

(No Model.)

4 Sheets—Sheet 1.

D. C. BELLIS.

AUTOMATIC CHAIN MOTION FOR KNITTING MACHINES.

No. 482,892.

Patented Sept. 20, 1892.

Fig. 1.

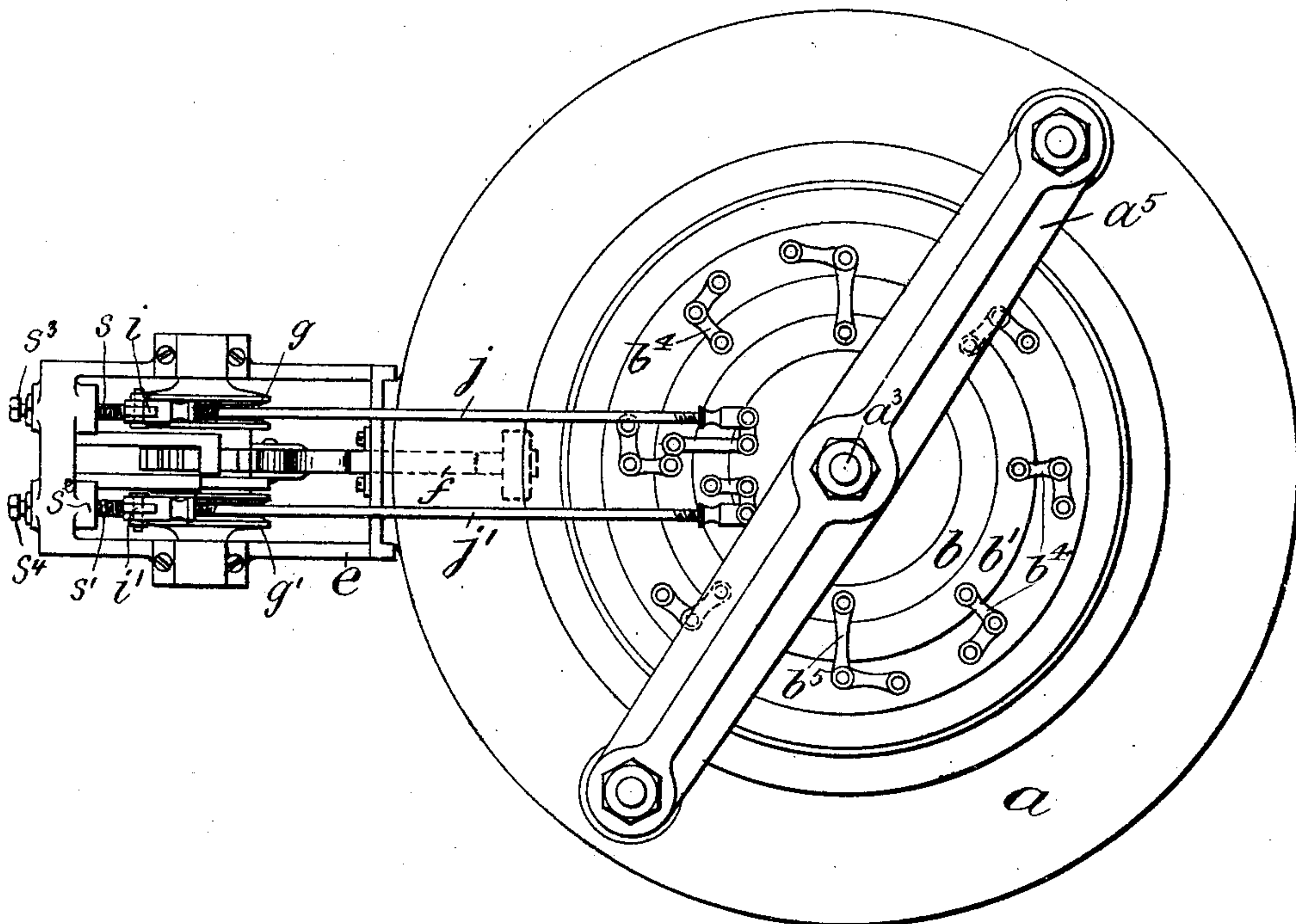
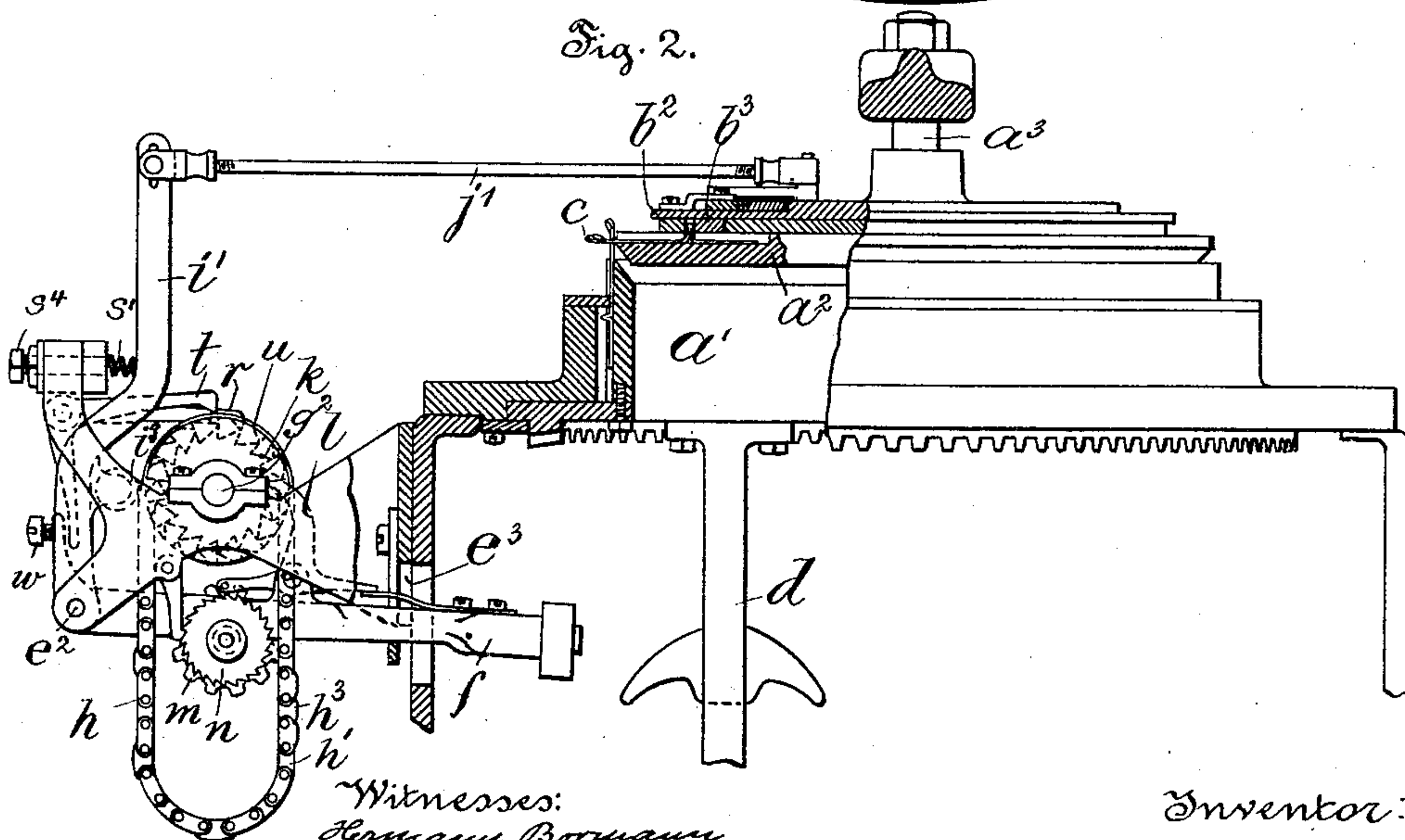


Fig. 2.



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Fig. 3.

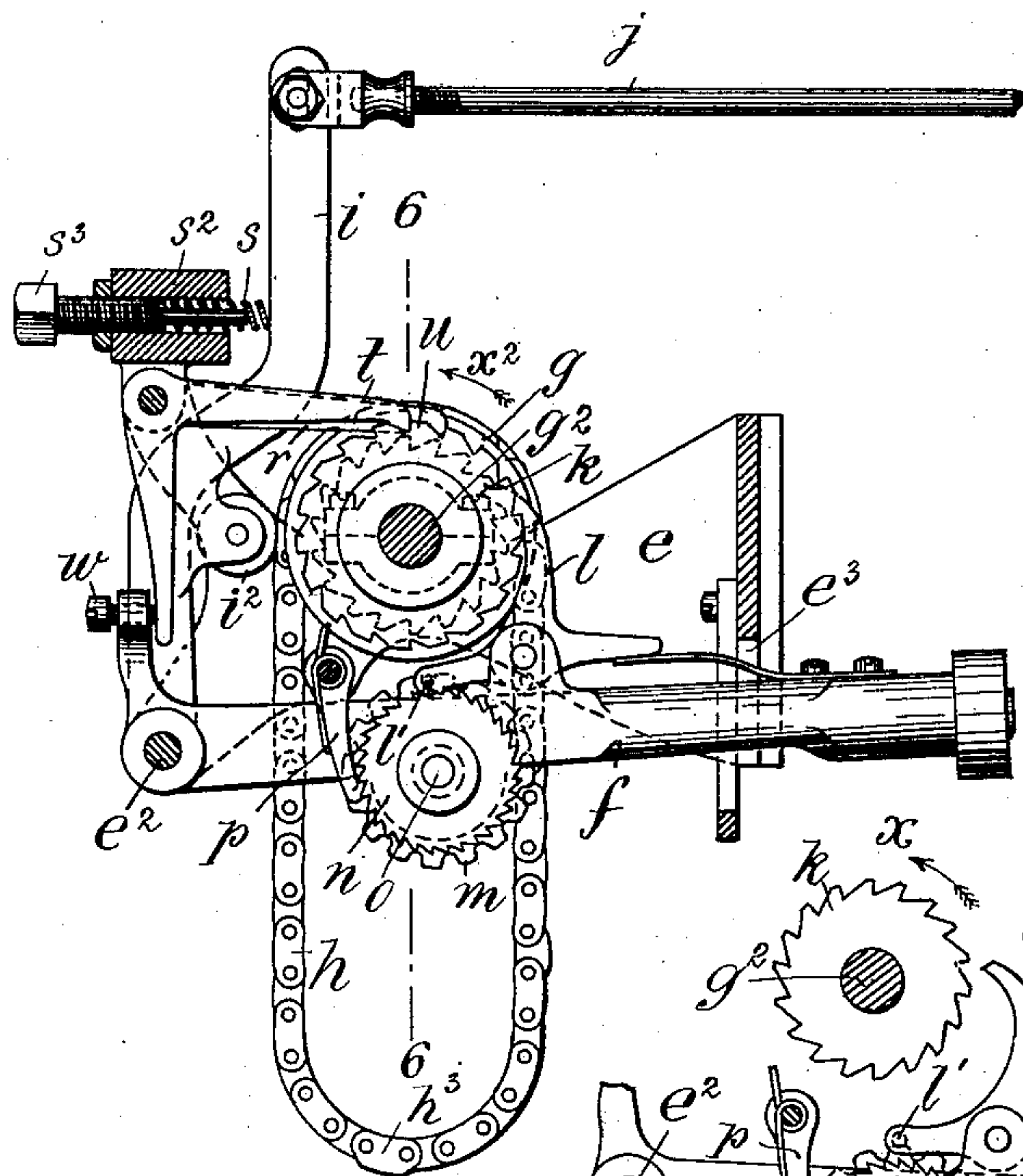


Fig. 5.

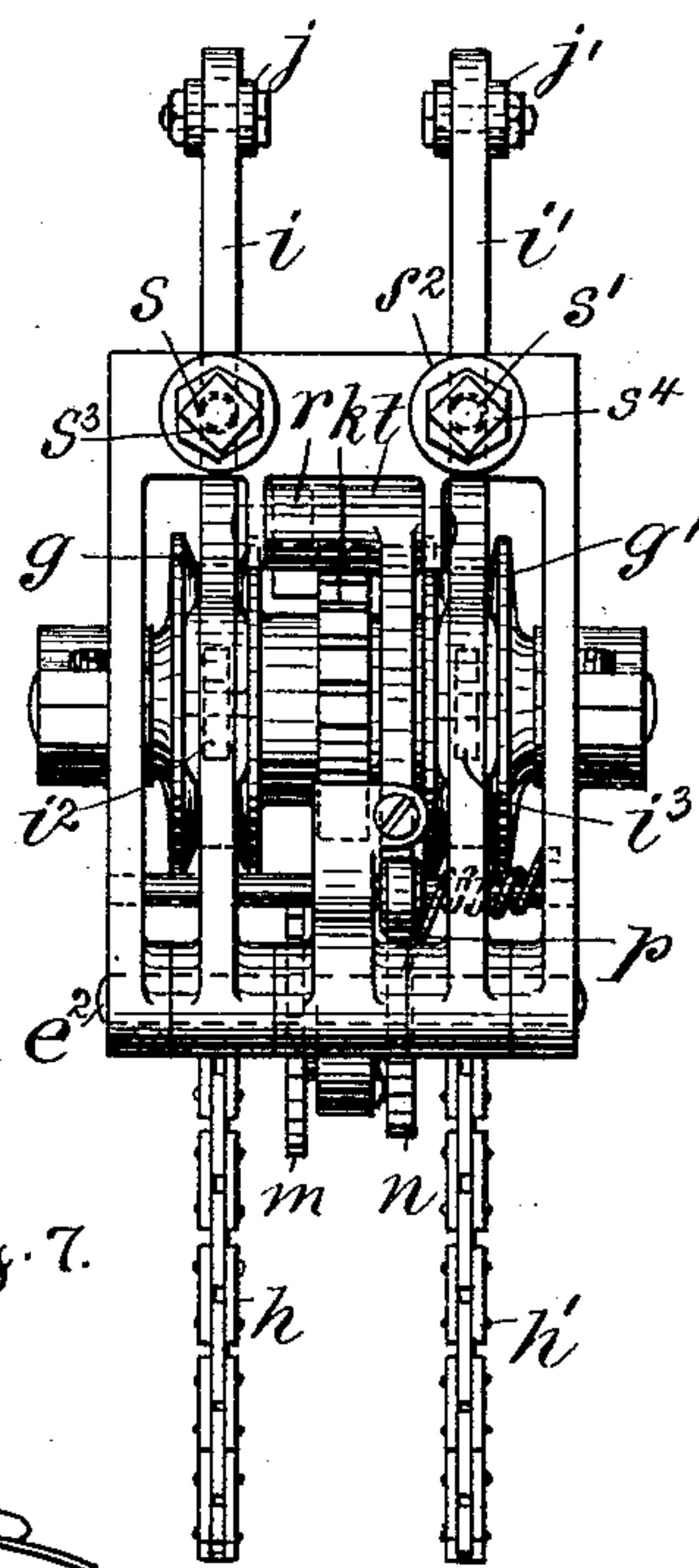


Fig. 7.

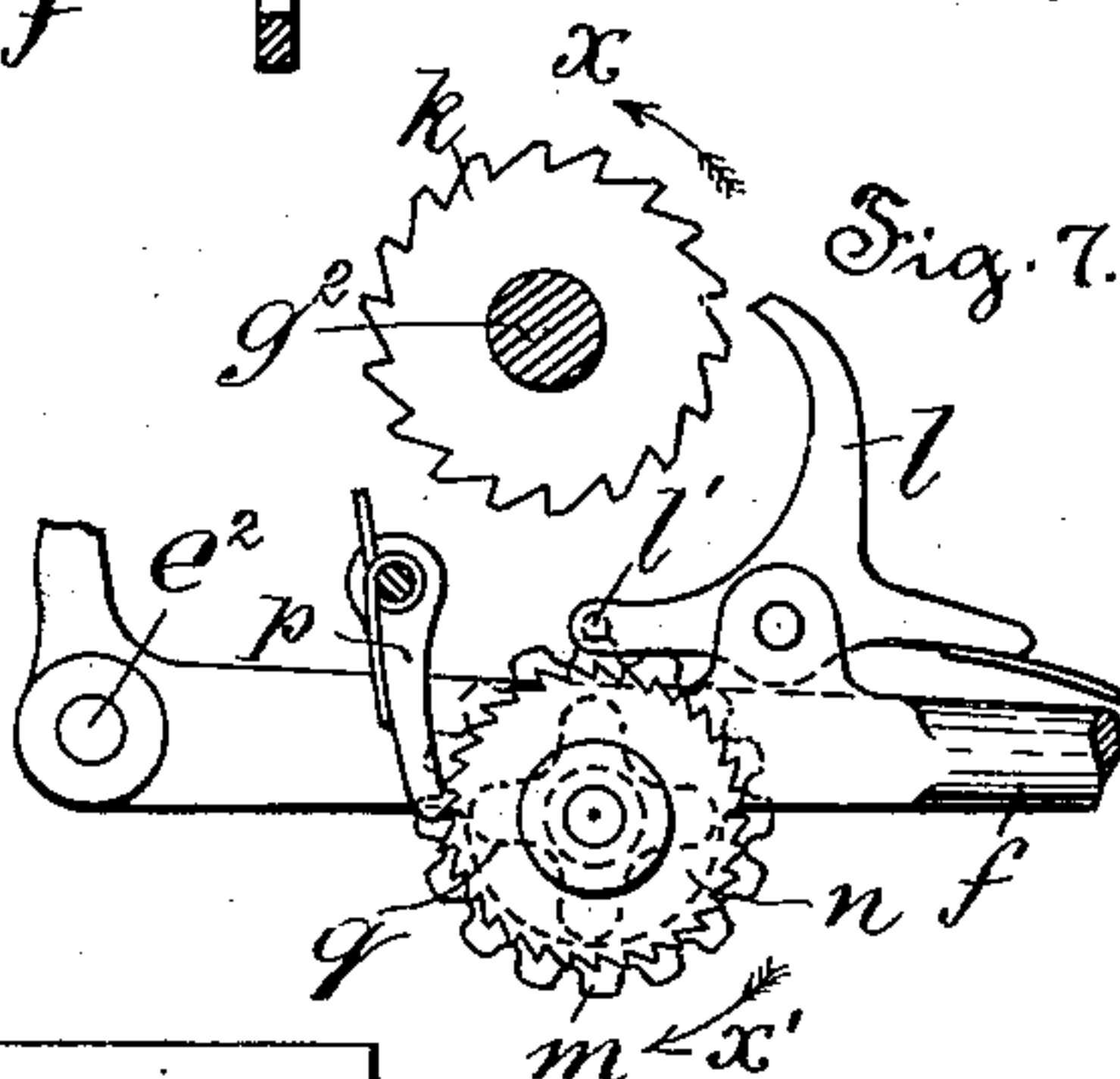


Fig. 4.

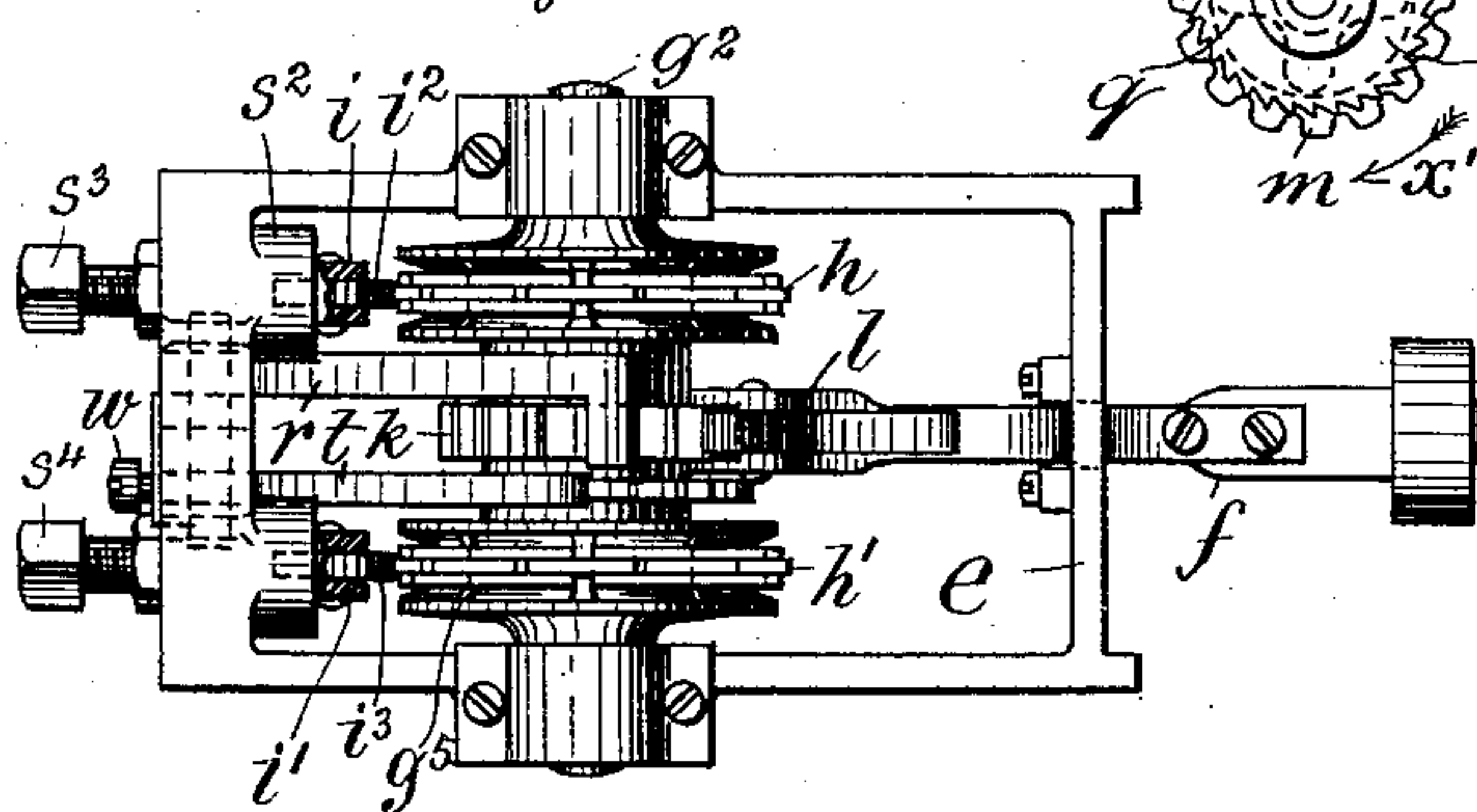
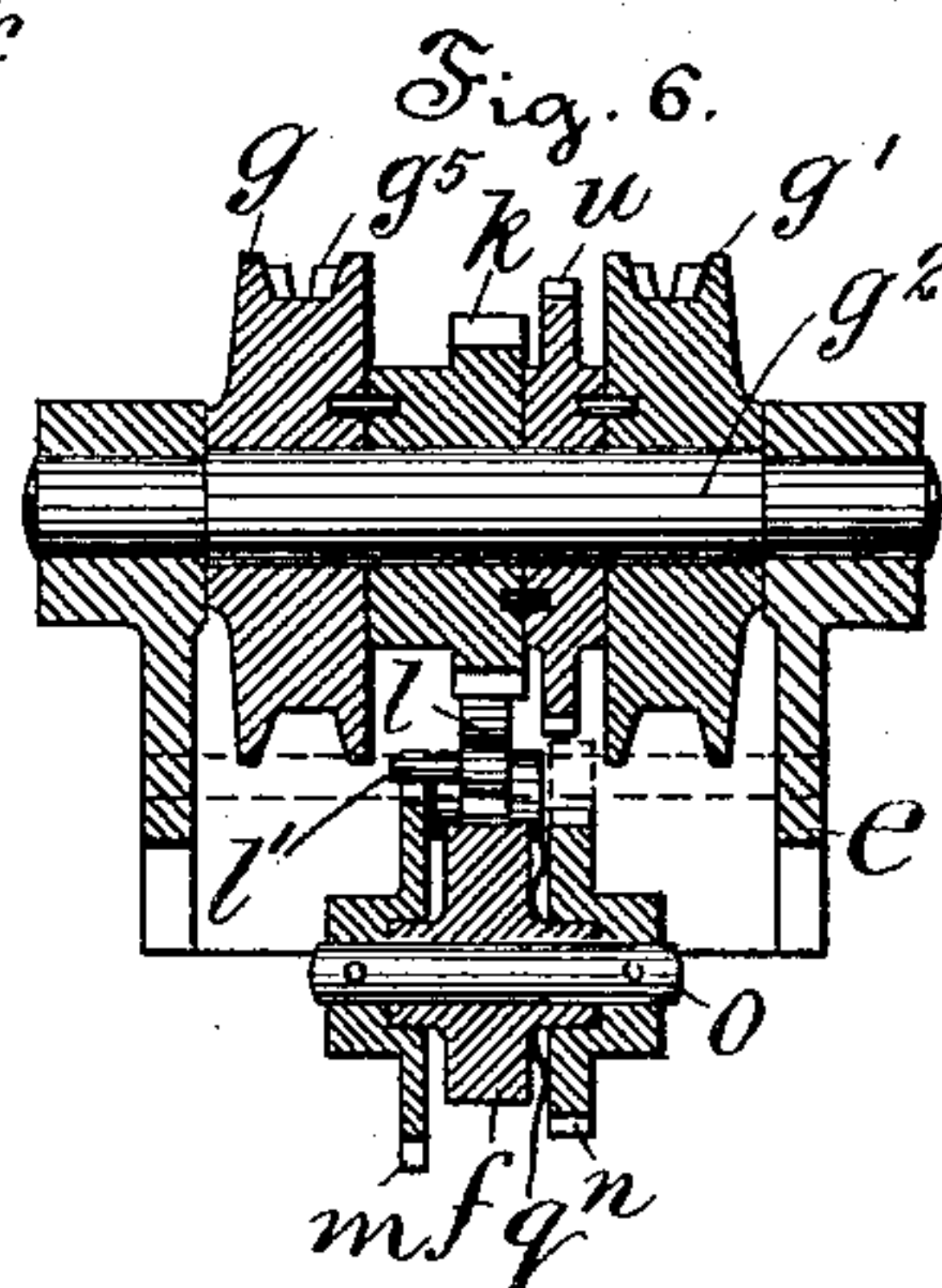


Fig. 6.



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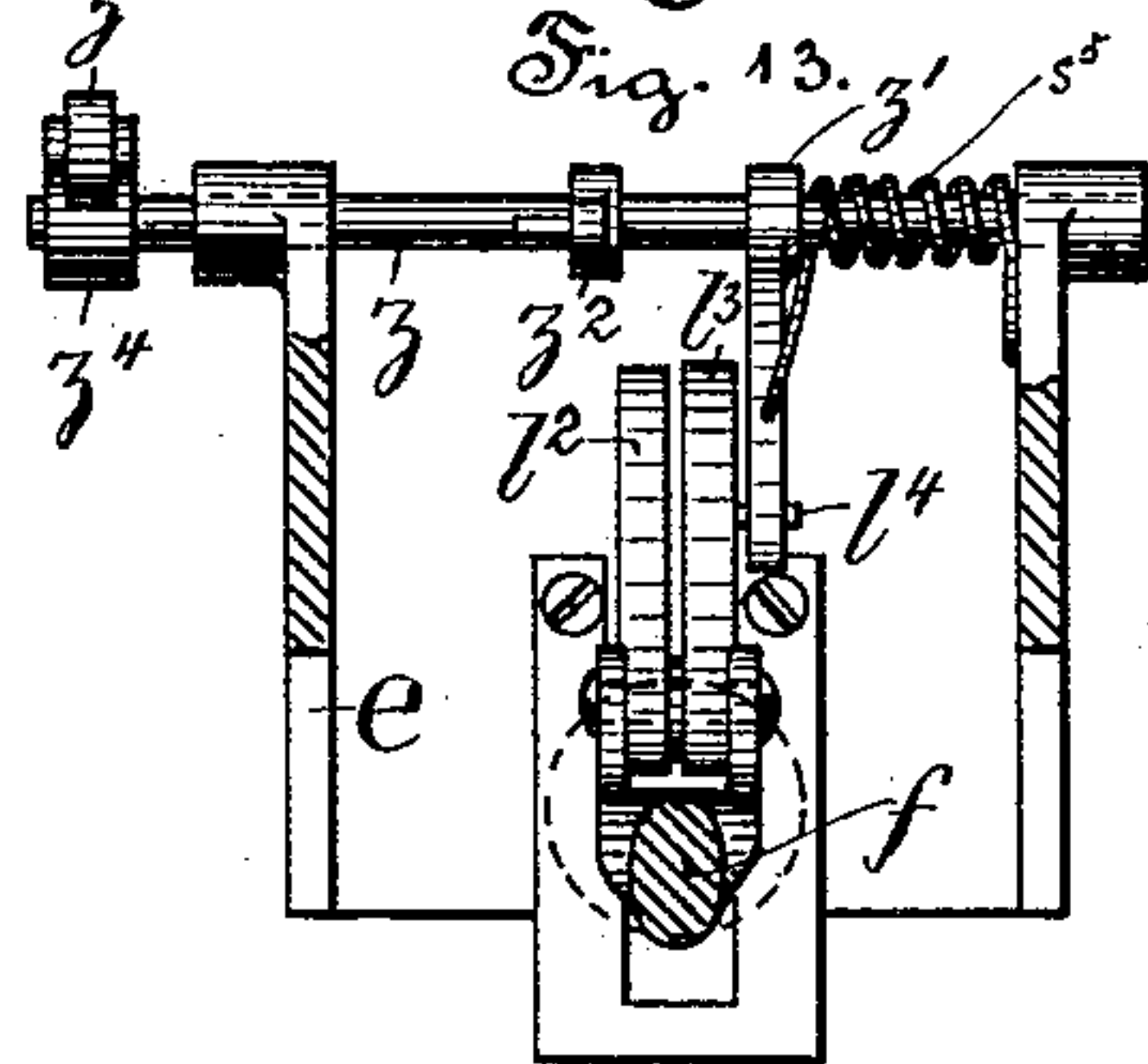
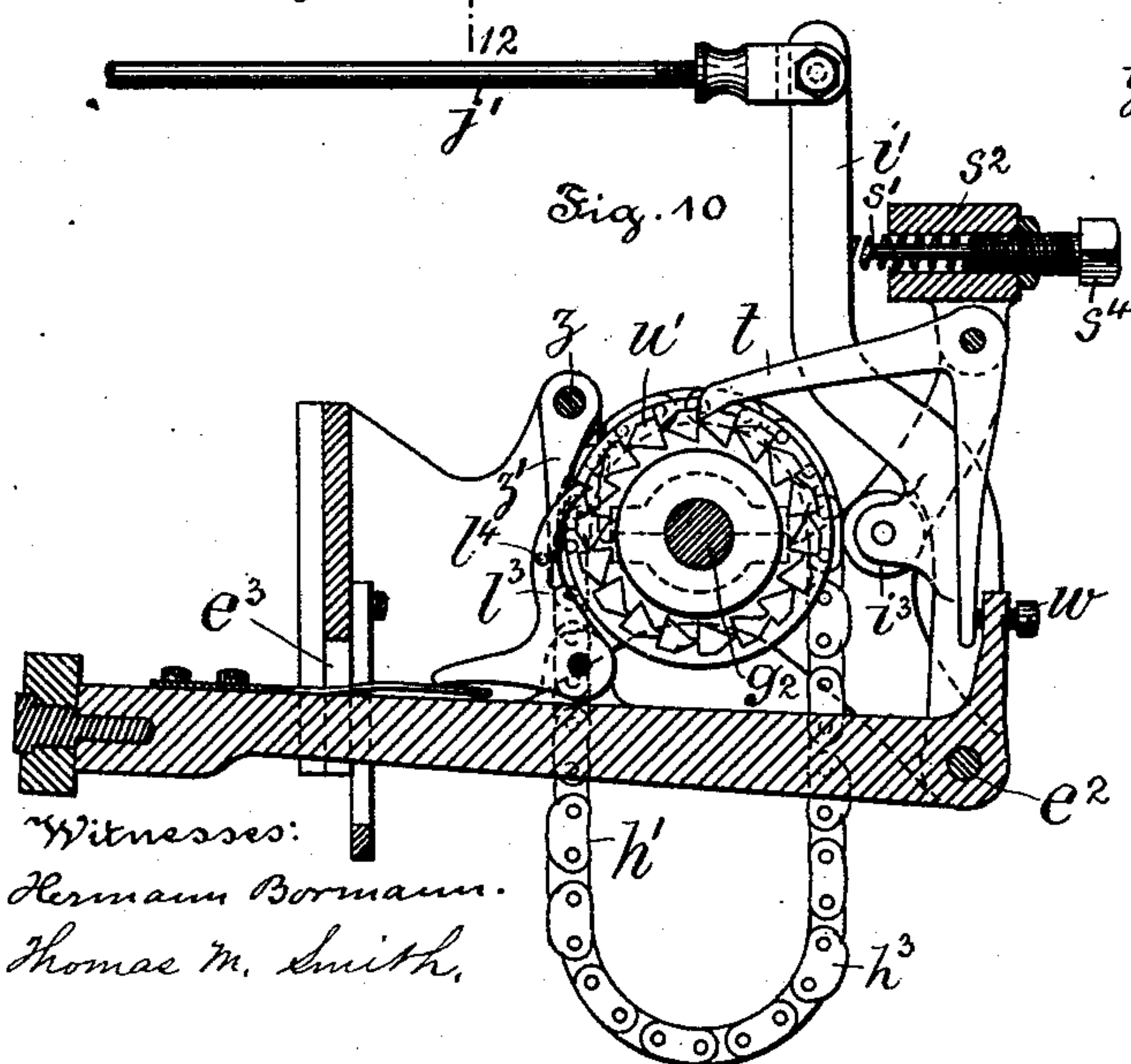
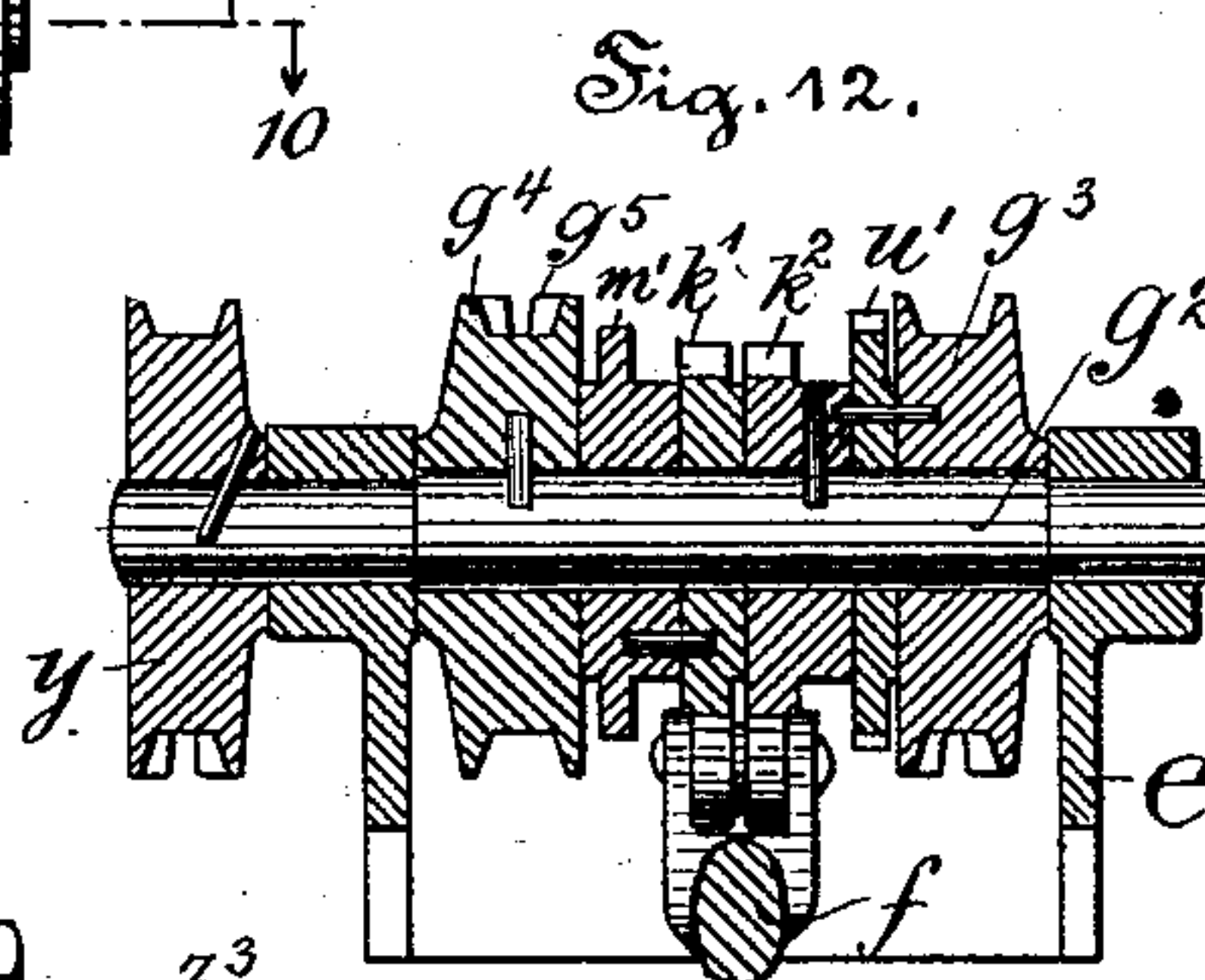
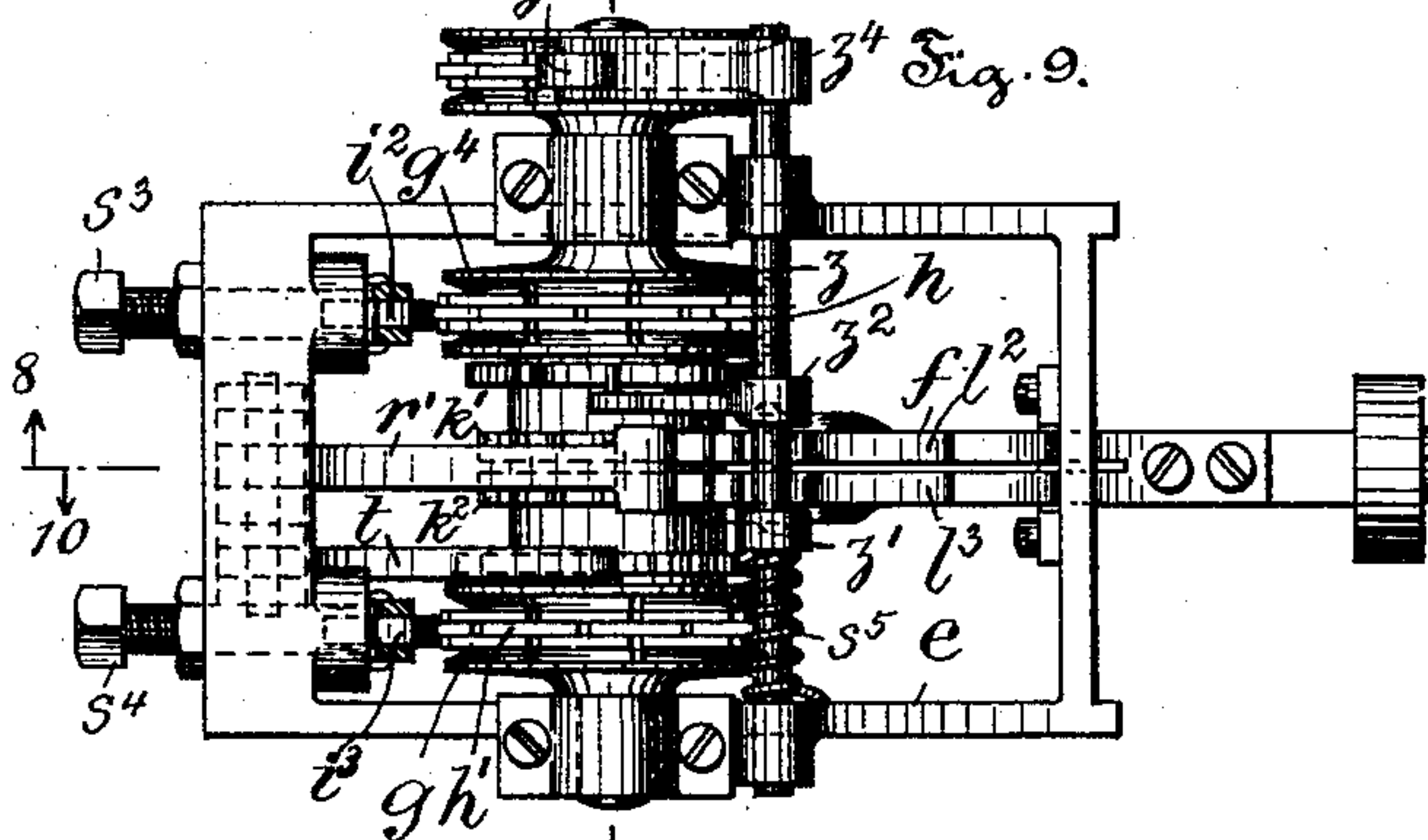
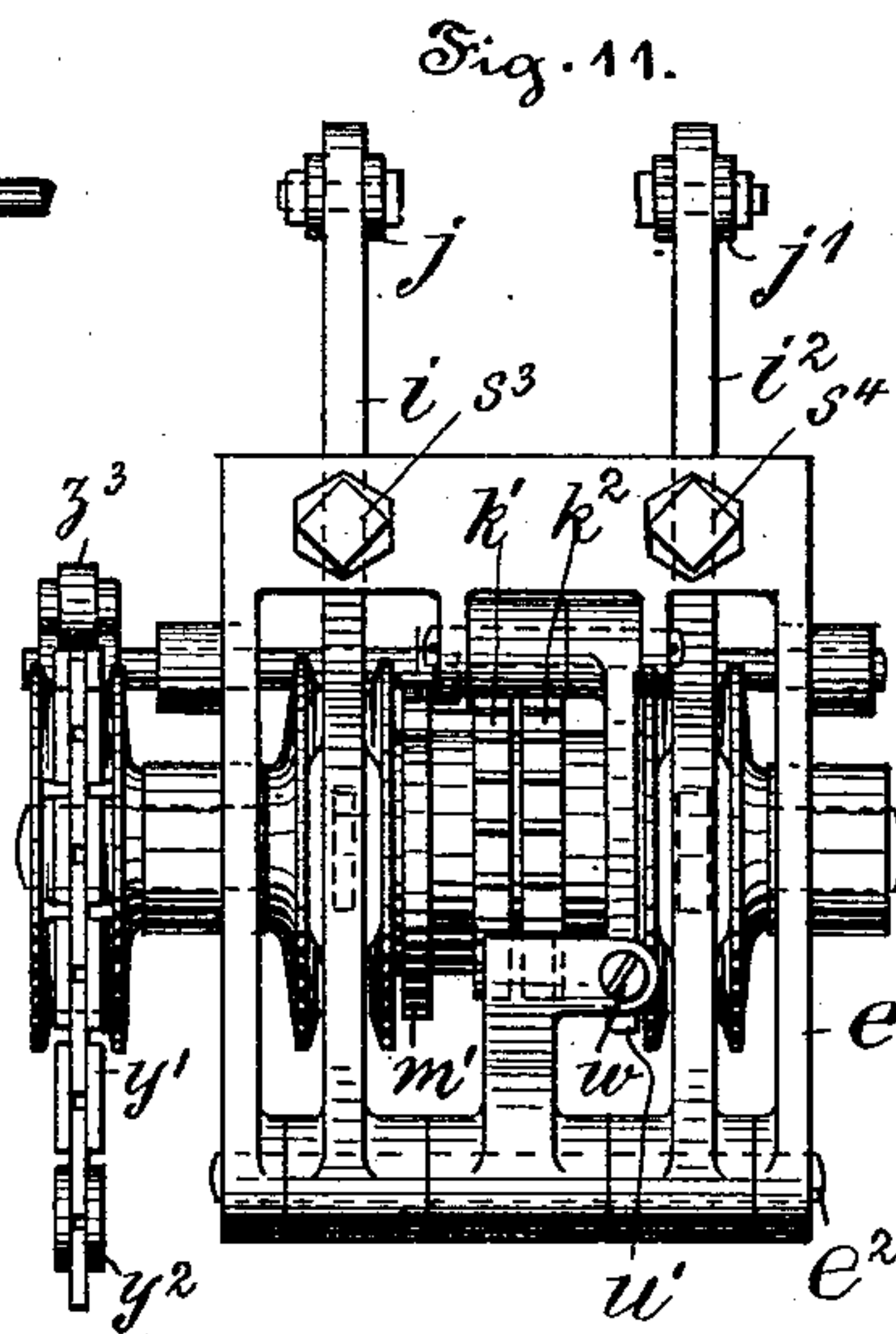
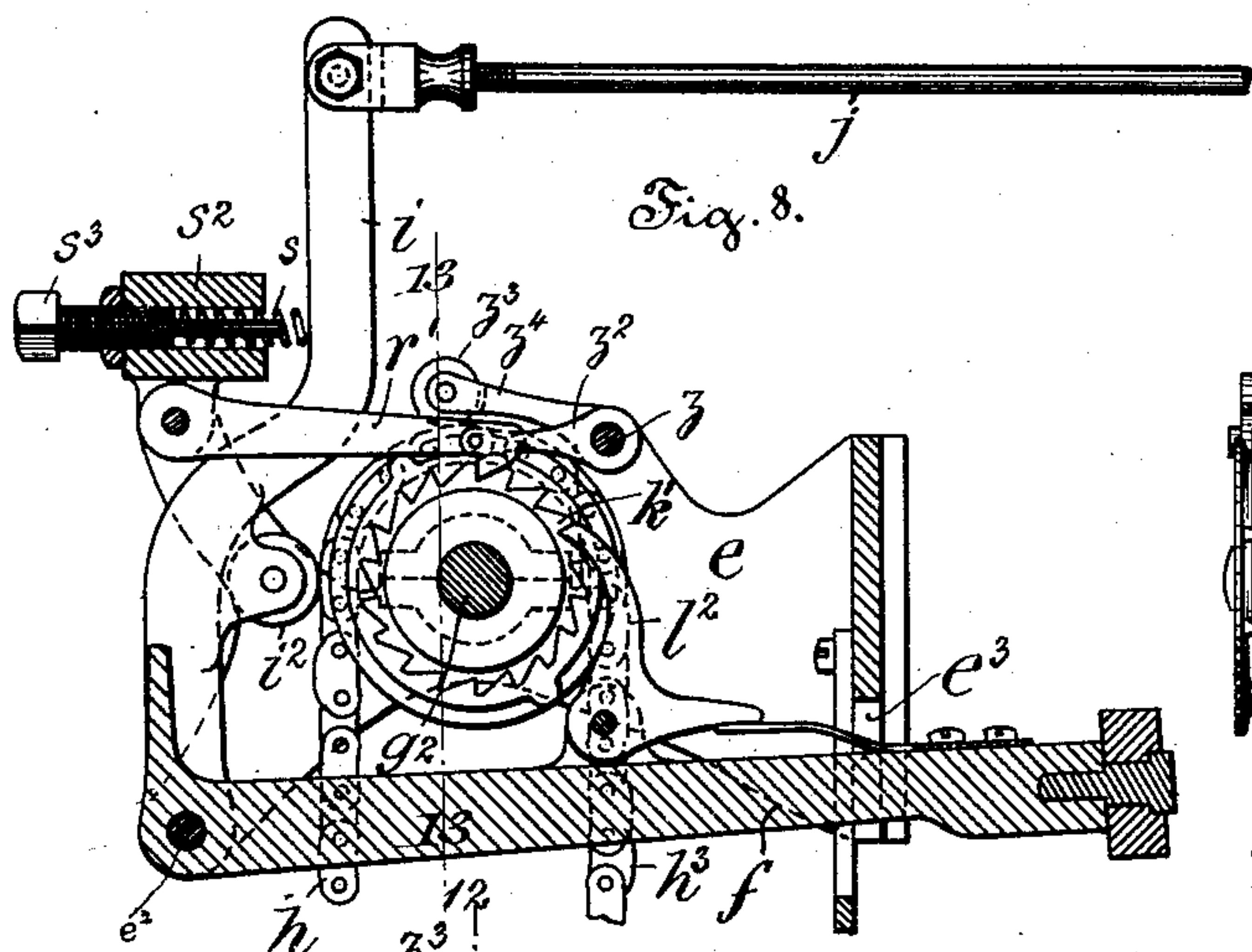
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AUTOMATIC CHAIN MOTION FOR KNITTING MACHINES.

No. 482,892.

Patented Sept. 20, 1892.



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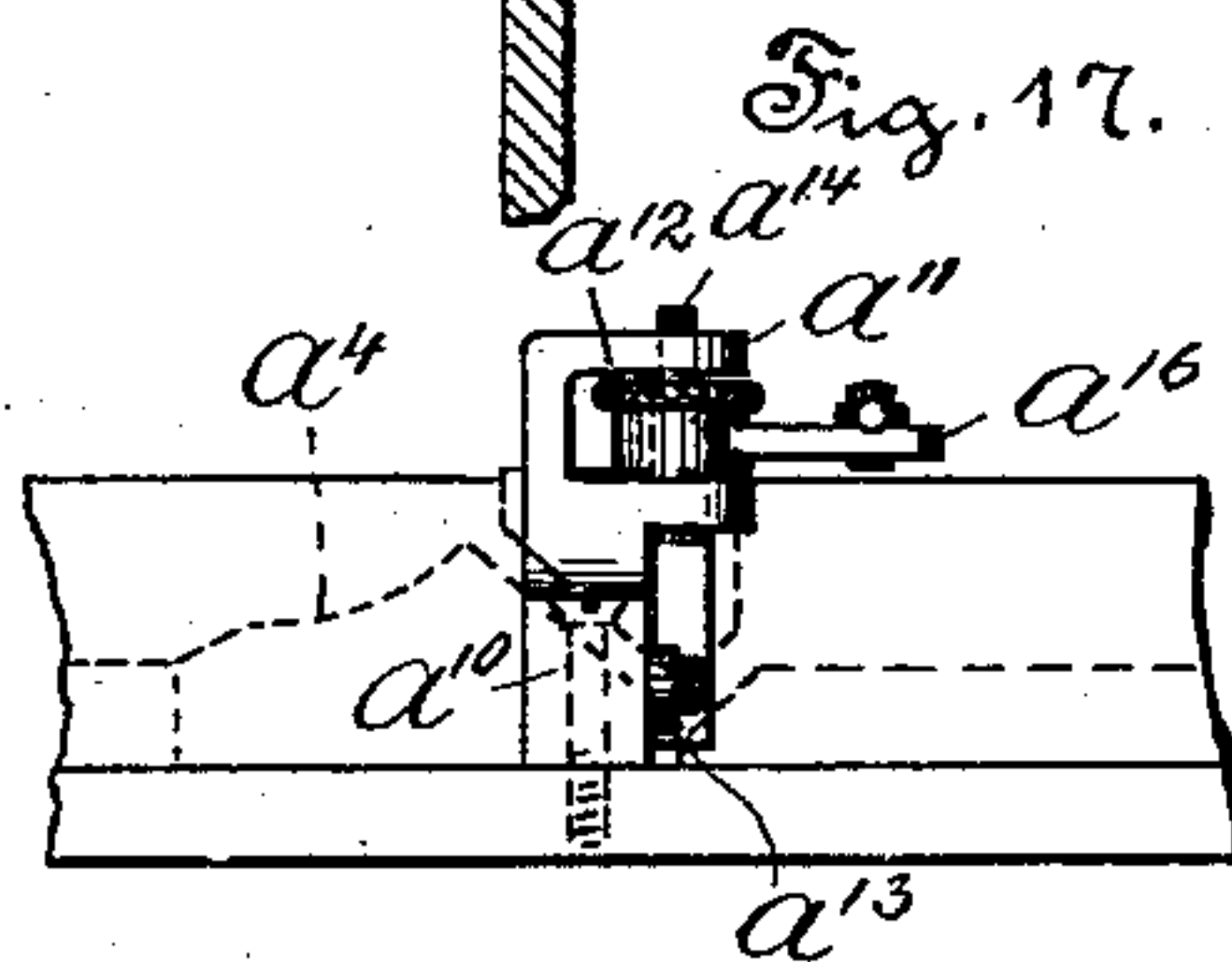
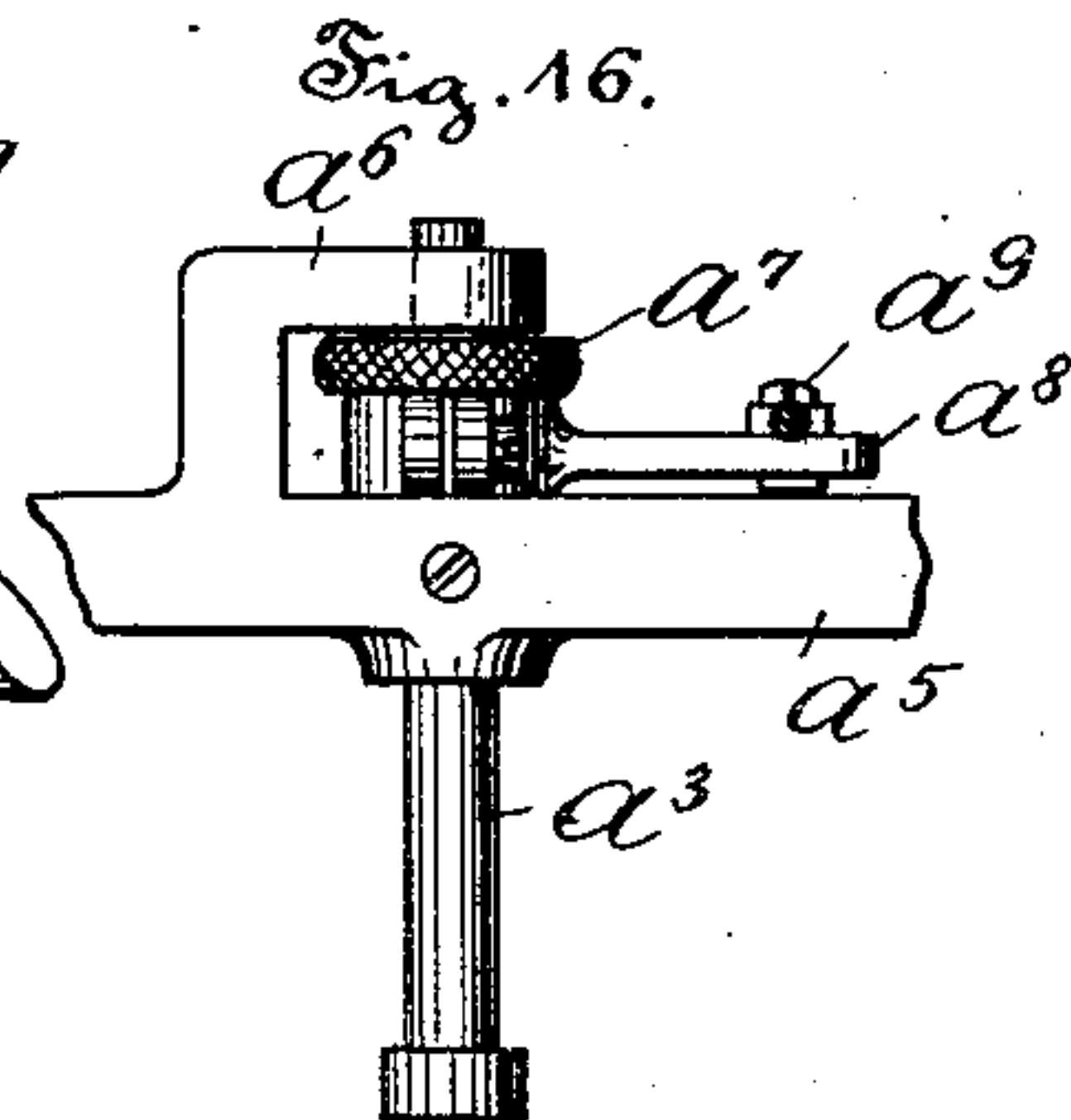
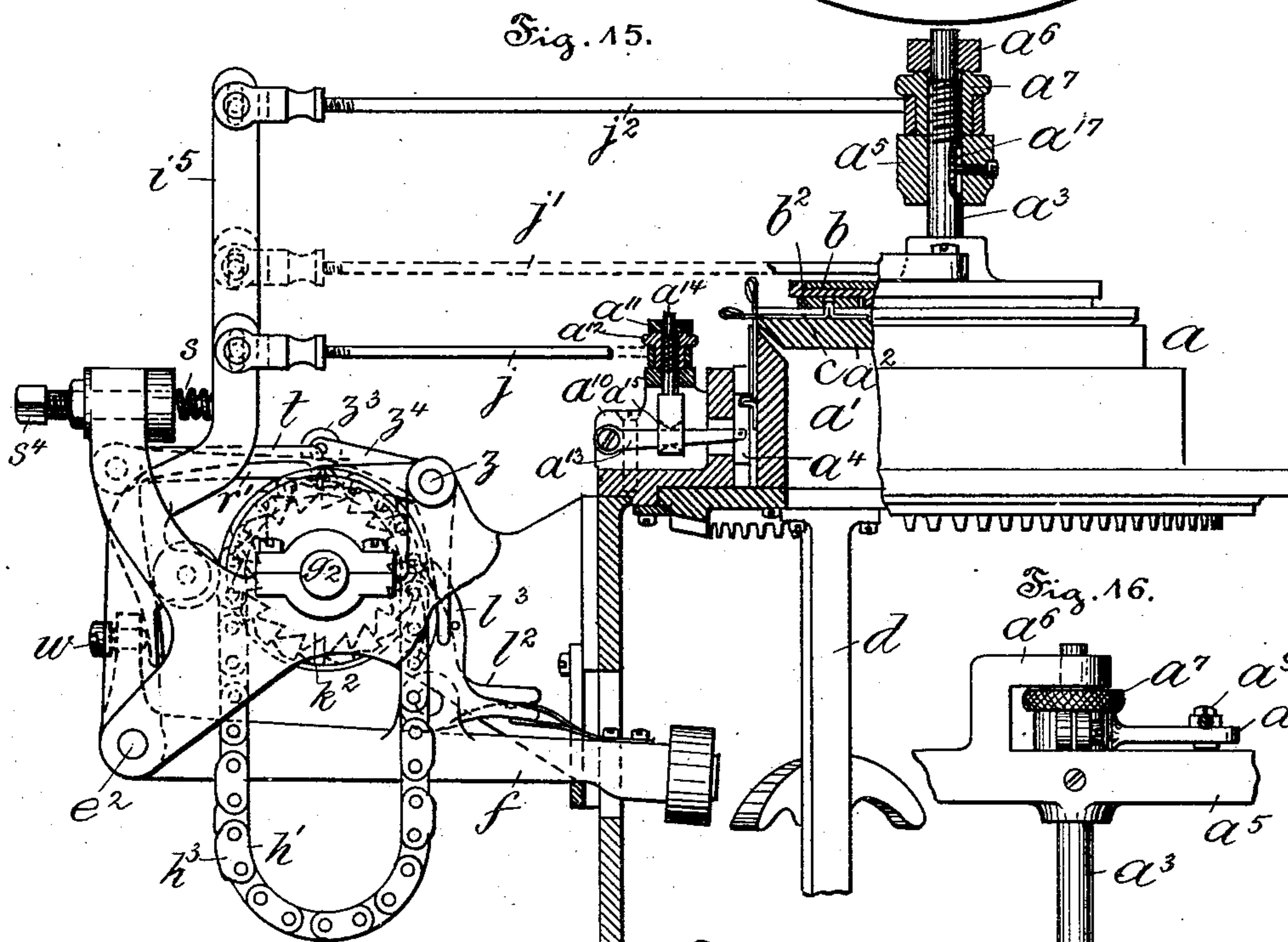
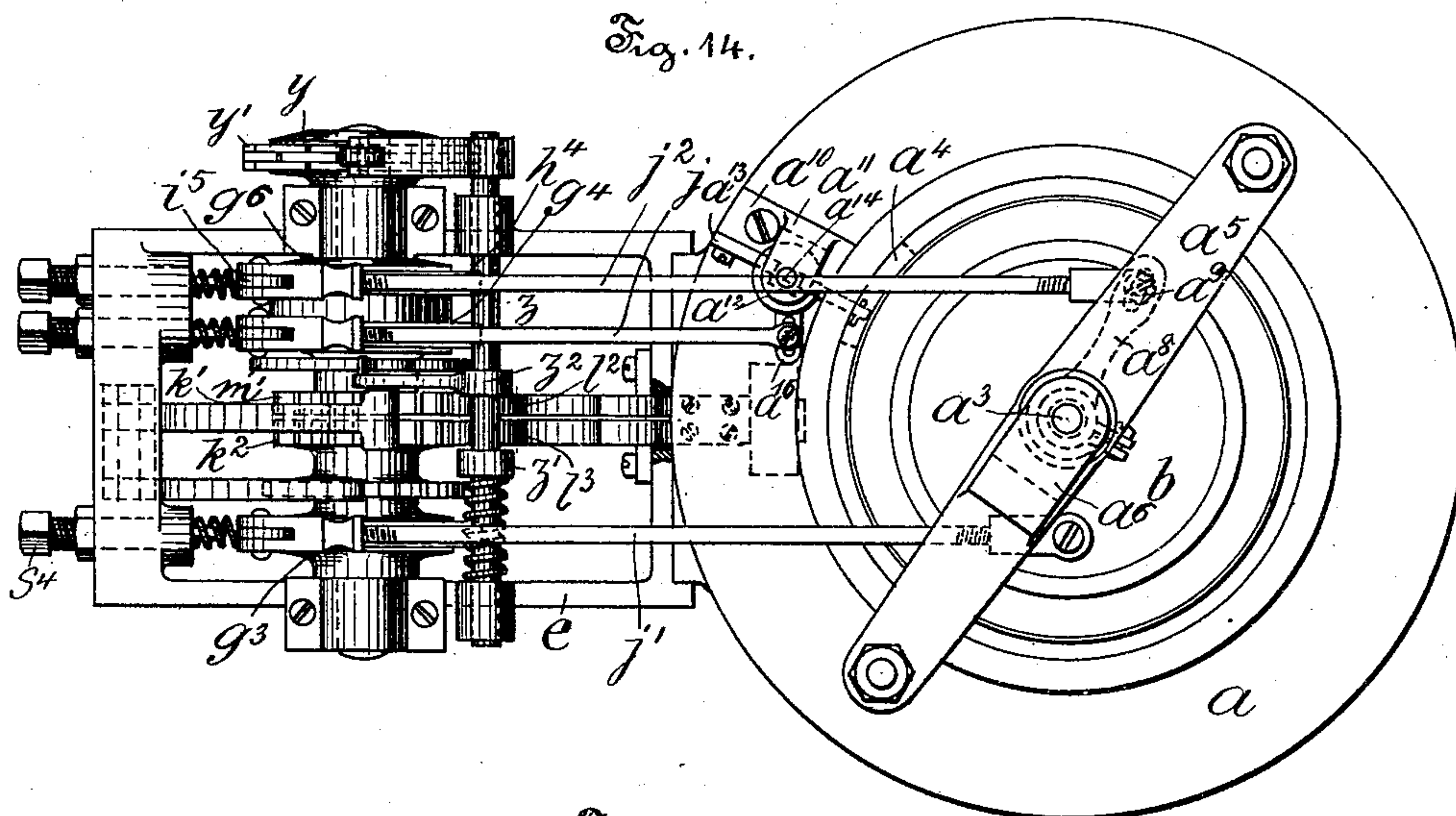
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# UNITED STATES PATENT OFFICE.

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## AUTOMATIC CHAIN-MOTION FOR KNITTING-MACHINES.

SPECIFICATION forming part of Letters Patent No. 482,892, dated September 20, 1892.

Application filed December 28, 1891. Serial No. 416,285. (No model.)

*To all whom it may concern:*

Be it known that I, DAVID C. BELLIS, a citizen of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Automatic Chain-Motions for Knitting-Machines, of which the following is a specification.

In the operation of most, if not all, of the many known types of knitting-machines it is customary to effect various changes or modifications in the character or form of the stitches comprising the finished web by shifting the needle-actuating cams and by shifting the dial-plate or horizontally-ranging needle-bed. The necessary adjustments for effecting the required movements of the needle-actuating cams are usually accomplished by means of one or more positively-driven endless pattern-chains and a system of levers controlled by the movements of the pattern-chains and connected with the respective needle-actuating-cams through the intervention of cam-rings.

The principal objects of my present invention are, first, to provide simple, durable, and comparatively inexpensive mechanism for imparting an intermittent feed motion to the pattern chain or chains of a knitting-machine; second, to regulate and control the feed of the pattern chain or chains in such manner that comparatively short chains may be employed in the production of tucked or top-welted fabrics; third, to provide simple, durable, and efficient means for automatically raising or depressing the dial-plate or horizontally-ranging needle-bed in order to tighten or loosen the stitches of the web, and, fourth, to provide convenient means for adjusting the resiliency of the springs which tend to maintain the needle-actuating cams in normal position.

My invention consists of automatic chain-motions for knitting-machines, as hereinafter described and claimed.

The nature and characteristic features of my present invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a top or plan view of an automatic chain-motion embodying features of my invention and showing also so much of an ordinary knitting-machine as is necessary

to illustrate the application of the chain-motion thereto for the purpose of shifting the needle-actuating cams appertaining to the horizontal needles. Fig. 2 is a view partly in elevation and partly in section of Fig. 1. Fig. 3 is a side elevation, drawn on an enlarged scale, of the automatic chain-motion illustrated at the left-hand side of Figs. 1 and 2. Fig. 4 is a top or plan view of Fig. 3. Fig. 5 is an elevation of the left-hand end of the chain-motion of Fig. 4. Fig. 6 is a section taken on the line 6 6 of Fig. 3. Fig. 7 is a detail view of portions of the mechanism shown in Fig. 3 and illustrating an oscillating feed-dog and a cam-wheel for throwing the oscillating feed-dog out of action. Fig. 8 is a central section looking in the direction indicated by the arrows 8 in Fig. 9 and illustrating a chain-motion for knitting-machines embodying modifications of my invention. Fig. 9 is a top or plan view of the same. Fig. 10 is a central section looking in the direction indicated by the arrows 10 in Fig. 9. Fig. 11 is an elevation of the left-hand end of the chain-motion of Fig. 9. Fig. 12 is a section on the line 12 12 of Fig. 9. Fig. 13 is a section on the line 13 13 of Fig. 8, showing the cam-wheels and cam-wheel shaft removed in order to illustrate the finger and its accessories for throwing one of the feed-dogs out of action. Fig. 14 is a top or plan view of the stop-motion illustrated in Figs. 8 to 13, inclusive, showing the same provided with an additional or third pattern-chain and arranged for automatically shifting the dial-plate of the horizontally-ranging needles and the needle-operating cams appertaining to both sets of needles. Fig. 15 is an elevation, partly in section, of Fig. 14, illustrating the mechanism interposed between the dial-spindle, the vertically-ranging needle-cams, and their respective pattern-chains. Fig. 16 is a detail view showing the dial-spindle and its accessories; and Fig. 17 is an end view looking toward the right in Fig. 14, showing the mechanism for shifting the vertical needle-operating cams.

Referring to the drawings and more especially to Figs. 1, 2, 14, and 15 thereof, *a* represents a known type of knitting-machine provided with a positively-driven needle-cylinder *a'* and with cam-rings *b* and *b'*, connected, respectively, with the needle-control-



ling cams  $b^2$  and  $b^3$  by means of two systems of levers  $b^4$  and  $b^5$ , and in such manner that the partial rotation of the cam-rings  $b$  and  $b'$  causes the cams  $b^2$  and  $b^3$  to be shifted, and thus effects the necessary regulation of the throw of the horizontal needles  $c$  for producing certain of the required changes in the character of the stitches comprising the finished web.

10  $a^2$  is a dial-plate or horizontally-ranging needle-bed provided with an upwardly-projecting spindle  $a^3$ , by means of which the horizontal needles may be shifted upward or downward, in order to loosen or tighten the stitches of the web.

15  $a^4$  is a stitch-cam appertaining to the vertical needles and afforded a range of play in a vertical direction in order to permit of the adjustment of the throw of the vertical needles to tighten or loosen the resultant stitches.

20  $d$  is a tappet-arm, connected with the rotating needle-cylinder  $a'$  and adapted to automatically actuate the chain-motion of the machine.

25 Having hereinbefore briefly described as many of the parts of a well-known type of knitting-machine, to which a chain-motion embodying my invention is applicable, I will now proceed to describe the construction and mode of operation of a chain-motion embodying features of my invention and afterward a modification thereof which is especially applicable to small knitting-machines—such, for example, as are usually employed in the production of stockings and socks.

30 In the drawings,  $e$  is a framework or housing detachably connected with the main casing of the machine by means of screws and adapted to support certain parts of the chain motion.

40  $f$  is a rocker-arm pivotally connected at one of its respective extremities to the framework or housing  $e$  by means of a shaft  $e^2$  and having the free extremity thereof in range of the tappet-arm  $d$  and afforded a range of oscillation in a slot  $e^3$ , so that every revolution of the needle-cylinder  $a'$  causes the tappet-arm  $d$  to shift the rocker-arm  $f$  upward and to permit it to return to its normal position by gravity. It will be observed that there is one operation of the rocker-arm  $f$  for every revolution of the needle-cylinder.

50  $g$  and  $g'$  are drums journaled to the main frame  $e$  by means of a shaft  $g^2$  and provided with toothed or serrated working-faces  $g^5$  for positively engaging the respective links of the pattern-chains  $h$  and  $h'$ . These pattern-chains  $h$  and  $h'$  are constructed with one or more projecting links  $h^3$ , as heretofore, but may be exceedingly short and still produce the required adjustments of the cam-rings, as will be hereinafter more fully explained.

60  $i$  and  $i'$  are chain-levers pivotally connected at one of the respective extremities thereof with the framework  $e$  by means of the shaft  $e^2$ . These chain-levers are respectively provided with rollers  $i^2$  and  $i^3$ , adapted to bear

upon the pattern-chains  $h$  and  $h'$ , so that the passage of the projecting links  $h^3$  of the respective pattern-chains under the rollers  $i^2$  and  $i^3$  causes the chain-levers to be shifted away from the drums  $g$  and  $g'$ .

70  $s$  and  $s'$  are helical springs supported in sleeves  $s^2$ , carried by the main frame  $e$  and having one of their respective extremities in contact with the levers  $i$  and  $i'$  and having the other of their extremities in engagement with the points of the set-screws  $s^3$  and  $s^4$  inserted into the rear portions of the sleeves. These springs  $s$  and  $s'$  serve to maintain the levers in contact with the respective links of the chains  $h$  and  $h'$ , and the set-screws  $s^3$  and  $s^4$  afford convenient means for increasing or diminishing the force or resiliency of the springs  $s$  and  $s'$ , and also for compensating for wear of the parts controlled thereby.

80  $j$  and  $j'$  are links having oppositely-disposed threads upon the respective extremities thereof. The threaded extremities of these links are screwed into suitable sockets, pivotally connected with the links  $i$  and  $i'$  and with the rings  $b$  and  $b'$ , operating the needle-controlling cams, so that the throw of the links may be readily increased or diminished in order to accommodate the chain-motion for attachment to knitting-machines of various sizes.

95 Referring now more especially to Figs. 1 to 7, inclusive,  $k$  is a toothed feed-wheel rotatably mounted upon the shaft  $g^2$  and rigidly connected with the chain-drums  $g$  and  $g'$ , as shown in Fig. 6.  $l$  is a spring-actuated feed-dog, pivotally connected with the rocker-arm  $f$  and adapted to engage and slide over the respective teeth of the feed-wheel  $k$ , in order to rotate the same with an intermittent motion in the direction indicated by the arrow  $x$  in Fig. 7.  $m$  is a cam-wheel rotatably mounted upon a circular boss projecting from one of the faces of the rocker-arm  $f$  and connected with a ratchet-wheel  $n$ , mounted upon a boss on the other face of the rocker-arm  $f$  by means of the key-shaft  $o$ , as shown in Fig. 6.  $p$  is a spring-actuated pawl connected with the framework  $e$  and adapted to mesh with the respective teeth of the ratchet-wheel  $n$  in order to rotate the cam-wheel  $m$  in the direction indicated by the arrow  $x'$  in Fig. 7.  $q$  is a spring-metal gasket or washer interposed between the inner face of the ratchet-wheel  $n$  and the rocker-arm  $f$ , in order to prevent accidental retrograde motion of the ratchet-wheel, due to the friction exerted by the spring-pawl  $p$  in sliding over the respective teeth of the ratchet-wheel  $n$ . The high surfaces or radial projections of the cam-wheel  $m$  are adapted to engage a pin  $l'$ , projecting from one of the cheeks of the feed-dog  $l$ , and thus serve to shift the feed-dog  $l$  out of range of the teeth of the feed-wheel  $k$ , in order to interrupt the advance or feed of the pattern-chains.  $r$  is a latch pivotally connected with the framework  $e$  and adapted to engage the respective teeth of the feed-wheel  $k$ , in order to lock the same and pre-



vent accidental retrograde motion thereof after each operation of the feed-dog  $l$ .  $t$  is a bell-crank detent pivotally connected with the framework  $e$  and having one extremity thereof adapted to mesh with the respective teeth of a star-wheel  $u$ , rigidly connected with the feed-drums  $g$  and  $g'$ , in order to limit the rotation of the feed-drums incident to each operation of the feed-dog  $l$ . The other extremity of the detent  $t$  is in range of the point of a set-screw  $w$ , extending through a lug formed upon the rocking arm  $f$ , so that the oscillations of the rocking arm  $f$  cause the set-screw  $w$  to engage the bell-crank lever and shift the same out of engagement with the respective teeth of the star-wheel  $u$ , in order to permit of the intermittent rotation of the feed-drums  $g$  and  $g'$ .

The mode of operation of the chain-motion mechanism hereinbefore described with reference to Figs. 1 to 7, inclusive, is as follows: Each revolution of the needle-cylinder  $a'$  causes the tappet-arms  $d$  to oscillate the rocking arm  $f$  and the parts connected therewith. During the upward motion of the rocking arm  $f$  the feed-dog  $l$  tends to engage with one of the teeth of the feed-wheel  $k$  and to advance or rotate it, whereby the rotary motion of the feed-wheel  $k$  is communicated to the chain-drums  $g$  and  $g'$ , so that the latter are rotated in the direction indicated by the arrow  $x^2$  in Fig. 3. The degree or extent of each of the intermittent motions of the chain-drums  $g$  and  $g'$  is limited by the bell-crank detent  $t$ , which is held out of range of the teeth of the star-wheel  $u$  by the set-screw  $w$ , when the rocking arm  $f$  is in a depressed position and which is permitted to fall into one of the spaces between the respective teeth of the star-wheel  $u$  as soon as the rocker-arm  $f$  is shifted in an upward direction. Moreover, the feed-drums are prevented from retrograding or running in a reverse direction by means of the latch  $r$ , which engages the respective teeth of the feed-wheel, whereby the chain-drums  $g$  and  $g'$  are positively rotated with an absolutely regular or synchronous intermittent motion and are locked after the completion of each of their movements, the object being to feed the respective links comprising the chains  $h$  and  $h'$  singly and accurately between the feed-drums  $g$  and  $g'$  and the chain-levers  $i$  and  $i'$ , in order to shift the needle-controlling cams by the rings  $b$  and  $b'$  into a position for effecting the required changes in the formation of the stitches comprising the fabric. If the feed-drums  $g$  and  $g'$  are fed forward at each complete revolution of the cam-cylinder  $a'$ , there must be as many links in the chains  $h$  and  $h'$  as there are courses of knitting in the completed articles, so that the chains would in many instances be unduly long and cumbersome. In my invention the feed-dog  $l$  is held out of range of the feed-wheel  $k$  during one or more consecutive revolutions of the needle-cylinder, so that the chains  $h$  and  $h'$  are not fed forward during the formation

of several courses of stitches, but only whenever it is required to change the formation of the stitches. This result is attained by means of the cam-wheel  $m$ , which is intermittently rotated by the ratchet-wheel  $n$  and spring-actuated pawl  $p$  at every downward motion of the rocking arm  $f$ , which occurs at every revolution of the needle-cylinder  $a'$ , so that the high places or radial projections of the cam-wheel  $m$  engage the pin  $l'$ , projecting from the feed-dog  $l$ , and force it out of operative position during the downward stroke of the rocking arm  $f$  and maintain it in such position until the cam-wheel  $m$  is rotated into position for permitting the pin  $l'$ , projecting from the feed-dog  $l$ , to enter a low place or recess in the cam, whereupon the feed-dog  $l$  is again permitted to return to operative position.

The number of courses of stitches that are formed while the feed-dog  $l$  is held out of action by the cam-wheel  $m$  may be varied, as required, and will depend upon the form of the working surface of the cam-wheel  $m$ . In the present instance the cam-wheel  $m$  is provided with one-half as many teeth as the ratchet-wheel  $n$ , so that the feed-dog  $l$  operates the chain-drums  $g$  and  $g'$ , and consequently feeds the pattern-chains forward a distance equal to the length of one of the links of the chains  $h$  and  $h'$  once for every two operations of the rocking arm  $f$ —that is, once during the formation of every two consecutive courses of stitches. It may be remarked that the chain-drums  $g$  and  $g'$  are locked or held against accidental rotation while the feed-dog  $l$  is out of action by means of the latch  $r$  and detent  $t$ , so that accidental retrograde motion of the pattern-chain is impossible.

The construction and mode of operation of the modified chain-motion illustrated in Figs. 8 to 13, inclusive, are as above explained with reference to Figs. 1 to 7, inclusive, with the exception that two feed-wheels  $k'$  and  $k^2$  are employed instead of one. One of these feed-wheels  $k'$  and the cam-wheel  $m'$  are pinned or otherwise connected together and are loosely mounted upon the shaft  $g^2$ , and the feed-wheel  $k^2$ , the two chain-drums  $g^3$  and  $g^4$ , and the star-wheel  $u'$  are all keyed or otherwise rigidly connected with said shaft.  $y$  is an auxiliary drum keyed to one extremity of the shaft  $g^2$  and adapted to feed or draw the cam-chain  $y'$  forward one link at a time for a purpose to be presently fully described.  $l^2$  and  $l^3$  are spring-actuated feed-dogs pivotally connected with the rocking arm  $f$  and adapted, respectively, to mesh with and operate the feed-wheels  $k'$  and  $k^2$  once during the formation of each course of stitches.  $r'$  is a latch pivotally connected with the framework  $e$  and adapted to engage the respective teeth of the feed-wheels  $k'$  and  $k^2$ .  $z$ , Fig. 13, is a rock-shaft journaled in suitable bearings formed in the framework  $e$  and provided with a finger  $z'$ , adapted to engage a pin  $l^4$ , projecting



from the feed-dog  $l^3$ , so that the feed-dog  $l^3$  may be thrown out of action by the partial rotation of the rock-shaft  $z$ , thus permitting the chain-drums to remain at rest. This rock-shaft  $z$  may be partially rotated in either of two ways: first, by means of a pin projecting from an arm  $z^2$  on the shaft into range of the cam-wheel  $m'$ , and, second, by means of a roller  $z^3$ , journaled in another arm  $z^4$ , projecting from the shaft  $z$  and adapted to ride upon the cam-chain  $y'$ .  $s^5$  is a spring coiled around the shaft  $z$  and having one of its respective extremities in engagement with the frame-work  $e$  and having the other of its extremities in engagement with the finger  $z'$ . This spring  $s^5$  serves to maintain the rock-shaft  $z$  and its accessories in operative position.

In use the cam-wheel  $m'$  is rotated once during the formation of every course of stitches through the instrumentality of the feed-dog  $l^2$  and rocking lever  $f$ , and the feed-dog  $l^3$  tends to rotate the chain-drums  $g^3$  and  $g^4$ , the star-wheel  $u'$ , and the auxiliary drum  $y$  in a similar manner. The rotation of the drums  $g^3$  and  $g^4$  in the manner above described causes the pattern-chains  $h$  and  $h'$  to be fed forward, and the high links  $h^3$  of these chains cause the cam-rings to be shifted in the manner and for the purposes hereinabove set forth. However, the rotation of the chain-drums  $g^3$  and  $g^4$  may be prevented during the formation of any required number of rows of stitches by turning the rock-shaft  $z$  in such manner that the finger  $z'$  lifts the feed-dog  $l^3$  out of range of the teeth of the feed-wheel  $k^2$ , and this motion of the rock-shaft  $z$  may be accomplished in either of two ways: first, by permitting the roller  $z^3$  to travel upon one or more low links of the cam-chain  $y'$ , and, second, by permitting the pin projecting from the radial arm  $z^2$  to traverse a low surface or portion of the cam-wheel  $m'$ , it being understood that the high links  $y^2$  and the high surfaces of the cam-wheel  $m'$  serve to oscillate the rock-shaft  $z$  in a reverse direction, thus permitting the feed-dog  $l^3$  to return to operative or normal position. By a combination of these two methods of throwing the feed-dog  $l^3$  out of action it is possible to produce a great number of changes in the character of the stitches comprising the knitted web without the employment of long pattern-chains of any kind. Moreover, the intervals during which the feed-dog  $l^3$  is in action may be increased or lessened by increasing or diminishing the number of high or operative surfaces upon either the draw or cam chain  $y'$  or cam-wheels  $m'$ , or both.

Referring now to Figs. 14 to 17, inclusive, the automatic chain-motion above described with reference to Figs. 8 to 13, inclusive, is provided with an additional chain-drum  $g^6$ , connected with the drum  $g^4$ , and with a complementary chain-lever  $i^5$  and a pattern-chain  $h^4$ . This chain-lever  $i^5$  is provided with a link  $j^2$ , adapted to operate the dial-plate  $a^2$ , it being understood that in this instance the link

$j$  is adapted to operate the stitch-cam  $a^4$ , appertaining to the vertically-ranging needles instead of the cam-rings.  $a^5$  is a yoke supported upon the bed-plate of the machine and provided with an arm  $a^6$ . The upper extremity of the dial-spindle  $a^3$  is threaded and is afforded a range of end-play in suitable apertures in the yoke and arm.  $a^{17}$  is a slot-and-feather connection for preventing accidental rotation of the dial-spindle.  $a^7$  is a nut engaging the threaded portion of the dial-spindle and held against end-play between the yoke  $a^5$  and arm  $a^6$ , so that the rotation of the nut  $a^7$  in one direction or the other causes the dial-plate  $a^2$  to be shifted upward or downward, and thus loosens or tightens the stitches of the fabric. The nut  $a^7$  may be rotated manually by means of its milled periphery and automatically by means of a radially-projecting arm  $a^8$ , connected with the link  $j^2$  and operated thereby. The link  $j^2$  is preferably connected with the arm  $a^8$  by means of a bolt  $a^9$ , having its shank adapted to work in a radially-ranging slot cut or otherwise formed in the arm  $a^8$ , so that the point of connection between the link and arm may be shifted with reference to the nut  $a^7$ , in order to permit of the regulation of the amount of rotary motion of the nut that occurs at each throw of the link  $j^2$ .  $a^{10}$  is a bracket supported by the bed-plate of the machine and provided with a perforated fork  $a^{11}$ , in which a nut  $a^{12}$  is rotatably mounted.  $a^{13}$  is a swinging arm pivotally connected with the bracket  $a^{10}$  and having its free extremity in engagement with the stitch-forming cam  $a^4$  appertaining to the vertically-ranging needles.  $a^{14}$  is a threaded stem engaging the nut  $a^{12}$  and provided with a jaw  $a^{15}$ , engaging the lever  $a^{13}$ . The lower portion of the stem  $a^{14}$ , that slides upon the bracket  $a^{10}$ , is faced in order to prevent accidental rotation of the stem  $a^{14}$ . The rotation of the nut  $a^{12}$  in one direction or the other causes the stem  $a^{14}$  to shift the swinging arm  $a^{13}$ , and thus causes the elevation or depression of the stitch-cam  $a^4$  appertaining to the vertical needles, and consequently effects the required tightening or loosening of the stitches. The required rotary motion for effecting these results may be attained manually by means of the milled periphery of the nut  $a^{12}$  and automatically by means of a radial arm  $a^{16}$  connected with the link  $j$ . The extremity of the link  $j$  and the radial arm  $a^{16}$  are preferably connected together by means of a bolt adapted to be shifted and clamped to place in a slot in the radial arm, in order to permit of the regulation of the amount of rotary motion imparted to the nut by each throw of the link  $j$ .

It will be obvious to those skilled in the art to which my invention appertains that modifications may be made in details of construction and arrangement without departing from the spirit of the invention. Hence I do not limit myself to the exact construc-



tion and arrangement of parts hereinabove set forth and illustrated in the accompanying drawings.

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

1. An automatic chain-motion for knitting-machines, provided with a pattern-chain drum having a feed-wheel, a pattern-chain, a rocker-arm, a feed-dog carried by said arm, a cam-wheel mounted on said arm and adapted to throw the feed-dog out of action, and a pawl for imparting rotary motion to said cam-wheel, substantially as and for the purposes set forth.

2. An automatic chain-motion for knitting-machines, provided with a pattern-chain, a bracket connected with the main frame of the machine, a pattern-chain drum and complementary feed-wheel connected with the bracket, a rocker-arm provided with a feed-dog and complementary cam-wheel, pawl-and-ratchet connections between said cam-wheel and bracket, and means for actuating the rocker-arm, substantially as and for the purposes set forth.

3. An automatic chain-motion for knitting-machines, provided with a tappet connected with a revolving member of the machine, a rocker-arm in range of said tappet, a pattern-chain, a pattern-chain drum provided with a feed-wheel, a feed-dog and its complementary cam-wheel carried by said rocker-arm, and means for rotating said cam-wheel at every oscillation of the rocker-arm, substantially as and for the purposes set forth.

4. In an automatic chain-motion for knitting-machines, a pattern-chain drum provided with a feed-wheel, a pattern-chain, a rocker-arm, a feed-dog, and a positively-driven cam-wheel carried by the rocker-arm, substantially as and for the purposes set forth.

5. In an automatic chain-motion for knitting-machines, a pattern-chain, a pattern-chain drum provided with a feed-wheel, a rocker-arm, an oscillating spring-actuated feed-dog on said rocker-arm, and a positively-driven cam-wheel carried by said arm and adapted to throw said feed-dog out of action, substantially as and for the purposes set forth.

6. In an automatic chain-motion for knitting-machines, a pattern-chain, a pattern-chain feed-wheel, a rocker-arm, a feed-dog carried by said arm and tending to engage the pattern-chain feed-wheel, a cam-wheel on said arm for throwing said dog out of action, a ratchet-wheel connected with the cam-wheel, and a spring-actuated pawl for operating said ratchet-wheel, substantially as and for the purposes set forth.

7. An automatic chain-motion for knitting-machines, provided with a pattern-chain drum provided with a feed-wheel, a pattern-chain, a rocking arm, a feed-dog on the rocker-arm, a counter-shaft provided with a finger for throwing the feed-dog out of action and with

a radial arm, a cam-wheel engaging the radial arm, and an auxiliary feed-dog on the rocker-arm for actuating said cam-wheel, substantially as and for the purposes set forth.

8. In an automatic chain-motion for knitting-machines, a pattern-chain drum provided with a feed-wheel, a pattern-chain, a rocker-arm provided with spring-actuated feed-dogs, a rock-shaft provided with a finger engaging one of said feed-dogs, and a cam-wheel actuated by the other of said dogs for controlling the rock-shaft, substantially as and for the purposes set forth.

9. An automatic chain-motion for knitting-machines, provided with a pattern-chain drum having a feed-wheel, a pattern-chain, a rocker-arm provided with a feed-dog for operating said drum, a rock-shaft provided with a finger for throwing the feed-dog out of action, a radial arm on said rock-shaft, and a positively-driven drum or cam-chain for controlling the radial arm, substantially as and for the purposes set forth.

10. An automatic chain-motion for knitting-machines, provided with a tappet and complementary rocker-arm, a pattern-chain, a pattern-chain drum having a feed-wheel, a pattern-chain feed-dog on said rocker-arm, a rock-shaft having a radial arm, a finger projecting from said shaft into range of the feed-dog, a draw or cam chain for engaging said radial arm, and pawl-and-ratchet connections operated by said rocker-arm to feed said draw or cam chain, substantially as and for the purposes set forth.

11. In an automatic chain-motion for knitting-machines, a pattern-chain drum, a pattern-chain, a feed-dog adapted to operate a pattern-chain, a rock-shaft provided with two radial arms, a finger projecting from said rock-shaft into range of said feed-dog, a draw-chain engaging one of said radial arms, a cam-wheel engaging the other of said radial arms, and means for feeding said cam-wheel and draw-chain, substantially as and for the purposes set forth.

12. In an automatic chain-motion for knitting-machines, a rocking arm and its complementary tappet, a counter-shaft provided with a draw-chain drum, a draw-chain, pattern-chain drums keyed to said shaft and provided with star and feed wheels, a feed-wheel and a cam-wheel connected together and rotatably mounted on said shaft, a detent for engaging said star-wheel, feed-pawls connected with the rocking arm for operating said feed-wheels, a rock-shaft provided with two radial arms, respectively engaging the cam-wheel and draw-chain, and a finger projecting from the rock-shaft into range of the chain-drum feed-dog, substantially as and for the purposes set forth.

13. In an automatic chain-motion for knitting-machines, a pattern-chain drum and its complementary feed mechanism, a star-wheel connected with said drum, a detent adapted



to engage the star-wheel, and a rocking arm in range of said detent, substantially as and for the purposes set forth.

14. In an automatic chain-motion for knitting-machines, a pattern-chain drum and its complemental feed mechanism, a star-wheel connected with said drum, a rocking arm provided with a lug, and a bell-crank detent having one of its arms in range of the lug and the other arm adapted to engage the respective teeth of the star-wheel, substantially as and for the purposes set forth.

15. In an automatic chain-motion for knitting-machines, a pattern-chain drum and its complemental feed mechanism, a star-wheel connected with said drum, a detent adapted to engage the respective teeth of the star-wheel, a rocking arm, and a set-screw connected with the rocking arm and having its point in range of said detent, substantially as and for the purposes set forth.

16. In an automatic chain-motion for knitting-machines, a pattern-chain drum and its complemental feed-wheel, a star-wheel connected with said drum, a detent for engaging said star-wheel, and a rocking arm provided with a feed-dog and in range of said detent, substantially as and for the purposes set forth.

17. An automatic chain-motion for knitting-machines, provided with a pattern-chain, a chain-lever riding on said chain, a needle-cam ring, a system of levers connected with the needle-cam ring and operated by said chain-lever, a spring working in a sleeve in the frame of the chain-motion mechanism and adapted to engage the chain-lever, and a set-screw mounted in said sleeve and having the point thereof in engagement with said spring, substantially as and for the purposes set forth.

18. An automatic chain-motion for knitting-machines, comprising a pattern-chain, a chain-drum having feed and star wheels, a rocking arm provided with a feed-dog, a detent in range of said rocking arm and engaging said star-wheel, a latch engaging said star-wheel, means operated by said rocking arm for throwing said dog out of action, a chain-lever contacting with the pattern-chain, and a link connected with the chain-lever and adapted to be connected with the cam-rings of a knitting-machine, substantially as and for the purposes set forth.

19. An automatic chain-motion for knitting-machines, provided with a pattern-chain and its complemental feed mechanism, a chain-lever operated by said chain, a rotatable nut engaging the dial-spindle of the knitting-machine and provided with a radial arm, and a link connected with said chain-lever and radial arm, substantially as and for the purposes set forth.

20. An automatic chain-motion for knitting-machines, provided with a pattern-chain and its complemental feed mechanism, a rotatable nut engaging the dial-spindle of the knitting-machine and provided with a radial arm, and

a link pivoted to the chain-lever and adjustably connected with said arm by means of a bolt engaging a slot in the arm, substantially as and for the purposes set forth.

21. An automatic chain-motion for knitting-machines, provided with a pattern-chain and its complemental feed mechanism, a yoke provided with an arm and supported upon the bed of the knitting-machine, a nut rotatably mounted between said yoke and arm, a threaded dial-spindle afforded a range of end-play in apertures in said arm and yoke and engaging said nut, and means connected with said chain-lever for operating said nut, substantially as and for the purposes set forth.

22. A chain-motion for knitting-machines, provided with a rotatable nut engaging the dial-spindle of the machine, and connections between said nut and chain-motions, substantially as and for the purposes set forth.

23. An automatic chain-motion for knitting-machines, provided with a pattern-chain and its complemental feed mechanism, a chain-lever operated by said chain, a swinging arm engaging the vertically-ranging stitch-cam of the machine, a stem provided with a jaw engaging said swinging arm, a nut engaging said stem and provided with a radial arm, and a link connected with said chain-lever and radial arm, substantially as and for the purposes set forth.

24. An automatic chain-motion for knitting-machines, provided with a pattern-chain and its complemental feed mechanism, a chain-lever operated by said chain, a bracket provided with a fork and supported upon the bed of the machine, a swinging arm pivoted to said bracket and engaging the vertically-ranging stitch-cams of the machine, a stem afforded a range of end-play in apertures in the fork and having a flat face in engagement with the bracket, a jaw on said stem for engaging the swinging arm, a nut rotatably mounted in said fork and engaging said stem, a radial arm on said nut, and a link connected with said radial arm and chain-lever, substantially as and for the purposes set forth.

25. An automatic chain-motion for knitting-machines, provided with a pattern-chain and its complemental feed mechanism, a chain-lever operated by said chain, a swinging arm engaging the vertically-ranging stitch-cam of the machine, a stem provided with a jaw engaging said swinging arm, a nut engaging said stem and provided with a radial arm, and a link pivoted to the chain-lever and connected with the radial arm by a nut engaging a slot in the radial arm, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

DAVID C. BELLIS.

Witnesses:

J. WALTER DOUGLASS,  
THOMAS M. SMITH.