

No. 624,018.

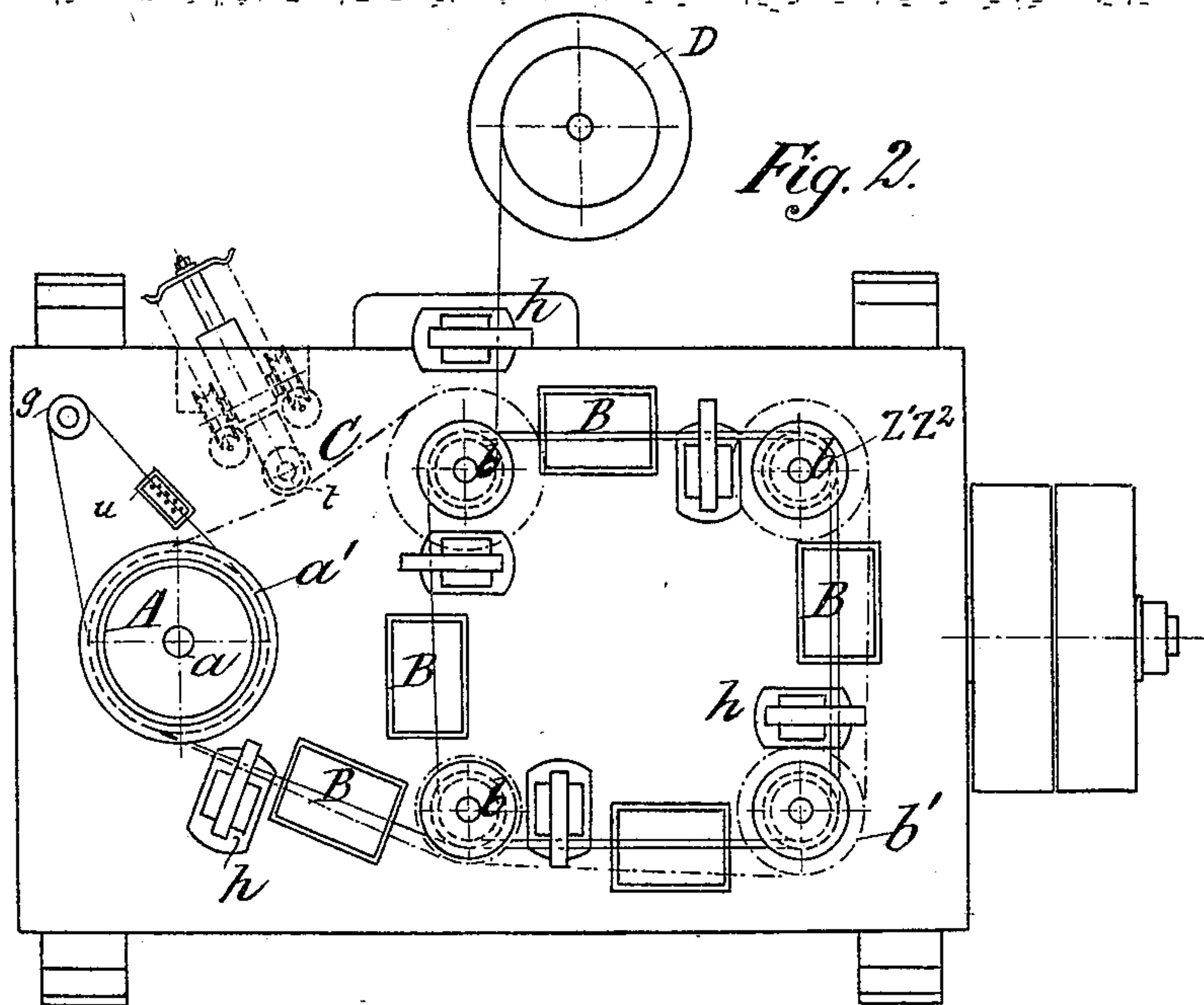
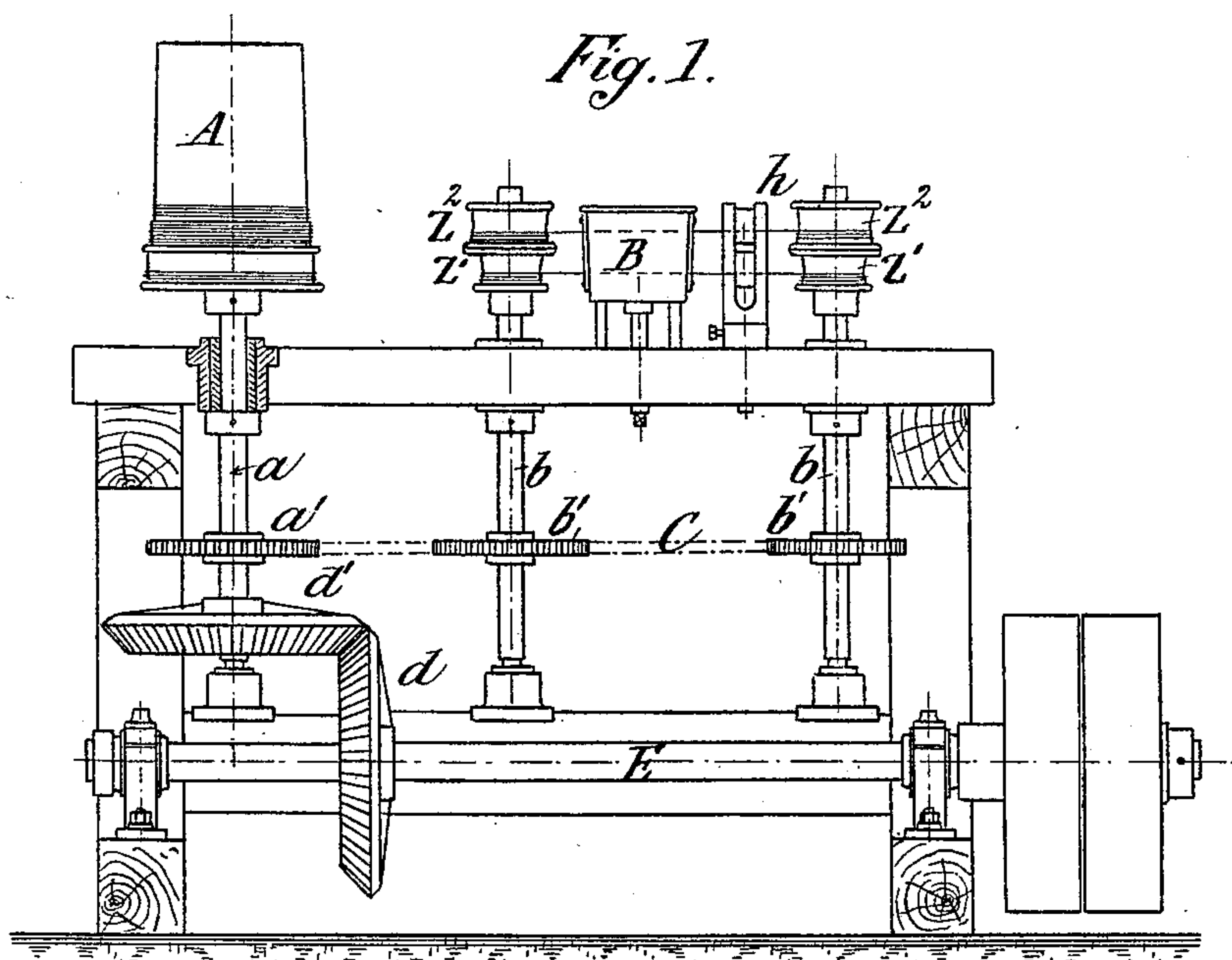
Patented May 2, 1899.

C. HARMANN.  
WIRE DRAWING MACHINE.

(Application filed Dec. 18, 1897.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:  
Eugene K. Kory  
b. A. Breto

Inventor:  
Carl Harmann  
by Fairfax & Wetter  
Attorneys

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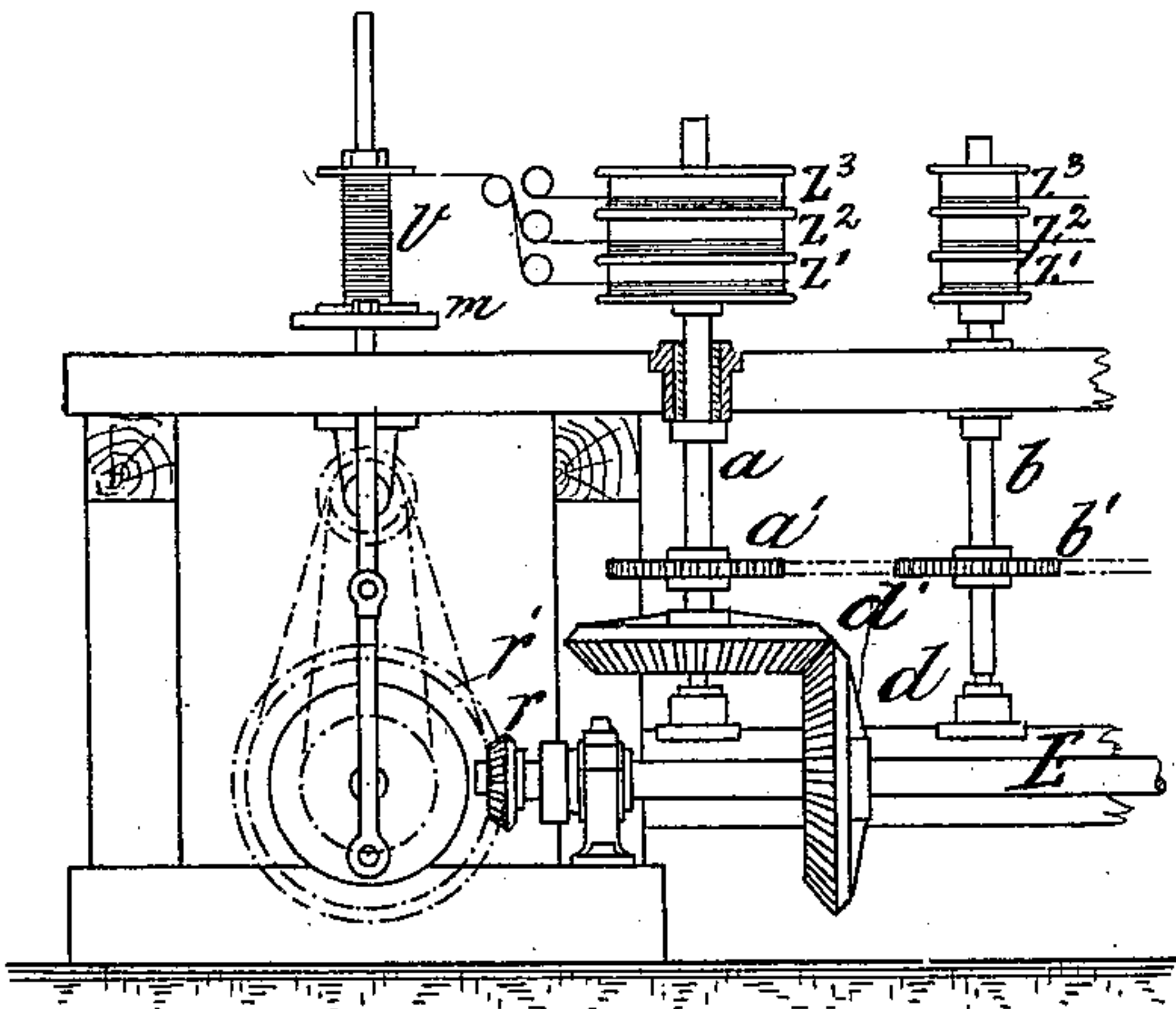
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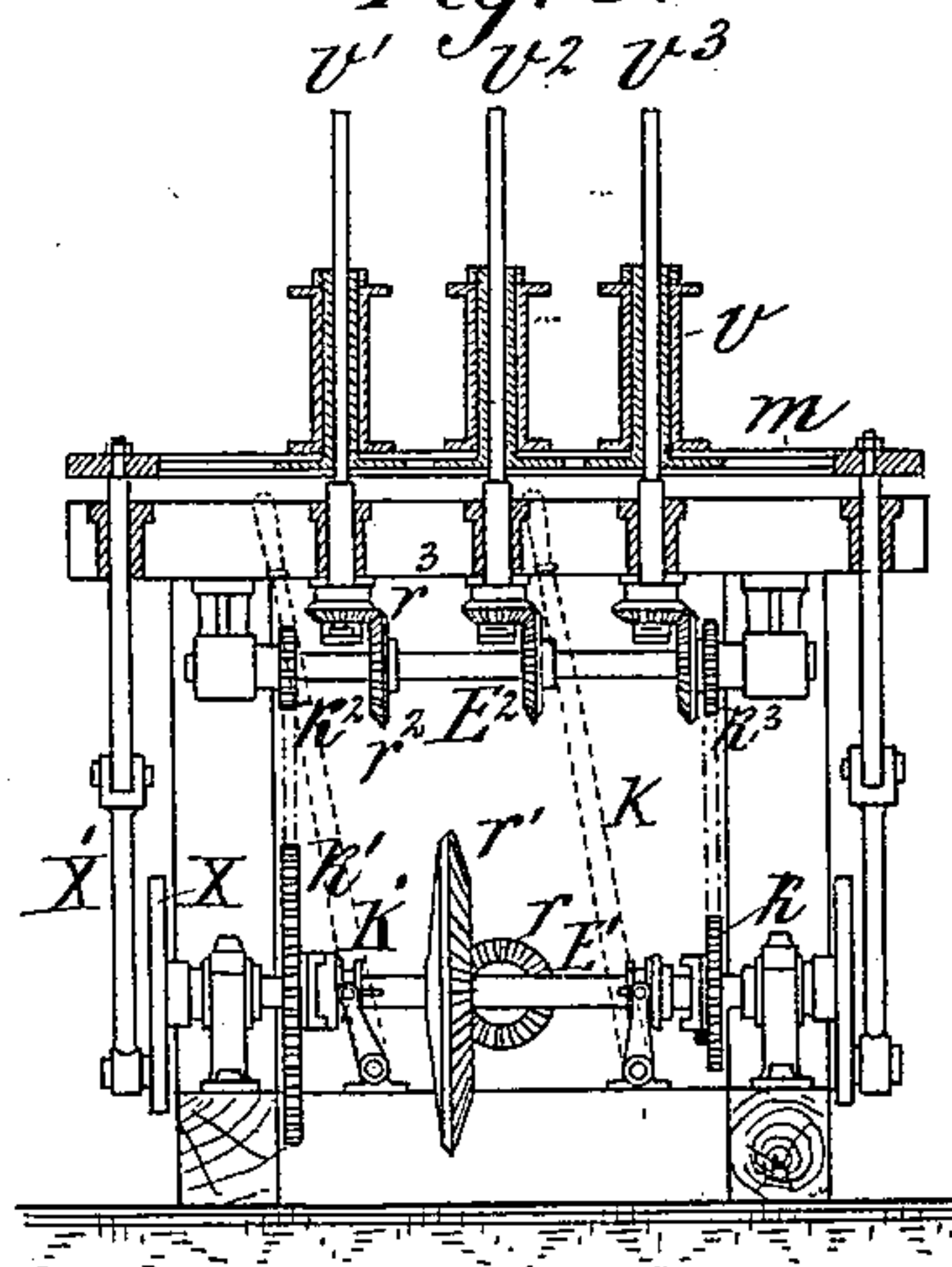
(No Model.)

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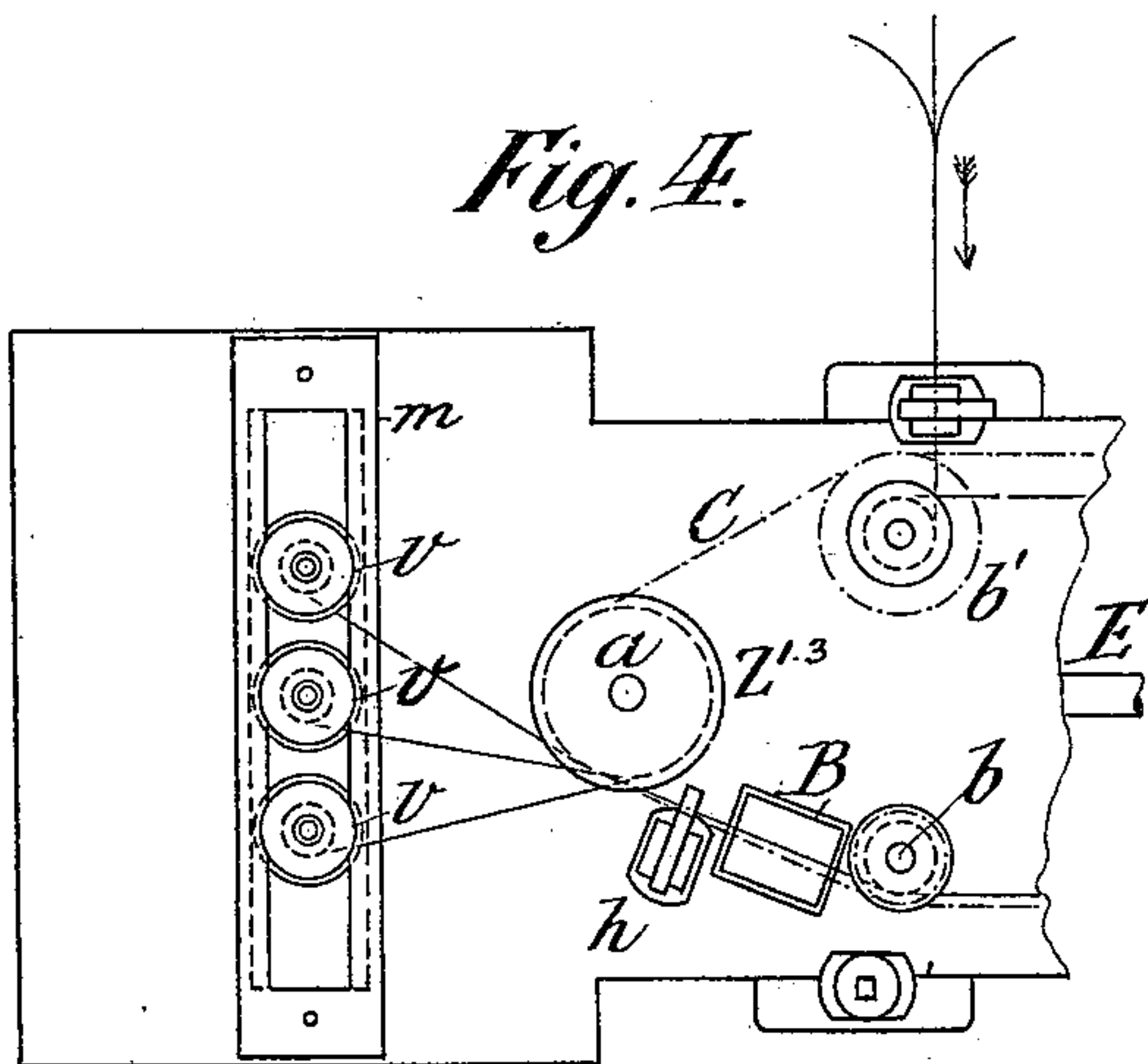
*Fig. 3.*



*Fig. 5.*



*Fig. 4.*



Witnesses:  
H. A. Kelsey.  
C. A. Brett

Inventor:  
Carl Harmann  
by Fairfax & Wetter  
Attorneys

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Fig. 6.

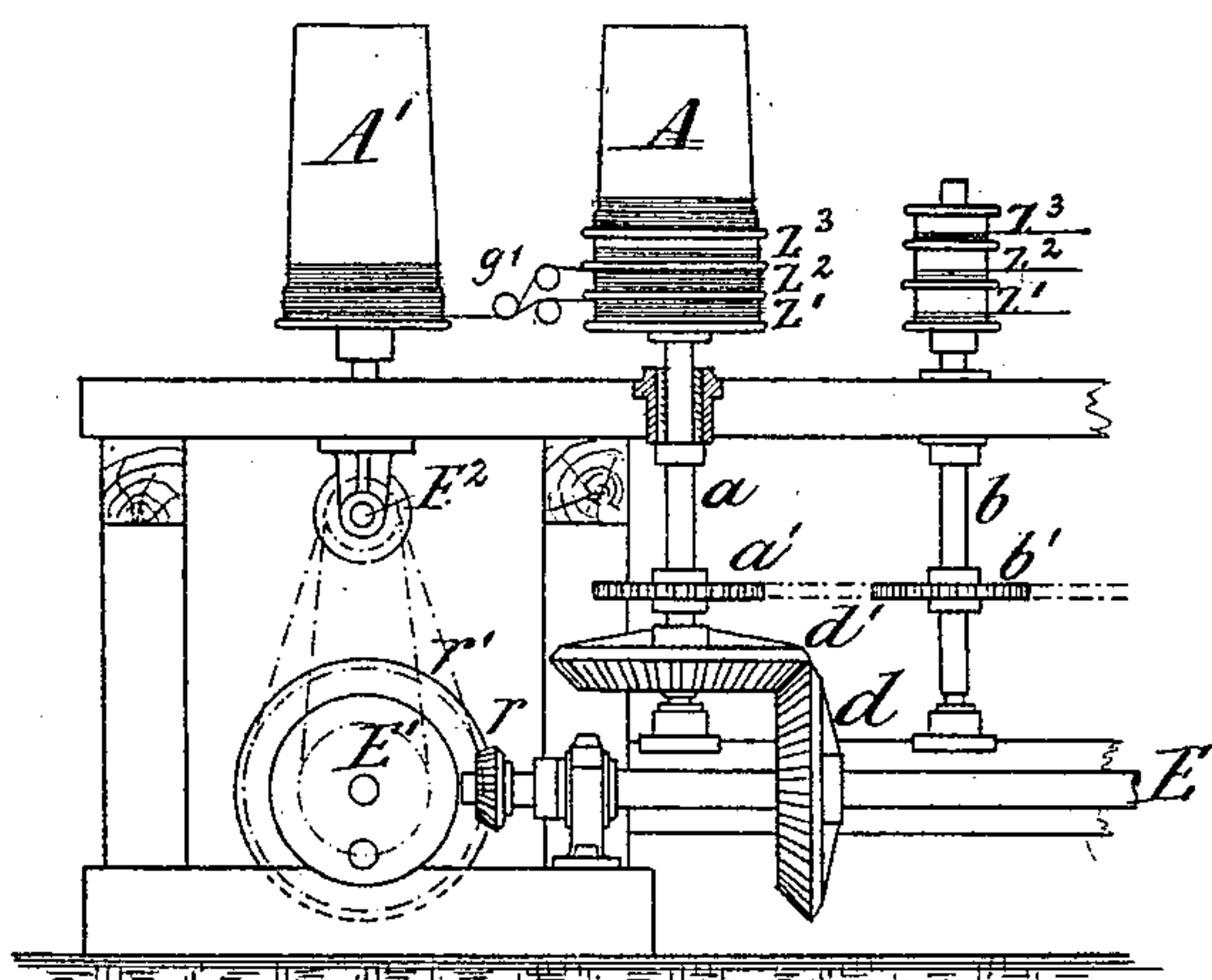


Fig. 8.

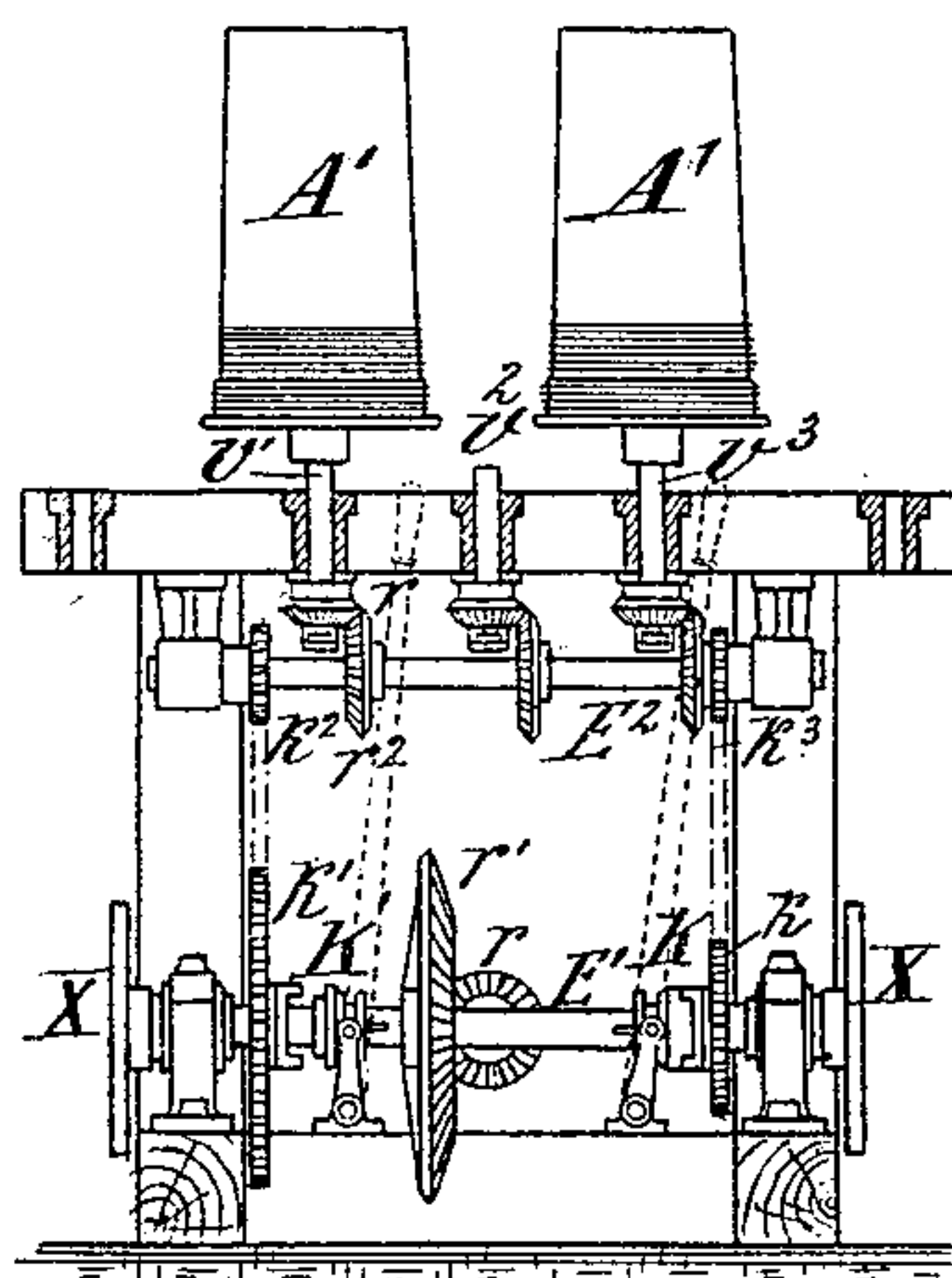
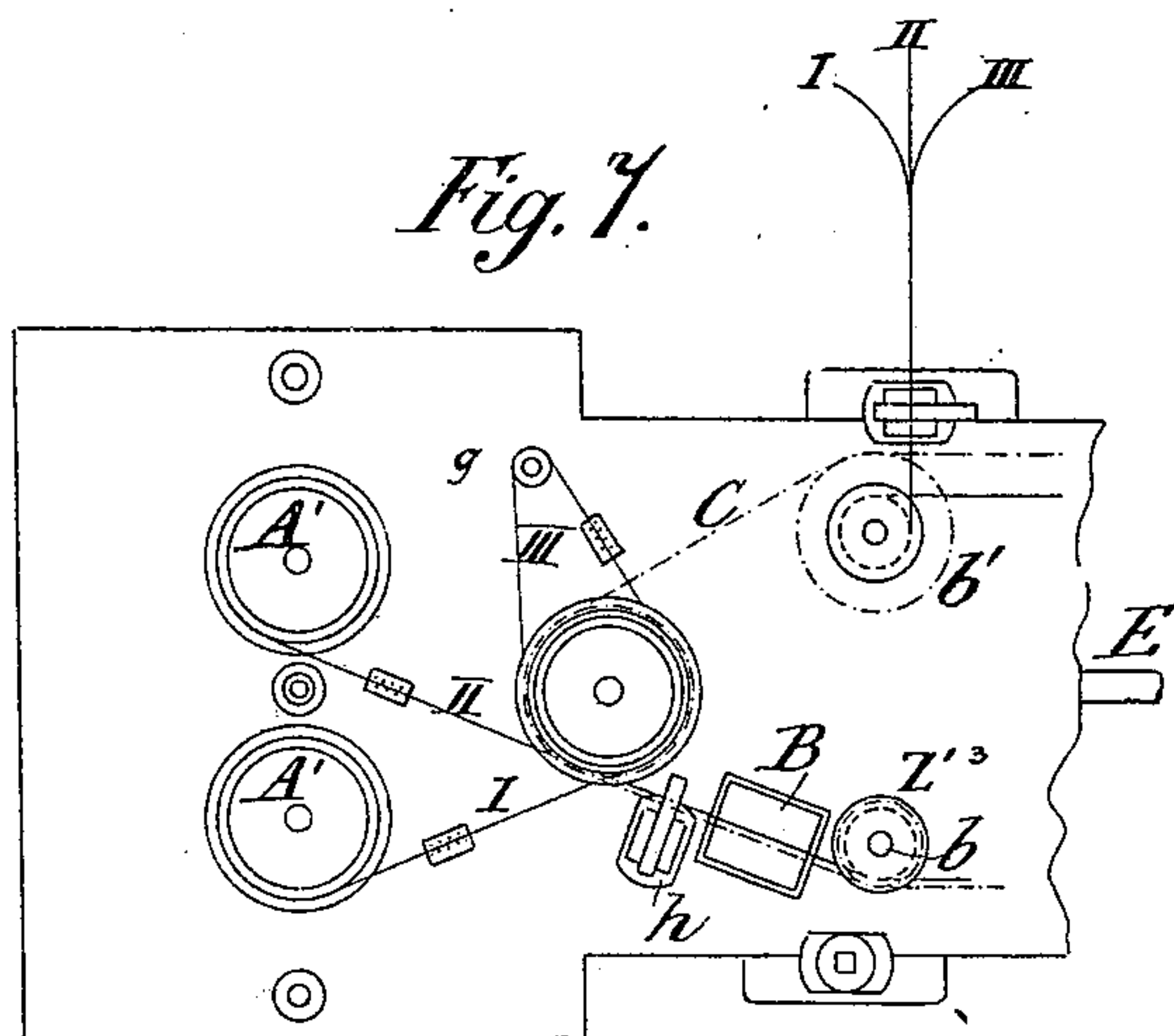


Fig. 7.



Witnesses:  
Eugene K. K. K.  
C. A. Bredd

Inventor:  
Carl Harmann  
by Fairfax & Wetter  
Attorneys



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Fig. 9.

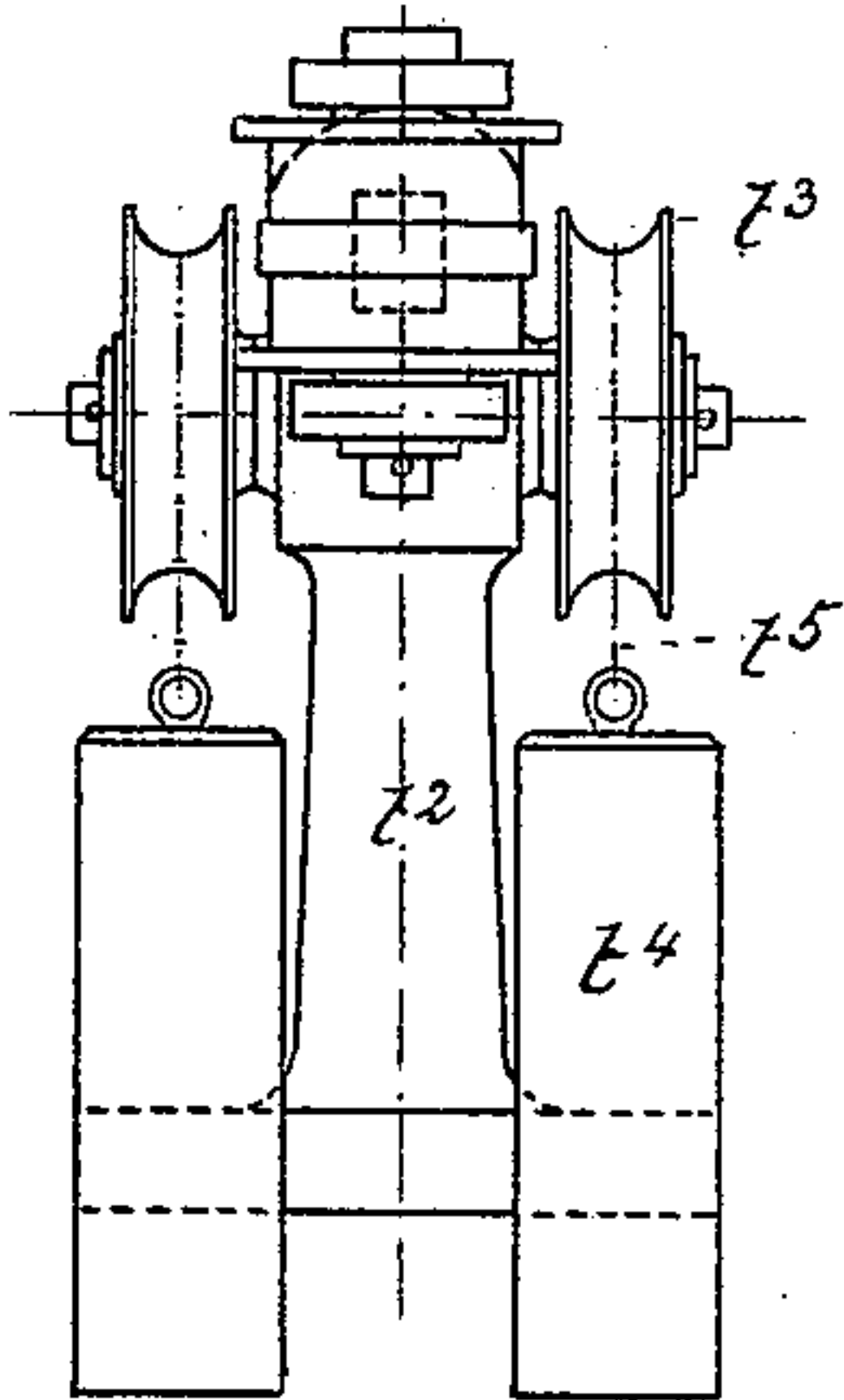


Fig. 10.

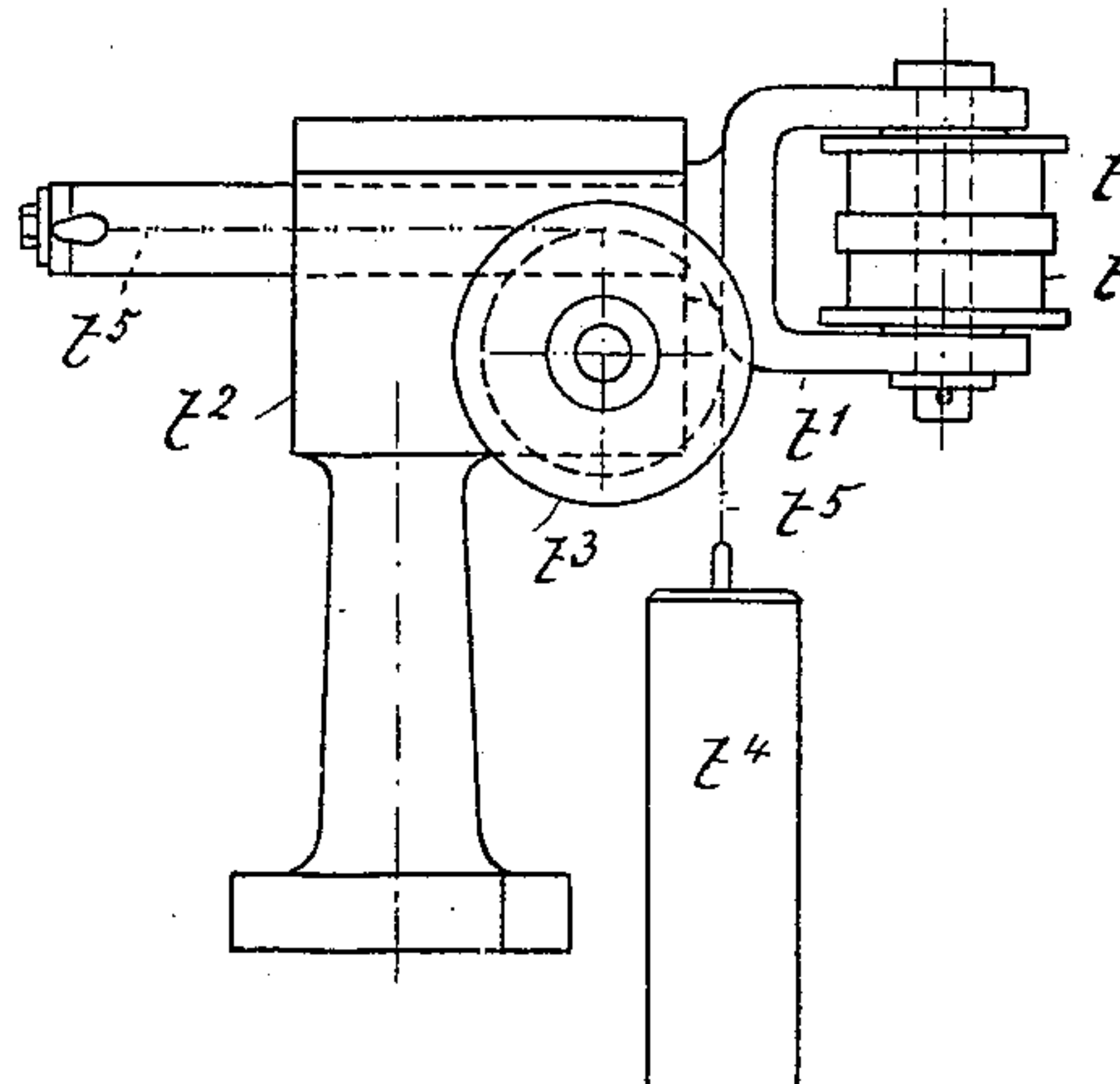


Fig. 11.

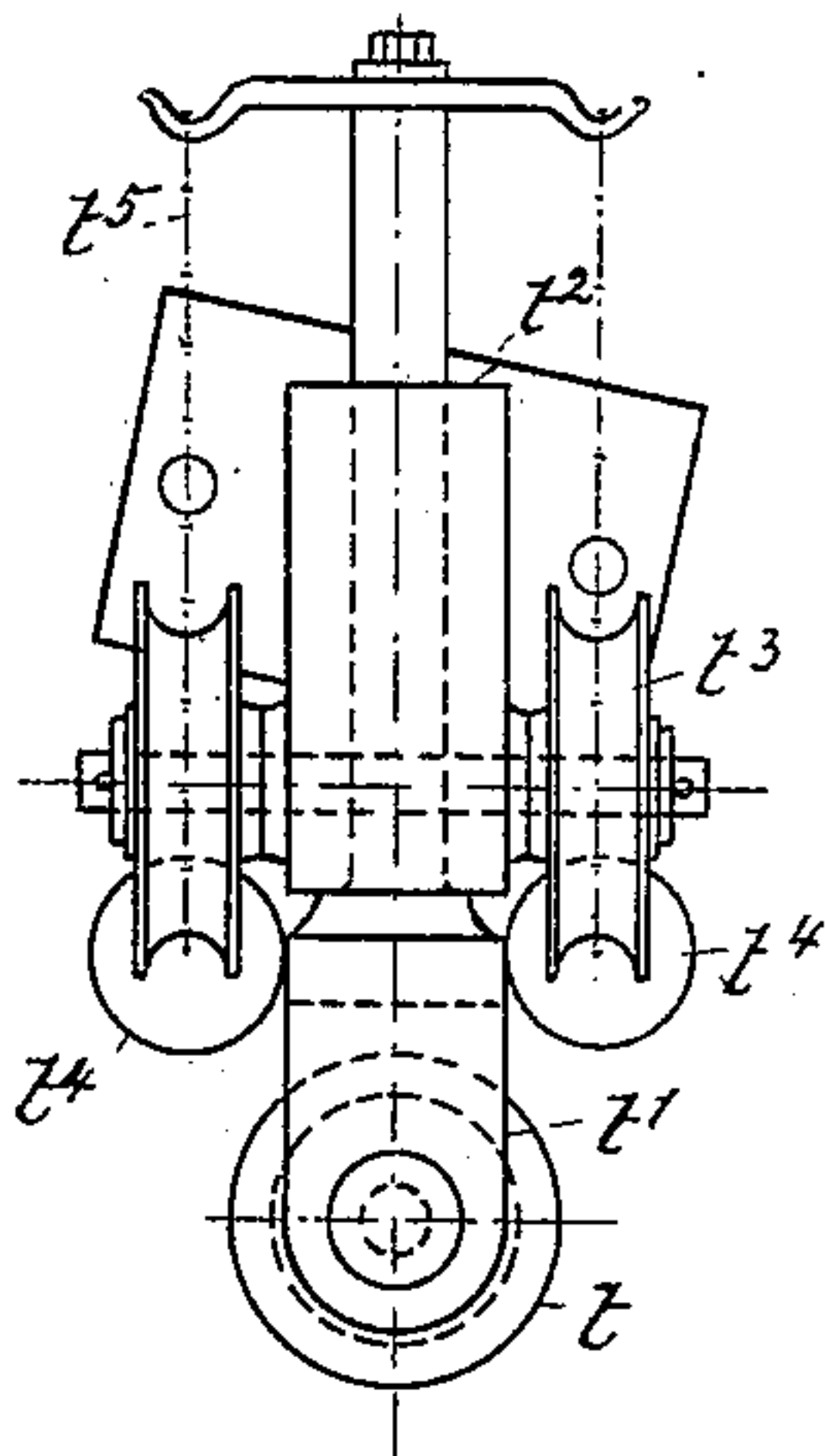


Fig. 12.

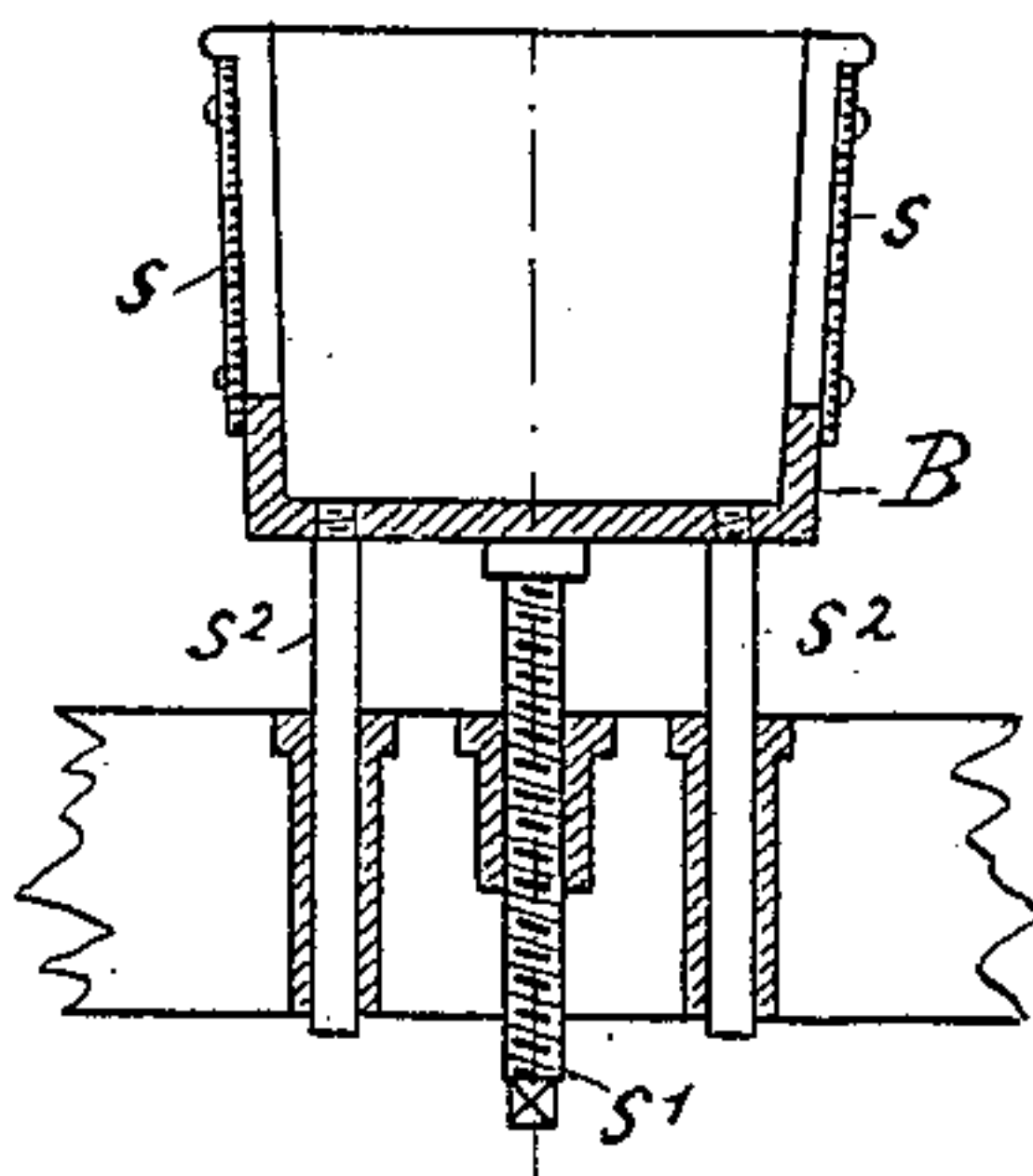


Fig. 13.

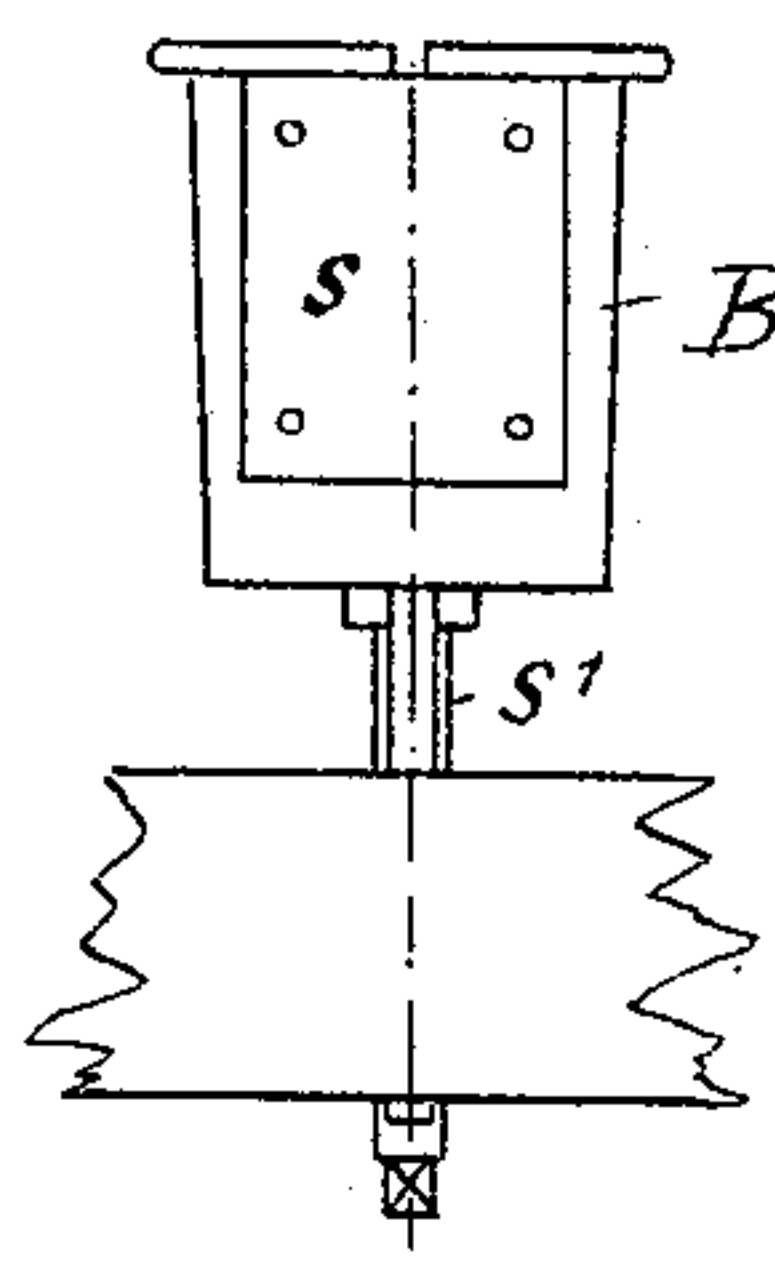
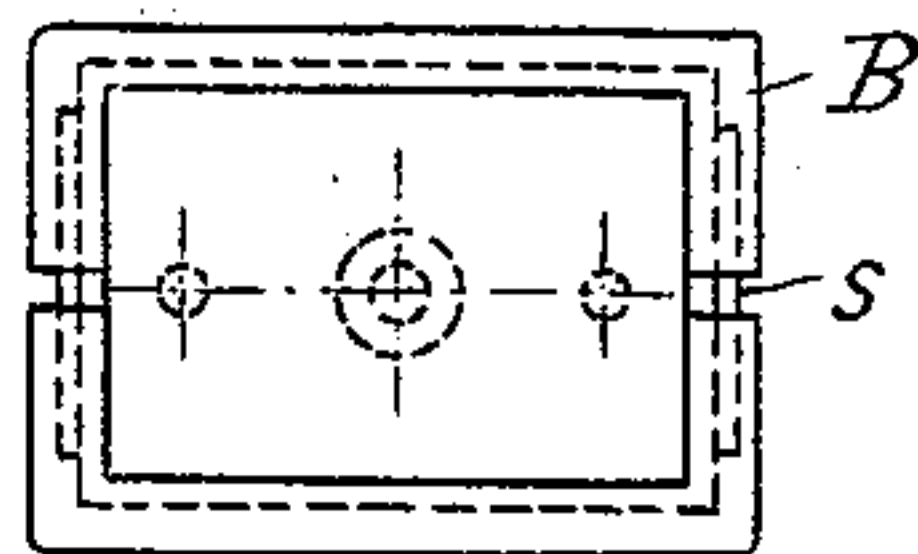


Fig. 14.



Witnesses:  
Elizabeth L. Loring  
J. A. Brett

Inventor:  
Carl Harmann  
by Fairfax & Wetters  
Attorneys

# UNITED STATES PATENT OFFICE.

CARL HARMANN, OF NEUSTADT, AUSTRIA-HUNGARY, ASSIGNOR OF ONE-HALF TO THEODOR GECK, OF ALTENA, GERMANY.

## WIRE-DRAWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 624,018, dated May 2, 1899.

Application filed December 18, 1897. Serial No. 662,478. (No model.)

*To all whom it may concern:*

Be it known that I, CARL HARMANN, a subject of the German Emperor, residing at Neustadt, near Vienna, in the Empire of Austria-Hungary, have invented certain new and useful Improvements in Wire-Drawing Machines, (for which patents have been granted to me in Great Britain, No. 5,221, dated March 12, 1895; in Switzerland, No. 9,942, dated March 16, 1895; in Germany, No. 92,580, and in France No. 243,995, dated December 29, 1894,) of which the following is a specification.

This invention has for its object to produce a wire-drawing machine which is adapted to draw several wires continuously through several draw-plates and to wind them on bobbins of any required size or on winding-drums corresponding in number to the wires or to draw several wires directly from the reel in one operation, as in the ordinary method of wire-drawing upon drawing-rollers corresponding in number to the spindles.

In the accompanying drawings, Figure 1 is an elevation of a wire-drawing machine embodying my invention. Fig. 2 is a plan of the same. Fig. 3 is an elevation of a portion of a multiple wire-drawing machine embodying my invention. Fig. 4 is a plan of the same. Fig. 5 is a vertical transverse section along line  $xx$  of Fig. 3. Fig. 6 is an elevation of a portion of another multiple wire-drawing machine embodying my invention. Fig. 7 is a plan of the same. Fig. 8 is an end view and partial section at right angles to Fig. 6; and Figs. 9 to 14 represent details of construction on a larger scale, as will be hereinafter more fully described.

The machine represented by Figs. 1 and 2 has five vertical shafts or spindles  $a$   $b$ , of which the shaft  $a$  receives motion from a horizontal shaft  $E$ , situated underneath the table, by means of bevel-wheels  $d$   $d'$ , while the other spindles  $b$   $b$  are driven from the shaft  $a$  by means of chain-wheels  $b'$  and a continuous chain  $C$  at suitable speeds corresponding to the elongation of the wire through each of the draw-plates. On each of the vertical spindles  $b$   $b$  is mounted above the table a pair of draw-rollers  $Z'$   $Z''$ , the circumference of which is slightly conical, the middle of each

roller being slightly less in diameter than the top and bottom. Each pair of rollers is adjustable on its shaft in order to vary its height above the table, as may be required. In proportion as the length of the wire increases its sectional area decreases. Each consecutive roller therefore runs faster than the preceding one, for which purpose the diameter of each chain-wheel is larger than that of the preceding chain-wheel, as shown by Fig. 2 of the drawings. In front of each pair of draw-rollers there is mounted a draw-plate holder  $h$ , adjustable in height like the draw-rollers, and between consecutive pairs of rollers there is inserted a receptacle  $B$  for the pickling liquid, hereinafter called the "pickling-trough." Each holder  $h$  contains one or more draw-plates similar to those used in other wire-drawing machines.

As shown by Figs. 12 to 14, the pickling-trough  $B$  has on two opposite sides vertical slots through which the wire enters and leaves the trough, and each slot is covered with a vertically-slitted rubber plate  $s$ , which serves to guide the wire, to cleanse the same, and to retain any excess of liquid in the pickling-trough. The trough rests on a vertical screw-spindle  $s'$ , by means of which it may be raised or lowered to the desired height, and it is guided by a pair of vertical guide-rods  $s''$ .

To keep the driving-chain  $C$  in gear with the chain-wheels  $a'$   $b'$  even when the links have become elongated by prolonged use and to prevent the chain from falling down, I employ an automatic tension-regulator  $T$ , as shown by Figs. 2, 9, 10, and 11. This regulator consists, chiefly, of a pair of horizontal guide-rollers  $t$   $t$ , mounted in a fork  $t'$ , the rear part of which is a prismatic bar supported and guided by a stand  $t''$ . This fork  $t'$  is constantly pressed against the chain by means of weights  $t^4$ , connected with the rear end of the fork by a pair of strings  $t^5$ , running over the guide-pulleys  $t^3$ . Fig. 9 is a front elevation, Fig. 10 a side elevation, and Fig. 11 a plan, of the automatic regulator  $T$ .

The multiple-wire-drawing machine represented by Figs. 3 to 5 is adapted to act on three wires simultaneously and is similar in



its general construction to that described above with this difference, however, that from the last set of draw-rollers  $Z'$  to  $Z^3$  the wires are wound direct on bobbins instead of being wound upon a drum. For this purpose the machine is provided with an automatic bobbin-winder adapted to be set in motion by the machine itself. Said bobbin-winder comprises three bobbins  $V$ , (equal in number to the number of draw-rollers mounted on the same vertical axle,) each of which bobbins is mounted on a vertical spindle  $v'$ ,  $v^2$ , or  $v^3$ , receiving rotary motion from the main driving-shaft  $E$  by means of large bevel-wheels  $r'$ ,  $r^2$ ,  $r^3$ , horizontal shafts  $E'$  and  $E^2$ , small bevel-wheels  $r^2$ ,  $r^3$ , and driving-chains passing over chain-wheels  $k$ ,  $k'$ ,  $k^2$ ,  $k^3$ . The chain-wheels  $k'$ ,  $k^2$  are loose on the driving-shaft  $E'$  and have different diameters in order to produce different speeds of the shaft  $E^2$ . Each of the said chain-wheels is combined with a movable coupling-sleeve and a coupling-lever  $K$ ,  $K'$ , adapted to set the chain-wheels in and out of gear alternately, as is well understood. According as the wheel  $k'$  or the wheel  $k$  is coupled with the shaft  $E'$ , the speed of the bobbins will be high or low. The bobbins  $V$  are adapted to slide on their respective spindles while receiving rotary motion from the same and are supported by a rectangular frame  $m$ , which is attached to a pair of vertical bars guided in the table or platform of the machine, as shown by Fig. 5. Said vertical bars are joined by means of connecting-rods  $X'$  to a pair of crank-disks mounted on the driving-shaft  $E'$ , so that as the latter revolves the frame  $m$ , together with the bobbins  $V$ , will rise and fall.

The multiple wire-drawing machine represented by Figs. 6, 7, and 8 is similar to that just described, but instead of the bobbins  $V$  it has a pair of drums  $A'$ , on which the wire is wound after it passes through the machine.

The conversion of the machine shown in Figs. 3 to 5 into the machine shown in Figs. 6 to 8 may be effected by removing the bobbins  $V$ , together with the frame  $m$  and the connecting-rods  $X'$ , and mounting on the spindles  $v'$  and  $v^3$  the drums  $A'$  and on the shaft  $a$  a drum  $A$ . The chain-wheel  $k'$  is set out of action by means of the coupling-lever  $K'$ , and in lieu thereof the chain-wheel  $k$  is coupled with the shaft  $E'$  in order to reduce the speed of the spindles  $v'$ ,  $v^3$ . As in the previously-described machine, the shaft  $a$  carries a set of drawing-rollers  $Z'$ ,  $Z^2$ ,  $Z^3$ , which are larger than those mounted on the shaft  $b$ . In Figs. 6 to 8 the wires I and II, after passing over the draw-rollers  $Z'$  and  $Z^2$  of the shaft  $a$ , are wound on the drums  $A'$ , as shown, while the third wire III passes from the roller  $Z^3$  of the shaft  $a$  over a small guide-roller  $g$  and is then wound on the drum  $A$ .

$g'$  are ordinary guide-rollers interposed between the last drawing-rollers and the bobbins  $V$  or between the said drawing-rollers and the drums  $A'$ .

The machine works as follows, (see Fig. 1:) The crude wire drawn off a reel or drum  $D$  passes through the first draw-plate mounted in the holder  $h$  to the first pair of draw-rollers  $Z'$ ,  $Z^2$ , where it is coiled several times on the roller  $Z'$ . Thence it passes through the first pickling-trough  $B$  to the second draw-plate and through the same to the second pair of rollers, thence through the second pickling-trough to the third draw-plate, and so on until it returns to the first pair of draw-rollers, where the wire, which has been reduced in thickness by the repeated drawing processes, is wound on the upper roller  $Z^2$ , of larger diameter than the lower roller  $Z'$ . The wire now passes from the larger roller again through the draw-plates and pickling-troughs in the same order as described above; but the second hole of each draw-plate, through which the wire now passes, is of course smaller than the first, because the diameter of the wire has been reduced during the interval. From the last draw-roller the wire is guided through the last pickling-trough  $B$  and through the last draw-plate to the winding-drum  $A$ . The latter receives the wire in its lower groove—that is to say, between its two bottom flanges—where it makes several turns, after which it is led over a guide-roller  $g$  and an ordinary wire straightener or rectifier  $u$  to the drum  $N$ , on the upper part of which it is now wound as a finished product. The wire-straightener has for its object to remove any kinks or bends that may occur in the wire and is only used for fine wire. For coarse wire the rectifier  $u$  is omitted.

As during the process of wire-drawing the length increases in proportion as the sectional area of the wire decreases, it is necessary to give to each pair of draw-rollers a greater speed than that of the preceding pair, and this increase must correspond to the elongation of the wire in order to prevent the wire from slipping off the roller. The required ratios of speed between the different spindles  $b$ ,  $b'$  may of course be obtained by giving to the corresponding chain-wheels  $b'$ ,  $b$  suitable diameters.

If the machine shown in Figs. 1 and 2 is to be used for drawing two or more wires at the same time, the draw-rollers  $L'$ ,  $L^2$  on each spindle must be removed and replaced by draw-rollers of equal diameter—that is to say, each of the rollers mounted on the same spindle must have the same diameter. Each wire makes only one circuit through the machine, so as to pass only once over the same spindle and through the same pickling-trough, instead of making two circuits, as represented in Figs. 1 and 2.

The pickling-trough  $B$ , inserted between consecutive draw-plates, has for its object to cool and lubricate the wire after every drawing operation. The composition of the liquid contained in the pickling-trough depends upon the nature of the wire intended to pass through the same.



The machine described above may be used for drawing wire from two millimeters in diameter down to the very finest numbers, and owing to the symmetrical arrangement of the tools the tension produced in the wire by the draw-rollers is approximately constant. The same wire may be drawn repeatedly on the same machine, which has also the advantage of occupying a small space, so that all the operating-tools are open and easily accessible, and the driving-gear is simplified by the use of a driving-chain, which sets in operation the various vertical spindles, together with their draw-rollers, at the same time.

For treating very soft wire the draw-rollers mounted on the shafts *b*, Figs. 3 to 5, may be taken off and replaced by guide-rollers.

The multiple wire-drawing machines described above may be converted into simple wire-drawing benches where the same wire does not pass consecutively over two or more draw-rollers mounted on separate spindles *bb*; but each spindle and draw-roller draws its wire off a separate drum through a separate draw-plate situated between the said draw-roller and drum. After such conversion the machine may be used for drawing galvanized wires.

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

1. A wire-drawing machine comprising in its construction a series of multiple draw-plates, a series of multiple draw-rollers and of pickling-troughs interposed between the said draw-plates, a winding apparatus adapted to receive the wire after its passage through the draw-plates, and mechanism for imparting to the said draw-rollers and to the winding apparatus in unison a continuous rotary motion about their respective axes, each multiple draw-roller consisting of several rollers mounted on the same axle, and the whole being adapted to draw the wire in one operation through the consecutive draw-plates and then to wind it on the said winding apparatus, substantially as described.

2. In a wire-drawing machine, the combination of a vertical driving-shaft carrying a chain-wheel, with a group of vertical spindles each of which carries a chain-wheel, a driving-chain passing from the chain-wheel of the driving-shaft over the chain-wheels of the said spindles one after another, and then back to the driving-shaft, so as to impart motion simultaneously to the whole group of spindles, and an automatic tension device adapted to support the driving-chain between two consecutive chain-wheels, to press it against the circumference of the same and thereby to prevent the driving-chain from dropping out of gear, substantially as described.

3. In a wire-drawing machine, a vertically-adjustable pickling-trough situated between two consecutive draw-rollers, said trough being filled with a suitable pickling liquid and provided on two opposite sides with vertical

slots covered with vertically-slotted india-rubber plates, substantially as and for the purpose described.

4. The combination of a multiple wire-drawing machine comprising in its construction a vertical main driving-shaft on which is mounted a multiple draw-roller, a series of vertical spindles each of which carries a multiple draw-roller and is adapted to be driven from the said vertical main shaft, a series of multiple draw-plates and a series of pickling-troughs, with a bobbin-winder geared together with the said wire-drawing machine, a series of winding-drums *A'* adapted to be mounted on the spindles of the bobbins after the removal of the latter, and a winding-drum *A* adapted to be mounted on the vertical main driving-shaft above its winding-roller, in order that the wire may be wound either on the bobbins or on the drums *A*, substantially as described.

5. The combination of a multiple wire-drawing machine with a bobbin-winder comprising in its construction a series of vertical spindles carrying bobbins mounted on a vertically-movable frame and adapted to slide on their respective spindles, a horizontal driving-shaft geared together with the main driving-shaft of the wire-drawing machine and carrying a pair of crank-disks, a pair of connecting-rods and guide-rods between the crank-disks and the bobbin-frame, a horizontal intermediate shaft geared together with the said spindles, two driving-chains and two unequal pairs of chain-wheels adapted to impart motion from the driving-shaft to the intermediate shaft alternately with the two pairs of chain-wheels, in order that the bobbin-frame together with the bobbins and connecting-rods may be removed and replaced by winding-drums to be driven at a different speed, substantially as described.

6. A wire-drawing machine, comprising in its construction a series of draw-plate holders, a series of vertical shafts each of which carries a pair of draw-rollers of unequal diameters, a series of pickling-troughs interposed between consecutive draw-plates, a winding apparatus adapted to receive the wire after its passage through the draw-plates, and mechanism for imparting to the said draw-rollers and to the winding apparatus in unison a continuous rotary motion about their respective axes, the whole being adapted to draw the wire first over the smaller draw-roller of each pair, then over the larger roller of each pair, and then to wind it up, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CARL HARMANN.

Witnesses:

LUDWIG HARMANN,  
PHILIPP MÜLLER-LUDE.