(No Model.) 3 Sheets—Sheet 1.

A. GIESLER.

WATER WHEEL GOVERNOR.

No. 540,094. Patented May 28, 1895.

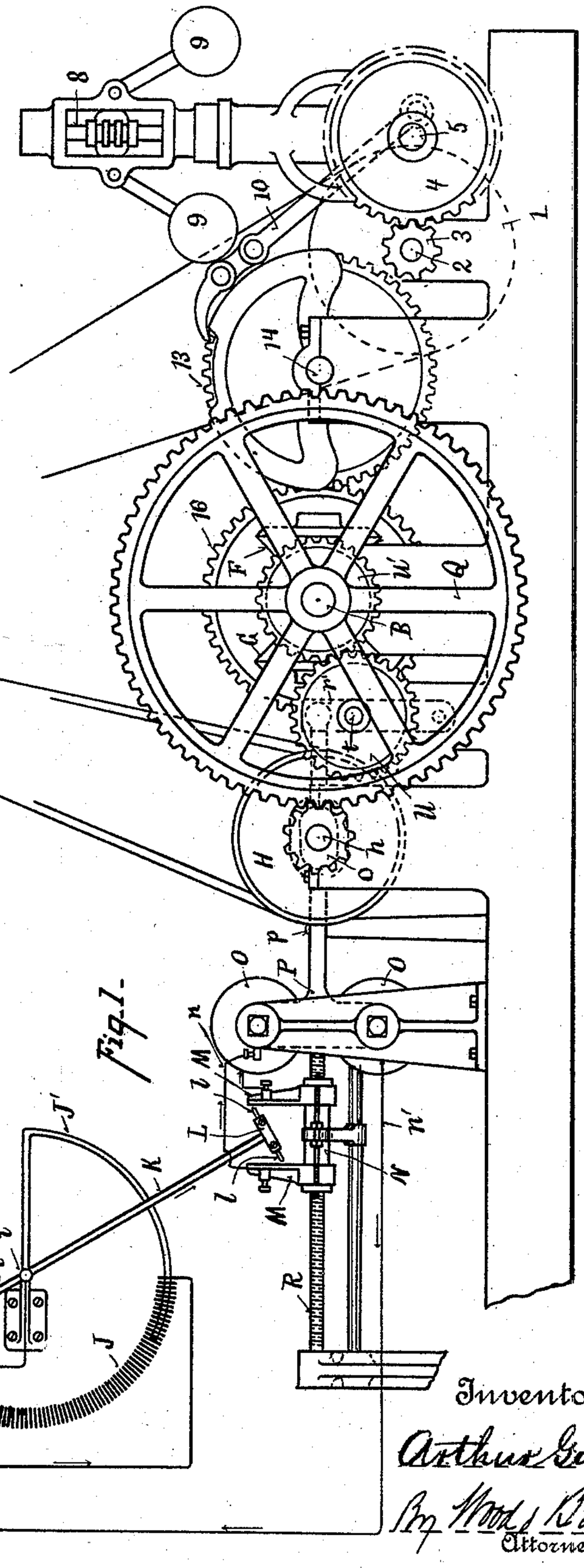

Fig. 1.

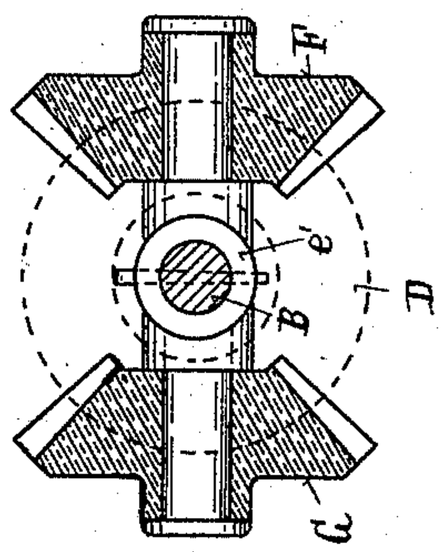

Fig. 4.

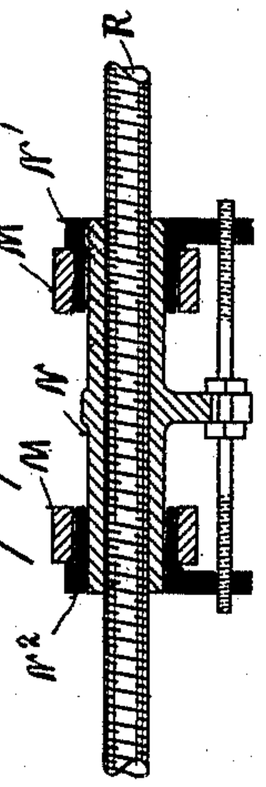

Fig. 3.

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(No Model.) 3 Sheets—Sheet 2.

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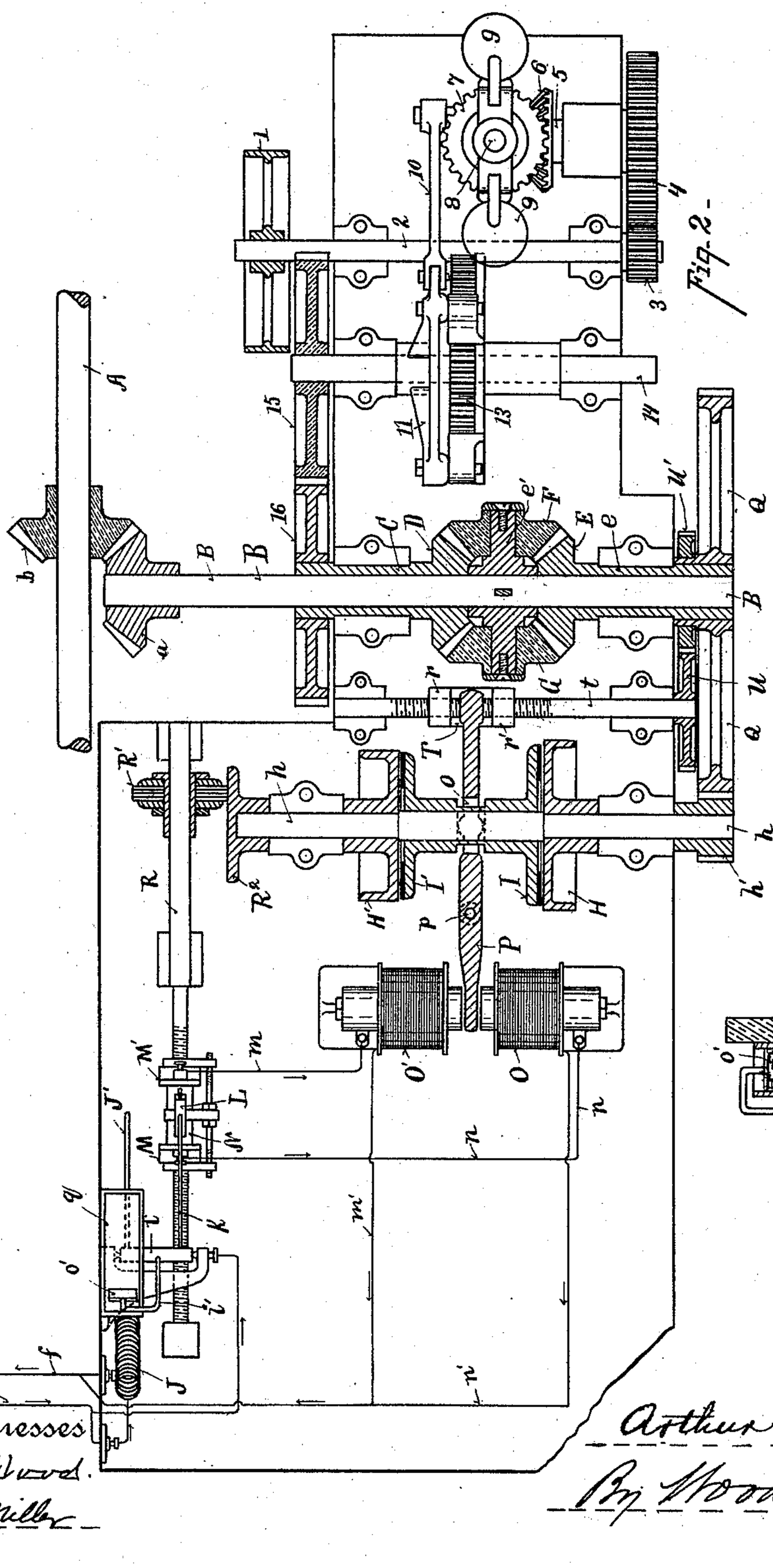

Fig. 2.

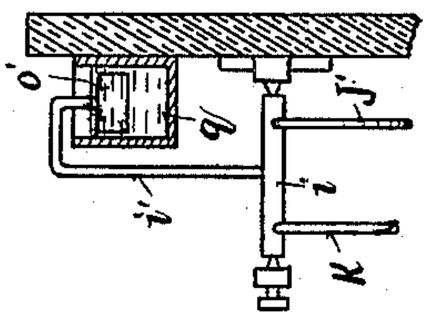

Fig. 5.

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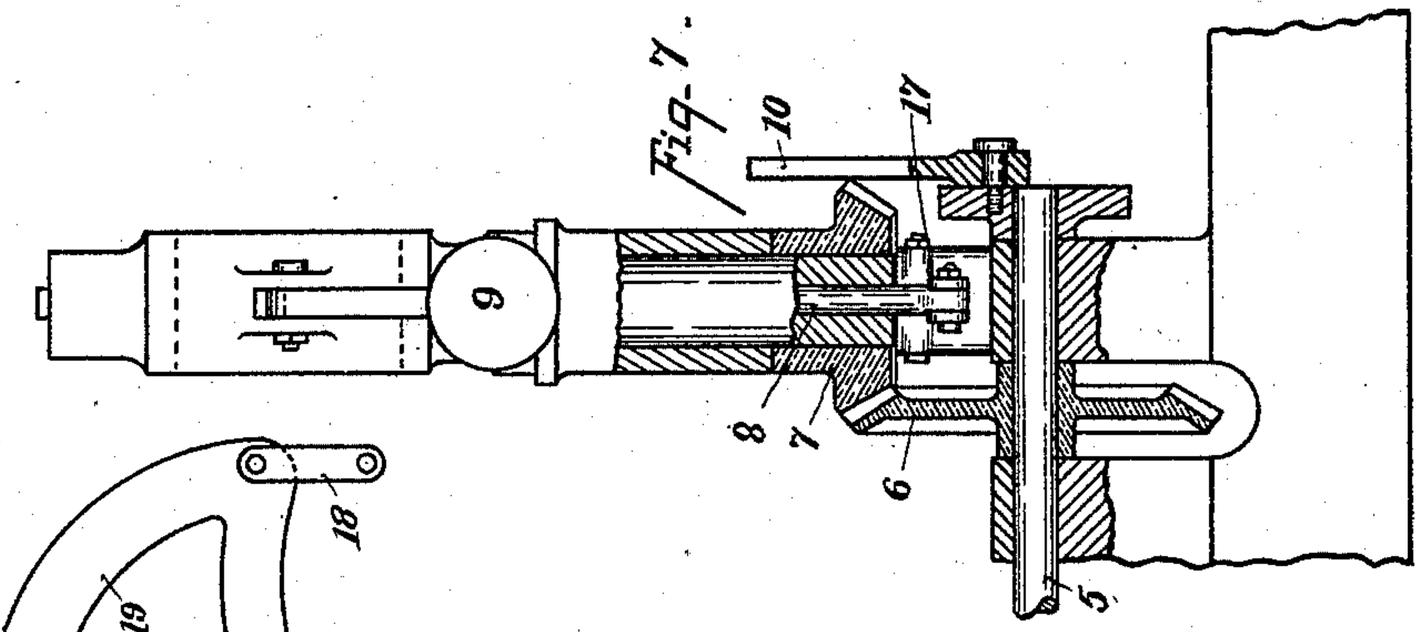

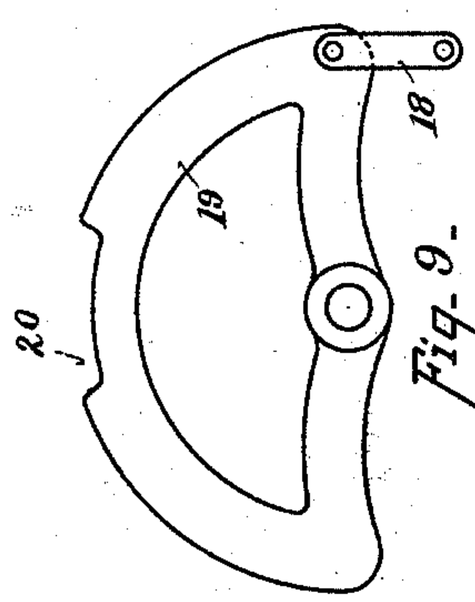

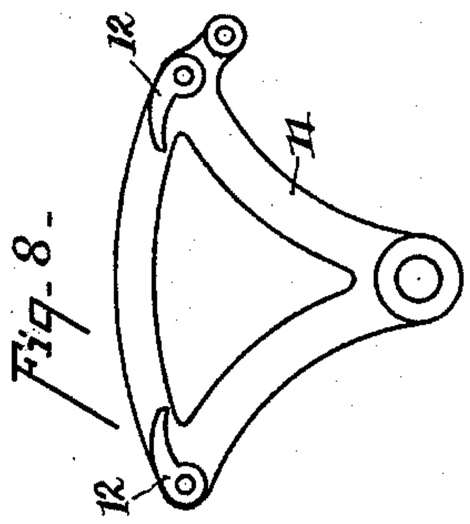

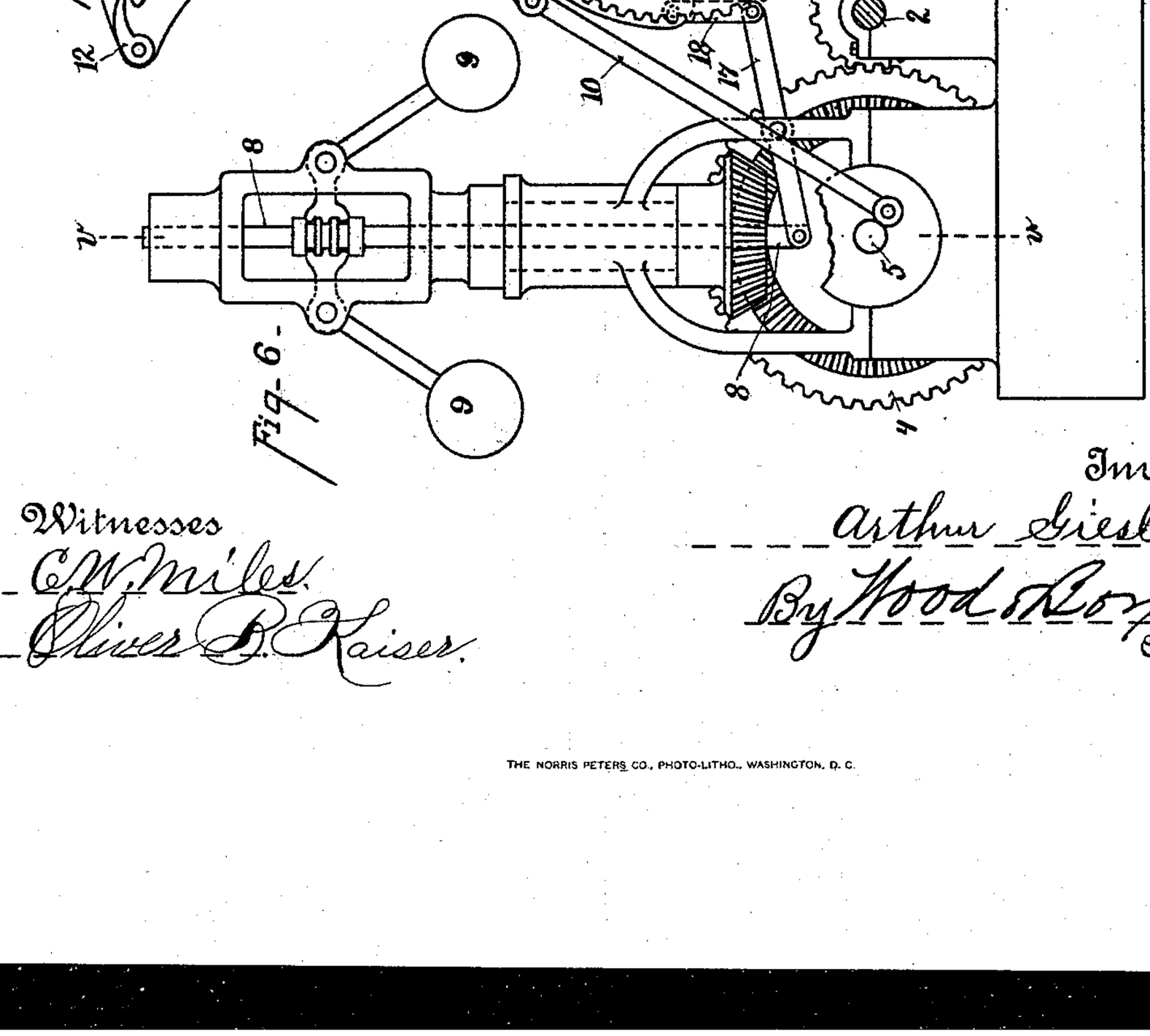

Witnesses
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UNITED STATES PATENT OFFICE.

ARTHUR GIESLER, OF DAYTON, OHIO, ASSIGNOR TO THE STILWELL-BIERCE & SMITH-VAILE COMPANY, OF SAME PLACE.

WATER-WHEEL GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 540,094, dated May 28, 1895.

Application filed August 13, 1894. Serial No. 520,221. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR GIESLER, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Water-Wheel Governors, of which the following is a specification.

The object of my invention is to provide a sensitive governor for water wheels and more especially wheels adapted to drive an electric dynamo. Electric governors are very sensitive but they are liable to get out of order by the burning out of fuses, the effect of lightening and some other causes. It is therefore desirable to combine an electric with a centrifugal governor so that in the case of accident to the former the centrifugal governor will act to control the speed of the water wheel.

My invention relates, first, to the construction of an electric governor which will operate independently, and, second, the combination of an electric and a centrifugal governor, so that either one or both may act, each without interfering with the other.

The features of my invention will be more fully set forth in the description of the accompanying drawings making a part of this specification, in which—

Figure 1 is a side elevation of my improvement. Fig. 2 is a plan view of Fig. 1. Fig. 3 is a sectional elevation of the worm-shaft and nut. Fig. 4 is a sectional elevation of loose epicycloidal gear-wheels. Fig. 5 is a sectional elevation of a dash-pot and connections with an electric-needle arm. Fig. 6 is a section on the line *x x*, Fig. 2. Fig. 7 is a sectional elevation, partly in section, on the line *v v*, Fig. 6. Fig. 8 is an elevation of the pawl-segment, and Fig. 9 is an elevation of the rocking segment.

1 represents a driving pulley for the centrifugal governor; 2, driving shafts; 3 4, gear wheels transmitting motion to shaft 5; 6, bevel gear on shaft 5 transmitting motion to bevel gear 7; 8, governor shaft; 9, weights of centrifugal governor; 10, connecting rod operating the rocker segment 11; 11 12, pawls operated by rocker segment 11, also engaging with the gear 13, keyed upon shaft 14.

15 represents transmitting gear keyed upon the opposite end of shaft 14; 16, driving gear for transmitting motion to the gate of an ordinary water wheel so as to open and close the same as it is revolved in the proper direction.

Referring to Fig 2, of the drawings, it will be noted that the two opposing pawls 12, are operated upon the gear wheel 13, by the rocker arm 10, so that one pawl is moved forward while the other is moved backward, and vice versa, according to the direction in which the transmitting wheel is turned.

When the balls 9, are raised, the shaft 8, is depressed. The shaft 8, is hinged to the rocking lever 17, which is in turn connected by means of the link 18, to the rocking segment 19. This segment is rocked or moved so that the slot 20 in the periphery of said segment is brought under one of the pawls 12, allowing said pawl to drop into engagement with the teeth of the rack gear 13. The shaft 14 which oscillates the segment arm 11, will move the rack gear 13 and consequently move the gate gear in a given direction. When the balls 9 are lowered, a reverse motion of the gate gear is effected. It will be seen that the connecting rod 10 is journaled upon a crank pin or shaft 5 which constantly oscillates the pawl segment with every revolution of said shaft 5, but the pawls do not engage with the teeth of rack gear 13 until the segment 19 is moved so as to bring the recess 20 opposite the said pawls when it will engage with the teeth of the rack gear 13.

The above described parts represent a centrifugal water wheel governor of the ordinary construction, the operation of the centrifugal governor being such as to revolve shaft 14 in one direction or the other, transmitting the proper motion to the gate shaft. In order to combine this or any other ordinary centrifugal governor of a water wheel with an electric governor so that either or both of the governors may be operated automatically as occasion requires, I have provided the following devices.

A represents a gate shaft which opens and closes the gates of a water wheel as it is turned in the proper direction. This shaft is driven by shaft B and bevel gear connections *a*, *b*. The centrifugal governor gear

wheel 16, is keyed upon sleve C which is journaled upon shaft B.

D represents a bevel gear affixed to sleeve C.

E represents a bevel gear affixed to sleeve *e* which is loosely journaled upon shaft B.

F, G, represent loose wheels journaling upon the hubs of a collar shaft *e'*. This collar shaft is keyed to shaft B.

The gears D, E, F, G, form an epicyclic train, so that when the sleeve C is revolved it will transmit motion to the shaft B through gears F, G, revolving on gear E as a center, and when gear E is revolved it will drive the gears F, G, which will revolve around gear D as their center, and transmit motion to shaft B. Sleeve C is driven by a centrifugal governor to transmit motion to shaft B, and sleeve *e* is operated by the electric governor to transmit motion to the said shaft B.

In the operation of the two governors, independently, when power is applied from the electrical governor side of the apparatus to transmit motion to shaft B, through gears E, F, and G, the gears F and G, simply travel around gear wheel D as a center, and do not turn the same as it is held against such turning movement by the frictional resistance of the operating parts. On the other hand, if power is applied from the mechanical governor side of the apparatus, from pulley 1, through gears 15, 16, sleeve C, gear D, and gears F, G to the shaft B, said gears F, G, would not transmit motion to gear E, on sleeve *e*, but would simply travel around said latter named gear which is held against backward rotation owing to the frictional resistance of the gears meshing therewith.

The electric governor apparatus is preferable as follows:

H, H', represent loose pulleys journaling on shaft *h*. They are driven by belts in opposite directions. Pulley H is preferably larger or else geared to run faster than pulley H', and controls the opening of the gates. Pulley H', runs in a direction for closing the gates. These pulleys are adapted to be clutched to the shaft *h* by means of friction clutches I, I', which are controlled and operated by the increase and decrease of the electric current to clutch either of the pulleys H, H', to the shaft in the following manner.

J represents a solenoid coil connected in circuit by the wires *f*, *g*.

J' represents a segmental core pivoted upon the shaft *i*.

L represents a cross head.

l l' represent terminals on said cross head.

M, M', represent terminals mounted upon the arms of the yoke N.

O, O' represent two pairs of magnets, one pair being connected in circuit by wire *m*, terminals *l*, M, lever K and wire *g*, and the return circuit by the wire *m'*, to the wire *f*. The other pair of magnets is connected in circuit by the wire *n*, terminals *l'*, M', lever K and the wire *g*, and the return current of said magnets by wire *n'* and wire *f* and they operate in the following manner: Say the current is electrically increased and the solenoid is wound so that the increase of current will draw the core J' inward, moving it on its axis *i*, lever K will be brought into contact with the terminals M' and bring the pair of magnets O in circuit. Armature P pivoted midway between the cores of the magnets, will be attracted to the core or magnet O. Armature P is provided with a yoke *o* in the rear of its center *p* which engages with the spool of the clutches I, I', and thus brings the clutched disk I' into frictional contact with the pulley H' which revolves the shaft *h* and transmits motion by gear *h'* to the gear Q on sleeve *e*, and drives it in the proper direction for transmitting motion to shaft A for closing the water wheel gate. The movement of the core J' in the opposite direction will bring the terminals *l*, M, in contact and bring the magnets O' in circuit, attracting the armature P to said cores and bringing the disk I into frictional engagement with the disk of pulley H, and this will drive the shaft *h* in the opposite direction say for opening the gates of the water wheel.

In order that the circuits may be quickly and automatically broken so as to cut out either of the magnets O, O', as the case may be, I have provided the following devices: The terminals, M, M', are mounted upon the arms of yoke N and insulated from metallic connection with the yoke N by means of the hubs N', N^2. The axis of the yoke is screw shreaded and receives a worm or screw shaft R. Said shaft is provided with a friction pulley R' in engagement with the disk R^2, of shaft *h*. Now as the disk R^2 is driven in either direction it will by frictional engagement with the pulley R' drive the shaft R which will move the axis of yoke N longitudinally on said shaft and break the contact of the terminals *l'* with M', or *l* with M, as the case may be. Hence the switch or cut-out mechanism is operated by the same shaft which transmits motion to the gate moving shaft, so that a small amount of gate movement takes place before the current of the battery is broken and the operation of the electric governor is stopped. As this governor is very sensitive and the rapid making or breaking of the contact would cause vibrations of the lever K, I atttach thereto a dash pot so as to prevent undue vibratory motion.

i' represents a dash pot rod carrying the dash *o'*. *q* represents the tank filled with liquid in which the dash *o'* moves backward and forward. This steadies the movement of lever K and prevents undue vibrations thereof. It is desirable also to prevent the gates from being opened or closed too far. Hence I provide a safety stop mechanism operated by the electrically controlled train of gears to stop excessive motion in either direction. The rear end of the armature P is projected be-

tween the arms r, r', of yoke T. Threads are chased in the arms r of the yoke T and they engage with threads of the worm shaft t.

U represents a gear wheel on the end of said shaft which receives motion from the gear wheel U′ on the sleeve e of shaft B. Now when said sleeve is driven in either direction the shaft t is controlled in a corresponding direction, and it moves one of the arms r into contact with the end of armature P, breaking its connection with the cores of magnets O or O′, as the case may be, and thus, releases the clutch connection of disks I, I′, with their pulleys H, H′, and stops the transmission of motion to shaft h. The operation of the arms r by the adjustment of the speed of shaft t is such as to bring one or the other of these arms into contact with the armature lever P just as the extreme movement of the gate has taken place. Under ordinary circumstances the electric cut-out operated by the shaft R will cut out the electric magnet circuits and stop the motion. This switch mechanism is adjusted so as to break the circuits very quickly, as but a slight movement in opening or closing the gates is ordinarily required to regulate the speed.

It will be observed that both the electric and the centrifugal governors can be practically operated at the same time. The one being more sensitive and starting the operation first would be followed up by the other without detriment to the operation of regulating the speed. Ordinarily however, the electric governor being the more sensitive would direct and control the speed of the water wheel.

It will be understood of course that the shaft A will control the gates of more than one water wheel when several water wheels are geared to said shaft.

I claim—

1. In combination with a shaft adapted to operate the gates of a water wheel, a centrifugal governor and train, and an electric governor and train, each geared to turn the gate shaft, and adapted to work independently or in unison to control the gate, and means connected to the electric train for limiting the movement of the gate shaft, substantially as described.

2. In combination with a transmitting shaft, of an electric governor and its train, a centrifugal governor and its train, and an epicyclic gear mounted upon said shaft and geared to each of said trains independently, substantially as described.

3. In a water wheel governor, the combination with the gate-shaft A, and drive-shaft B, of a centrifugal governor and train located to one side of said drive shaft, an electrical governor and train located to the other side of the drive-shaft, and an epicyclic gear carried by said drive-shaft and operated by the train of the centrifugal governor, or the train of the electrical governor, either simultaneously or independently, substantially as described.

4. In a water-wheel governor, the combination with the gate-shaft A, and drive-shaft B, geared to said gate-shaft, of the pulley-shaft h, located alongside the drive shaft and geared thereto, oppositely revolving pulleys mounted on said pulley-shaft, friction clutches I, I′, mounted on said latter named shaft, intermediate the pulleys, an armature lever adapted to operate said clutches, and electro-magnets and their circuits for controlling the armature-lever, substantially as described.

5. In a water-wheel governor, the combination with the gate-shaft A, and drive-shaft B, geared thereto, of a pulley-shaft h located alongside the drive-shaft and carrying pulleys H, H′, clutches I, I′, adapted to engage said pulleys, an armature lever P arranged to operate said clutches, magnets O, O′, and their circuits adapted to actuate said armature-lever, a threaded shaft t, located intermediate the drive and pulley shafts, and geared to the former and arms r, r', moving upon said threaded shaft, and adapted to control the movement of the armature-lever, as and for the purpose described.

6. In an electric governor for water-wheels, the combination with the gate-shaft A, and drive-shaft B, geared thereto, of the pulley-shaft h located alongside, and geared to the drive-shaft, pulleys carried by said pulley-shaft, clutches located intermediate the pulleys, and armature lever operated by electro-magnets O, O′, and adapted to actuate the clutches, a disk R^2, mounted on the end of the pulley-shaft, a screw-shaft R, mounted at right angles to said pulley shaft, and carrying a friction pulley R′ which engages the disk R^2, a solenoid and its core connected in circuit with the magnets O, O′, and an automatic cut-out carried by the screw shaft, and adapted to control the electric circuit, substantially as described.

7. In an electric water-wheel governor, the combination with the gate-shaft A, and drive-shaft B, of the screw-shaft R carrying a friction pulley R′, gearing intermediate the screw-shaft and gate-shaft whereby motion is communicated from one to the other, a yoke N carried by said screw-shaft, terminals M, M′ on said yoke, a solenoid and core and their circuits a lever K carried by said core and provided with a cross-head L, terminals l, l' mounted on said cross-head and adapted to engage with the terminals on the yoke, and a dash-pot connected to the core arm, as and for the purpose described.

8. In combination with an electric-governor and its train of gears operated by electric circuits, and an armature common to both circuits, a stop mechanism operated by the transmitting mechanism and adapted to engage with the armature lever at intervals for the purpose described, a solenoid and core operating to make electric circuits, and a dash-pot connected to the core-arm, substantially as described.

9. In combination with the gate-shaft of a water-wheel, an electric-governor controlled

by a solenoid and its core, two pairs of magnets and electric circuits connected with said core through terminals controlled by said solenoid and core, a shaft R geared to the gate-shaft, and an automatic cut-out operated by said shaft R, substantially as and for the purpose described.

10. In a water wheel governor, the combination with the shaft *h*, carrying oppositely revolving pulleys H, H′, and friction clutches I, I′, of the electro-magnets O, O′, and their circuits automatically controlled by a main circuit, an armature lever P engaging with the frictional clutch and adapted to convey motion to the shaft *h*, and a mechanical device operating upon said armature lever to break its connection with the cores of the magnets in either direction, substantially as described.

11. In combination with the gate-shaft of a water-wheel, of a centrifugal governor and its train, and an electric governor and its train, each of said trains being geared to the gate shaft and adapted to operate the same independently or in unison, substantially as described.

In testimony whereof I have hereunto set my hand.

ARTHUR GIESLER.

Witnesses:

CHARLES W. DALE,

WILLIAM H. DALE.