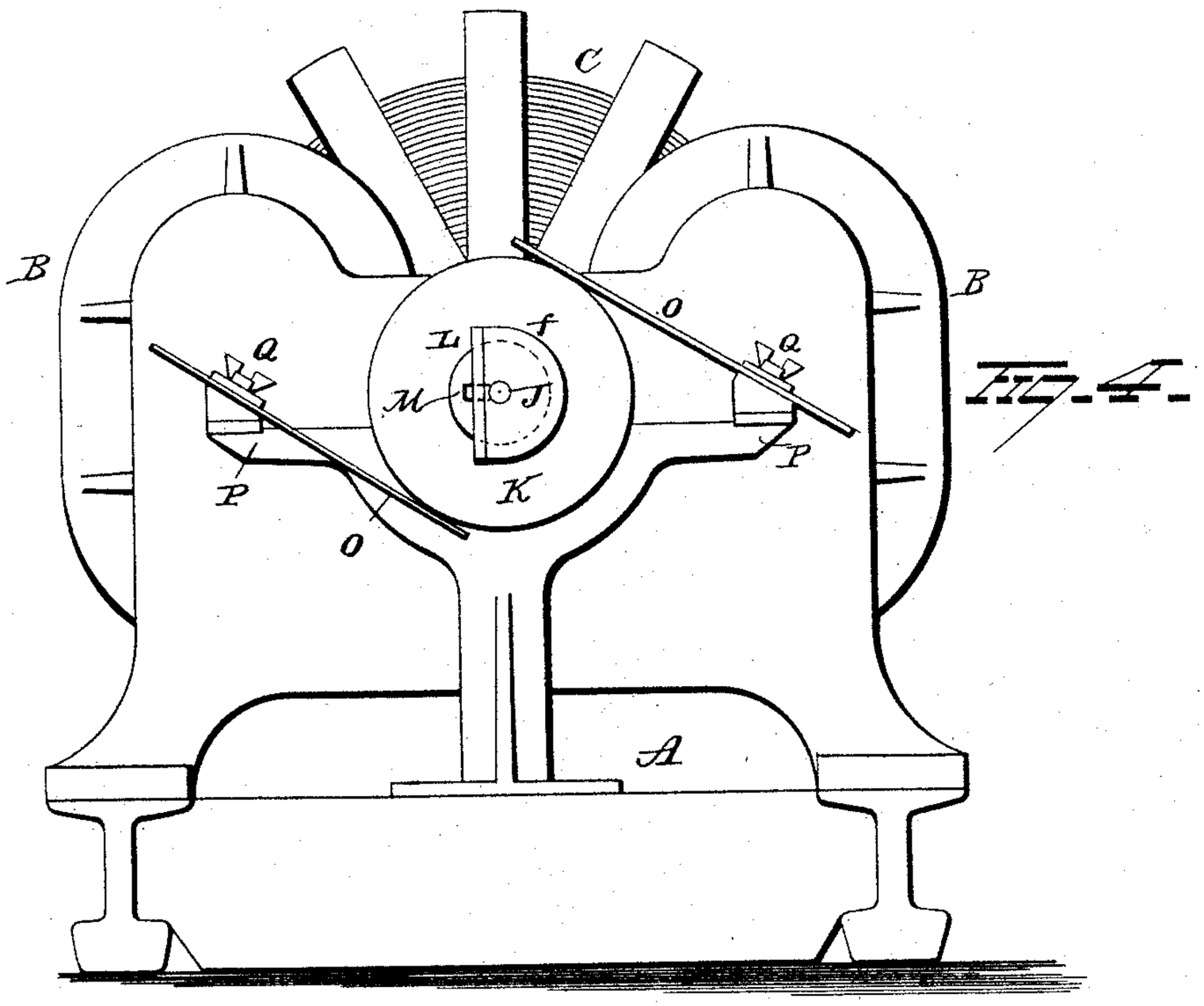


FIG. 4.

FIG. 6.

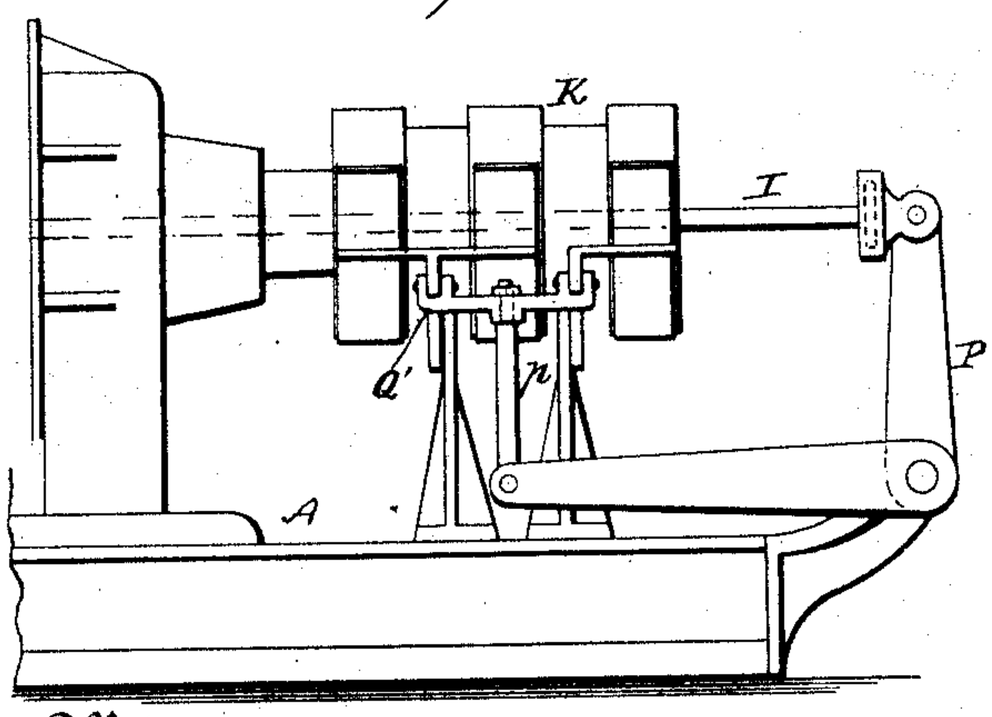
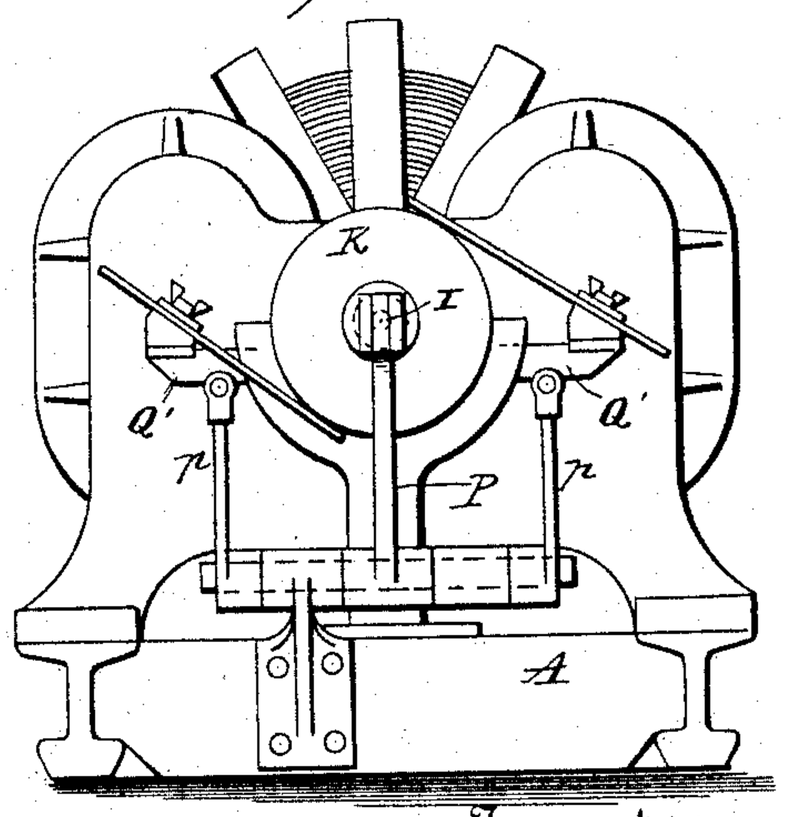


FIG. 7.



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UNITED STATES PATENT OFFICE.

GUSTAV PFANNKUCHE, OF CLEVELAND, OHIO.

REGULATOR FOR ELECTRIC-CURRENT GENERATORS.

SPECIFICATION forming part of Letters Patent No. 428,317, dated May 20, 1890.

Application filed June 8, 1889. Serial No. 313,591. (No model.)

To all whom it may concern:

Be it known that I, GUSTAV PFANNKUCHE, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Regulators for Electric-Current Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in regulators for electric-current generators, the object of the invention being to regulate and control the output of the generator or the amount of current generated thereby by means of the varying load imposed on the dynamo, and thus insure the generation of such an amount of current as shall at all times bear a proper and definite relation to the amount of work interposed in the external or working circuit.

With this object in view my invention consists in the combination, with the rotary shaft of an electric-current generator and a band-pulley, through which power is transmitted to the generator, of devices for varying the relative adjustment of the commutator brushes and segments and devices interposed between the band-pulley and shaft, whereby the relative position of the brushes and segments will be regulated by and be dependent upon the varying load imposed on the generator.

In the accompanying drawings, Figure 1 is a view in side elevation of an electric-current generator. Fig. 2 is a longitudinal section of the band-pulley. Fig. 3 is a transverse section taken through *a a* of Fig. 2. Fig. 4 is an end view of the generator. Fig. 5 is a detached view in side elevation of the adjusting-rod, and Figs. 6 and 7 illustrate a modified construction. Fig. 8 is a detached view of the rotary shaft D.

A represents the bed-plate of what is known as a "Brush" dynamo-machine, B B being the field-magnets, and C the rotating armature, which latter is secured to the rotary shaft D. On one end of shaft D is loosely mounted the band-pulley E, through which power is transmitted to operate the dynamo. Band-pulley E is connected to the shaft, so as to rotate therewith, by means of a spiral or inclined key or feather F, which is fastened within a spiral groove in the shaft, and which engages a spiral or inclined groove formed in the hub of the band-pulley. The spiral or inclined key-connection of the band-pulley with the shaft causes the band-pulley to rotate with the shaft, but enables it to move laterally thereon, owing to the fact that it operates as a nut on a threaded bolt or shaft. The band-pulley when turned in one direction is moved laterally toward the end of the shaft, and when rotated in the opposite direction is moved laterally in the opposite direction until its hub engages the shoulder *b*, formed on the shaft.

G represents a cap, which is secured to the outer end of the shaft by a hollow threaded bolt *c*, which enters the end of the shaft. The outer end of the hub of the band-pulley is recessed, forming an annular space *d* between the hub and shaft, within which space is placed a spiral spring H, which encircles the shaft, one end of the spring bearing against the hub and its other and outer end bearing against a flange *e*, formed on the cap. Thus it will be observed that spring H operates to force the band-pulley inwardly and cause its hub to engage the shoulder *b* on the shaft.

On the outer end of the band-pulley hub is secured a cap I, to which is suitably fastened the outer end of an adjusting-rod J, which latter extends through the hollow bolt *c* and completely through the shaft D. On the opposite end of the shaft D is loosely mounted the commutator K, which is of any approved construction, and is provided with an extended sleeve *f*, which is cut away to form a flat bearing or face, upon which is fastened the plate L by means of bolts *l l*, inserted through the arc-shaped slots *m m* in the plate, this method of fastening allowing of the angular adjustment of plate L on its seat. Plate L is provided with an inclined slot *n*, through which projects a pin M, that is fastened to the adjusting-rod J, the extended sleeve being suitably slotted or cut away to permit of the longitudinal adjustment of the pin M. Brushes O, of any suitable construction, are adjustably secured to the supports P by thumb-screws Q. From the foregoing it will be observed that by imparting an endwise ad-

justment to the rod J the pin M, engaging the inclined slot in the plate L, will impart a rotary adjustment to the commutator with relation to the shaft D.

Having described the construction and relative arrangement of parts of this embodiment of my invention, I will now describe its operation. When any pressure or force is applied to the pulley tending to rotate it, the pulley will move laterally on the shaft, owing to its engagement with the inclined feather or key on the shaft, and such lateral movement will continue until checked or arrested by the counter-pressure exerted by the spring H. Now, if the driving-belt on the band-pulley is started and the pulley rotated, the generator running empty, and hence having only its friction and windage to overcome, the band-pulley will slide or move laterally on the shaft a short distance and until the counter-pressure of the spring H balances the outward thrust of the pulley. If the load on the dynamos is increased to one-half its full value, the band-pulley will move still farther to the left, or outward on the shaft, and until the spring H is compressed one-half its length. With the full or maximum load imposed on the dynamo the band-pulley will move outwardly to the limit of its travel, and will have compressed the spring H to the full extent of its compression; hence it will be observed that the spring H operates as a counter-balance to the lateral thrust of the band-pulley. When the dynamo is at rest, the spring H will force the hub of the band-pulley against the shoulder *b* on the shaft, while the adjusting-rod will retain the commutator in such adjustment that the "maximum points" on the commutator-segments will be at the maximum distance from the commutator-brushes, and by "maximum points" I mean those points on the commutator where the contact of the brushes will insure the production of the maximum effect in the field of force of the machine.

When the dynamo is put into operation and load is imposed on it by placing work in the form of electric lamps or other translating devices in the working-circuit, the band-pulley will move laterally on its shaft by reason of the tendency of the driving-belt to rotate the pulley at a higher rate of speed than that of the shaft, the latter being retarded by the load, which results in the longitudinal adjustment of the rod J, and such a rotary adjustment of the commutator as will move its maximum points nearer the commutator-brushes, and thereby strengthen the current in the field of force, and correspondingly increase the amount of current generated by the machine, and this increase of current strength will be automatically effected to provide for any increase of load on the dynamo up to its full capacity. On the other hand, when the dynamo is operating with its maximum load and a portion of the load be removed therefrom, the counterbalancing-spring will move the band-pulley inwardly until the force of the spring and the outward thrust of the band-pulley are equal. The inward movement of the band-pulley will operate through the adjusting-rod to impart such a rotary adjustment to the commutator as will move its maximum points away from the contact of the commutator-brushes, thereby decreasing the strength of the field and correspondingly decreasing the amount of current generated by the machine. I am thus enabled to promptly regulate and control the strength of current in the external circuit by varying the strength of the field by means of a regulator whose action is dependent on the varying load on the dynamo.

Figs. 6 and 7 represent a modification in which the commutator is fastened to the shaft and the commutator-brushes are adjusted relatively to the commutator-segments. In this construction of regulator the adjusting-rod I is connected at one end with one arm of a bell-crank lever P, the other arm of which is connected by a link *p* with an adjustable yoke Q′, to which the commutator-brushes are connected. The operation of this form of regulator is the same as the one heretofore described, excepting that the brushes, instead of the commutator, are adjusted.

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

1. In a dynamo-electric machine, the combination, with the shaft, a band-pulley loosely mounted on the shaft, a spiral feather or key connecting the band-pulley to the shaft, and a spring for forcing the band-pulley in one direction, of a longitudinally-adjustable rod connected at one end with the band-pulley and arranged to transmit motion to suitable devices for adjusting the relative position of the commutator and brushes, substantially as set forth.

2. In a dynamo-electric machine, the combination, with a commutator loosely mounted on the shaft of the machine, a sliding rod situated within the shaft, and devices connecting the rod and commutator, whereby a longitudinal movement of the rod imparts a rotary adjustment to the commutator, of a band-pulley mounted on the shaft to rotate therewith and capable of lateral movement thereon, devices connecting the band-pulley and shaft, whereby the variations in load imposed on the dynamo will operate to impart lateral movement to the band-pulley and cause the latter to actuate the adjusting-rod and adjust the commutator, substantially as set forth.

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

GUSTAV PFANNKUCHE.

Witnesses:
JOHN C. DOLPH,
W. A. PALLANT.