

No. 684,927.

Patented Oct. 22, 1901.

S. Z. DE FERRANTI.  
GOVERNOR GEAR FOR STEAM ENGINES.

(Application filed Mar. 2, 1901.)

(No Model.)

6 Sheets—Sheet 1.

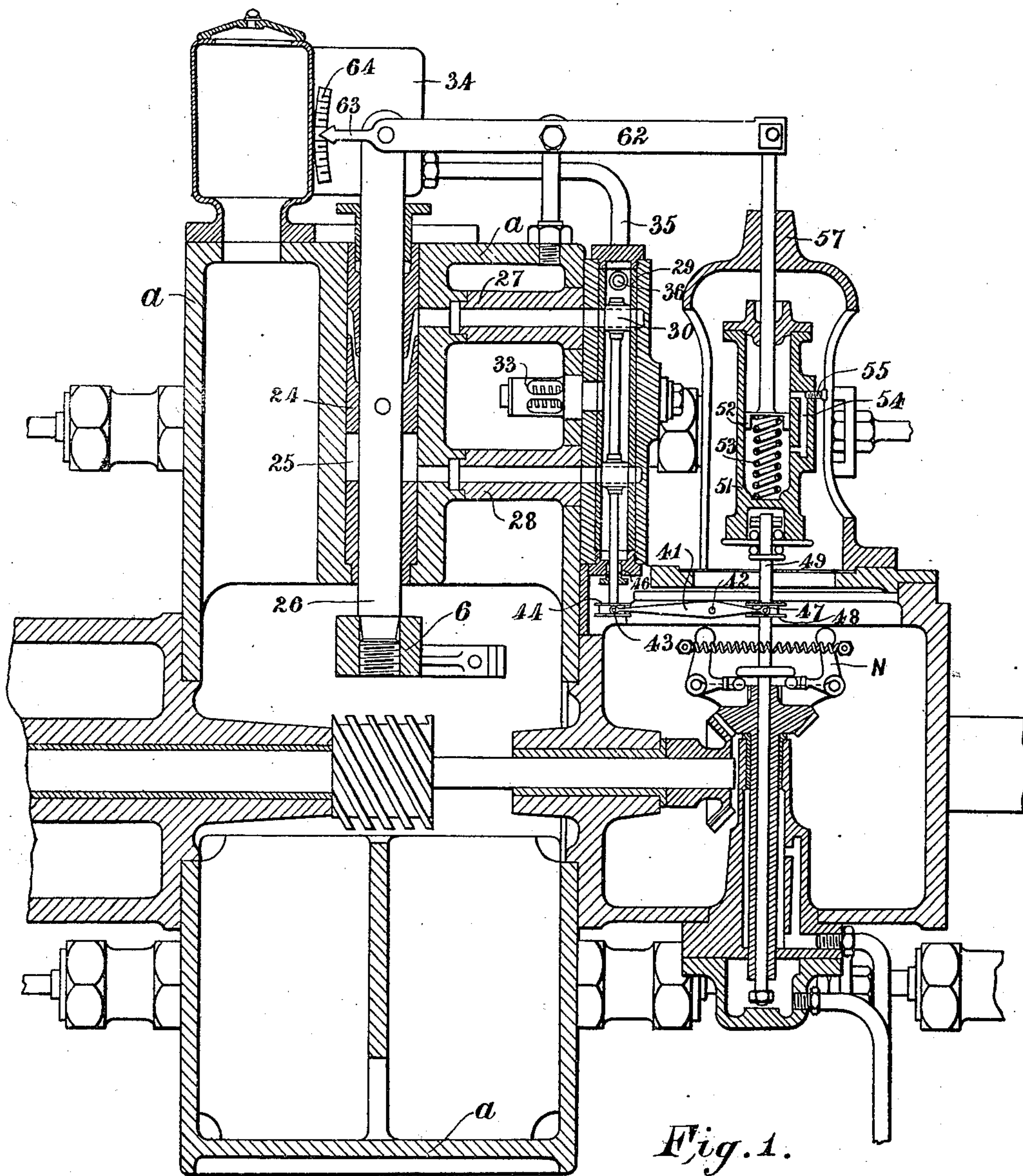


Fig. 1.

WITNESSES:  
Isabella Valaron  
Barbara Lambis

INVENTOR.  
Sebastian Ziani de Ferranti  
BY  
Richard R.  
ATTORNEYS.

No. 684,927.

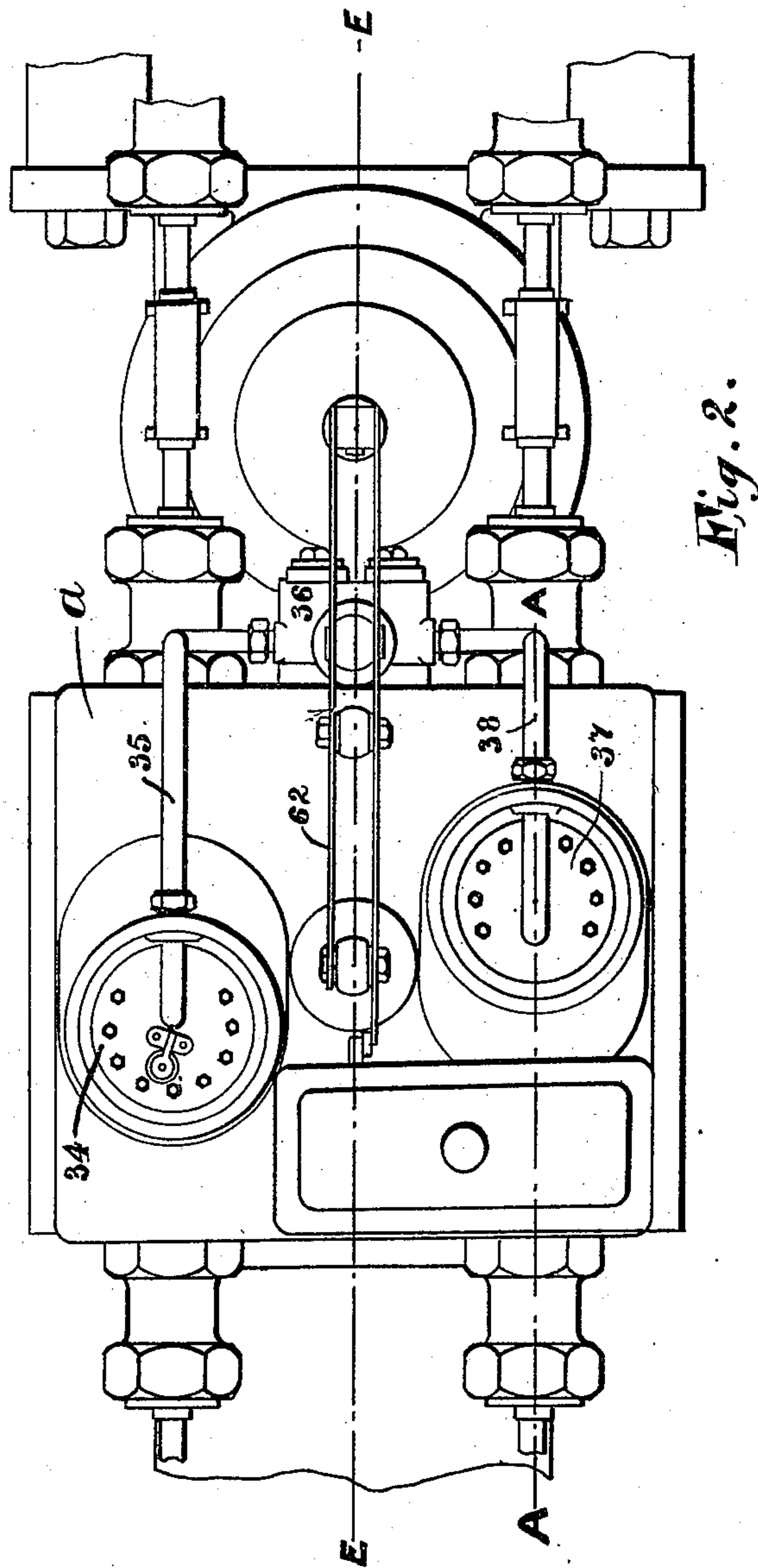
Patented Oct. 22, 1901.

S. Z. DE FERRANTI.  
GOVERNOR GEAR FOR STEAM ENGINES.

(Application filed Mar. 2, 1901.)

(No Model.)

6 Sheets—Sheet 2.



WITNESSES:  
Isabella Waldron  
Barbara Lambie

INVENTOR.  
Sebastian Ziani de Ferranti  
BY  
Richardson

ATTORNEYS.



No. 684,927.

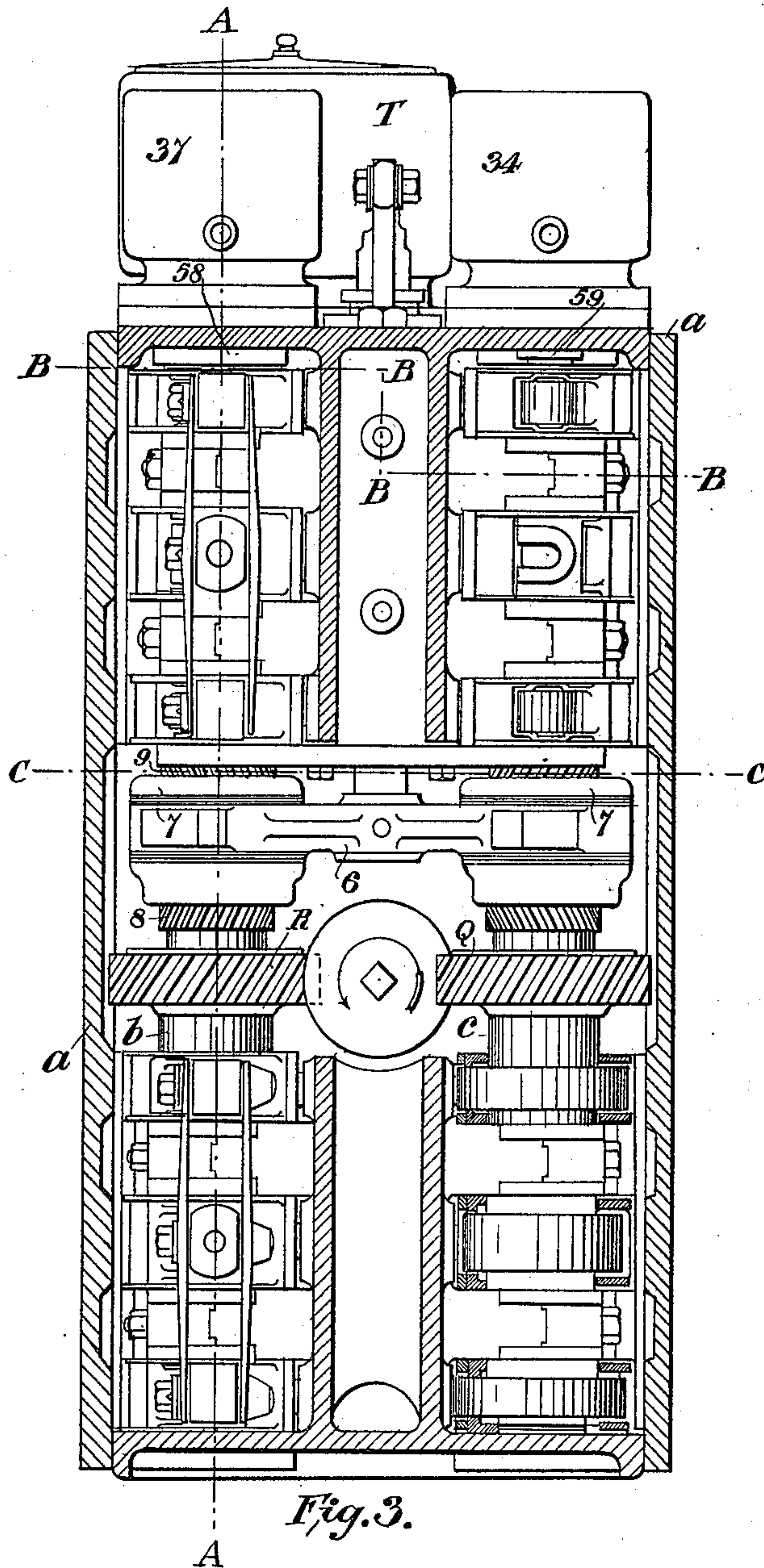
Patented Oct. 22, 1901.

S. Z. DE FERRANTI.  
GOVERNOR GEAR FOR STEAM ENGINES.

(Application filed Mar. 2, 1901.)

(No Model.)

6 Sheets—Sheet 3.



WITNESSES  
Ella L. Giles  
O. J. ...

INVENTOR  
Sebastian Ziani de Ferranti  
BY  
Richard ...  
ATTORNEYS

No. 684,927.

Patented Oct. 22, 1901.

S. Z. DE FERRANTI.  
GOVERNOR GEAR FOR STEAM ENGINES.

(Application filed Mar. 2, 1901.)

(No Model.)

6 Sheets—Sheet 4.

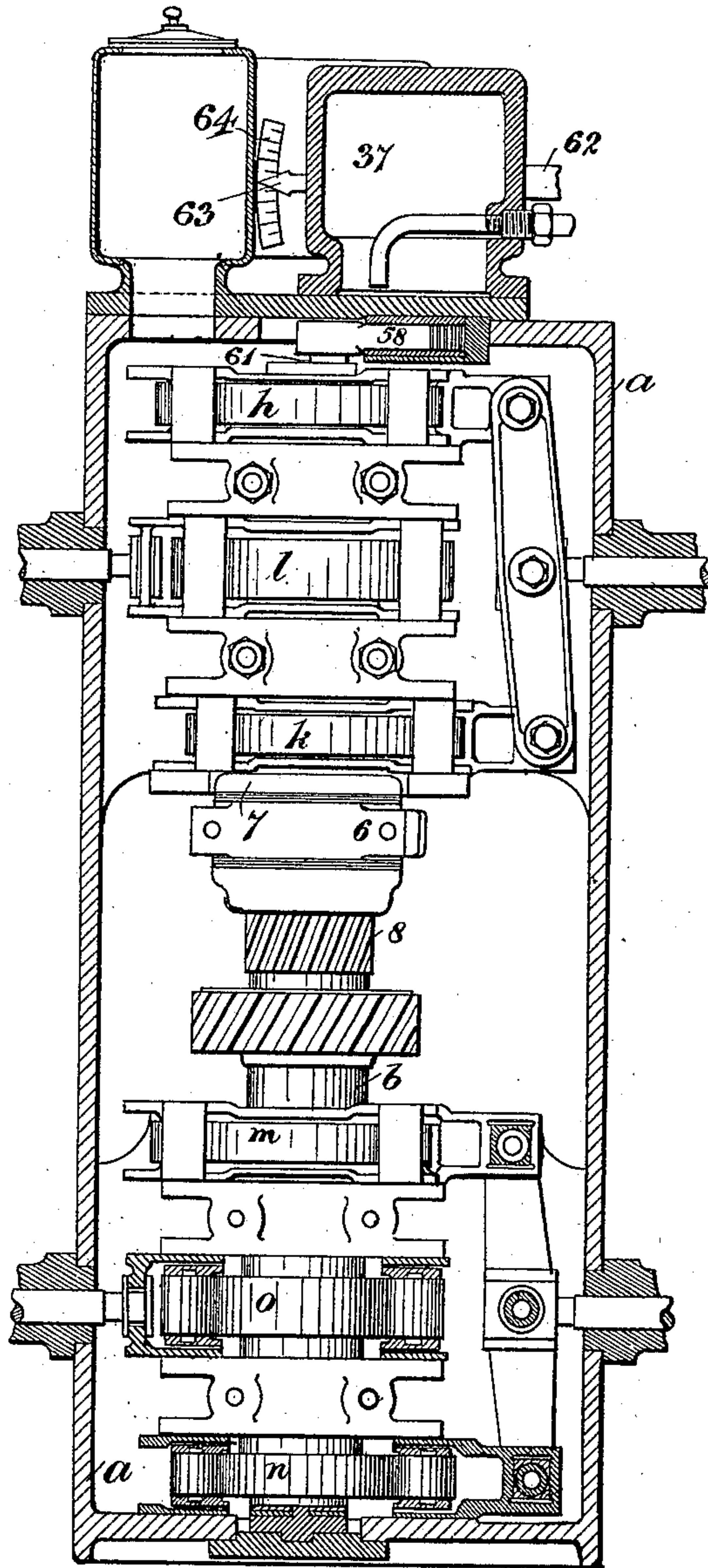


Fig. 4.

WITNESSES:  
*Ella L. Giles*  
*Attorney*

INVENTOR  
*Sebastian J. de Ferranti*  
BY  
*Richard S. [Signature]*  
ATTORNEYS

No. 684,927.

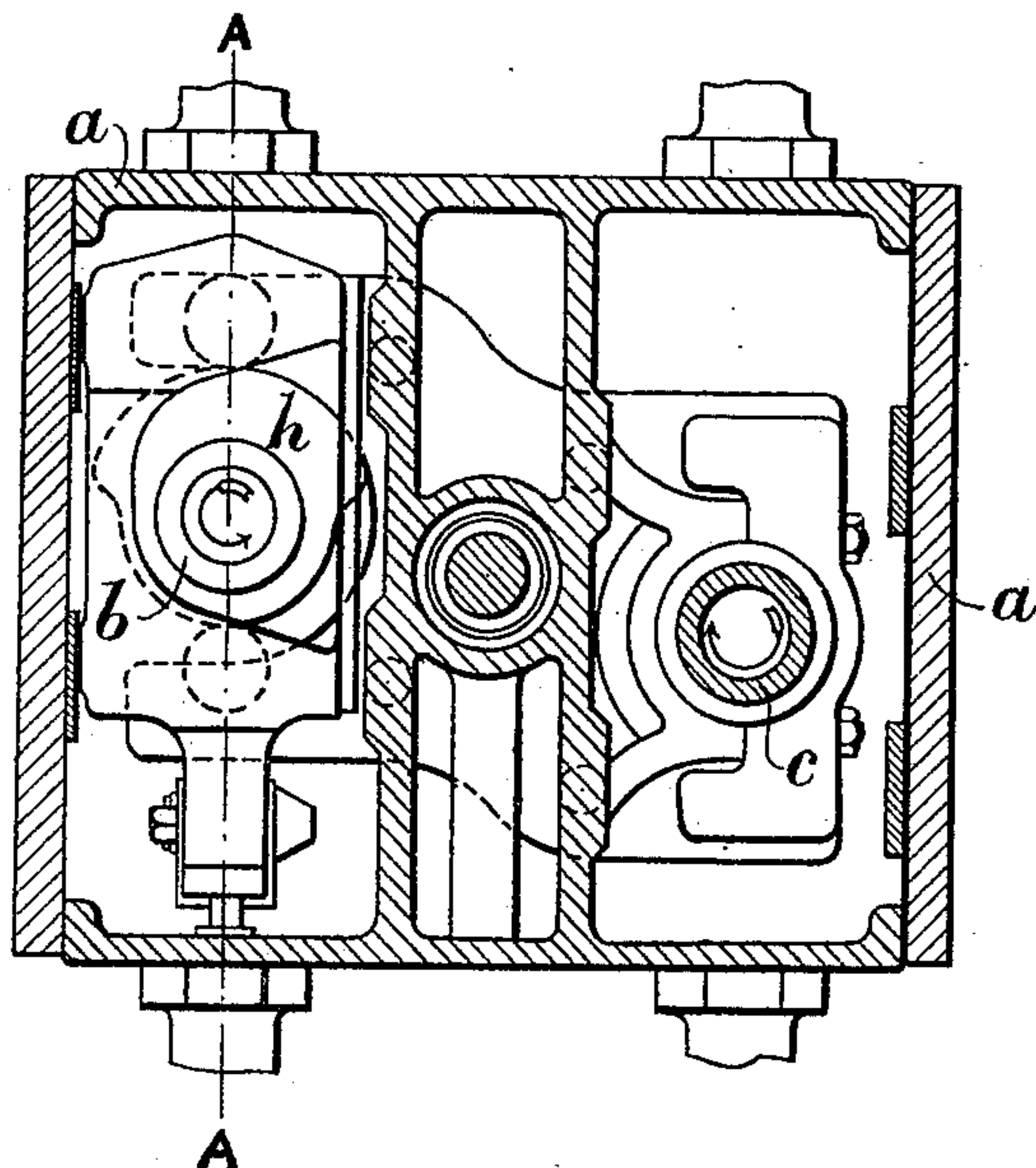
Patented Oct. 22, 1901.

S. Z. DE FERRANTI.  
GOVERNOR GEAR FOR STEAM ENGINES.

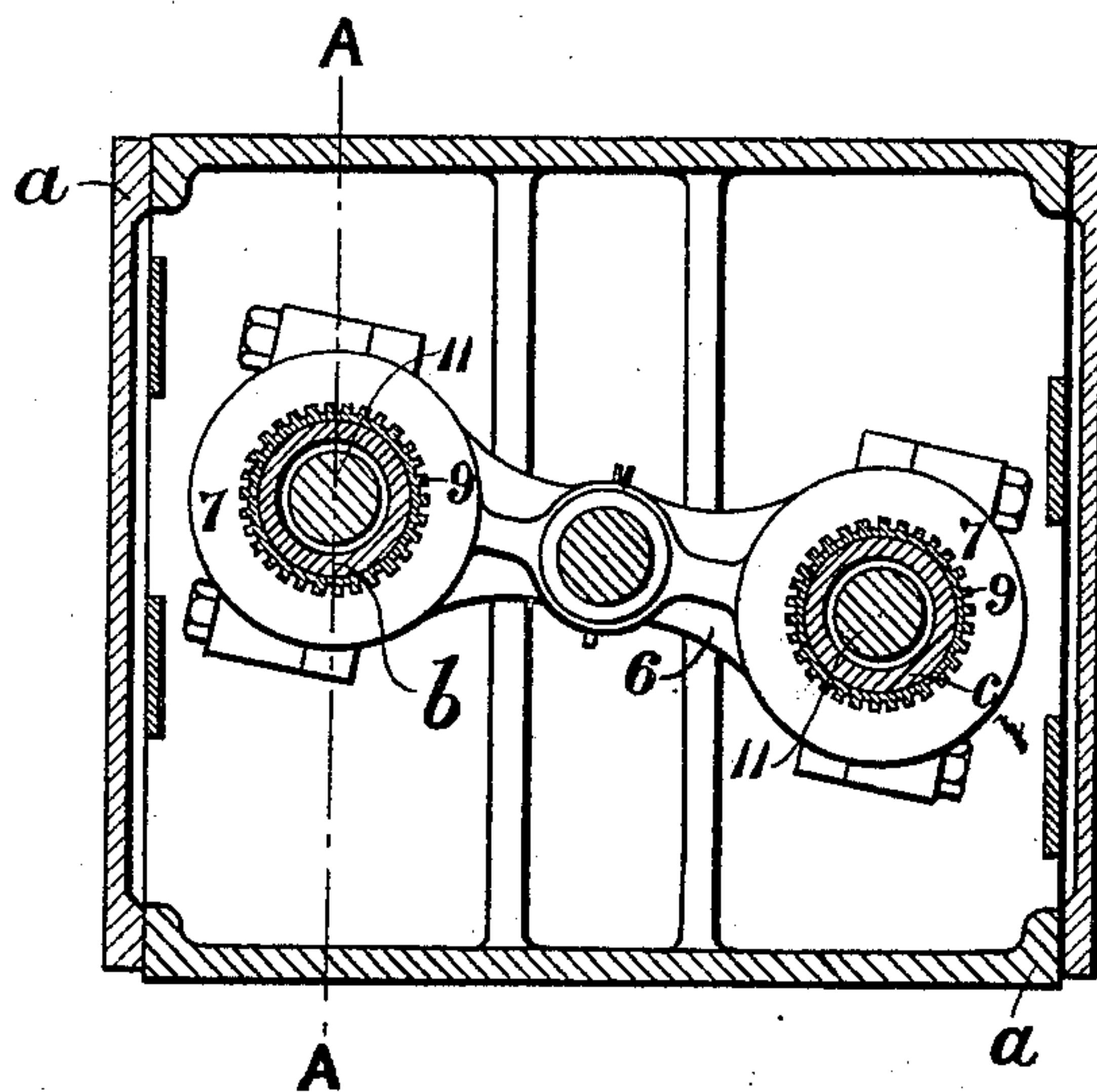
(Application filed Mar. 2, 1901.)

(No Model.)

6 Sheets—Sheet 5.



*Fig. 5.*



*Fig. 6.*

WITNESSES:  
*Ellis L. Giles*  
*Oliver*

INVENTOR  
*Sebastian Zani de Ferranti*  
BY  
*Richardson*  
ATTORNEYS



No. 684,927.

Patented Oct. 22, 1901.

S. Z. DE FERRANTI.  
GOVERNOR GEAR FOR STEAM ENGINES.

(Application filed Mar. 2, 1901.)

(No Model.)

6 Sheets—Sheet 6.

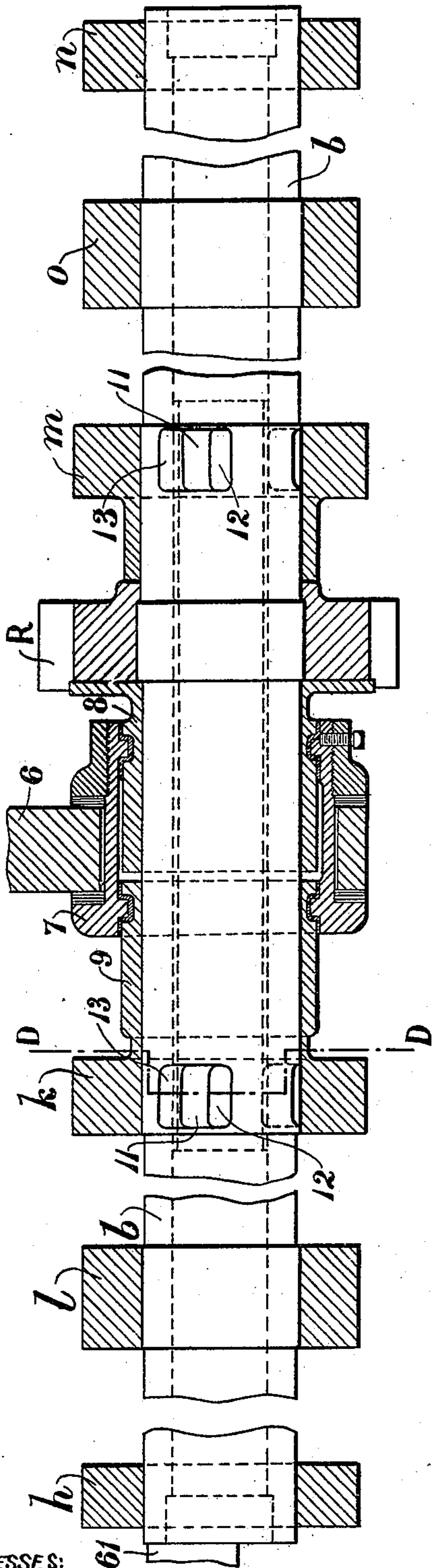


Fig. 7.

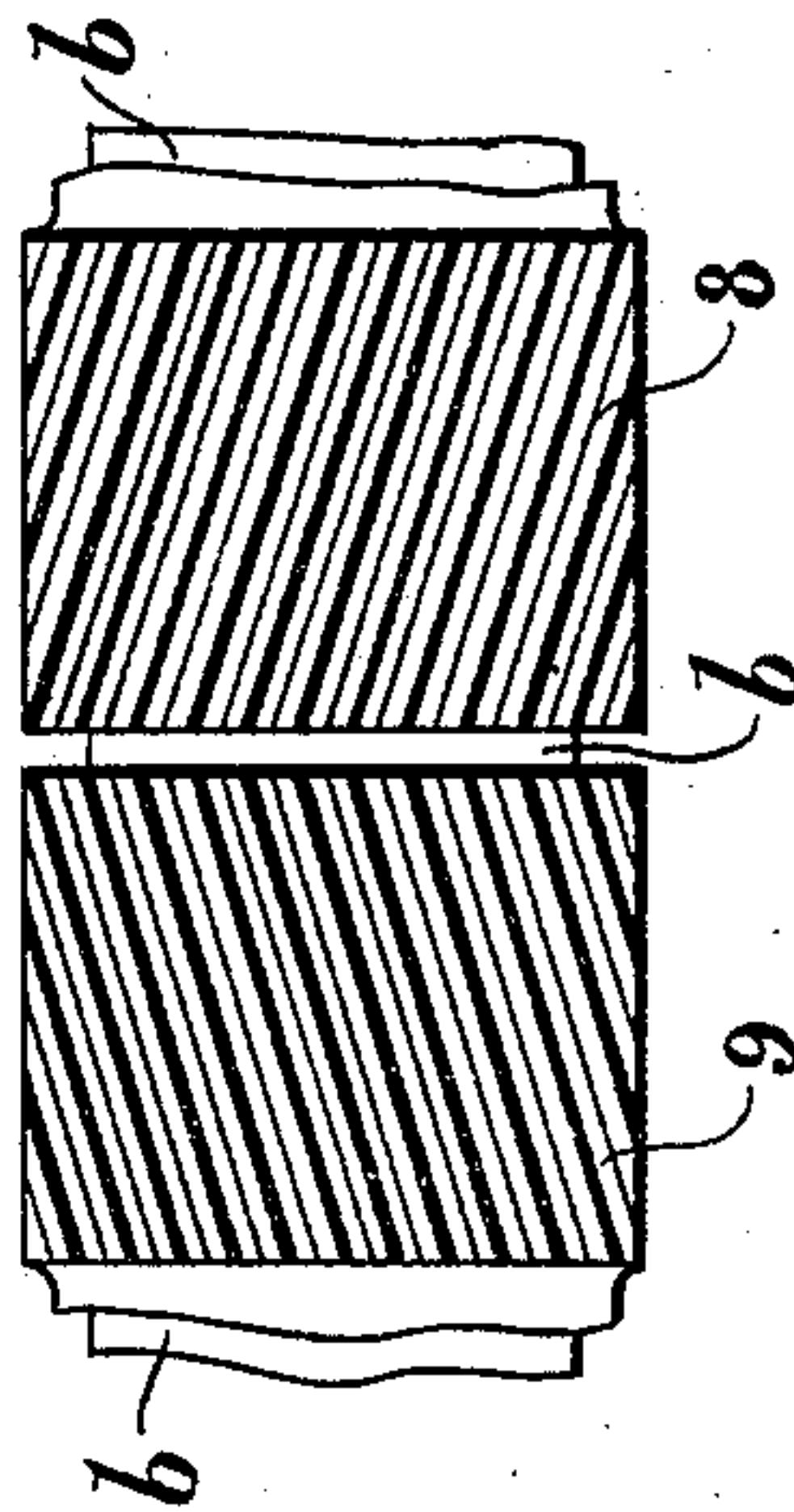


Fig. 8.

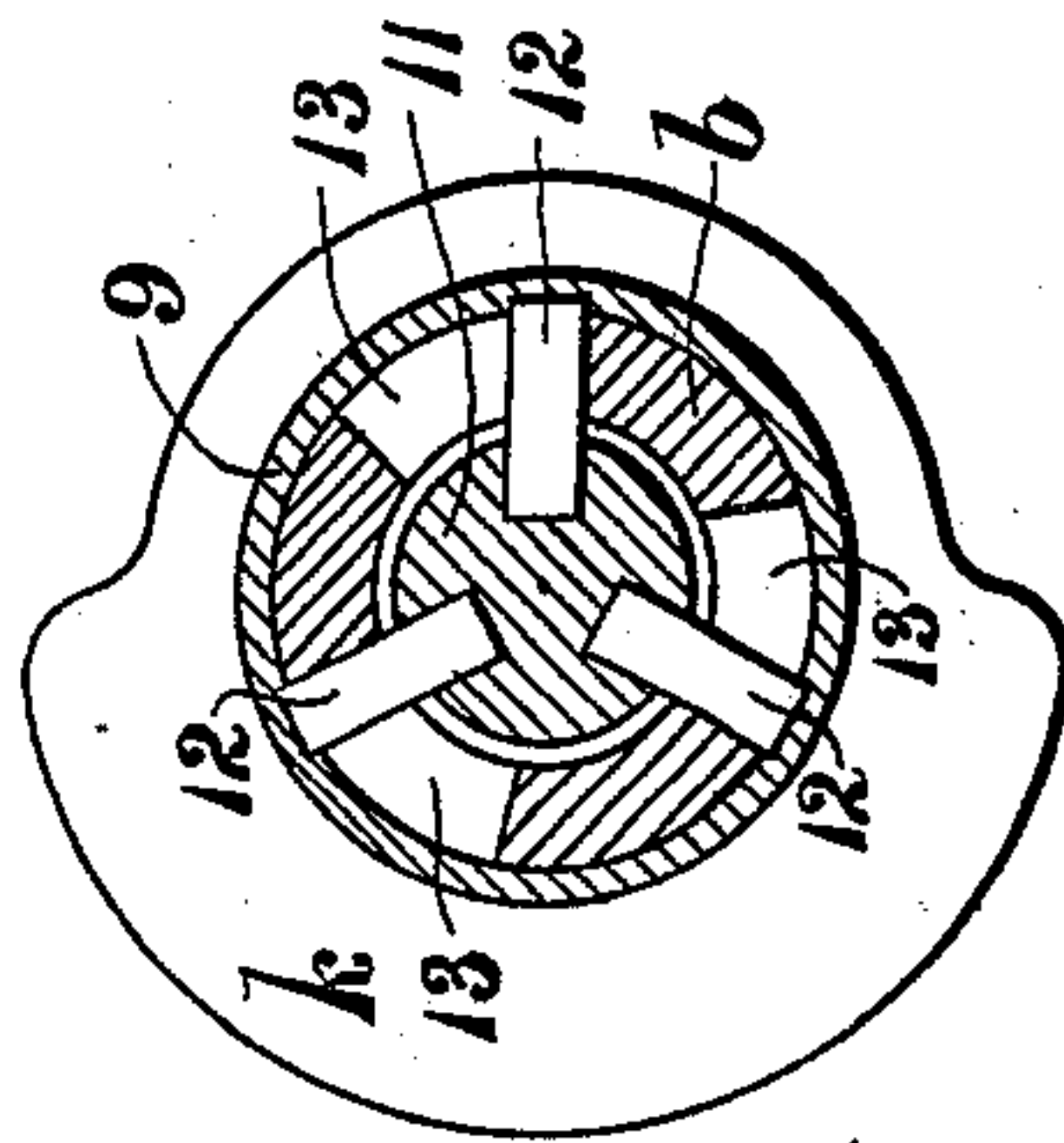


Fig. 9.

WITNESSES:  
Ella L. Giles  
O. J. ...

INVENTOR  
Sebastian J. de Ferranti  
BY  
Richard ...  
ATTORNEYS



# UNITED STATES PATENT OFFICE.

SEBASTIAN ZIANI DE FERRANTI, OF HOLLINGWOOD, ENGLAND.

## GOVERNOR-GEAR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 684,927, dated October 22, 1901.

Application filed March 2, 1901. Serial No. 49,559. (No model.)

*To all whom it may concern:*

Be it known that I, SEBASTIAN ZIANI DE FERRANTI, engineer, a subject of the King of Great Britain and Ireland, residing at Hollingwood, in the county of Lancaster, England, have invented certain new and useful Improvements in Governing-Gears for Steam-Engines, (for which I have made application for patent in Great Britain, No. 3,536, dated the 22d of February, 1900,) of which the following is a specification.

My invention relates principally to the governing of high-speed steam-engines having a valve-gear like that described in the specification of my application Serial No. 25,428; and my object is to govern in an effective manner by causing relay mechanism controlled by the governor to alter the angular position of the cams which effect the cutting off of the steam.

My invention consists in certain novel devices and combinations, as will be hereinafter fully described, and pointed out in the claims.

Referring now to the accompanying drawings, which illustrate one form of my invention as applied to the valve-gear of a compound vertical steam-engine such as that described in the specification of my application Serial No. 25,428, Figure 1 is a sectional elevation of the valve-casing, showing the relay cylinder and governing-gear, the section being taken on the line E E of Fig. 2. Fig. 2 is a plan of the valve-casing and governing-gear. Fig. 3 is a cross-section of the valve-casing. Fig. 4 is a section of the valve-casing, the section being taken on the lines A A of Figs. 2, 3, 5, and 6. Fig. 5 is a sectional plan of the same, the section being taken on the line B B B B of Fig. 3. Fig. 6 is another sectional plan of the same, the section being taken on the line C C of Fig. 3. Fig. 7 shows one of the cam-shafts with the cams, screwed sleeves, sliding nut, and cross-piece in section. Fig. 8 shows the screwed sleeves for actuating the valve-closing cams. Fig. 9 is a section taken on the line D D of Fig. 7 and illustrates the method of rotating the valve-closing cams on the cam-shaft.

The valve-casing *a* is adapted to be placed between the high-pressure and the low-pressure cylinders and is full of oil, which is supplied from the reservoir T. Inside the cas-

ing *a* are two cam-shafts *b* and *c*, which are rotated by the crank-shaft by means of suitable gearing. The cam-shaft *b* carries at its upper part the fixed cams *h* and *l* and the moving cam *k* and at its lower part the moving cam *m* and the fixed cams *n* and *o*. The cam-shaft *c* is similarly provided with cams. The moving cams *n* and *o* on the shaft *b* and the corresponding moving cams on the cam-shaft *c* are adapted to effect the cutting off of the steam from both ends of the two cylinders of the engines, as described in the specification of my application Serial No. 25,428.

Between the cam-shafts I provide a cross-piece 6, which is adapted to be moved up and down by a relay controlled by a governor. This cross-piece carries a nut 7 at each end, the nuts inclosing the cam-shafts *b* and *c*. Each nut is able to rotate in the end of the cross-piece and is screwed internally with two very quick threads, one right hand and the other left hand, which engage, respectively, with two similar threads cut on the outside of two sleeves 8 and 9, Figs. 3, 4, 6, 7, and 8. The sleeve 8 is rigidly attached to the cam-shaft, and therefore revolves with it. The other sleeve 9 is formed in one piece with the moving cam *k*. Therefore if the nut 7 be moved parallel to the axis of the shaft it will rotate a certain amount relatively to the shaft in one direction and a certain amount relatively to the moving cam *k* in the other direction. The angular displacement of the cam *k* relatively to the shaft will therefore equal the sum of these amounts. The shaft *b* is made hollow and incloses an inner shaft 11, which is keyed to the moving cams *k* and *m* by the keys 12, so that the two moving cams and the inner shaft rotate together. The keys 12 work in holes 13 in the shaft *b*, which allow the inner shaft to rotate through a certain angle relatively to the cam-shaft *b*. Any movement of the cross-piece 6 parallel to the axes of the shafts therefore causes the moving cams *k* and *m* to rotate relatively to the cam-shaft, and this will happen whether the cam-shaft be at rest or in motion.

The cross-piece 6 is operated by means of a piston 24, Fig. 1, working in an oil relay-cylinder 25 and connected to the cross-piece by the piston-rod 26. The oil-cylinder re-



ceives oil through two pipes 27 and 28, having ports 31 and 32 in the oil valve-cylinder 29. The ports 31 and 32 can be placed either in communication with the ends of this valve-cylinder or with the spring-controlled exhaust-valve 33 by means of the piston-valve 30. The top end of the cylinder 29 communicates with the oil pressure-reservoir 34 by means of the tube 35, which enters the valve-cylinder at 36, Figs. 1 and 2. The lower end of the oil valve-cylinder communicates similarly with the oil pressure-reservoir 37 by means of the tube 38, which cannot be seen in Fig. 1, but is seen in Fig. 2. The governor N is driven from the engine crank-shaft by suitable gearing, and the piston-valve 30 is controlled by the governor by means of the lever 41, pivoted at 42. This lever has at one end pins 43, which work between collars 44 on the piston-valve spindle 45, which passes through a stuffing-box 46 at the bottom of the valve-cylinder. The other end of the lever 41 is provided with pins 47, which work between collars 48 on the governor-spindle 49. The governor-spindle carries a dash-pot 51, containing a piston 52. The piston 52 has a rod 52<sup>a</sup>, which couples it to the lever 62, connected at the other end to the piston-rod 26. The portion of the dash-pot below the piston 53 contains a spring 53, and this portion is joined to the part above the piston by the passage 54, which can be more or less closed by the regulating-screw 55. The spring 53 may be dispensed with and a spring 56 applied to the governor instead, or both springs may be used. The dash-pot is preferably inclosed in the casing 57. An increase or decrease of the speed of the engine causes a rise or fall, respectively, in the governor-spindle 49, owing to the action of the governor. This causes a fall or rise in the piston-valve spindle 45 and admits oil to one or the other of the ports 31 and 32, while the other port is put in communication with the exhaust-valve 33 in a manner that is well understood. The oil-piston 24, having unequal pressures on top and bottom, therefore moves down or up and actuates the cross-piece 6, which alters the angular position of the steam-closing cams on the cam-shafts, as hereinbefore described. The pivoted lever 62 may carry a pointer 63, which traverses a scale 64. This pointer then indicates on the scale the exact cut-off at which the valves are operating. The pivoted lever is, as above described, coupled to the governor through the dash-pot, and it thus effectually prevents what is known as "hunting" by the governor by providing an additional control of the cut-off gear. The spring 53 gives a predetermined speed variation depending on the tension to which it is adjusted. This is specially useful for engines driving alternators in parallel, as it enables the governors to be adjusted so that the speed of the engine slightly falls as the load increases, and thus insures each engine taking up its share of the load. The oil pressure-reser-

voirs receive oil under a constant pressure from pumps 58 and 59, actuated by eccentric-pins 61 on the end of the cam-shafts *b* and *c*. The spring in the discharge-valve 33 limits the rate of motion of the oil-piston 24 when very great variations in the load on the engine suddenly occur.

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

1. In governing-gear for steam-engines, in combination, a governor, a piston-valve controlled by the governor, an oil relay-cylinder supplied with oil by said piston-valve, a piston working in said cylinder, a piston-rod actuated by said piston, a cam-shaft, cams rotatably carried by said shaft and means whereby the piston-rod operates to rotate said cams relatively to the cam-shaft, substantially as and for the purpose described.

2. In governing-gear for steam-engines, in combination, a governor, a piston-valve controlled by the governor, an oil valve-cylinder adapted to contain said piston-valve, an oil pressure-reservoir, means whereby the oil pressure-reservoir supplies oil to said oil valve-cylinder, an oil relay-cylinder supplied with oil by said piston-valve, a piston working in said oil relay-cylinder, a piston-rod actuated by said piston, a cam-shaft, cams rotatably carried by said shaft, means whereby the piston-rod operates to rotate said cams relatively to the cam-shaft, a scale such as 64, and a pointer such as 63 operated by the piston-rod and adapted to indicate on the scale the cut-off effected by the cams, substantially as and for the purpose described.

3. In governing-gear for steam-engines, in combination, a governor, a piston-valve controlled by the governor, an oil valve-cylinder 29 containing said piston-valve, an oil relay-cylinder such as 25 receiving oil through the said oil valve-cylinder, a piston 24 working in said oil relay-cylinder, a piston-rod 26 actuated by said piston, a cross-piece such as 6 carried by said piston-rod, cam-shafts such as *b*, *k* and *m* rotatably carried by said shafts and means whereby the aforesaid cross-piece operates to rotate said cams relatively to the cam-shafts, substantially as and for the purpose described.

4. The combination with a steam-engine having a valve-gear including cam-shafts and movable cams for effecting the cutting off of the steam, of a relay-governing gear including a piston-rod, a governor and means interposed between the latter and controlled thereby for operating the relay-gear, a pivoted lever connected at one end to said piston and a dash-pot interposed between the opposite end of the lever and the spindle of said governor.

5. The combination with a steam-engine having a valve-gear including cam-shafts, and movable cams for effecting the cutting off of the steam, of a relay-governing gear including a piston-rod, a governor and gov-



ernor-spindle, means interposed between the latter and operated therethrough for operating the relay-gear, a pivoted lever connected at one end to said lever, a dash-pot having  
5 one member connected to the opposite end of said lever, and its other member to the governor-spindle and a spring interposed between said members adapted to effect a predeter-

mined speed variation in the engine, substantially as described. 10

In witness whereof I have hereunto set my hand in presence of two witnesses.

SEBASTIAN ZIANI DE FERRANTI.

Witnesses:

ALBERT E. PARKER,  
FRANCIS J. BIGNELL.