No. 718,221. PATENTED JAN. 13, 1903.

C. SCHMITTHENNER.

INDIRECTLY ACTING CENTRIFUGAL REGULATOR.

APPLICATION FILED JUNE 27, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

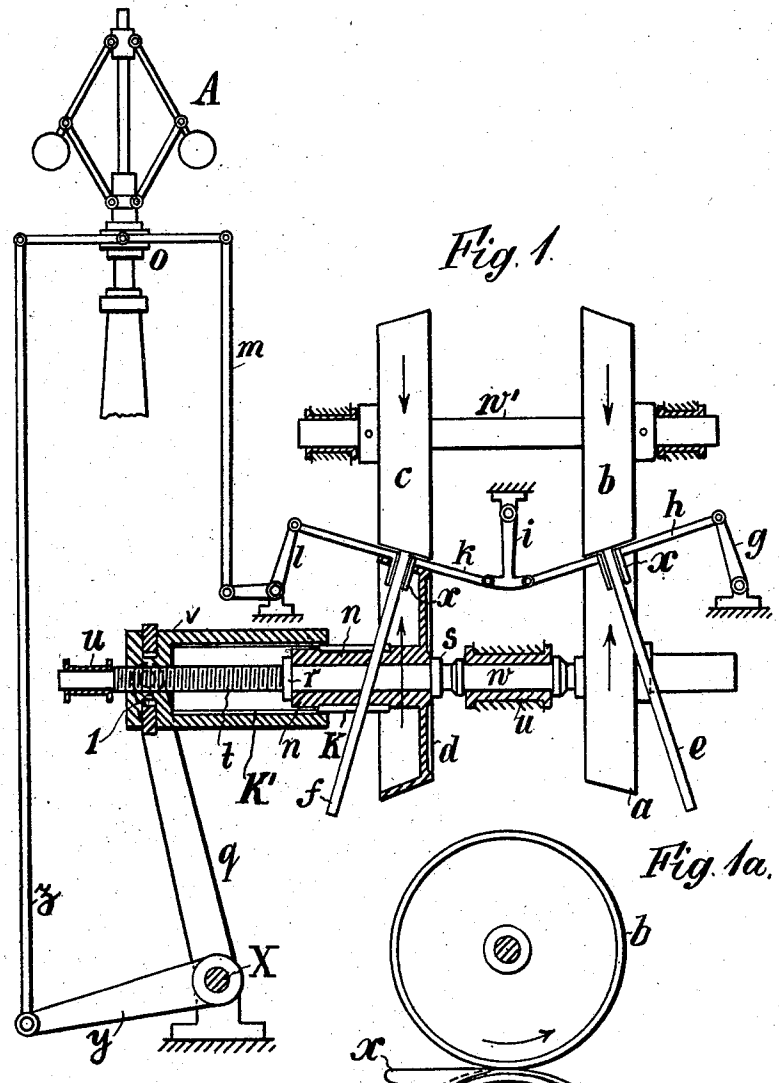
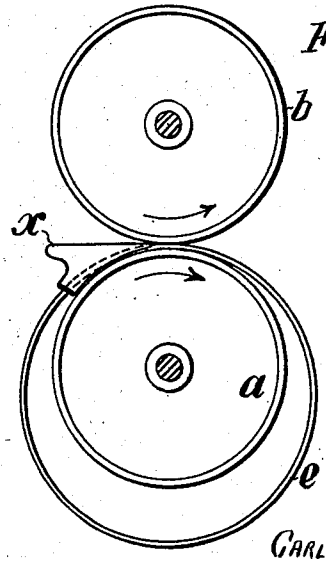


Fig. 1a.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2

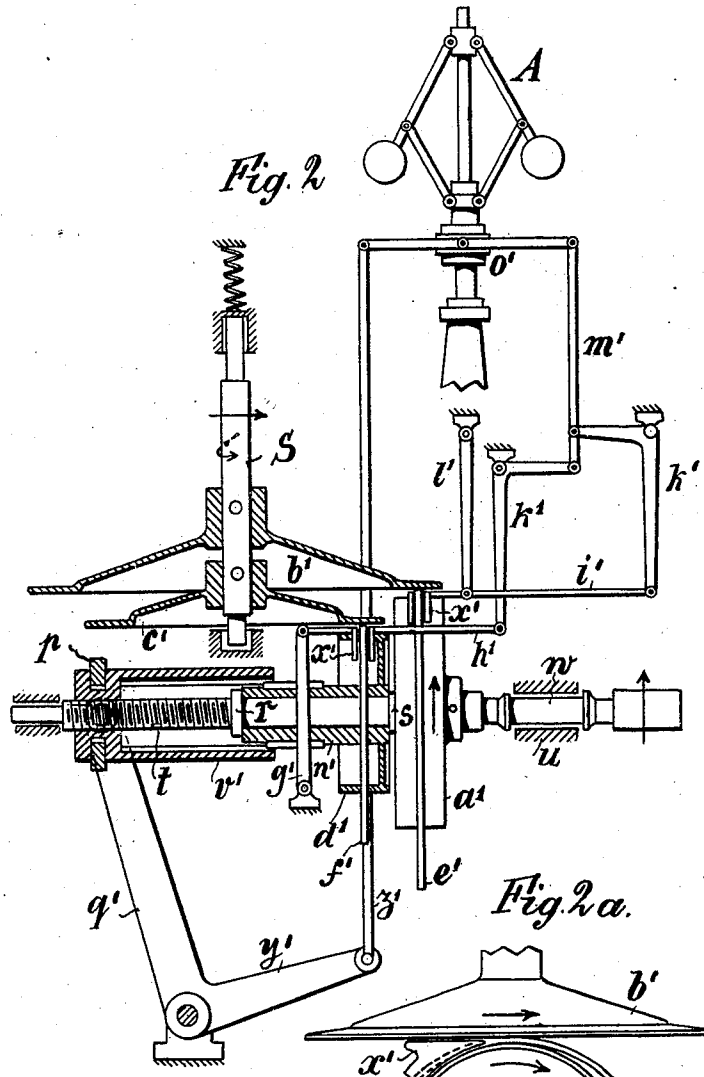
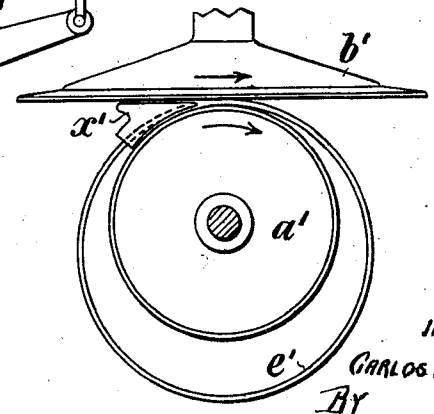


Fig. 2a.



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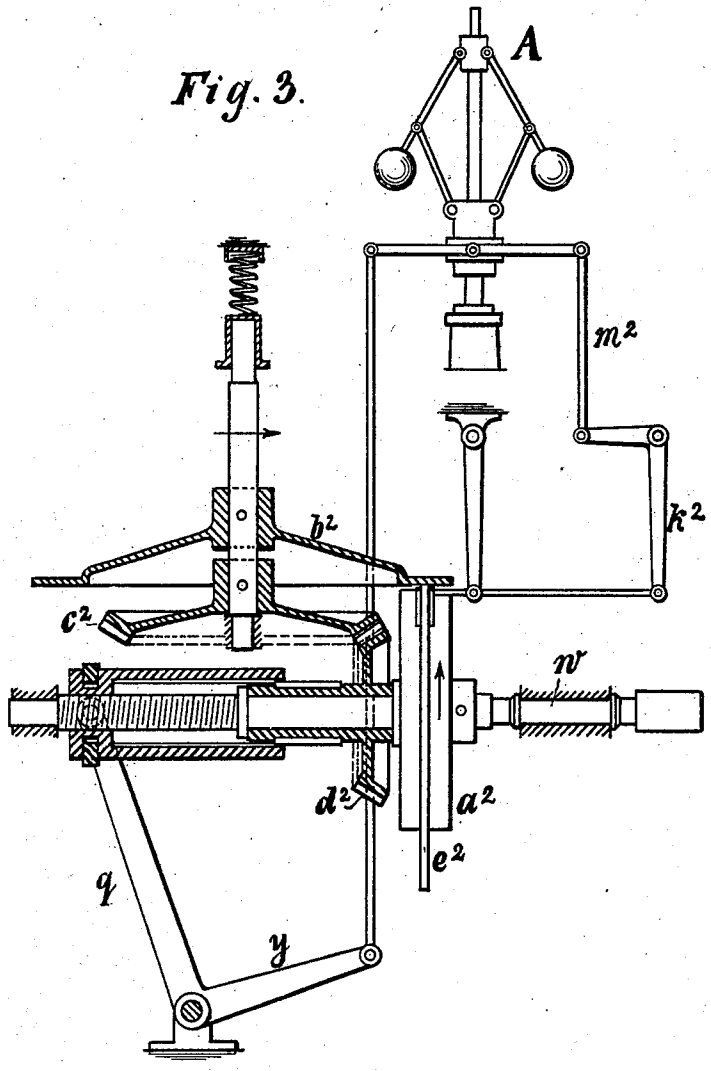
NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

CARLOS SCHMITTHENNER, OF HEIDENHEIM-ON-BRENZ, GERMANY, ASSIGNOR TO J. M. VOITH, MASCHINENFABRIK, OF HEIDENHEIM-ON-BRENZ, GERMANY.

INDIRECTLY-ACTING CENTRIFUGAL REGULATOR.

SPECIFICATION forming part of Letters Patent No. 718,221, dated January 13, 1903.

Application filed June 27, 1902. Serial No. 113,383. (No model.)

To all whom it may concern:

Be it known that I, CARLOS SCHMITTHENNER, engineer, a subject of the King of Würtemberg, residing in Heidenheim-on-Brenz, Würtemberg, Germany, (and having a post-office address at No. 27 Bahnhofstrasse, in said Heidenheim-on-Brenz,) have invented Improvements in Indirectly-Acting Centrifugal Regulators, of which the following is a specification.

The present invention relates to motor-driven auxiliary driving-gear for regulating indirectly the controlling movement of centrifugal governors—for example, such governors as are used to cut off the water-supply to a turbine more or less or altogether. The mechanism is adapted to make it possible to produce this cut off in varying short time according to the needs of the special case. This regulating-gear must not, however, be suddenly accelerated or suddenly retarded, as is the case with centrifugal governors working by means of a gear changing the sense of governing motion and needing a too-long time of cutting off.

The auxiliary driving-gear is provided with a differential gear which is turned with variable degrees of difference in speed according to regulation from a centrifugal governor, as by shifting belts between the disks or cone-pulleys of the differential gear. This differential gear is preferably combined with two threaded parts in such manner that, following the belt-shifting, a difference in the speed of the revolution of the two parts takes place. One part makes an independent movement in one or the other direction, which movement is utilized for the regulation of the working of the motor.

Figure 1 shows one manner of carrying out the invention in side elevation, partly in section. Fig. 1^a is a cross-section through the shafts of the auxiliary driving-gear. Fig. 2 is a modification in elevation, also partly in section; Fig. 2^a, a cross-section through one of the shafts of the auxiliary driving-gear, Fig. 2. Fig. 3 is a second modification in elevation, partly in section.

In all the views the motor which is to be regulated transmits motion to the spindle of the centrifugal regulator A and to the shaft w of the auxiliary driving-gear.

X is the controller-shaft, through which the turbine gate-valve or other controlling means is to be shifted, and $q\,y$ represent the lever by which said shaft X is moved.

In the device of Fig. 1 my invention is carried out by the means of belt-rings $e\,f$, carried along between conical friction-pulleys $a\,b$ and $c\,d$ and displaced between the pulleys by means of belt-forks x. On the shaft w, protected at the bearing u by means of collars against a lengthwise displacement, there is revolubly mounted a conical friction-pulley d, the hub n of which is secured between collars $r\,s$ against lengthwise motion. On the same shaft w the conical friction-pulley a is firmly fixed. The conical friction-pulley d, loosely mounted on the shaft w, is revolved from pulley a through the medium of the two conical friction-pulleys b and c on a countershaft w', parallel to shaft w. The friction-pulleys a and d of the shaft w have their smaller diameters toward each other, while the friction-disks b and c of the parallel shaft have their greater diameters toward each other.

The belt-rings e and f are tightly held between the conical friction-disks a and b and c and d, respectively. These belt-rings transmit the rotary motion from one set of pulleys to the other by means of friction and are guided by belt-shifting forks x.

The diameters of the two sets of conical pulleys are so proportioned that the number of revolutions of the loose pulley d corresponds to that of the shaft w when the belt-rings $e\,f$ are in the center of the conical pulleys a and d; but if, on the other hand, the belt-rings are shifted by the belt-forks x (which are connected with each other by the rods $g\,h\,i\,k\,l$) to the right or left a change in the relative speeds of the conical pulleys a and d takes place, and the loose pulley d will run either faster or slower than the shaft w, according to the extent and direction of the shifting of the belt-rings e and f. This mechanism, therefore, as regards the relative movement between d and w constitutes a differential gear with change of speed from nothing to a certain maximum limit, and this dif-

ference may be made as great as desired, according to the size and taper of the pulleys.

The relative revolution of the shaft w, with the pulley d and the hub n, is converted by means of a screw-spindle t and a sleeve v, provided with an internal thread, into a reciprocating or sliding motion suitable for controlling the motor to be regulated. The screw-spindle t turns with the shaft w, while the sleeve v is revolved through groove k' and key K by the hub n of the pulley d. The sleeve v is thereby displaced lengthwise on the spindle. A collar p, lying in a circular groove of the sleeve v, serves to transmit the reciprocating motion to the bell-crank lever $q\,y$, to which it is secured and which controls the motor through the shaft X.

The shifting of the belt-rings e and f between the friction-pulleys a and b or c and d is effected by a centrifugal governor A by means of the rods $o\ m\ l\ k\ i\ h\ g$. The return of the belt-rings toward the central positions shown takes place from the centrifugal governor by means of the rod z, connected with the arm y of the bell-crank lever $q\,y$.

When the motor works too fast or too slowly, the centrifugal governor A will shift the belts from the central position to the right or to the left, whereby an increase or decrease of speed of the pulley d and hub n as compared with shaft w takes place, and thereby the controlling bell-crank lever is moved over.

According as the change in speed is greater or less the shifting of belt and the distance which the controlling bell-crank lever is moved will be greater or less.

Fig. 2 shows a modification with friction-disks and belt-rings. The friction-pulleys a' and d' (one, d', loosely mounted and one, a', fast on the shaft w') are cylindrical, and the friction-disks b' and c', acted upon by the friction-pulleys a' and d' through the belt-rings e' and f', are fastened onto a shaft S, which is placed perpendicularly to the shaft w'.

The friction-surface of the two disks b' and c' lie in two horizontal planes parallel to each other, and the disk b' bears on the pulley a' and has a greater diameter than the disk c', lying below it. In order to obtain the desired change of speed with this form of friction-disks, it is of course necessary that the two belt-forks x', under the influence of the centrifugal governor A, be contrarily shifted, and the rods $o'\ m'\ i'\ l'\ k'\ h'\ g'$ are arranged accordingly. The action is otherwise the same as that described with regard to Fig. 1. The reshifting of the belts from the controlling bell-crank $q'\ y'$ is transmitted to the centrifugal governor A by means of the rod z', connected with the arm y' of the controlling bell-crank $q'\ y'$.

In Fig. 3 there is shown another modification. This employs merely one belting e^2, which passes around the friction-pulley a^2 to contact with the friction-disk b^2. The second friction pulley and disk (shown in Fig. 2) is replaced by a pair of conical gearing $c^2\ d^2$. The connection-rod m^2 serves to connect the centrifugal governor with the controlling bell-crank lever k^2, similar as in Fig. 2. The action of this modified construction is the same as with that shown in Fig. 1 or Fig. 2.

I claim as my invention—

1. An indirect centrifugal governor comprising a controlling-lever, means to operate it, a differential gear to control said means, and levers from the governor to the gear to vary the movement of the gear to control the lever-operating means, substantially as described.

2. An indirect centrifugal governor, comprising a differential gear, variable friction means between the parts of the gear, a centrifugal governor to regulate the gear and a controlling-lever adapted to be operated by said gear, substantially as described.

3. An indirect centrifugal governor, comprising a differential gear, a centrifugal governor to regulate the gear, a threaded slide adapted to be operated by the gear and a controlling-lever operated by the slide, substantially as described.

4. An indirect centrifugal governor, comprising a centrifugal governor, a countershaft with a threaded end, a fast and a loose pulley on the counter-shaft, a differential gear between said pulleys adapted to drive the loose by the fast pulley, means connected to the centrifugal governor to regulate the differential gear, a threaded slidable sleeve rotatable with the loose pulley and a controlling-lever connected to the slidable sleeve, substantially as described.

5. An indirect centrifugal governor, comprising a differential gear, a centrifugal governor to regulate the gear, a slide adapted to be operated by said gear and means connected to the slide whereby on its movement the differential gear will be further regulated, substantially as described.

6. An indirect centrifugal governor, comprising a differential gear, a centrifugal governor, a shaft and fast and loose pulleys thereon, forming part of the differential gear, a slidable threaded sleeve on the shaft, keys between the loose pulleys and sleeve to cause the sleeve to revolve with the loose pulley, a controlling-lever connected to the sleeve, levers adapted to be operated by the governor to regulate the differential gear, and a connection from said controlling-lever to the governor to further regulate said gear, substantially as described.

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

CARLOS SCHMITTHENNER.

Witnesses:
ERNST ENTENMAN,
WM. HAHN.