C. W. DAKE.

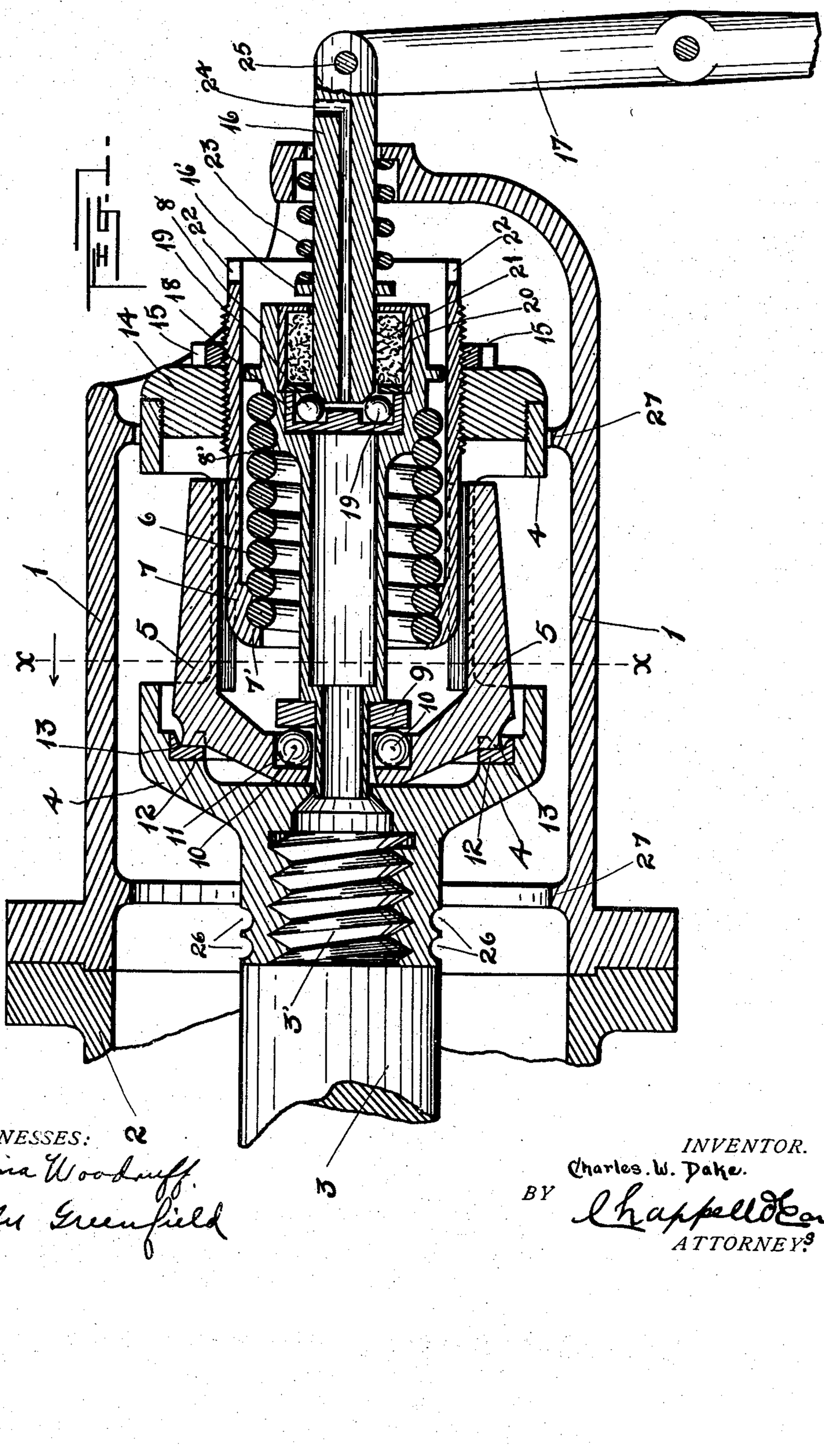
GOVERNOR FOR STEAM OR ELASTIC FLUID ENGINES.

APPLICATION FILED JUNE 13, 1908.

959,471.

Patented May 31, 1910.

3 SHEETS—SHEET 1.



WITNESSES:

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3 SHEETS—SHEET 2.

FIG. 2.

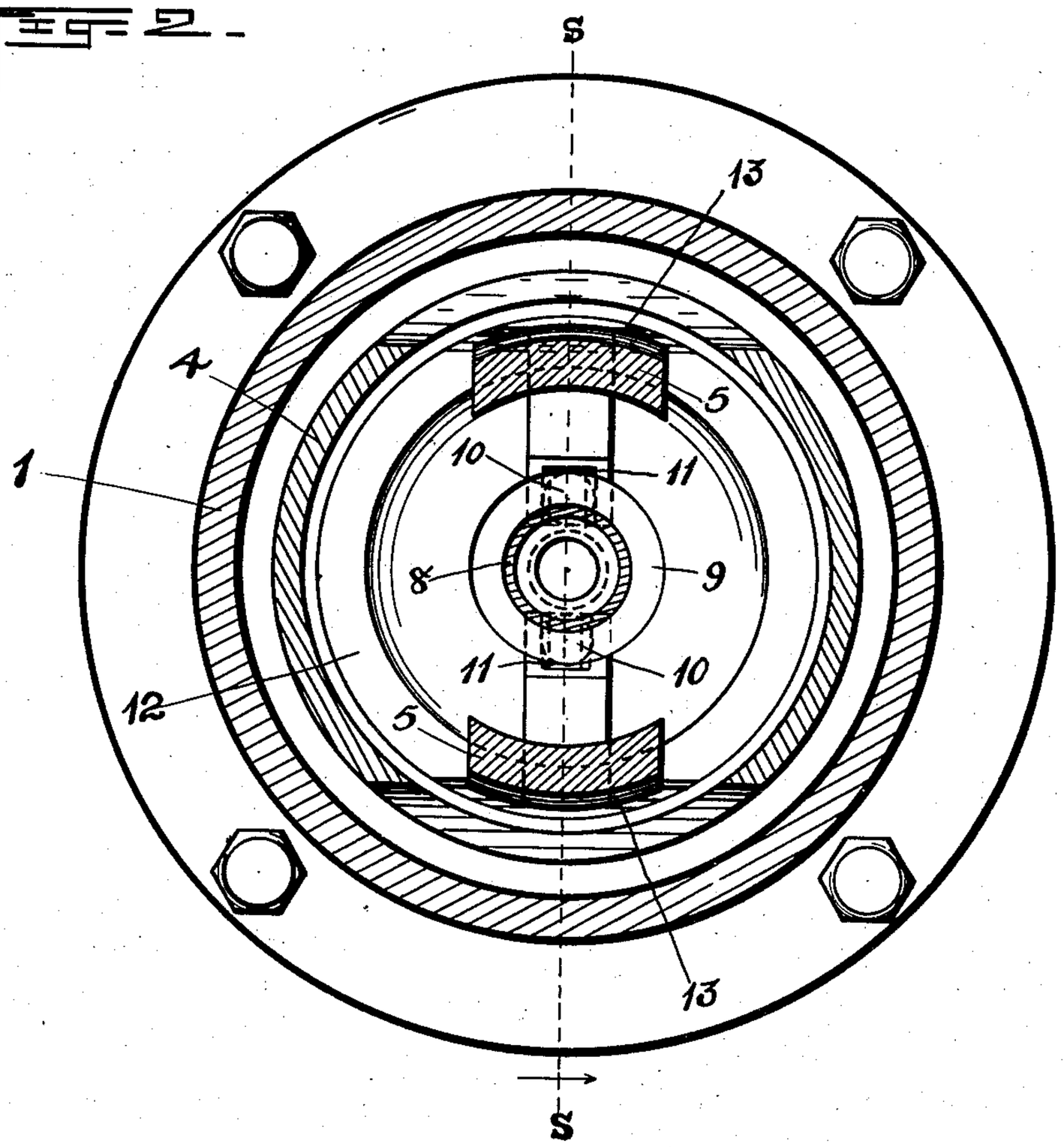


FIG. 3.

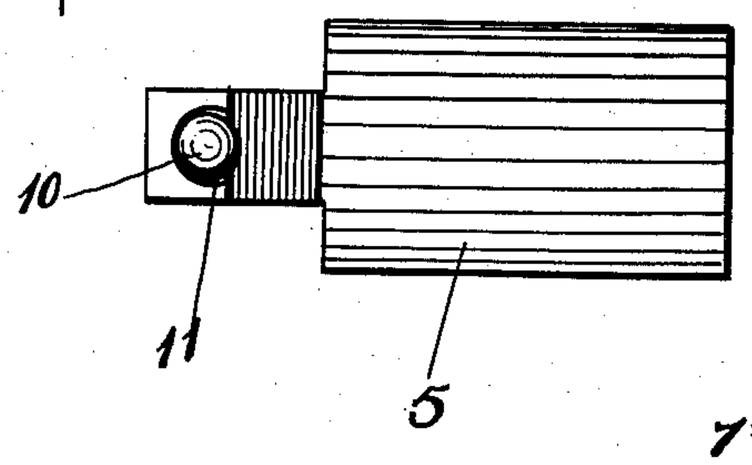
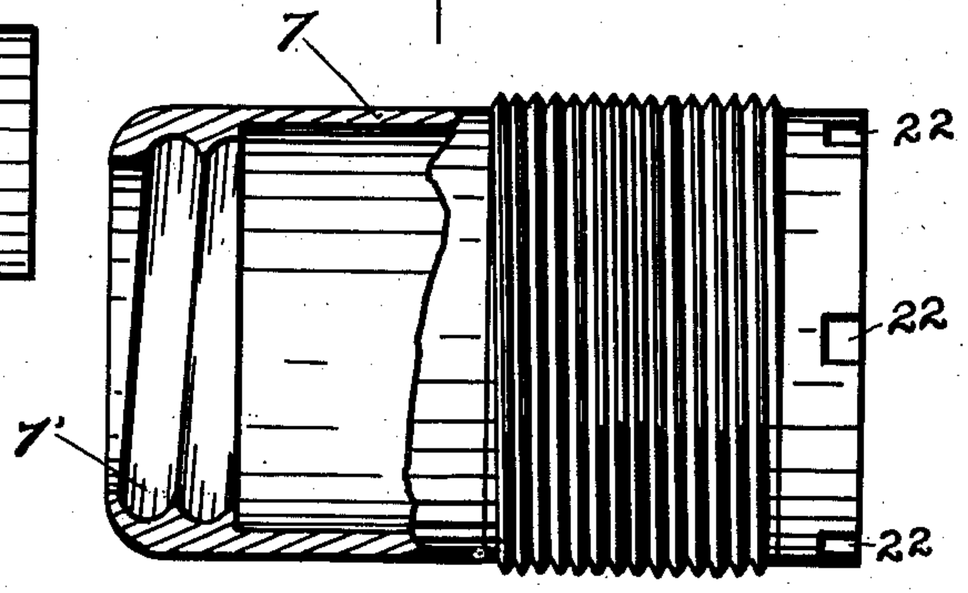


FIG. 7.



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3 SHEETS—SHEET 3.

FIG. 5.

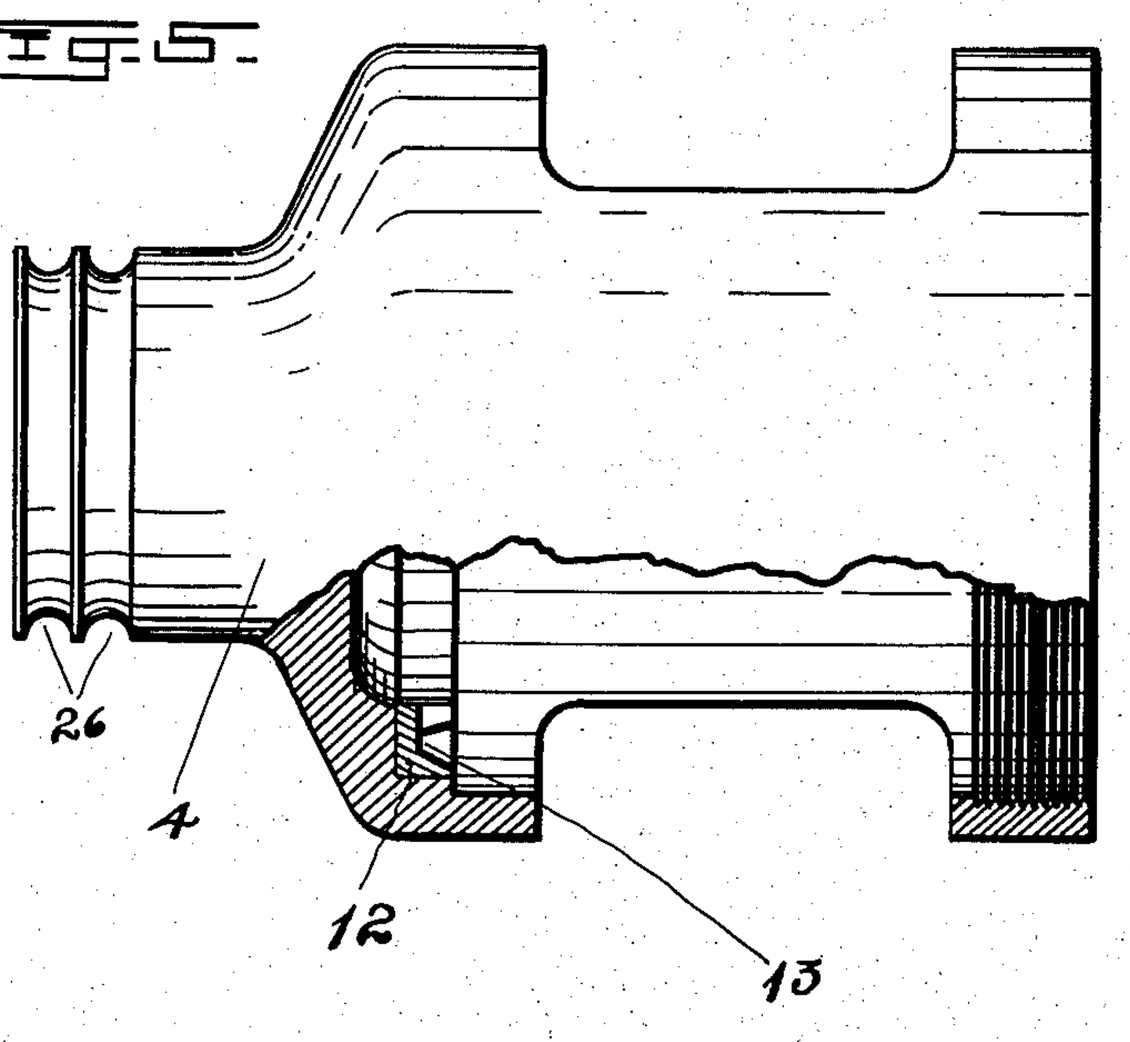


FIG. 6.

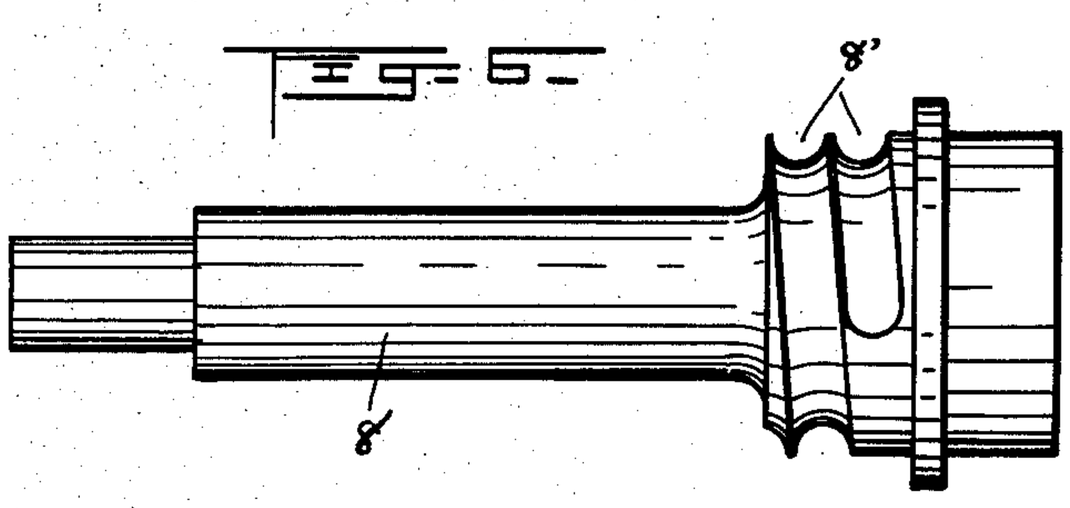


FIG. 8.

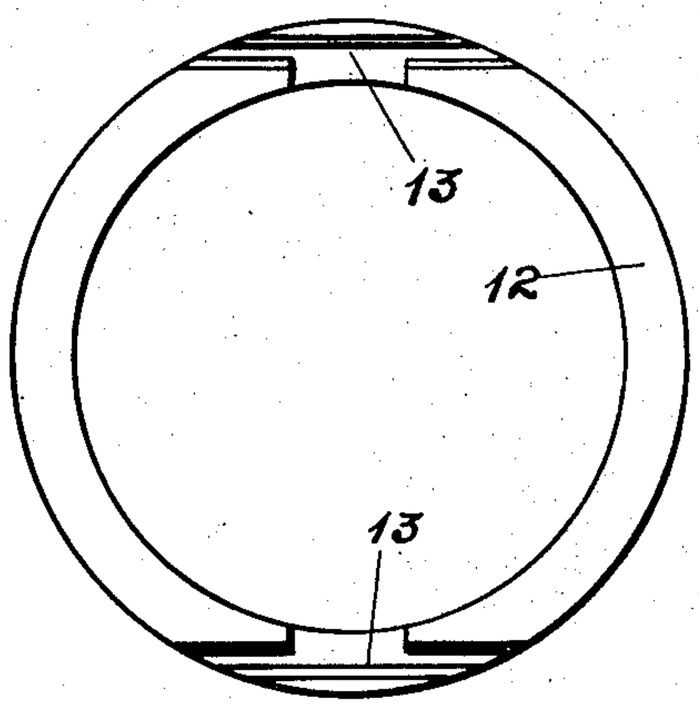
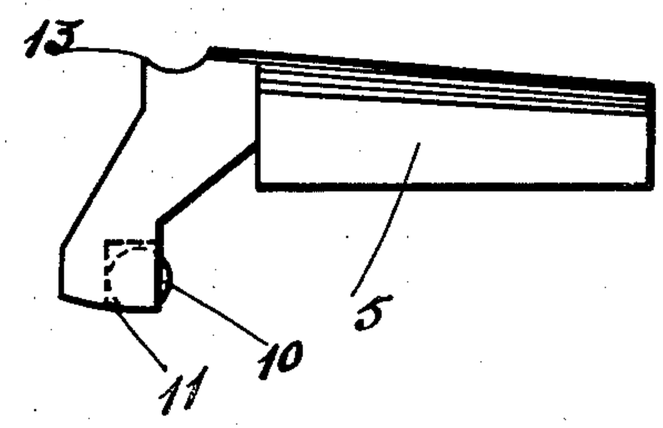


FIG. 4.



WITNESSES:

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UNITED STATES PATENT OFFICE.

CHARLES W. DAKE, OF GRAND RAPIDS, MICHIGAN, ASSIGNOR TO THE DAKE-AMERICAN STEAM TURBINE COMPANY, OF GRAND RAPIDS, MICHIGAN.

GOVERNOR FOR STEAM OR ELASTIC-FLUID ENGINES.

959,471. Specification of Letters Patent. Patented May 31, 1910.

Application filed June 13, 1908. Serial No. 438,416.

To all whom it may concern:

Be it known that I, CHARLES W. DAKE, citizen of the United States, residing at the city of Grand Rapids, county of Kent, and State of Michigan, have invented certain new and useful Improvements in Governors for Steam or Elastic-Fluid Engines, of which the following is a specification.

This invention relates to improvements in governors for steam or elastic fluid engines, it being particularly well adapted and intended for use on turbine engines.

The objects of this invention are: First, to provide a governor of the class described in which the running parts are in perfect balance, which is a matter of the highest importance where the governor is applied to the shaft of a steam or elastic fluid turbine. Second, to provide an arrangement and construction in a governor in which a coiled tension spring is used in such a manner that the action of the governor weights elongates the same, in order to preserve the equilibrium of the parts. Third, to provide a construction of governor in which the friction of the parts moving on each other is minimized in order to insure its effectiveness. Fourth, to provide a governor which is compact and the parts of which are simple to construct.

Further objects, relating to details of construction, will appear from the detailed description to follow.

A structure embodying the features of my invention is fully described in the following specification.

The invention is clearly defined and pointed out in the claims.

A structure embodying the features of my invention appears fully illustrated in the accompanying drawing, forming a part of this specification, in which:

Figure 1 is a longitudinal detail sectional view of my improved governor, the casing of which is secured to the side of the casing of a turbine, the governor revolving parts of the governor being secured to the end of a turbine shaft, the view being taken on a line corresponding to line S—S of Fig. 2; Fig. 2 is a transverse detail sectional view taken on a line corresponding to line *x*—*x* of Fig. 1; Fig. 3 is a detail view of one of the governor weights, looking from the inner side outwardly, showing the anti-friction ball thereof inserted in the socket; Fig. 4 is a detail side elevation of the governor weights appearing in Fig. 3, showing the same parts and the projecting knife edge rocking contacting part thereof; Fig. 5 is a side view, partially in section, of the revolving shell 4 of the governor, which supports and protects the interior mechanism; Fig. 6 is an elevation view of the interior spindle spring connection to the governor stem; Fig. 7 is a detail side elevation view, partially in section, of the adjustable spring tension sleeve connection; and Fig. 8 is a detail view of the hardened steel ring which forms the bearing for the knife edges of the governor weights.

In the drawing, the sectional views are taken looking in the direction of the little arrows on the section lines, and similar numerals of reference refer to similar parts throughout the several views.

Considering the numbered parts of the drawing, the governor protecting casing 1, through which extends the governor stem 16, is secured to a suitable flange 2 of the turbine casing, or to any other support surrounding the revolving shaft.

To the outer end of the turbine shaft or other engine shaft 3 is secured by a suitable screw thread 3′ the revolving shell 4 of the governor. Within this shell are a pair of governor weights 5, which are provided with knife edges 13 at their outer angles which rest in suitable oppositely arranged bearing grooves 13 in the hardened ring 12, which is supported and centrally located in the said outer shell 4. The inwardly projecting arms of these weights are notched or recessed at 11 in such a manner as to form suitable bearing pockets for anti-friction balls 10, the said balls being retained in place on the central sleeve by a collar 9 thereon, hereafter to be more fully indicated. The expansible tension spring 6 of the governor fits into a spiral or screw shaped recess 8′ in the interior sleeve spring connection 7 to the governor stem. The opposite end of the spring fits into an internal screw thread 7′ in the adjustable spring tension sleeve connection 7. This adjustable spring tension sleeve connection 7 is threaded externally and is adjustable by fitting corresponding screw threads in the collar 14, which collar is screw threaded or otherwise effectively fitted and secured into the outer end of the outer shell 4. The adjustable

sleeve is provided with notches 22 for the application of a wrench or other means for adjusting it, and when once adjusted is effectively locked and secured in place by the jam-nut 15, which contacts with the outer face of the collar 14. A collar 9, heretofore referred to, is on the inner end of the said connection spindle 8 and serves as the thrust collar to receive and transmit the force of the governor weights 5.

The stem 16 of the governor, which extends outwardly in axial relation with the casing 1 and the governor, is provided with a collar 16′, which receives the thrust of a compressible coiled spring 23, the stem fitting very loosely in the hole of the casing 1 to permit its slight oscillation in actuating the lever 17 to which it is connected by the pivot 25, the said lever 17 being a connecting means for controlling the governor valve or governor valve mechanism.

A ball race 18 is arranged and fitted into the outer end of the spindle 8, and the inner end of the valve stem 16 is formed conical to contact with the said ball bearings and permit the free rotation of the governor parts in contact with the said stem 16.

A sheet metal shell 20, containing a suitable oil absorbent, as waste, 21, is inserted in the outer end of the spindle 8 and embraces the stem 16. An oil hole 24 extends through the stem 16 for receiving oil to oil the ball bearing at the inner end thereof. Annular grooves 26 are cut into the hub of the shell 24 to prevent the passage of oil from the shaft 3, such grooves collecting the oil and insuring its discharge from the hub by centrifugal force. The centrifugal force also prevents the oil passing such grooves. Dams 27 are in the external casing 1 to prevent the passage of surplus oil outwardly from the shaft bearing.

It will be seen that in operation the centrifugal force acting on the weights 5 will cause them to rock on their knife edges 13 and exert pressure at their inner ends on the anti-friction balls 10 against the collar 9, thereby forcing the sleeve 8 outward, which puts tension on the expansible spring 6, and by regulating the tension of the spring 6 the governor is set at any point within the scope of its mechanism.

The stem 16 of the governor does not revolve. Only slight pressure is exerted against it,—sufficient to operate the governor valve or governor valve mechanism, which force is very slight, and as a consequence it will be seen that there is no bearing between the parts revolving at high speed under the pressure of the governor spring; and it will also be seen that as the spring is secured at its opposite ends by a complete screw thread, the tension on the spring will not cause it to buckle and throw the governor out of equilibrium, and consequently the governor runs very smoothly without vibration or strain, and as there are no parts revolving under heavy pressure, the friction is minimized.

I have shown the complete organization of the governor with all of the details as I prefer to use them, but I desire to remark that, while I wish to claim the details specifically in this relation as especially effective, I also desire to present broad claims which will embrace and dominate the broad features of the structure as well.

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

1. In a governor mechanism, the combination of the external protecting casing 1; a revoluble shell 4 suitably secured to the end of the engine shaft; governor weights within the said shell having suitable knife edge projections; bearings within the shell to receive the knife edges; ball bearings in suitable pockets at the inner ends of said weights; an internal spring connection spindle 8 with a collar 9 thereon for receiving the force of the said governor weights; an external adjustable connecting sleeve 7; a coiled tension spring fitting in suitable screw thread recesses between the said sleeve and internal spring connection; a collar 14 on the outer end of the said shell 4 within which the said sleeve 7 is adjustably supported by suitable screw threads; a suitable ball race with bearing balls 19 arranged in the outer end of the spindle 8; a governor stem 16, conical at its outer end to fit the said ball bearing; a suitable oil-packing 20—21 around the said stem; a spring 23 around the said stem; and a collar 16′ on the stem for receiving the thrust of the said spring for holding it in yielding contact with the ball bearing, all coacting substantially as described and for the purpose specified.

2. In a governor mechanism, the combination of a revoluble shell 4 suitably secured to the end of the engine shaft; governor weights within the said shell having suitable knife edge projections; bearings within the shell to receive the said knife edges; ball bearings in suitable pockets at the inner ends of said weights; an internal spring connection spindle 8 with a collar 9 thereon for receiving the force of the said governor weights; an external adjustable spring connecting sleeve 7; a coiled tension spring fitting in suitable screw thread recesses between the said sleeve and internal spring connection; a collar 14 on the outer end of the said shell 4 within which the said sleeve 7 is adjustably supported by suitable screw threads; a suitable ball race with bearing balls 19 arranged in the outer end of the spindle 8; a governor stem 16, conical at its inner end to fit the said ball bearing; a

suitable oil packing 20—21 around the said stem; a spring 23 around the said stem; and a collar 16′ on the stem for receiving the thrust of the said spring for holding it in yielding contact with the ball bearing, all coacting substantially as described and for the purpose specified.

3. In a governor mechanism, the combination of a revoluble shell 4 suitably secured to the end of the engine shaft; governor weights within the said shell having suitable knife edge projections; bearings within the shell to receive the said knife edges; ball bearings in suitable pockets at the inner ends of said weights; an internal connection spindle 8 with a collar 9 thereon for receiving the force of the said governor weights; an external adjustable spring connecting sleeve 7; a coiled tension spring fitting in suitable screw thread recesses between the said sleeve and internal spring connection; a collar 14 on the outer end of the said shell 4 within which the said sleeve 7 is adjustably supported by suitable screw threads; a suitable ball race with bearing balls 19 arranged in the outer end of the spindle 8; and a governor stem 16, conical at its inner end to fit the said ball bearing, with means for holding it yieldingly against said bearing, all coacting substantially as described and for the purpose specified.

4. In a governor mechanism, the combination of a revoluble shell 4 suitably secured to the end of the engine shaft; governor weights within the said shell; an internal spring connection spindle 8 with a collar 9 thereon for receiving the force of the said governor weights; an external adjustable spring connecting sleeve 7; a coiled tension spring fitting in suitable screw thread recesses between the said sleeve and internal spring connection; a collar 14 on the outer end of said shell 4 within which the said sleeve 7 is adjustably supported; a suitable ball race with bearing balls 19 arranged in the outer end of the spindle 8; and a governor stem 16, conical at its inner end to fit the said ball bearing, with means for holding it yieldingly against said bearing, all coacting substantially as described and for the purpose specified.

5. In a governor mechanism, the combination of a revoluble shell 4 suitably secured to the end of the engine shaft; governor weights within the said shell; an internal spring connection spindle 8 with a collar 9 thereon for receiving the force of the said governor weights; an external adjustable spring connecting sleeve 7; a coiled tension spring fitting in suitable screw thread recesses between the said sleeve and internal spring connection; a collar 14 on the outer end of the said shell 4 within which the said sleeve 7 is adjustably supported; a suitable thrust bearing at the outer end of the spindle 8; a governor stem fitting against said bearing, with means for holding it yieldingly against said bearing, all coacting substantially as described and for the purpose specified.

6. In a governor mechanism, the combination of a suitable shell; governor weights within the same; an axially-arranged movable member on which the weights act; a thrust ball bearing at the outer end of said axially-arranged member; and a stem with means for urging it yieldingly against the said ball bearing, coacting for the purpose specified.

7. In a governor mechanism, the combination of a suitable shell; governor weights within the same; an axially-arranged movable member on which the weights act; a thrust bearing at the outer end of said axially-arranged member; and a stem with means for urging it yieldingly against the said bearing, coacting for the purpose specified.

In witness whereof, I have hereunto set my hand and seal in the presence of two witnesses.

CHARLES W. DAKE. [L. S.]

Witnesses:
JESSE N. ELLSWORTH,
BERTHA M. WEBSTER.