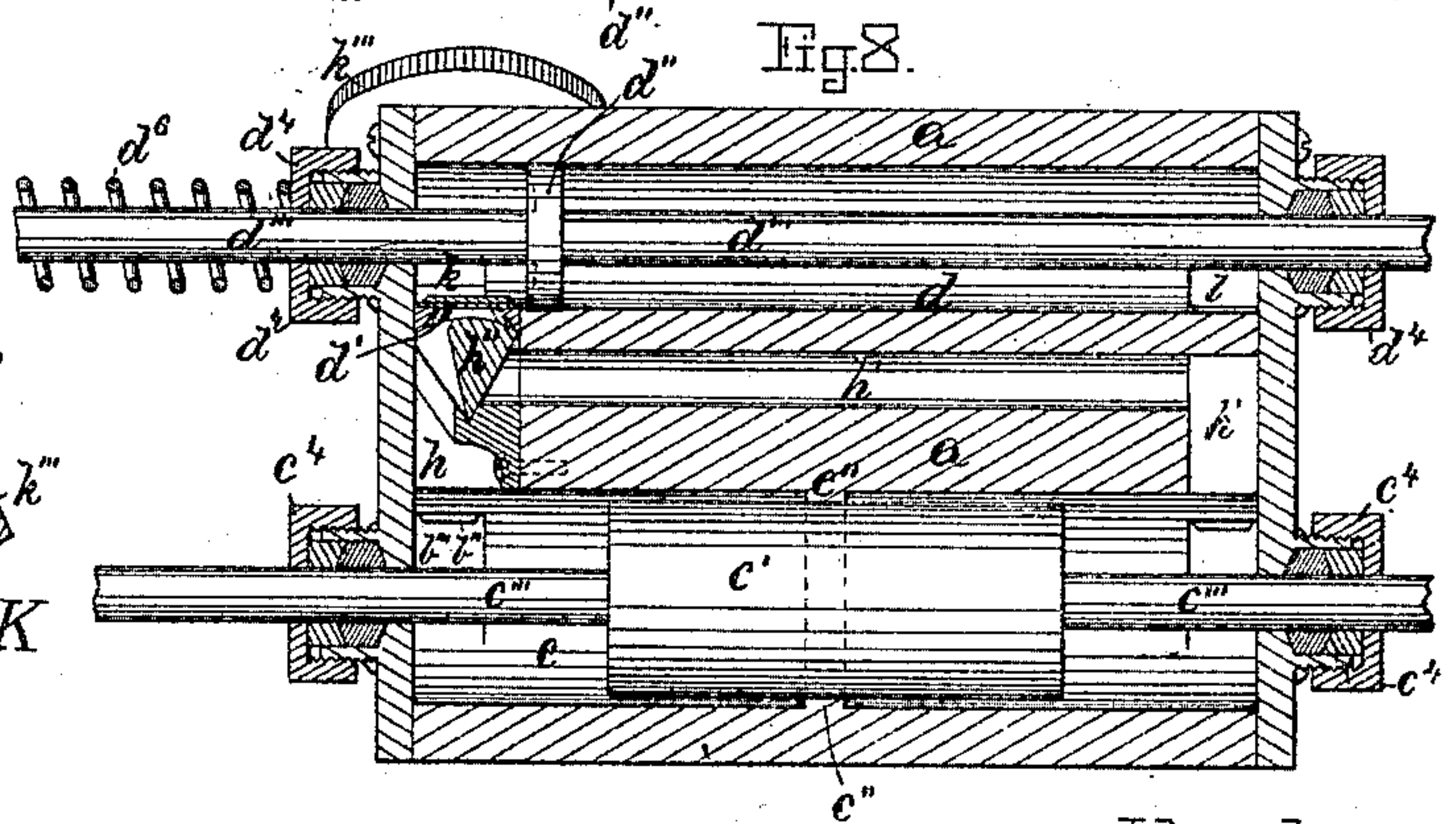
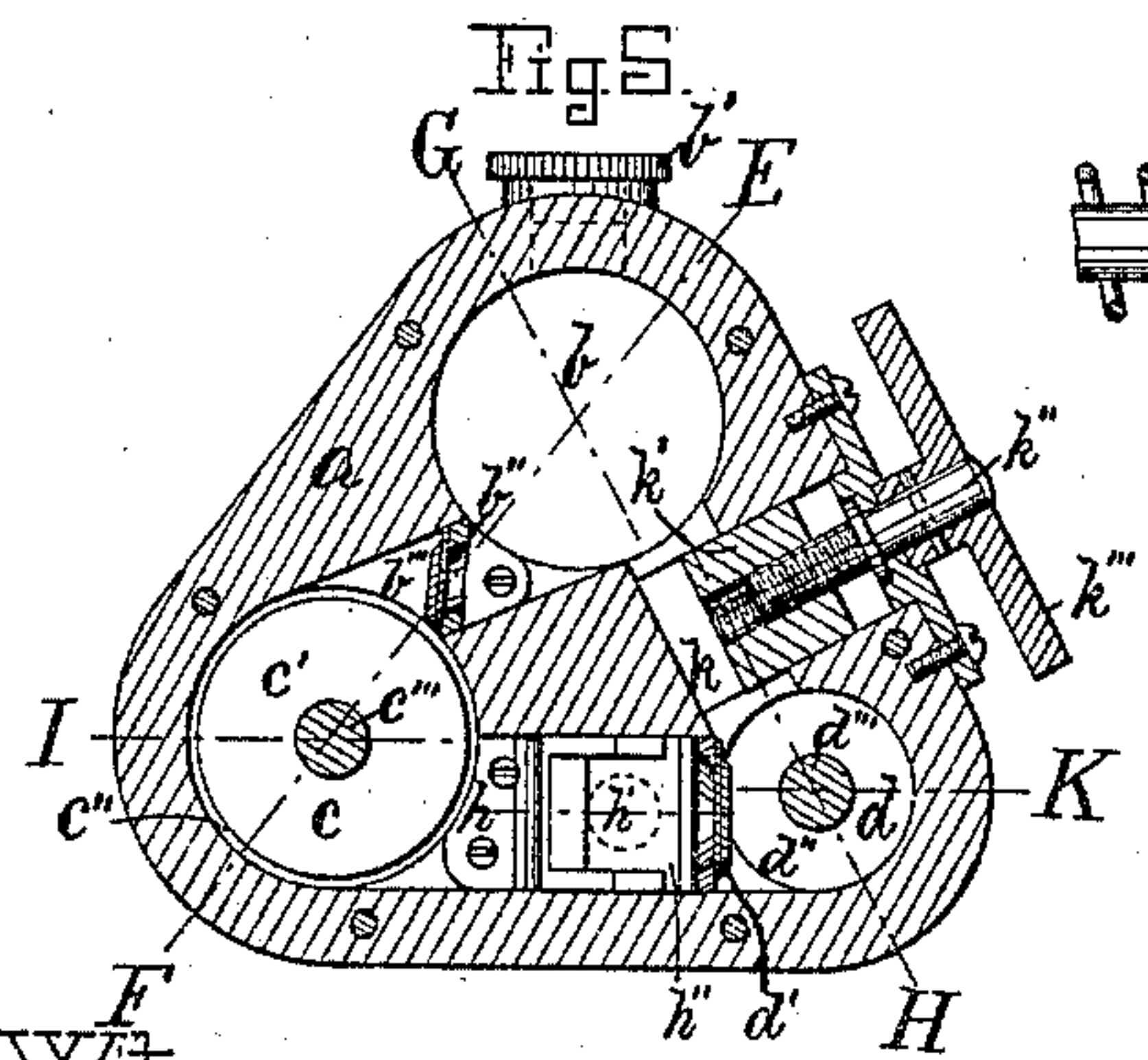
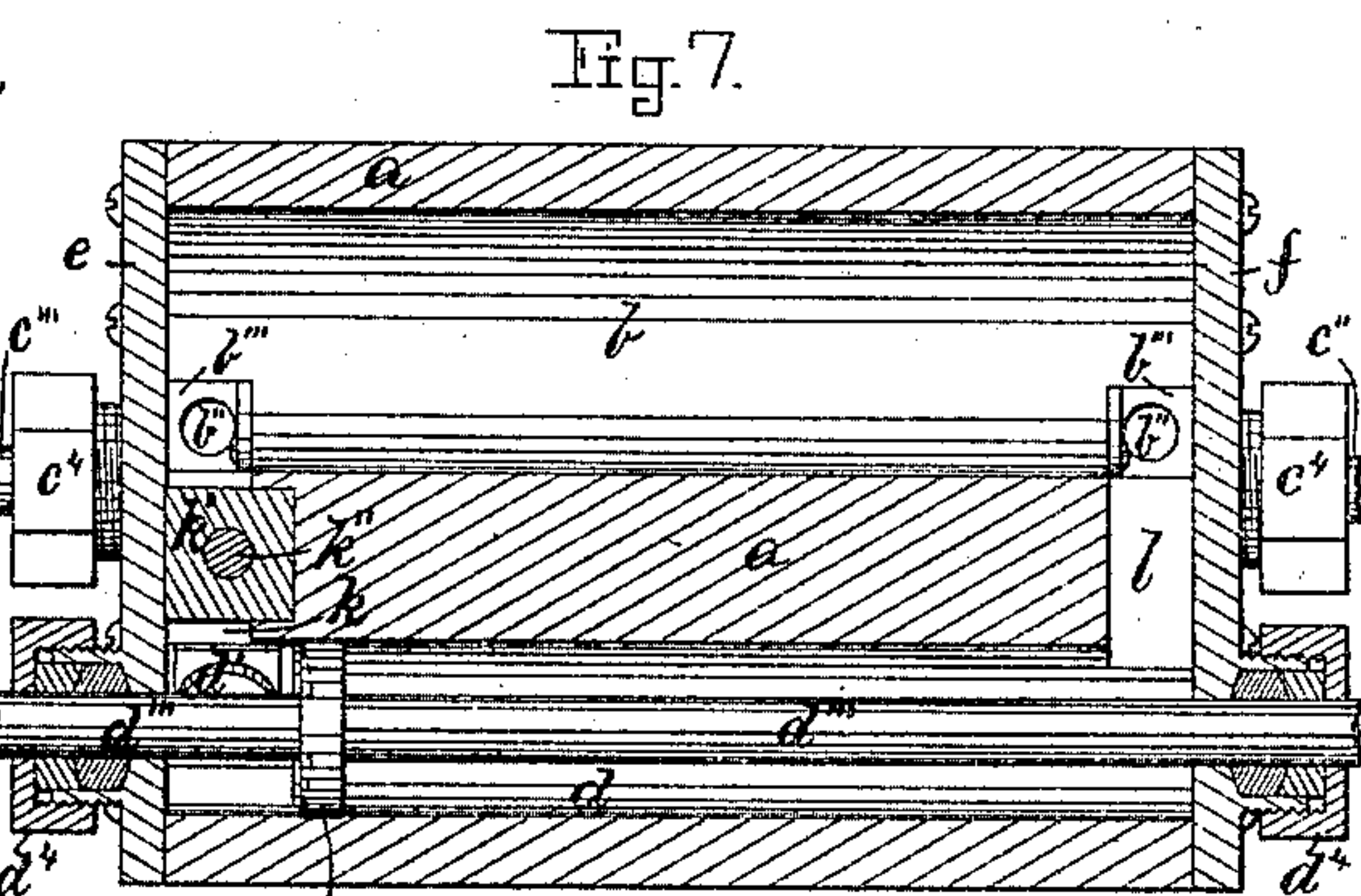
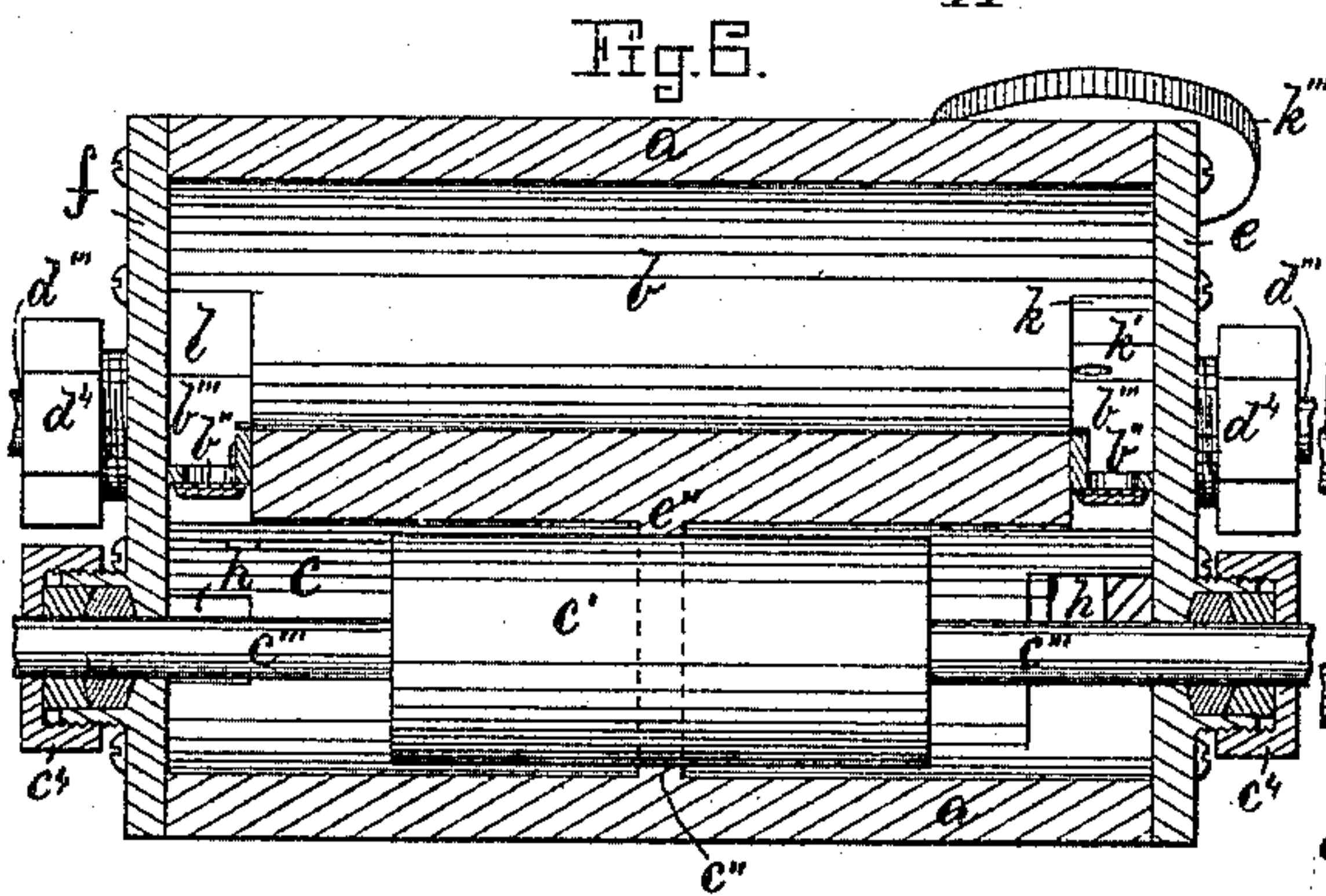
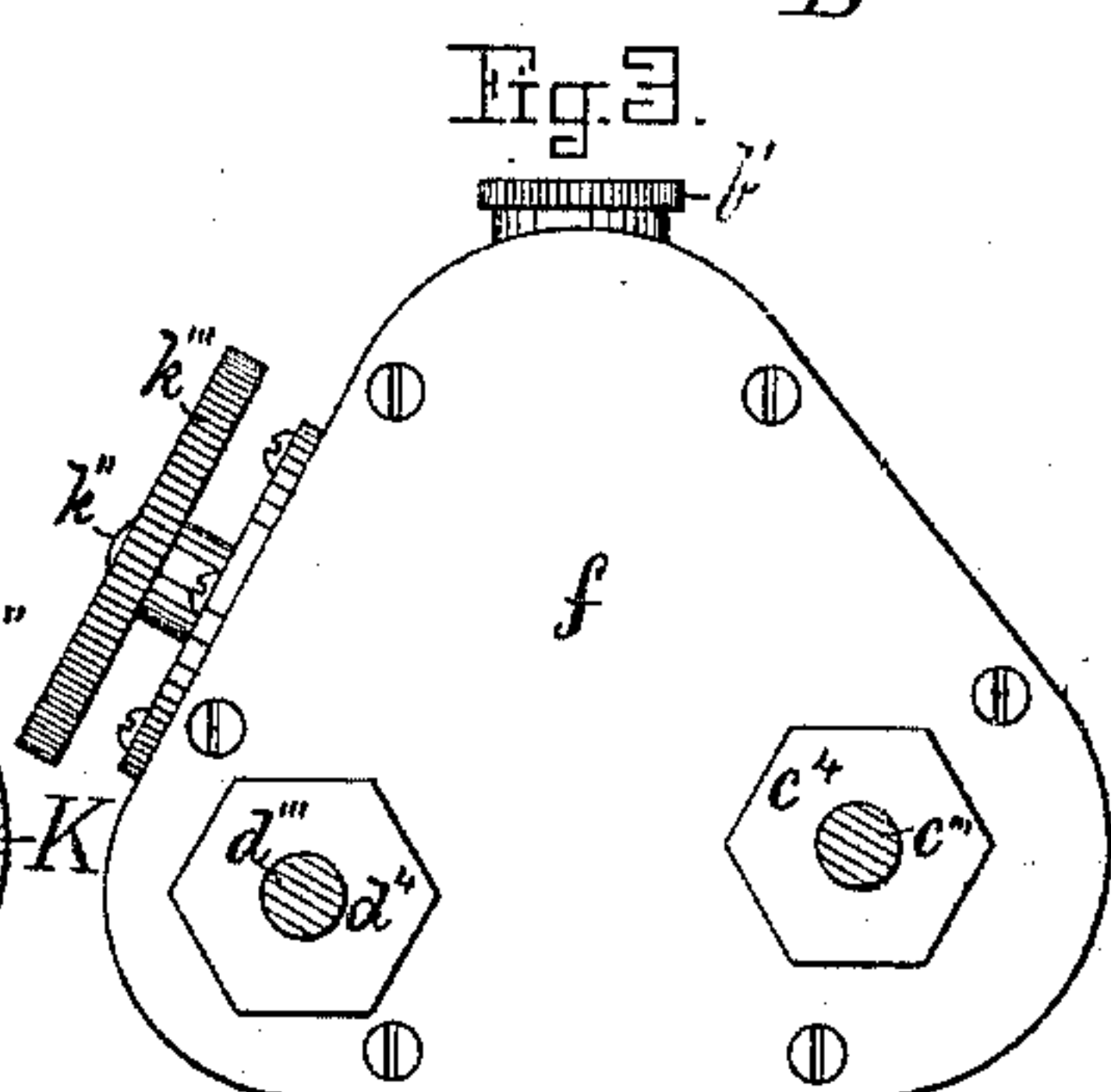
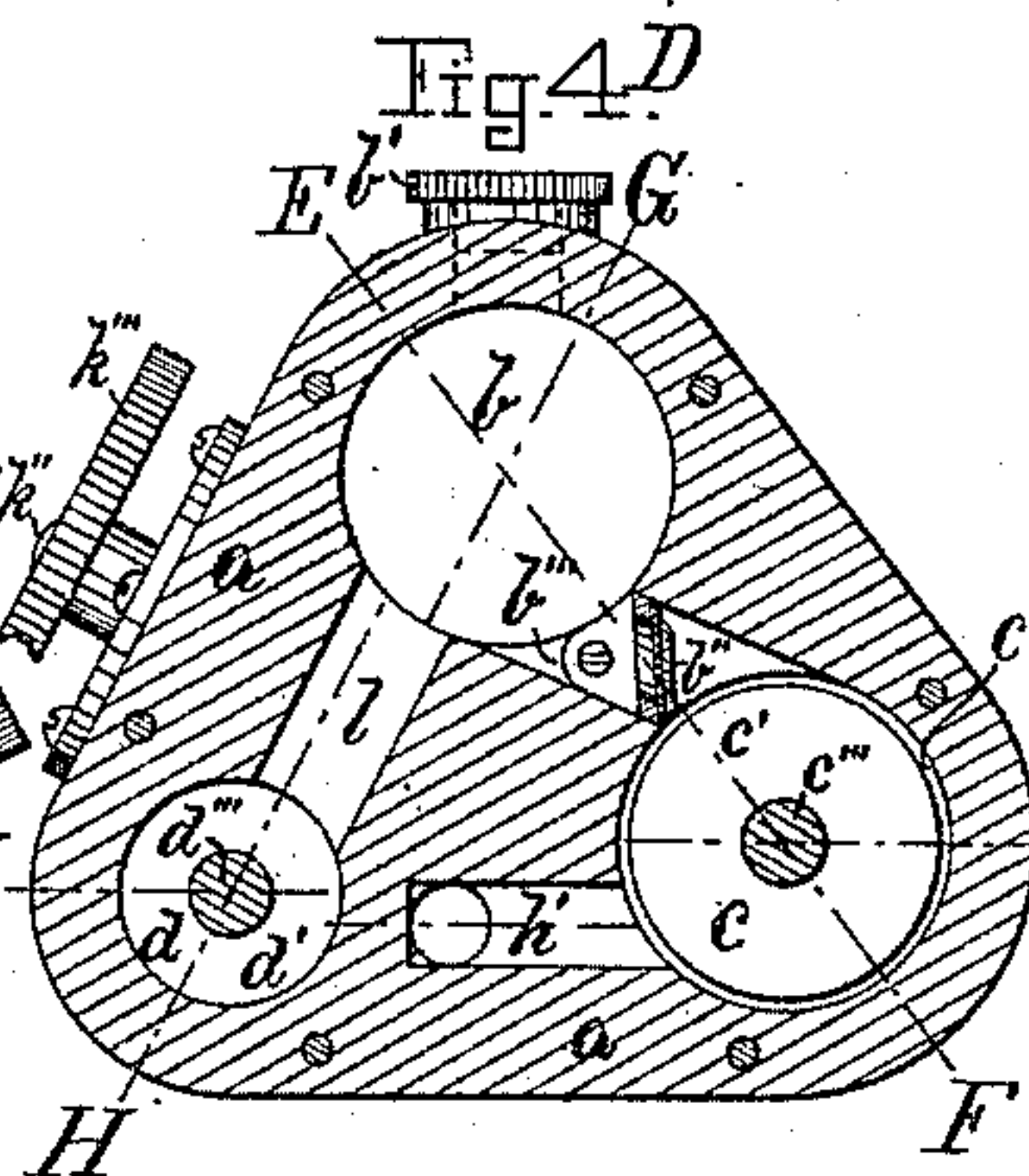
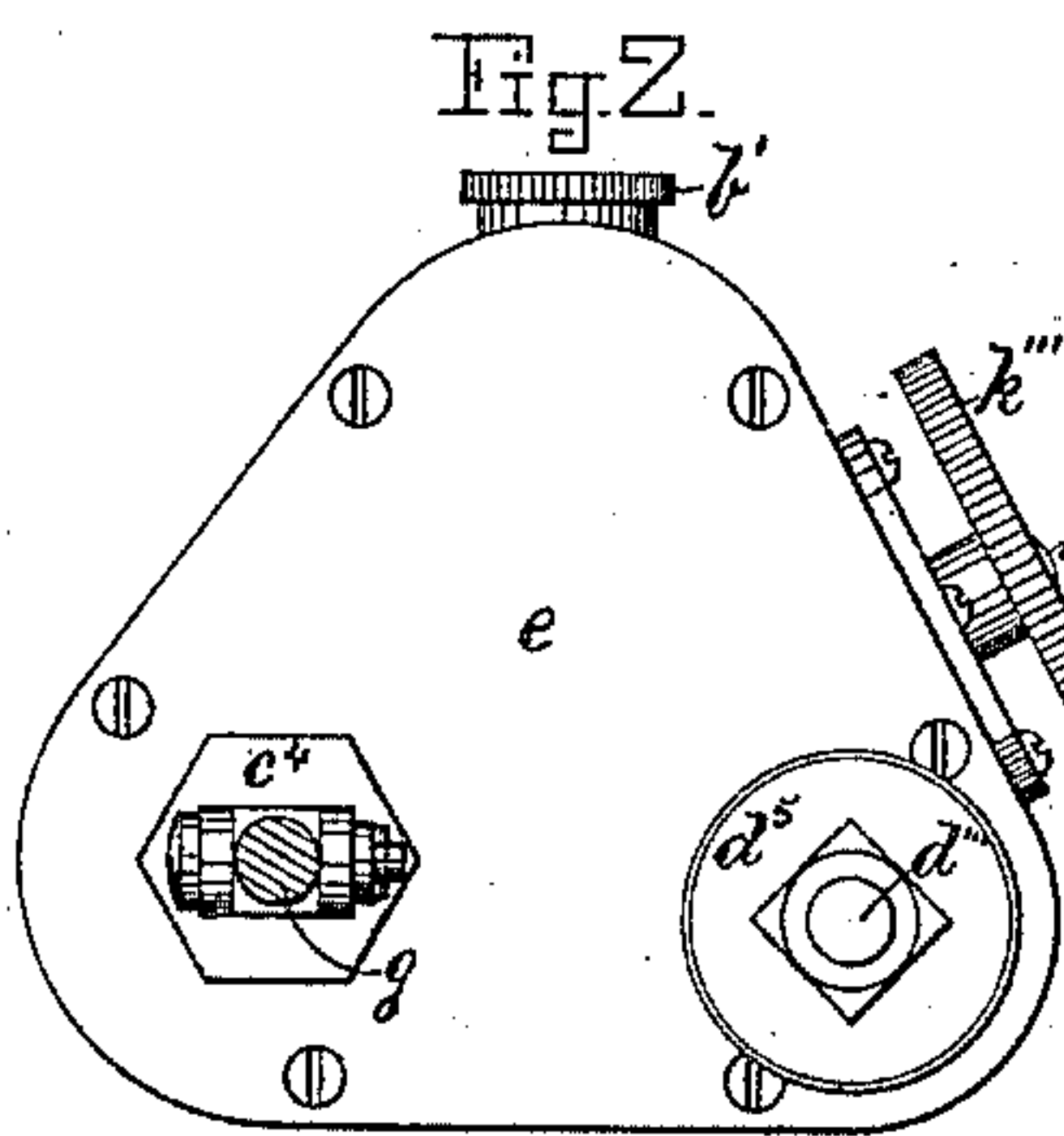
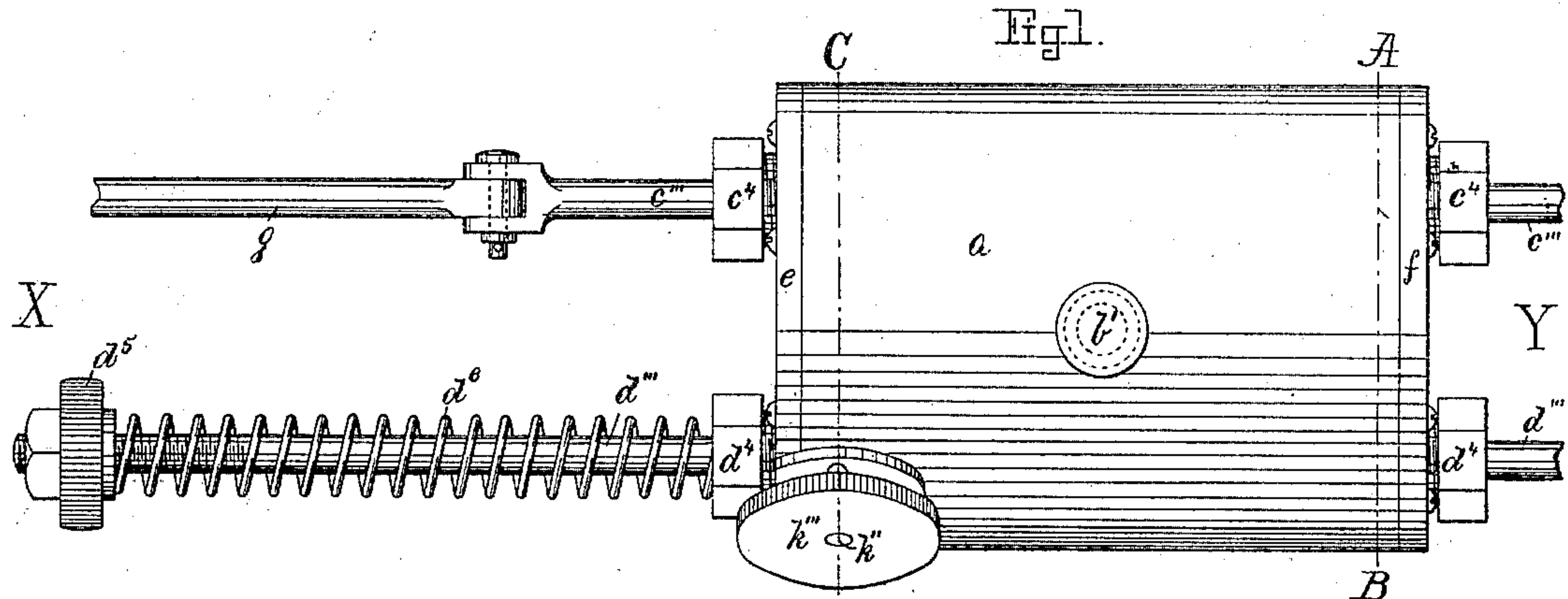


(No Model.)

H. F. HODGES.
SPEED REGULATOR.

No. 271,245.

Patented Jan. 30, 1883.



Witnesses
Henry Chadbourne.
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UNITED STATES PATENT OFFICE.

HORACE F. HODGES, OF CHELSEA, MASSACHUSETTS.

SPEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 271,245, dated January 30, 1883.

Application filed April 26, 1882. (No model.)

To all whom it may concern:

Be it known that I, HORACE F. HODGES, a citizen of the United States, residing at Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Automatic Speed-Regulators for Motors; and I do hereby declare that the same are fully described in the following specification and illustrated in the accompanying drawings.

This invention relates to improvements in automatic speed-regulators for motors; and it consists of the combination of a force-pump, having its piston actuated by the motor the speed of which is to be regulated, with a pressure-chamber into which the force-pump discharges, and a reservoir from which the pump draws its supply, and into which the contents of the pressure-chamber escape under pressure by passing through an orifice leading from the pressure-chamber to the reservoir, the size of which orifice is regulated by a suitable valve, operated either by hand, at the will of the attendant, or automatically. Within the pressure-chamber is a movable piston, with a piston-rod projecting through one or both ends of said chamber and connected to the mechanism or valve by which the source of power of the motor is affected. Between the pump-chamber and its reservoir are suitable check-valves, to allow the liquid to flow freely to the pump from the reservoir, but not in the opposite direction. Between the pump-chamber and the pressure-chamber is also situated a check valve or valves, to permit the liquid to pass from the pump to the head of the pressure-chamber, but not in the opposite direction. Between the head of the pressure-chamber and the reservoir is an orifice, the size of which is controlled by a valve, either by manipulation of the operator or automatically by suitable connection from such valve to the piston-rod of the pressure-chamber, and by these means the speed of the motor is regulated by the increase or decrease of the pressure in the pressure-chamber caused by the delivery of the pump and relative opening of the orifice between the pressure-chamber and reservoir. To move the piston in the pressure-chamber in an opposite direction to the motion produced by the internal pressure from the pump, it is neces-

sary to provide such piston with a tendency to a recoil motion of accelerated power, and this I obtain preferably by means of a coiled spring surrounding the pressure-chamber piston-rod between the head of the cylinder and an adjustable nut on the end of said piston-rod, by which arrangement the resistance of such spring may be regulated in accordance to the power required to move the regulating mechanism of the motor and the sensitiveness required of this speed-regulator.

On the drawings, Figure 1 represents a plan view of my improved speed-regulator. Fig. 2 represents an end view seen from X in Fig. 1. Fig. 3 represents an end view seen from Y in Fig. 1. Fig. 4 represents a cross-section on the line A B, shown in Fig. 1. Fig. 5 represents a cross-section on the line C D, also shown in Fig. 1. Fig. 6 represents a longitudinal section on the line E F, shown in Figs. 4 and 5. Fig. 7 represents a longitudinal section on the line G H, shown in Figs. 4 and 5; and Fig. 8 represents a longitudinal section on the line I K, shown in Figs. 4 and 5.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.

a is the main case or shell, containing the reservoir *b*, the force-pump cylinder *c*, and the pressure-chamber *d*, and having closely-fitting heads *e* and *f* at its ends, as shown.

b' is a removable cover or cap to close the filling-orifice leading to the reservoir *b* after it is filled with a suitable liquid, preferably a mixture of glycerine and water.

c' is the piston or plunger, fitting within a packing-ring, *c''*, in said cylinder *c*; and *c'''* is the piston-rod, projecting through suitable stuffing-boxes, *c⁴ c⁴*, in opposite ends of said cylinder, as shown.

g is a connecting-rod jointed to the piston-rod *c'''* in one end, and to a suitable eccentric, cam, or equivalent device on the motor to be regulated, such motor and connecting mechanism being, however, not shown in the drawings.

b'' b'' are check-valves in the passages *b''' b'''*, leading from the reservoir *b* to opposite ends of the pump-cylinder *c*, as shown in Figs. 4, 5, and 6, to admit the liquid to pass freely from the reservoir *b* to the pump-cylinder *c*, but not back again. From the pump-cylinder

c, near the head *e*, leads a passage, *h*, to the pressure-chamber *d*, and *h'* is a similar passage leading from the opposite end of pump-cylinder *c* to the said pressure-chamber *d*, and such passages are closed at their common entrance to the pressure-chamber *d* by means of a suitable check-valve, *d'*, to allow the liquid from the pump-cylinder *c* to pass through either of its passages *h h'* into the pressure-chamber *d*, but not in an opposite direction.

At the junction of the passages *h* and *h'* is located a double-acting check-valve, *h''*, adapted to close one of said passages *h h'* when the liquid from the pump is being forced through the other, in this manner preventing the liquid in one end of the pump-cylinder *c* being forced into the opposite end thereof.

Within the pressure-chamber *d* is located the piston *d''*, secured to the piston-rod *d'''*, passing through suitable stuffing-boxes, *d⁴ d⁴*, in opposite ends, as shown. One end of the piston-rod *d'''* is provided with a regulating-nut, *d⁵*, and a coiled spring, *d⁶*, located around said piston-rod *d'''*, between the nut *d⁵* and its stuffing-box *d⁴*, as and for the purpose set forth. The opposite end of the piston-rod *d'''* is to be connected to the mechanism or valve by which the source of power of the motor is affected, such mechanism being, however, not shown in the drawings, and does not form a part of this invention.

k is the orifice leading from the end of the pressure-chamber *d*, near the head *e*, to the reservoir *b*; and *k'* is the adjustable gate-valve or block, which is actuated by the screw-spindle *k''* and hand-wheel *k'''*, to regulate the size of said orifice *k* according to the amount of speed desired in the motor. Said valve hand-wheel *k'''* may be connected by means of suitable mechanism to the pressure-chamber piston-rod *d'''*, whereby the said valve *k'* is automatically operated from the said piston-rod *d'''*, thereby increasing or diminishing the sensitiveness of this regulator. The opposite end of the pressure-chamber *d* has a free passage, *l*, leading to the rear end of the reservoir *b*, whereby the piston *d''* is left free to move as actuated by the pressure at its opposite end.

The operation of this my improved speed-regulator is as follows: Upon the piston *c'* being reciprocated the liquid is steadily drawn

from the reservoir *b* and forced into the pressure-chamber *d* at the end near the head *e*, and from thence through the orifice *k* back again to the reservoir *b*; but in order for the liquid to pass through such orifice *k* an adequate pressure must exist in the pressure-chamber *d*, according to hydrostatic laws, whereby the flow of a liquid through an orifice is in direct ratio to the pressure upon that liquid, and consequently any increase or decrease of the speed of the motor is followed by a proportionate increase or decrease of the amount of liquid forced into the pressure-chamber *d*, and in order for such liquid to pass through the orifice *k* into the reservoir *b* a proportionately greater or less pressure must exist in the pressure-chamber to enable such flow to take place, causing a longitudinal motion of the pressure-piston *d''*, its piston *d'''*, and connected mechanism or valve, by which the source of the power of the motor is affected. The motion of the piston rod *d'''* being controlled by the spring *d⁶*, the latitude of such motion is proportionate to the pressure in the pressure-chamber. Any decrease and increase in the size of the orifice *k* results in a corresponding decrease and increase in the speed of the motor.

What I wish to secure by Letters Patent, and claim, is—

In a speed-regulator, the combination of the reservoir *b*, closed in both ends, and having valves and passages *b'' b'''* at both ends, leading to corresponding end of the pump-chamber *c*, in which is arranged the double-acting piston *c'*, the pump-chamber *c*, having passages *h h'*, leading from its opposite ends and terminating by a single passage and double-acting valve *h''* at one end of pressure-chamber *d*, the closely-fitting piston *d''* within the pressure-chamber *d*, the piston-rod *d'''*, projecting through one or both ends of said pressure-chamber *d* and provided with the tension-spring *d⁶*, and the regulating-valve *k'*, for regulating the flow of the liquid from the pressure-chamber *d* to the reservoir *b* through the orifice *k*, as and for the purpose set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

HORACE F. HODGES.

Witnesses:

ALBAN ANDRÉN,
HENRY CHADBURN.