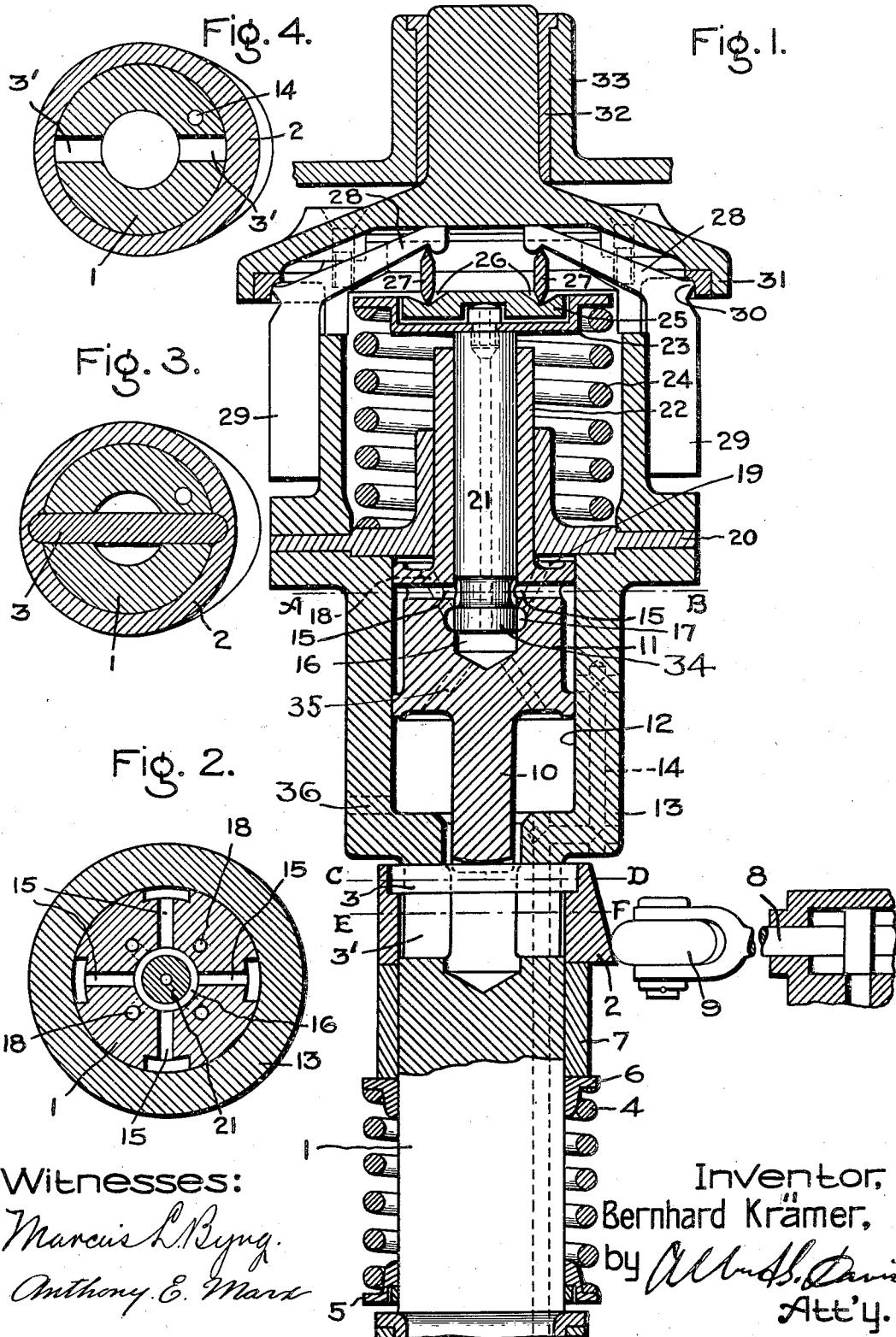


B. KRÄMER.
CENTRIFUGAL GOVERNOR.
APPLICATION FILED DEC. 27, 1911.

1,130,177.

Patented Mar. 2, 1915.



Witnesses:

Marcus L. Byng.

Anthony E. Marx

Inventor,

Bernhard Krämer,

by *Alfred S. Davis*
Att'y.

UNITED STATES PATENT OFFICE.

BERNHARD KRÄMER, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL GOVERNOR.

1,130,177.

Specification of Letters Patent.

Patented Mar. 2, 1915.

Application filed December 27, 1911. Serial No. 668,141.

To all whom it may concern:

Be it known that I, BERNHARD KRÄMER, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Centrifugal Governors, of which the following is a specification.

This invention relates to centrifugal governors for motive power engines, and its object is to provide a compact and effective piece of apparatus in which the motor for effecting the shifting of the valve mechanism is contained in and rotates with the spindle of the governor.

The invention particularly relates to those engines in which the valve or valves is or are actuated by a rod or stem which receives its motion from a rotating cam, the governor acting to shift said cam axially in order to bring portions of different radii into position to operate said stem.

The various novel points of construction and the relative arrangement of the parts will appear from the following detailed description and claims, reference being had to the accompanying drawing in which—

Figure 1 is a longitudinal section of the entire governor, and Figs. 2, 3 and 4 are respectively cross sections taken respectively at the lines A—B, C—D, E—F.

The shaft 1 is journaled in suitable bearings and is operatively connected with the engine so as to be rotated in synchronism therewith. An annular cam 2 surrounds the shaft and is slidable longitudinally thereon, but is maintained in rotative connection therewith by a cross bar 3 which passes through a diametrical slot 3' in said shaft and engages at each end with said cam. The cam is biased upwardly toward its highest position, as shown in Fig. 1, by a helical spring 4 encircling the spindle and abutting at each end against collars 5 6, the former fixed to the spindle and the latter loose thereon. A short sleeve 7 is preferably interposed between the collar 6 and the cam, so that by using sleeves of different length the tension of the spring can be altered. The stem 8 by means of which movement is imparted to the valve of the engine is preferably provided with an anti-friction roller 9 bearing against the periphery of the cam. By sliding the cam longitudinally along the shaft portions of different radii can be made to act upon the stem and thus impart

strokes of different lengths to said stem, with corresponding variations in the opening of the valve, to meet different conditions of load.

Bearing upon the cross bar 3 is a plunger 10 located axially in the shaft and extending downwardly from a piston 11 working in a cylindrical recess 12 formed in an enlargement 13 of the shaft. This piston constitutes the motor which actuates the cam. Motive fluid, preferably oil under pressure, is fed through a longitudinal duct 14 in the shaft, shown in dotted lines Fig. 1, to longitudinal grooves in the outer surface of the piston and thence through radial ducts 15 to a valve chest 16 formed centrally in the piston. In the wall of the valve chest is an annular groove 17 which communicates by ports 18 with a chamber 19 formed between the upper end of the piston and an annular head 20 at the upper end of the cylindrical recess 12. A valve 21 slides centrally in the valve chest and in a tubular extension 22 of the piston and controls the radial ducts 15 and the ports 18. The valve is secured to a spring plate 23 which rests upon the upper end of a compression spring 24 whose lower end is supported upon the head 20. Superimposed upon the spring plate is a disk 25 preferably of hardened steel in whose upper face are notches 26 to receive the upright thrust rods 27 having knife edges at each end. The upper ends of these rods are engaged by arms 28 extending inwardly from the centrifugal weights 29 which are fulcrumed on knife edges 30 having bearings in a casing 31 which stands upon the annular head 20 and incloses the spring 24. The upper end of the casing has a journal 32 which is rotatably mounted in a bolster bearing 33 axially in line with the bearings of the shaft.

The operation is as follows:—The cam is shown in the position which it occupies at full load. If now the load falls off, the number of revolutions increases, and the weights fly outwardly, causing a downward movement of the valve. This opens the ports 18 and the motive fluid is admitted to the chamber 19, forcing down the piston and sliding the cam downward to bring a portion of smaller radius in line with the valve stem 8, so that the engine valve receives a shorter stroke and a lessened opening. The downward movement of the pis-

ton carries the ports 18 down opposite the solid portion 34 of the valve 21, so that the pressure of the motive fluid is cut off and the piston is held in its new position; when the motive fluid is, as I prefer, oil or other liquid under pressure, the parts of the motor are locked in their adjusted position until that is changed by the action of the valve. If, now, the load increases again, the engine slows down, and the weights drop, allowing the valve 21 to rise sufficiently to put the ports 18 into communication with the lower end of the valve chest so that the fluid contained in the chamber 19 can escape through the ports into said lower part of the valve chest and thence through passages 35 to the cylinder below the piston, from which it flows off through an exhaust port 36. The spring 4 now raises the cam toward or to its former position in which it imparts a longer stroke to the stem 8 and gives a greater opening to the engine valve.

In accordance with the provisions of the patent statutes, I have described the principle of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. A governor comprising a weight the position of which changes with variations of speed, a rotating shaft, a fluid motor contained within the shaft and rotating therewith, a valve for the motor controlled by the weight, and a cam movable on the shaft to alter its stroke, such motion being controlled by the fluid motor.

2. A centrifugal governor comprising a shaft, a cam rotated by and longitudinally movable on the shaft, the stroke of the cam varying in accordance with its position, and means for controlling the position of the cam; such means consisting of a fluid motor contained in and rotating with the shaft, a weight the position of which changes with changes of speed, and a connection from the weight controlling the motor.

3. A centrifugal governor comprising a shaft and centrifugal weights, the shaft containing a cylinder and piston, means for supplying fluid pressure to the piston, a valve controlling the pressure and positioned by the weights, and a cam on the shaft moved by the piston.

4. Governing apparatus for prime motors, comprising a rotating shaft, a cam rotated by and movable along the shaft, the movement of the cam along the shaft altering its action, a fluid motor carried by and rotating with the shaft which moves the

cam against a spring, and a centrifugal device controlling the fluid motor.

5. Governing apparatus for a prime motor, comprising a rotating shaft, a cam rotated by and movable along the shaft, a liquid motor carried by the shaft which moves the cam against a spring, the movement of the cam along the shaft altering its action; a valve and piston in the liquid motor; and a centrifugal device controlling the positions of the valve and piston.

6. Governing apparatus for a prime motor, comprising a rotating shaft containing a liquid motor having a controlling valve; a cam rotated by the shaft and movable longitudinally thereon by the liquid motor; and a centrifugal device controlling the valve of the liquid motor.

7. In a governor, a rotating shaft, a cam rotated thereby and longitudinally movable thereon, the stroke of the cam changing in accordance with its change of longitudinal position; a liquid motor contained within the shaft and rotating therewith, the motor controlling the position of the cam; and a centrifugal device bringing the motor into action, or cutting it out, at desired times.

8. A centrifugal governor comprising a shaft containing a cylindrical recess, a piston therein, a cam sliding on the shaft and actuated by the piston, means for supplying fluid pressure to the piston, a valve controlling the fluid pressure, and a centrifugal device determining the position of the valve.

9. A centrifugal governor comprising a shaft containing a cylindrical recess, a piston therein, a valve for the piston, a spring for the valve, weights rotated by the shaft positioning the valve against the pressure of the spring, a cam on the shaft actuated by the piston, the stroke of the cam changing with its change of position, and a spring opposing the piston.

10. Governing apparatus for a prime motor, comprising a rotating shaft and weights, a cam movable longitudinally on said shaft, a liquid motor controlling the cam, the liquid motor having a piston, a valve positioned by the weights and regulating the motion of the piston against a spring, and ports controlled by the valve and piston; the movement of the valve causing the piston to close the ports which the valve opens, thus tending to limit its own motion and locking it except when the valve is actuated.

In witness whereof, I have hereunto set my hand.

BERNHARD KRÄMER.

Witnesses:

ERICH ÜBERLÉC,
GUSTAV HÜLBROCK.