

C. GRANT.  
ENGINE GOVERNOR.  
APPLICATION FILED MAY 21, 1906.

959,853.

Patented May 31, 1910.

3 SHEETS—SHEET 1.

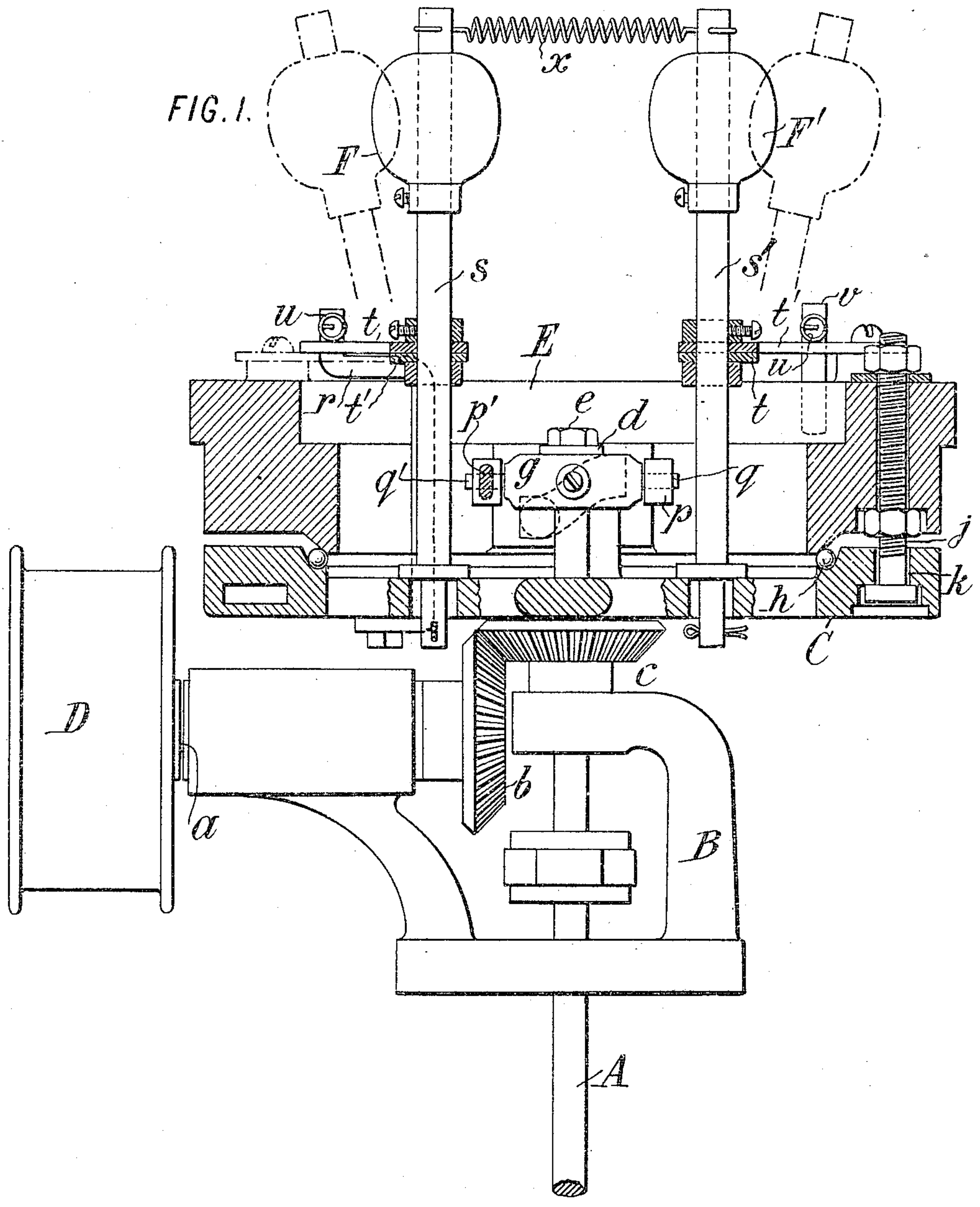
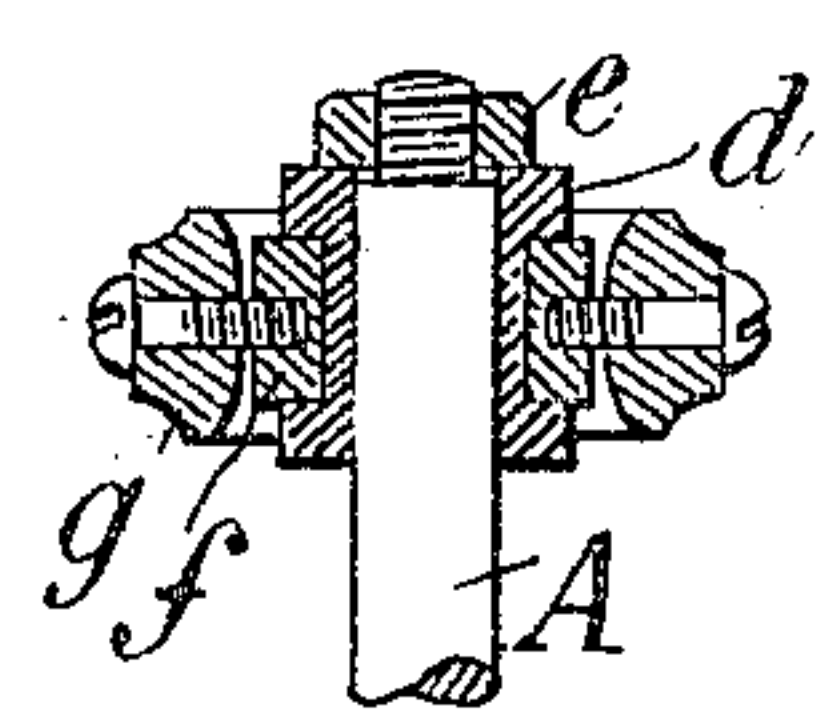


FIG. 2.



WITNESSES:  
*Fred White*  
*Rene Muir*

INVENTOR:  
*Charles Grant,*

By Attorneys,  
*Arthur C. Fraser & Co.*

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3 SHEETS—SHEET 2.

FIG. 3.

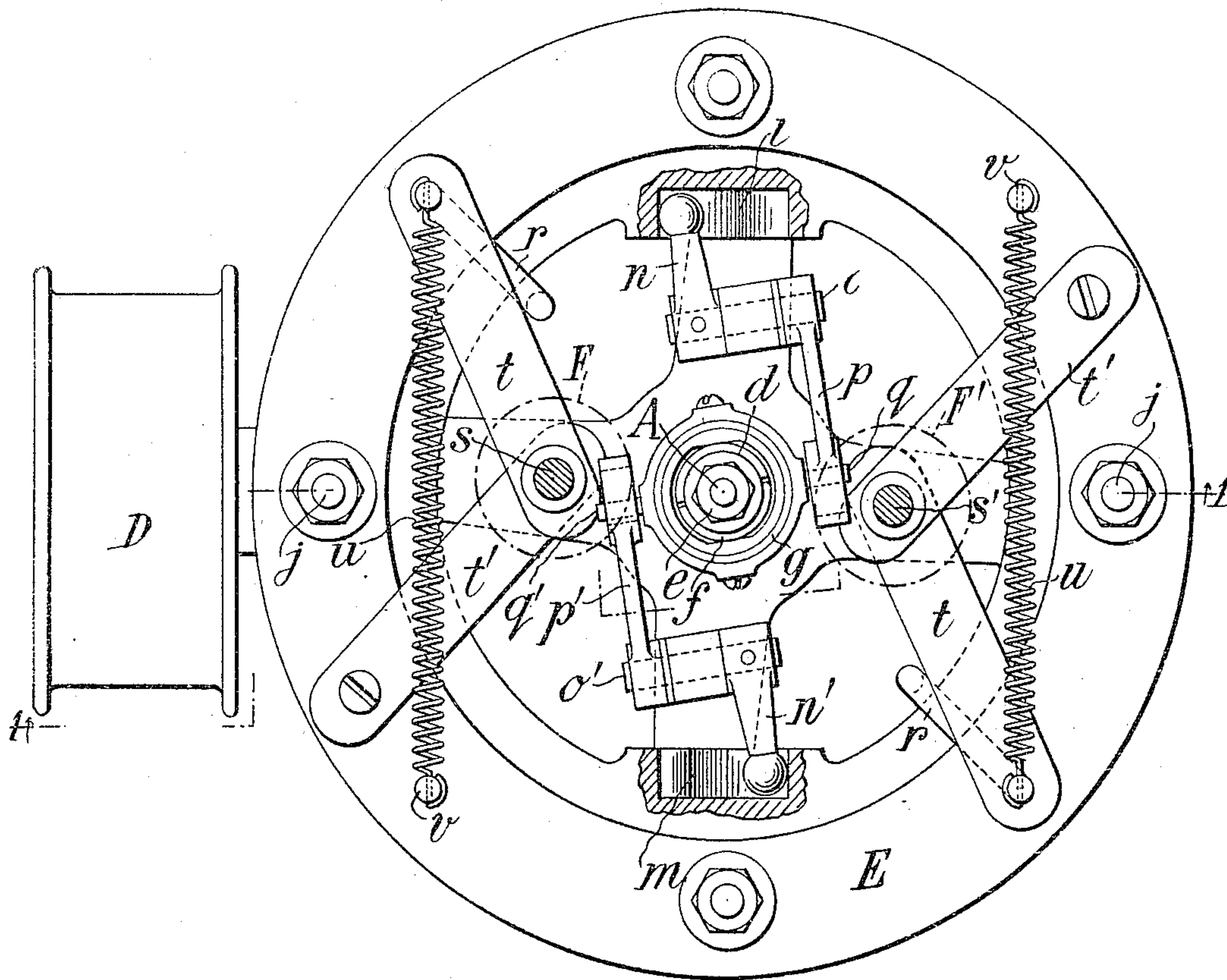
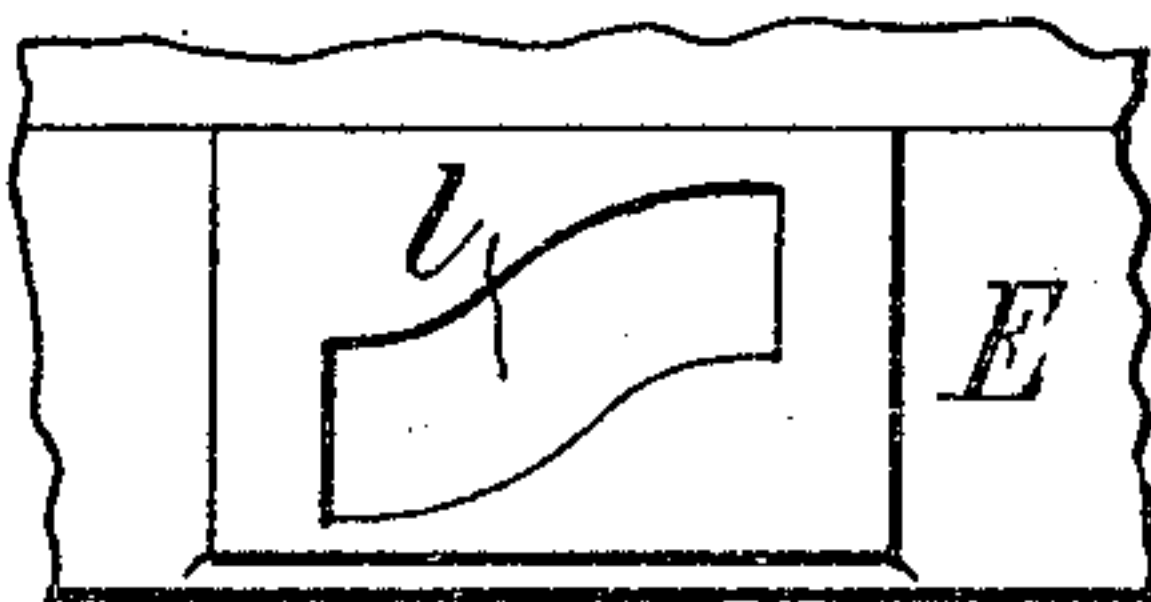


FIG. 4.



WITNESSES:  
*Fred White*  
*René Gruine*

INVENTOR:  
*Charles Grant,*

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# UNITED STATES PATENT OFFICE.

CHARLES GRANT, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO RICHARD PLUNKETT, OF NEW YORK, N. Y.

## ENGINE-GOVERNOR.

959,853.

Specification of Letters Patent.

Patented May 31, 1910.

Application filed May 21, 1906. Serial No. 317,972.

*To all whom it may concern:*

Be it known that I, CHARLES GRANT, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Engine-Governors, of which the following is a specification.

This invention relates to governors for engines or the like, and aims to provide certain improvements therein.

In its preferred form my invention comprises a governor having an inertia element and a centrifugal element, both of which conjointly act upon the valve stem or other part controlling the admission of fluid. By preference I utilize for the inertia element a ring which is rotatably mounted upon the governor body, and for the centrifugal element a pair of fly-balls which are loosely mounted upon the governor body so that they are capable of an angular movement relative thereto. Preferably the two elements are so connected that the action of one necessarily involves the action of the other so that they modify each other and provide an extremely even and regular movement of the engine or other device.

In the drawings wherein I have shown my invention in its preferred form, Figure 1 is a diametrical section taken approximately on the line 1, 1 in Fig. 2; Fig. 2 is a detail; Fig. 3 is a plan with the fly balls removed; Fig. 4 is a detail showing the shape of the cam employed; Fig. 5 is a plan of the governor showing the parts in normal running position.

In the drawings let A indicate the valve stem or other part which it is desired to control, B a suitable bracket adapted to be bolted to the engine frame, C the governor body, and D a suitable pulley geared to the governor body by means of a shaft *a* and beveled gears *b*, *c*. Any other method of mounting the governor may be adopted, and for the valve stem A may be substituted any part by the movements of which the engine is to be controlled. The valve stem is continued upwardly through the governor body, and is provided at its upper end with a grooved collar *d* held in place by a nut *e*. *f* is a split ring fitting loosely in the groove of the collar *d*, the halves of which ring are carried by a collar *g* as best seen in Fig. 2. This construction permits the governor body

and ring *g* to rotate independently of the valve stem while permitting the ring *g* to move the valve stem lengthwise in accordance with the position of the elements of the governor.

The form of inertia weight which I prefer to employ is a heavy ring E, mounted above the governor body C, a series of balls *h* being preferably interposed between the two. Bolts *j* screwed to the inertia ring E and working in slots *k* in the governor body hold the parts against vertical separation. The relative movements of the governor body C and the inertia ring E are communicated to the valve stem A by means of suitable cams *l*, *m*, fixed upon the inertia ring, said cams acting upon arms *n*, *n'* fixed to the ends of rock shafts *o*, *o'* mounted in bearings upon the governor body, such shafts carrying at their opposite ends arms *p*, *p'* engaging pins *q*, *q'* upon the collar *g*.

The centrifugal element of the governor preferably comprises two comparatively light balls F, F' which are preferably fixed at the upper ends of shafts *s*, *s'*, the lower ends of which shafts are mounted in the governor body in such manner as to permit an angular movement of the shafts as well as the usual radial movement which would be occasioned by the outward and inward movements of the balls acting centrifugally. The balls F, F' are connected to the valve stem through the medium of the inertia ring E and the parts just described. The mechanism which I prefer to employ between the fly-balls and the inertia ring is best seen in Fig. 3, and comprises links *t*, *t'* the inner ends of which are pivoted to the shafts *s*, *s'*, and the outer ends of which are pivoted respectively to the governor body and the inertia ring. The connection with the governor body is preferably made through the medium of arms *r*, *r*, fixed to the governor body and extended upwardly within the governor and outwardly to points near the periphery of the inertia ring, as shown in Fig. 3. Springs *u*, *u* are provided for resisting relative movement of the inertia ring and governor body in a forward direction, such springs having one end fixed to the arms *r*, *r*, on the governor body and one to the studs *v*, *v* on the inertia ring E. An additional spring *w* is preferably provided between the shafts *s*, *s'*, which tends to effect the same result.



In operation, if the engine be started slowly and evenly, the fly-balls will gradually move outwardly under the action of centrifugal force from the position shown in Fig. 3 to the position in which the arms  $n, n'$  are about midway between the ends of the cams  $l, m$ , as shown in Fig. 5. The valve A, which, is fully open in Fig. 3 is moved to the partly open position it normally occupies during running. If part of the load is suddenly taken off the engine the governor body will at once tend to run ahead of the inertia ring so that the arms  $n, n'$  rise suddenly higher in the cams  $l, m$ , whereby the valve is more nearly closed. As the governor body runs ahead of the inertia ring, the arms  $r, r'$  are carried from the positions shown in Fig. 5 in full lines to those shown in dotted lines, and the fly balls F, F' move outwardly toward the dotted line position in this figure. In this operation the fly balls also tend to lag behind the governor. As they move outwardly they also move relatively rearwardly as shown in Fig. 5, being constrained to follow this path by reason of the fact that the levers  $t, t'$  swing around the arms  $r$  which are fixed to the governor body. The centrifugal weights also act as inertia weights and being mounted upon the ends of the long shafts  $s$ , such centrifugal weights act with considerable leverage against the arms  $t, t'$ . When an additional load is thrown upon the engine the governor body tends to lag behind the inertia ring and fly-balls so that the cams  $l, m$  move forwardly until the arms  $n, n'$  near the position shown in Fig. 3, thus further opening the valve. To effect this result the fly-balls must be moved inwardly against the action of centrifugal force which tends to maintain them in their given circular path of movement. All sudden changes in load are promptly communicated to the valve stem through the inertia action of the governor, while gradual changes are communicated through the centrifugal element.

I have found in practice that the governor provided by my invention is exceptionally sensitive in its movements, responding to small variations in the load upon the engine. The most important feature of my invention, however, is that the movements of the governor do not tend to produce a greater correction in the position of the valve than is required by the differences in variation of load. Heretofore no great difficulty has been encountered in providing a governor of sufficient sensitiveness, but most of such governors do not operate so as to provide an even and regular movement of the engine notwithstanding the differences in load. The governor provided by me will quickly respond to minute variations, but this response is even and holds the engine

to its adjusted load without producing an overthrow of the valve.

Although I have described in detail the preferred form of my invention, I do not wish to be limited thereto, as many changes may be made therein without departing from the spirit of my invention.

What I claim is:—

1. In a governor, the combination of a body mounted for rotation in a fixed plane, an inertia wheel coaxial therewith and movable thereto in a fixed plane, a centrifugal weight mounted on said body to swing freely, a connection between said centrifugal weight and said inertia wheel adapted to cause said centrifugal weight to lag relatively to said governor body in the direction opposite the direction of rotation when said centrifugal weight moves outwardly under centrifugal force, and said connection being adapted to cause said centrifugal weight to advance relatively to said governor body when the former moves inwardly, and a transmission connection adapted to be moved by the movement of the parts before mentioned.

2. In a governor, the combination of a body mounted for rotation in a fixed plane, an inertia wheel coaxial therewith and movable thereto in a fixed plane, a centrifugal weight mounted on said body to swing freely, a connection between said centrifugal weight and said inertia wheel adapted to cause said centrifugal weight to lag relatively to said governor body in the direction opposite the direction of rotation when said centrifugal weight moves outwardly under centrifugal force, and said connection being adapted to cause said centrifugal weight to advance relatively to said governor body when the former moves inwardly, and a transmission connection adapted to be moved by the movement of the parts before mentioned, said connection comprising a toggle mechanism, a joint of which is connected with said centrifugal weight.

3. In a governor, the combination of a body mounted for rotation in a fixed plane, an inertia wheel coaxial therewith and movable thereto in a fixed plane, a centrifugal weight mounted on said body to swing freely, a connection between said centrifugal weight and said inertia wheel adapted to cause said centrifugal weight to lag relatively to said governor body in the direction opposite the direction of rotation when said centrifugal weight moves outwardly under centrifugal force, and said connection being adapted to cause said centrifugal weight to advance relatively to said governor body when the former moves inwardly, and a transmission connection adapted to be moved by the movement of the parts before mentioned, said connection comprising a toggle mechanism, a joint of which is connected with said centrifugal weight, and said cen-



trifugal weight being mounted upon an elongated shaft the end of which is loosely connected to said governor body.

4. In a governor, the combination of a  
5 body mounted for rotation in a fixed plane,  
an inertia wheel coaxial therewith and movable thereto in a fixed plane, a plurality of  
centrifugal weights mounted on said body  
to swing freely, a connection between said  
10 centrifugal weights and said inertia weights  
adapted to cause said centrifugal weights  
to lag relatively to said governor body in  
the direction opposite the direction of rotation when said centrifugal weights move  
15 outwardly under centrifugal force, a spring  
tending to hold said centrifugal weights in  
their inward positions, and a transmission  
connection adapted to be moved by the  
movements of said inertia wheel and weights.  
20 5. In a governor, the combination of a  
body mounted for rotation in a fixed plane,  
and an inertia wheel coaxial therewith and  
movable relatively thereto in a fixed plane,  
a centrifugal weight mounted on said body  
25 at a point which is eccentric to the axis of  
said body and adapted to move rearwardly

as it moves outwardly, a connection between  
said centrifugal weight and said inertia  
weight, and a transmission connection  
adapted to be moved by the movements of 30  
the parts before mentioned.

6. In a governor, the combination of a  
body mounted for rotation in a fixed plane,  
an inertia wheel coaxial therewith and movable relatively thereto in a fixed plane, a 35  
centrifugal weight mounted on said body to  
swing freely, and means for causing said  
centrifugal weight to lag relatively to the  
governor body in the direction opposite the  
direction of rotation when said centrifugal 40  
weight moves outwardly under centrifugal  
force, and said centrifugal weight being  
adapted to maintain a substantially fixed  
plane during its outward, inward and lag-  
ging movements. 45

In witness whereof, I have hereunto  
signed my name in the presence of two sub-  
scribing witnesses.

CHARLES GRANT.

Witnesses:

DOMINGO A. USINA,  
THEODORE T. SNELL.