

No. 778,549.

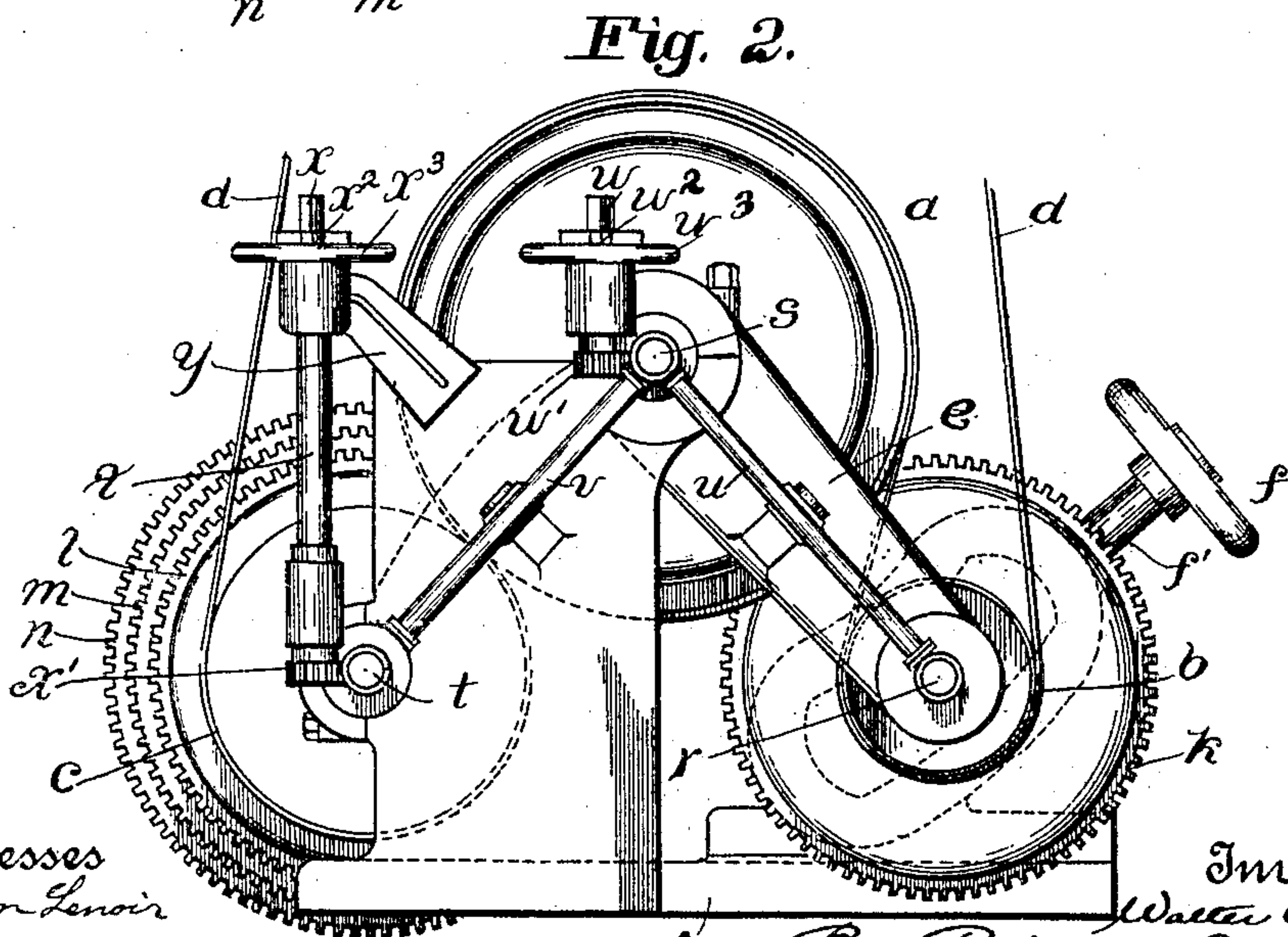
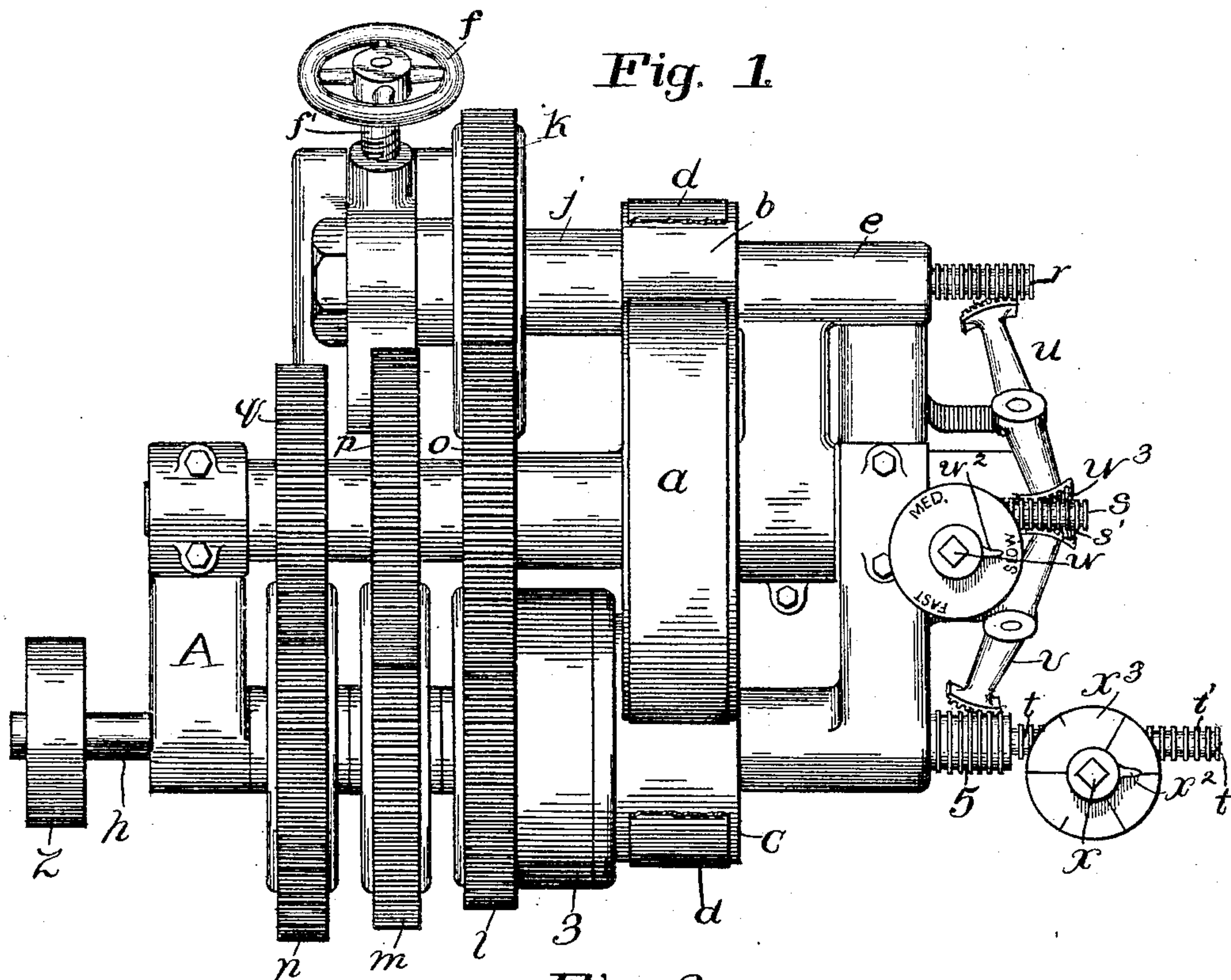
PATENTED DEC. 27, 1904.

W. F. RICE.

APPARATUS FOR TRANSMITTING POWER AT VARYING SPEEDS.

APPLICATION FILED JULY 20, 1903.

3 SHEETS—SHEET 1.



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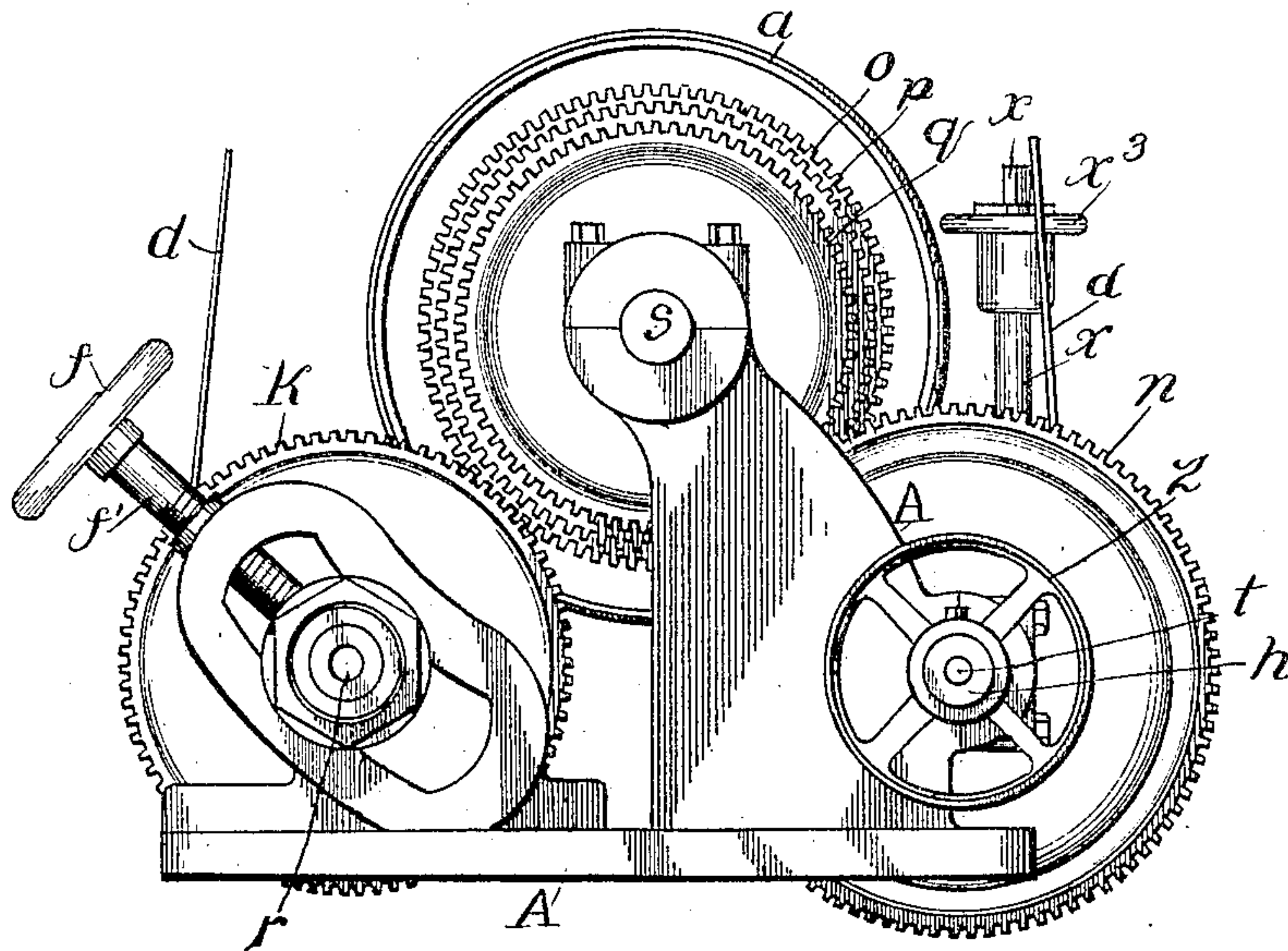


Fig. 3.

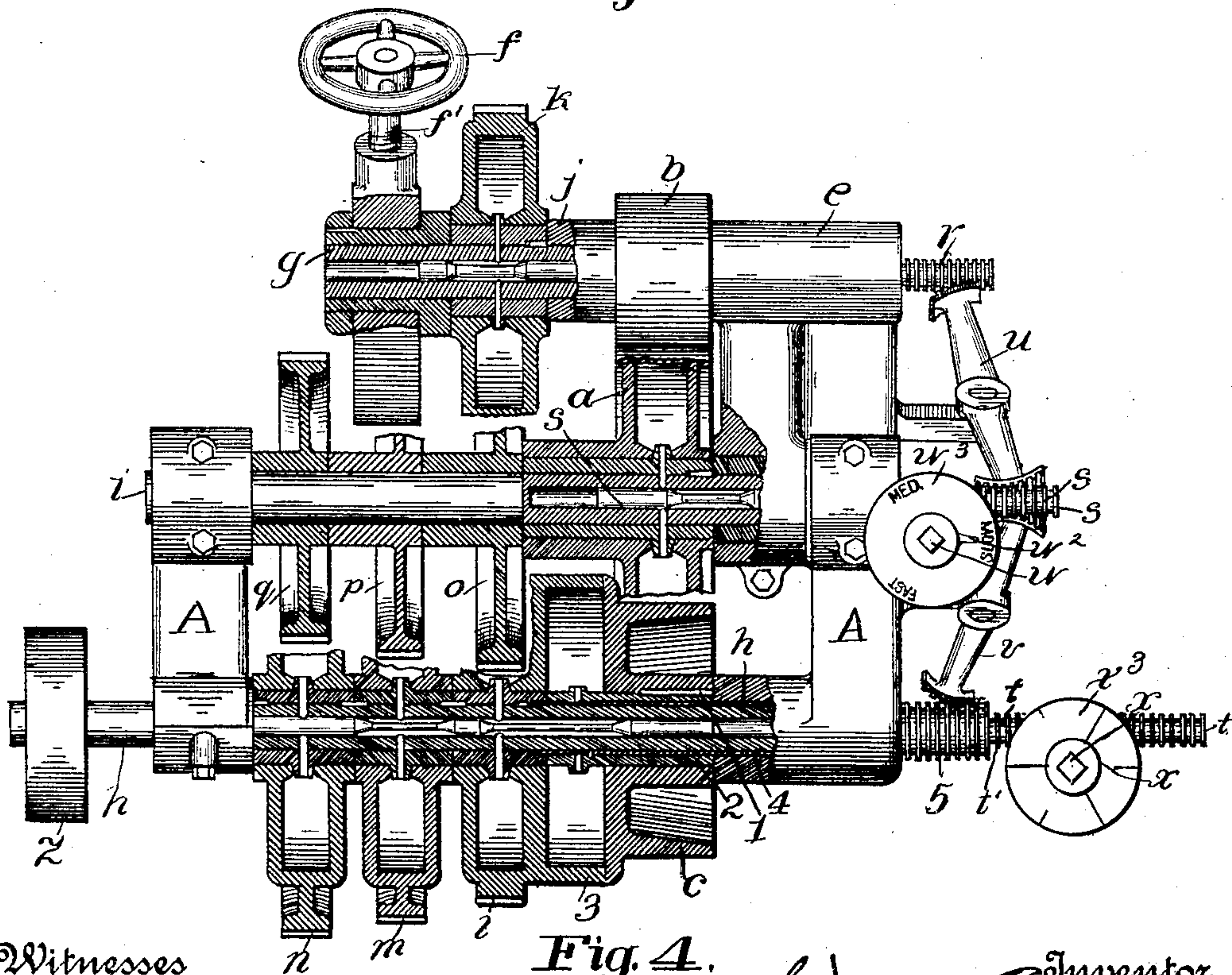


Fig. 4.

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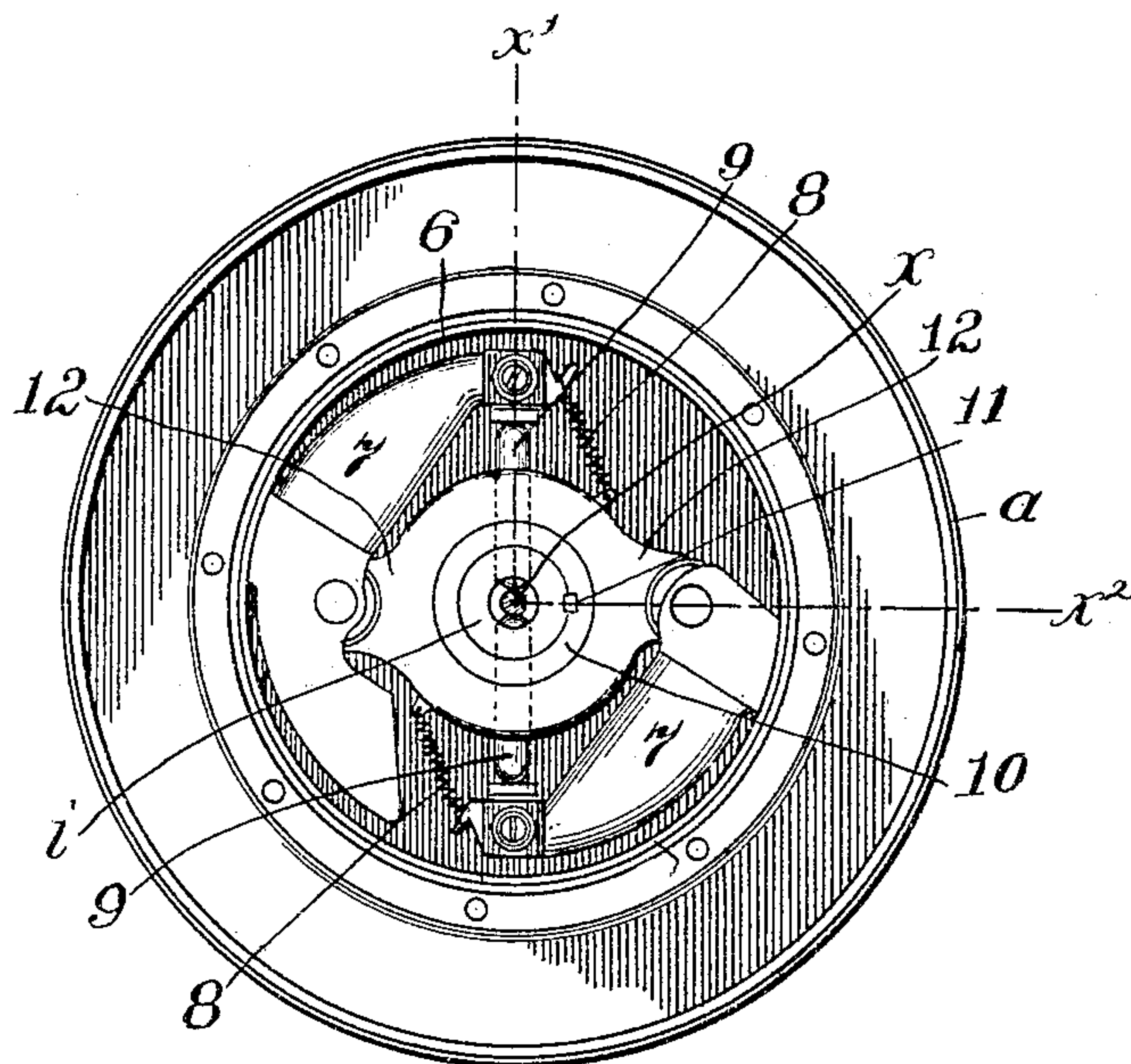


Fig. 5.

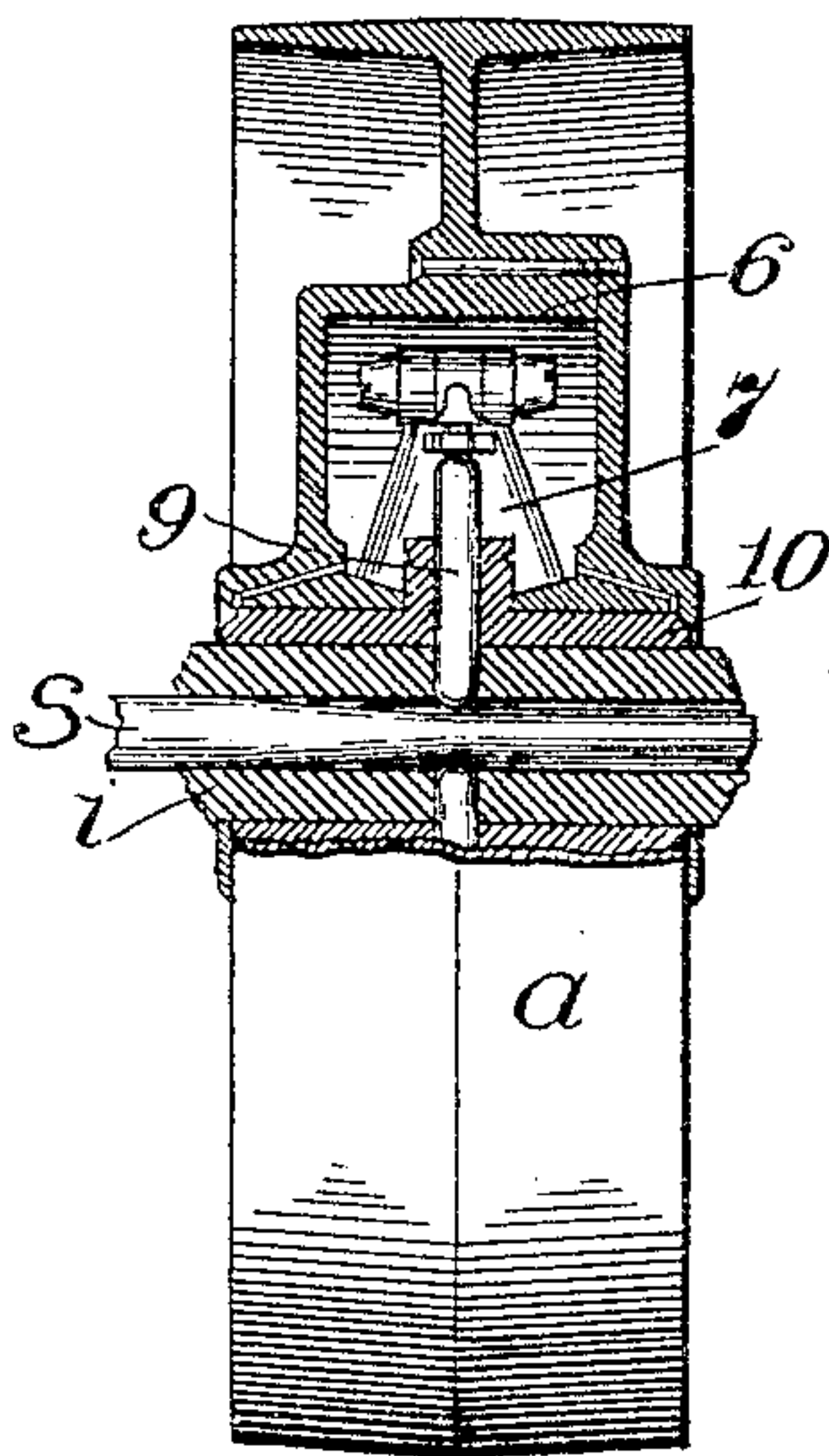


Fig. 6.

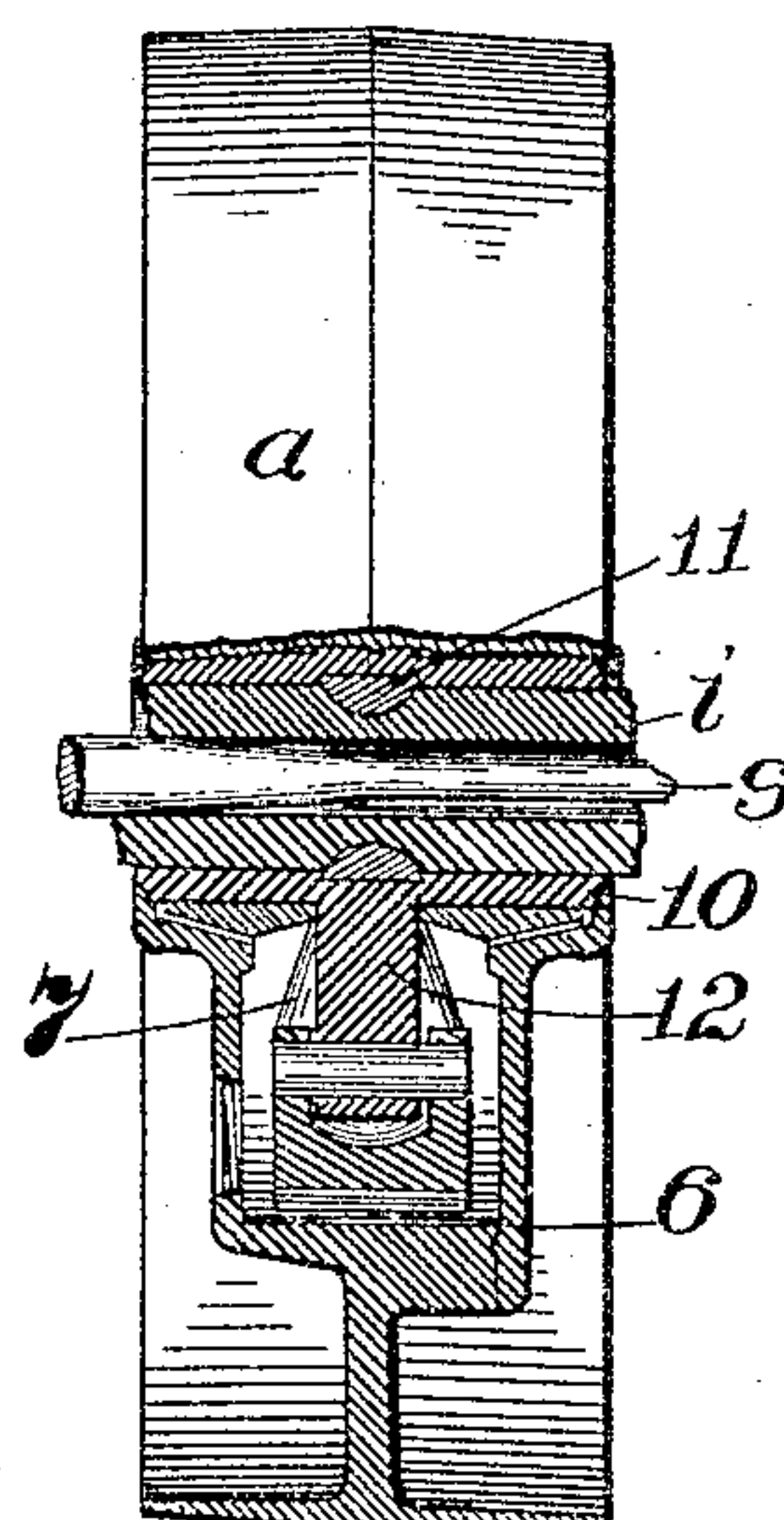


Fig. 7.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TRANSMITTING POWER AT VARYING SPEEDS.

SPECIFICATION forming part of Letters Patent No. 778,549, dated December 27, 1904.

Application filed July 20, 1903. Serial No. 166,346.

To all whom it may concern:

Be it known that I, WALTER F. RICE, a citizen of the United States, residing at Fitchburg, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Apparatus for Transmitting Power at Varying Speeds, of which the following is a specification, accompanied by drawings forming a part of the same, in which—

Figure 1 represents a plan view of an apparatus embodying my invention. Fig. 2 is an end elevation. Fig. 3 is an end elevation representing the end opposite that shown in Fig. 2. Fig. 4 is a top view with each of the driving-shafts shown in horizontal central sectional view, and Figs. 5, 6, and 7 are detail views representing the construction of the clutches. Fig. 5 is a side elevation in section, showing the interior. Fig. 6 is a sectional view on line xx' , Fig. 5; and Fig. 7 is a sectional view on line xx'' , Fig. 5.

Similar reference letters and figures refer to similar parts in the different views.

My invention relates to an apparatus by which rotary motion may be transmitted from one shaft to another at different speeds, with means for varying and controlling the speed at will; and it consists in the construction and arrangement of parts as hereinafter described, and set forth in the annexed claims.

Referring to the accompanying drawings, A denotes the supporting-framework for the operative parts of the mechanism. Power is imparted to three pulleys a , b , and c by a belt connection d from a driving-shaft. (Not shown.) The belt d drives the three pulleys by passing beneath the pulleys b and c and over the top of the pulley a . The pulley b serves as a tightening-pulley, it being carried by a rotating sleeve which turns on a shaft g , held in a swinging frame e and capable of being adjusted to tighten the belt by means of a hand-wheel f and an adjusting-screw f' . The pulley c is supported upon a shaft h , journaled in the framework A, and the pulley a is supported upon a shaft i , journaled in the framework. The pulley b is attached to a sleeve j , having a spline connection with the shaft g . The shaft h is provided with the spur-gears

l , m , and n of different sizes, each capable of rotating loosely on the shaft h , but of being individually connected therewith by suitable clutching mechanisms. Splined upon the shaft i are three spur-gears of varying size o , p , and q . The gear o is permanently in mesh with a gear k on the shaft g and also with the gear l on the shaft h . The gear p is permanently in mesh with the gear m and the gear q is permanently in mesh with the gear n .

The shaft g is hollow and contains a sliding clutch-actuating bar r , having one end projecting beyond the end of the shaft and provided with circumferential teeth forming a circumferential rack-bar. The shaft i is hollow through a portion of its length and is provided with a sliding clutch-bar s , having one end extending beyond the end of the shaft i and provided with circumferential teeth s' , forming a rack-bar, and the shaft h is likewise hollow throughout a portion of its length and is provided with a sliding clutch-bar t , having one end extending beyond the end of its shaft and provided with circumferential teeth t' . The toothed ends of the sliding clutch-bars r and s engage segmental gears formed on the ends of a rocking lever u , so that the rocking movement of the lever u will simultaneously slide the bars r and s in opposite directions. The sliding clutch-bar s also engages a toothed segment on one end of a rocking lever v , which is simultaneously rocked with the sliding movement of the clutch-bar s . The clutch-bar s is moved in and out of the hollow shaft i by means of a short rotating shaft w , having its upper end squared to receive a wrench bar or handle and its lower end carrying a pinion w' , which engages the toothed end of the clutch-bar s . The shaft w also carries a pointer w'' , which swings over a fixed dial-plate w''' to indicate the position of the clutch-bar s in the shaft i . The clutch-bar t is moved in and out of its hollow shaft h by means of a shaft x , having its upper end squared to receive a wrench-handle and carrying on its lower end a pinion x' , engaging the toothed end of the clutch-bar t . The shaft x also carries a pointer x'' , which rotates over a fixed dial-plate x''' to indicate the position of the clutch-bar t in its hollow shaft. The

upper end of the shaft *x* is supported by a bracket *y*, attached to the frame A. The shaft *h* projects beyond the frame A and is provided in the present instance with a pulley *z*,
 5 from which power is taken to whatever mechanism it is desired to drive.

The pulley *c* is attached by a spline 1 to a sleeve 2, and integral with the gear *l* is a cylindrical shell 3, inclosing a clutch-chamber
 10 containing clutch mechanism, by which the sleeve 2 may be connected at will with the gear *l* by means of a sliding clutch-sleeve 4, interposed between the shaft *h* and the sleeve 2. The sliding clutch-sleeve 4 is provided at
 15 its outer end with circumferential teeth 5, forming a rack-bar, which is engaged by a toothed segment on the lower end of the rocking lever *v*, by which the clutch 4 is made to slide out or in simultaneously with the clutch-
 20 bar *s*, but in the opposite direction.

The pulley *a*, gears *k*, *l*, *m*, and *n* are each provided with clutch-chambers containing clutching-dogs, by which each may be attached at will to its respective shaft, the clutching
 25 mechanism in each being identical with that contained in the shell 3 and consisting of the well-known Wheaton clutch, the construction of which is shown in Figs. 5 and 6, which represents the clutching mechanism inclosed in
 30 the pulley *a*. The clutching mechanism comprises a chamber having an interior friction-surface 6 and containing a pair of pivoted dogs 7 7, which are drawn inward and normally held out of contact with the friction-
 35 surface 6 by the spiral springs 8 8. When it is desired to connect pulley *a* with its shaft *i*, the free ends of the dogs 7 7 are moved out by two radially-sliding pins 9 9, held in a central hub 10, which is keyed to the shaft *i* by
 40 a spline 11 and provided with arms 12 12, to which the dogs 7 7 are pivotally connected. The sliding pins 9 9 are pushed out by cam-surfaces formed on the sliding clutch-rod *s*. Similarly the gear *l* is connected at will with
 45 the sleeve 2 by the action of the sliding clutch-sleeve 4 or with the shaft *h* by the action of the sliding clutch-bar *t*. The gear *k* is connected with the shaft *g* by the action of the sliding clutch-bar *r*, and the gears *m* and *n*
 50 are each connected at will with their shaft *h*.

The several different speeds are imparted to the shaft *h* from the driving-belt *d*, running at a constant speed, as follows: The pulley *c* and its sleeve 2 may be connected with
 55 the gear *l* by sliding the clutch-sleeve 4 outwardly and simultaneously moving the clutch-bar *s* inwardly to disconnect the pulley *a* from the shaft *i*, which is accomplished by rotating the short shaft *w*, the gears *l*, *m*, and *n* having
 60 been disconnected from the shaft *h* by suitably moving the clutch-bar *t*. The gear *l* may then be connected, by means of a partial movement of the clutch-bar *t*, with the shaft *h*, which will be rotated at the speed of the
 65 pulley *c*, and at the same time, the shaft *i* will

be rotated at the same speed, as the gear *l*, attached to the shell 3 and revolving with it, is the same size as the gear *c*, which is keyed upon the shaft *i*. The rotation of the shaft *i* will be imparted to the gears *m* and *n*, which
 70 are constantly in mesh with the gears *p* and *q*; but the gears *m* and *n* will revolve loosely on the shaft *h*. By disconnecting the gear *l* from the shaft *h* and connecting the gear *m* with the shaft *h* the latter will be driven at a
 75 reduced speed through the gears *p* and *n*, the pulley *a* remaining connected with the shaft *i*, and by disconnecting the gear *m* and connecting the gear *n* with the shaft *h* the latter will be driven at a still slower speed from the gear
 80 *q*, thereby obtaining three separate speeds of the shaft *h* through the pulley *c*. By disconnecting the gear *l* from the sleeve 2 the pulley *c* will be allowed to run free, and by connecting the pulley *a* with the shaft *i* the lat-
 85 ter will be driven at the speed of the pulley *a*, and the shaft *h* may then be driven from the shaft *i* and at the same speed by connecting the gear *l* only with the shaft *h* or at speeds reduced from that of the pulley *a* by con-
 90 necting either the gears *m* or *n* with the shaft *h*, thereby obtaining three separate speeds from the pulley *a*. In like manner the gear *k* may be connected by its clutch with the sleeve *j*, which is splined to the shaft *g* and
 95 rotating the shaft *h* at the same speed as the pulley *b*, through the gears *o* and *l* when the latter is attached to the shaft *h*, or the shaft *h* may be driven at a reduced speed from the pulley *b* through either of the gears *m* and *n*,
 100 thereby imparting three separate speeds to the shaft *h* from the pulley *b*.

By the above-described apparatus I am, therefore, enabled to obtain nine distinct
 105 speeds of the shaft *h* with the driving-belt *d* running at a constant speed and by the employment of three clutch-connected gears only on the shaft *h* and three driving-gears on the shaft *i*. Three additional speeds, however,
 110 may be obtained by each additional pair of gears on the shafts *i* and *h*.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an apparatus of the class described, the combination of three pulleys of different sizes
 115 arranged to be driven by a common belt, means for moving one of said pulleys in order to tighten the belt, a driven shaft, and intermediate connecting mechanism by means of which said shaft may be connected at will with either
 120 of said pulleys.

2. In an apparatus of the class described, the combination of a plurality of pulleys arranged in the same plane and capable of being driven
 125 by a common belt, of a driven shaft, means for connecting said shaft with either of said pulleys at will, two or more sets of intermediate gearings between said shaft and said pulleys, and clutching mechanisms by which the
 130 motion of either of said pulleys can be trans-

mitted through either set of gearings, substantially as described.

3. In a power-transmitting mechanism, the combination with a driven shaft, of a plurality of gears of different sizes adapted to be connected with and disconnected from the driven shaft at will, a laterally-movable shaft, means for moving the shaft at will, a gear carried on the shaft and adapted to be detachably secured to the movable shaft, a driving-shaft, gearing secured to the driving-shaft and meshing with the gears on the driven shaft and on the movable shaft, pulleys carried by each of the shafts, means for detachably connecting the driven-shaft pulley to the adjacent gear thereon, and means for detachably connecting the driving-shaft pulley to its shaft, the means operating simultaneously to clutch one of the pulleys to its respective cooperating member and to release the other of said pulleys from engagement with its respective cooperating member.

4. In a power-transmitting mechanism, the combination with a driven shaft, of gears loosely mounted thereon, means for clutching any of the gears to the shaft, a pulley loosely mounted on the shaft, a driving-shaft, a pulley loosely mounted thereon, a series of gears mounted on the driving-shaft and meshing with the gears on the driven shaft, means for driving the pulleys, and means for clutching the pulley on the driven shaft to one of the gears thereon and simultaneously releasing the loose pulley on the driving-shaft from positive engagement with the latter.

5. In a power-transmitting mechanism, the combination with a driven shaft, a pulley and gearing loosely mounted thereon, a driving-shaft, a pulley loosely mounted thereon, gearing keyed to the driving-shaft and meshing with the gearing on the driven shaft, means for clutching and unclutching the pulleys, a movable shaft, a swinging frame in which the movable shaft is journaled, a pulley mounted thereon, a belt engaging the pulleys and manually-operated means for actuating the movable shaft to tighten the belt.

6. In a power-transmitting device, the combination with a driven shaft, of a plurality of gears loosely mounted thereon, a longitudinally-movable clutch member mounted on the shaft, a sleeve secured upon the shaft, a pulley loosely mounted on the sleeve, means for connecting the sleeve and one of the gears, a driving-shaft, gearing permanently secured thereto and meshing with the gearing on the driven shaft, a pulley loose on the driving-shaft, means for clutching the pulley on the driving-shaft and simultaneously clutching the pulley on the driven shaft to one of the gears thereon, and separate means for clutching any one of the gears on the driven shaft to the shaft.

7. In a power-transmitting device, the com-

bination with a driven shaft, of a plurality of loose gears thereon, means for clutching the gears to the shaft, a pulley loosely mounted on the shaft, means for clutching the pulley to rotate with one of the gears, a driving-shaft, a pulley loosely mounted thereon, a rack-toothed clutch member for securing the last-named pulley to the driving-shaft, a pivotally-supported arm, the ends of which engage the clutch member of the driving-pulley and the clutch means of the driven pulley, respectively, and means for operating the rack-tooth clutch member to release or clutch, respectively, the driving-pulley from its shaft and simultaneously clutch or release the driven pulley through the pivoted arm.

8. In an apparatus of the class described, the combination of three pulleys of different sizes arranged to be driven by a common belt, shafts upon which the pulleys are mounted, one of the shafts being a driven shaft, means for moving one of said pulleys and its shaft in order to tighten the belt, and intermediate connecting mechanism by which the driven shaft may be connected at will with either of said pulleys.

9. In an apparatus of the class described, the combination of a plurality of pulleys of different sizes arranged to be driven by a common belt, a suitable frame, a driving, a driven and an adjustable shaft journaled in the frame, the pulleys mounted on the shafts, the adjustable shaft adapted to be swung toward and from the remaining shafts, means for positively retaining the shaft in its adjusted position, and intermediate mechanism connecting the shafts with each other.

10. In a power-transmitting apparatus, the combination of a plurality of pulleys of varying sizes arranged to be driven by a common belt, a driven shaft, a driving-shaft and an adjustable shaft upon which the pulleys are mounted, intermeshing mechanism carried by each of the shafts and means for connecting the driven shaft at will with either of the remaining shafts.

11. The combination in a power-transmitting apparatus, with a plurality of driving-pulleys driven from a common source of power, of a driven shaft, means rotatably connecting the driven shaft with each of the driving-pulleys, clutching mechanisms controlling the operation of the connecting means and means connecting the clutch mechanisms for simultaneously operating the clutching mechanisms in opposite directions.

12. In a power-transmitting apparatus, the combination with a drive-shaft, of a driven shaft located on one side thereof and a third shaft located upon the opposite side of the drive-shaft, intermeshing gearing carried by the three shafts, the gearing on the drive-shaft being fast thereon, pulleys loosely carried on the drive and driven shafts, separate clutch mechanisms controlling the gearing on the

third shaft, and the pulleys on the drive and driven shafts, means connecting the several clutch mechanisms to operate the clutch mechanisms of the third and driven shafts simultaneously with and in opposite directions to the movement of the clutch mechanism on the driving-shaft and independent means for clutching or unclutching any of the driven-shaft gears to or from the driven shaft.

10 13. In a power-transmitting apparatus, the combination with a drive-shaft, of a driven shaft and an adjustable shaft, pulleys located on each of the shafts, means for driving the pulleys, gearing secured upon the driving-
15 shaft, gearing loosely mounted on the driven

shaft and means for clutching any one of the loose gears to the driven shaft.

14. In a power-transmitting apparatus, the combination with a plurality of shafts, one of which constitutes the driven shaft, of pulleys of varying sizes arranged to be driven by a common belt, each shaft provided with a pulley, and means independent of the belt for connecting the driven shaft at will with either of the pulleys.

Dated this 8th day of July, 1903.

WALTER F. RICE.

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