

(No Model.)

3 Sheets—Sheet 1.

A. STARK.
CORD KNOTTER FOR GRAIN BINDERS.

No. 445,788.

Patented Feb. 3, 1891.

Fig. 1.

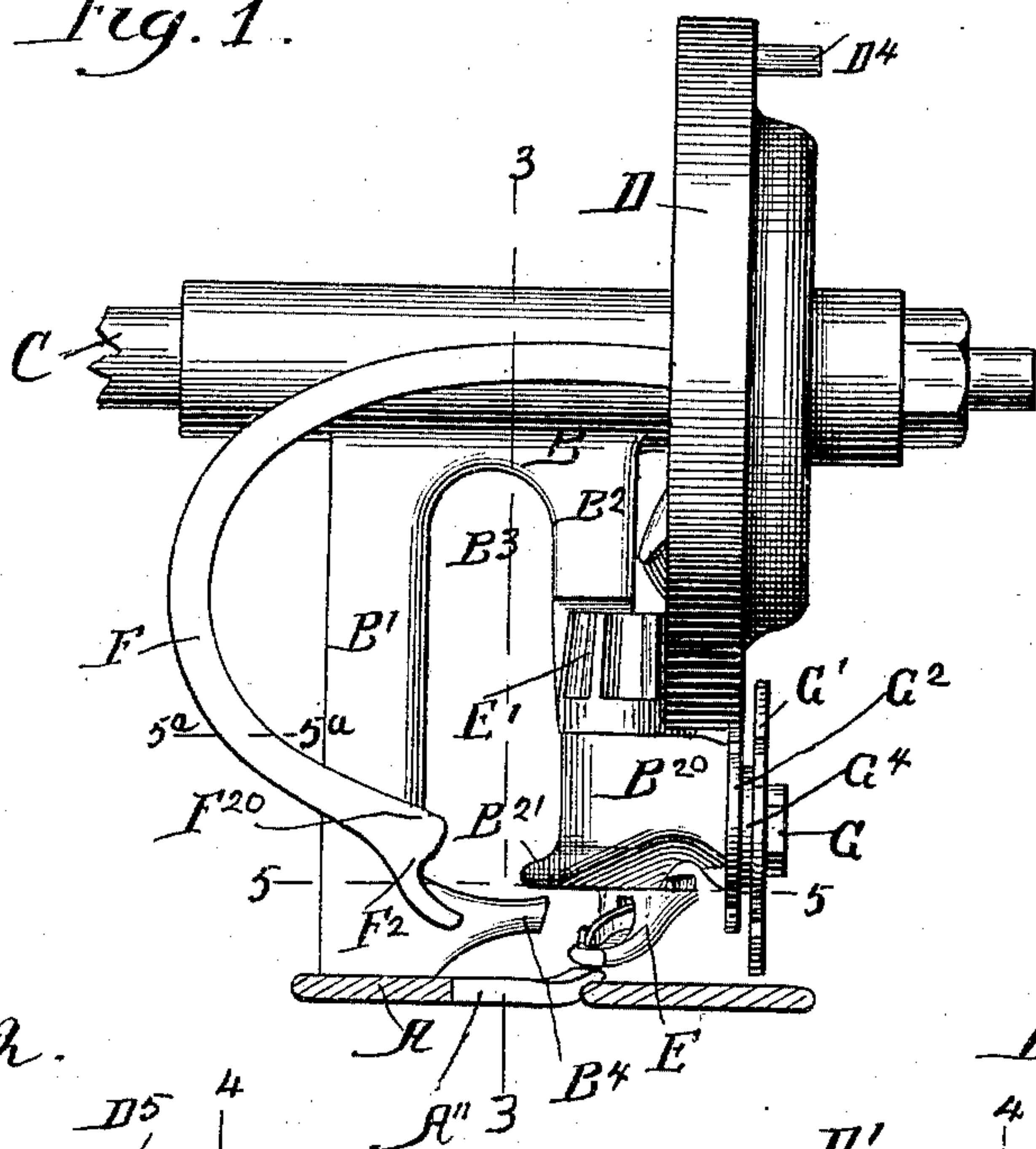


Fig. 2.

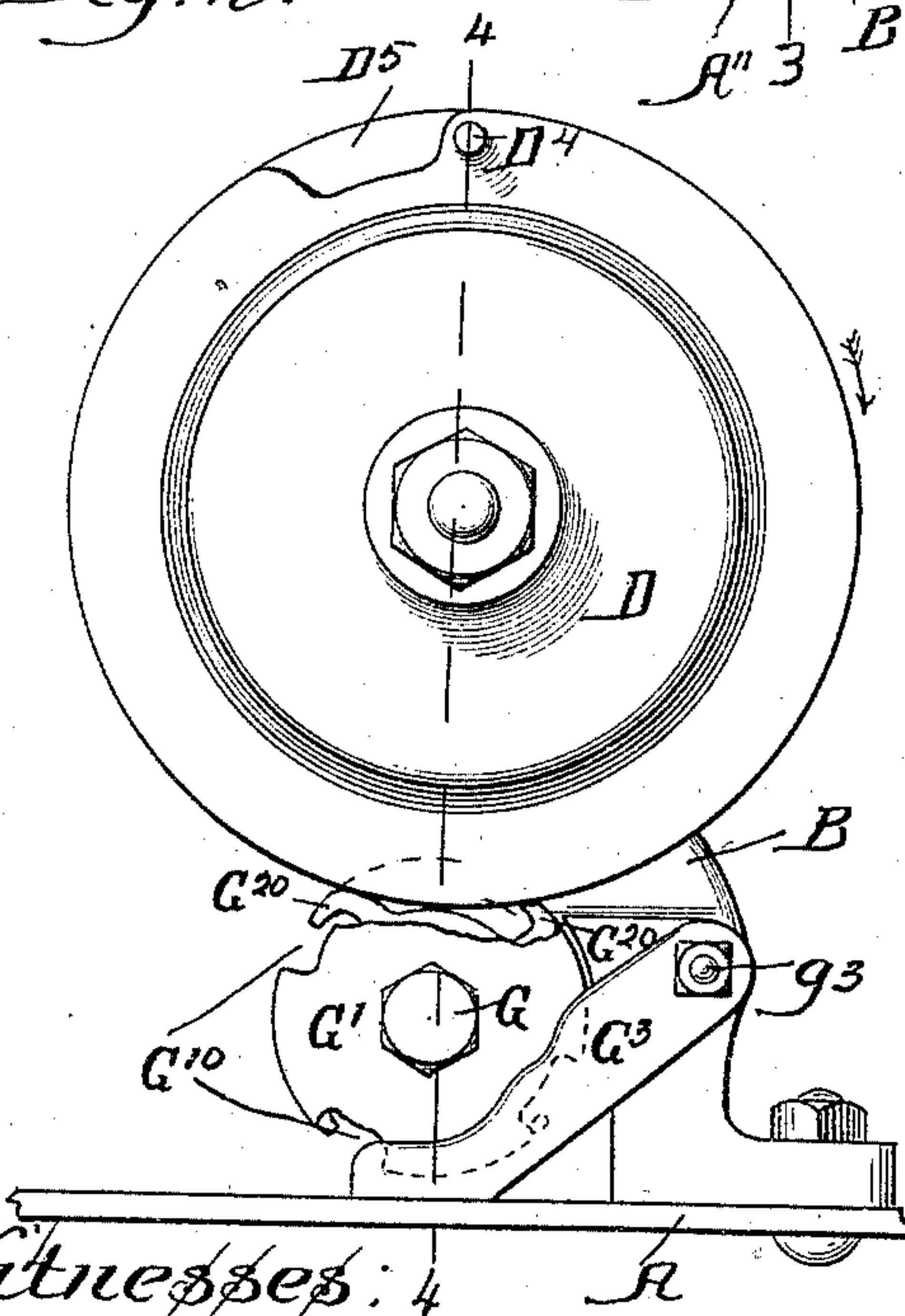
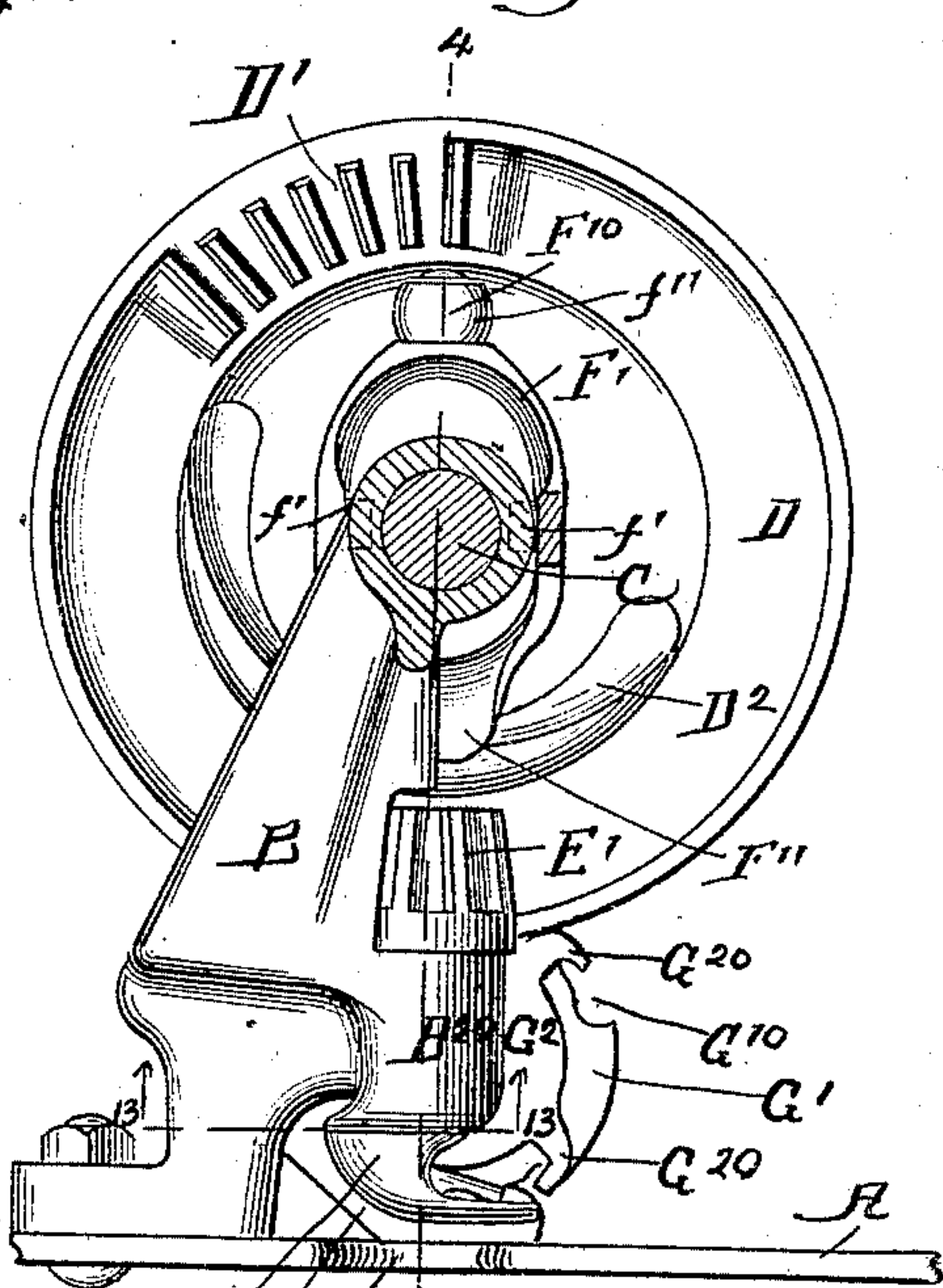


Fig. 3.



Witnesses: 4
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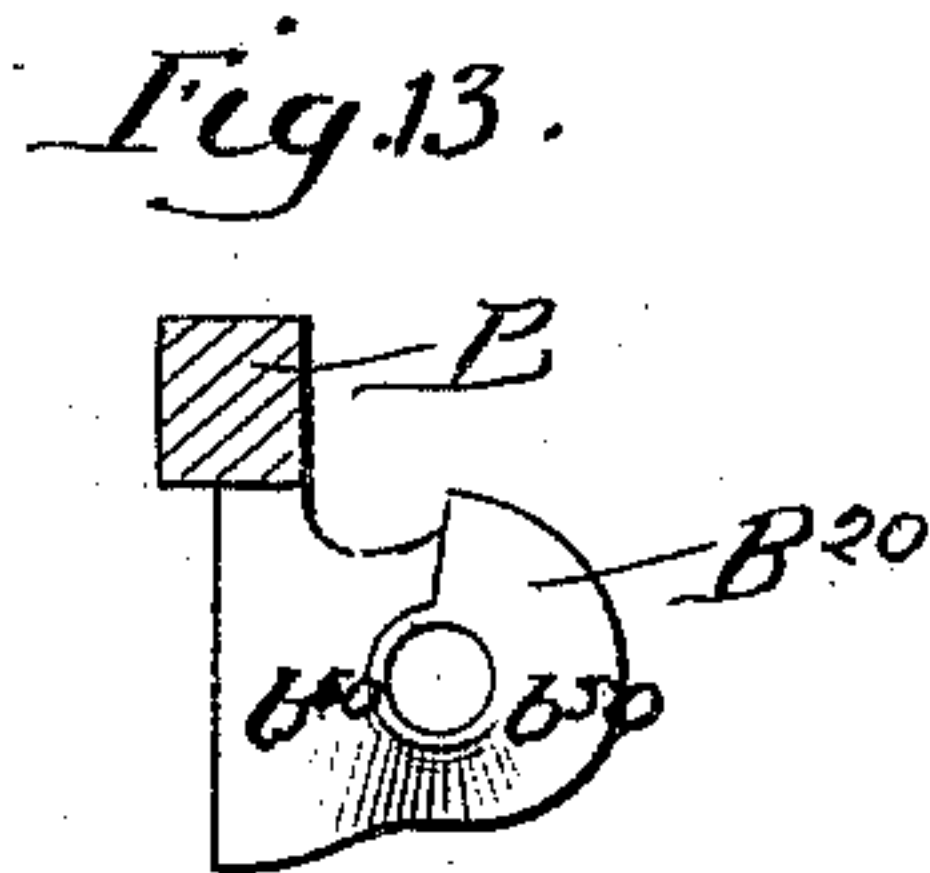
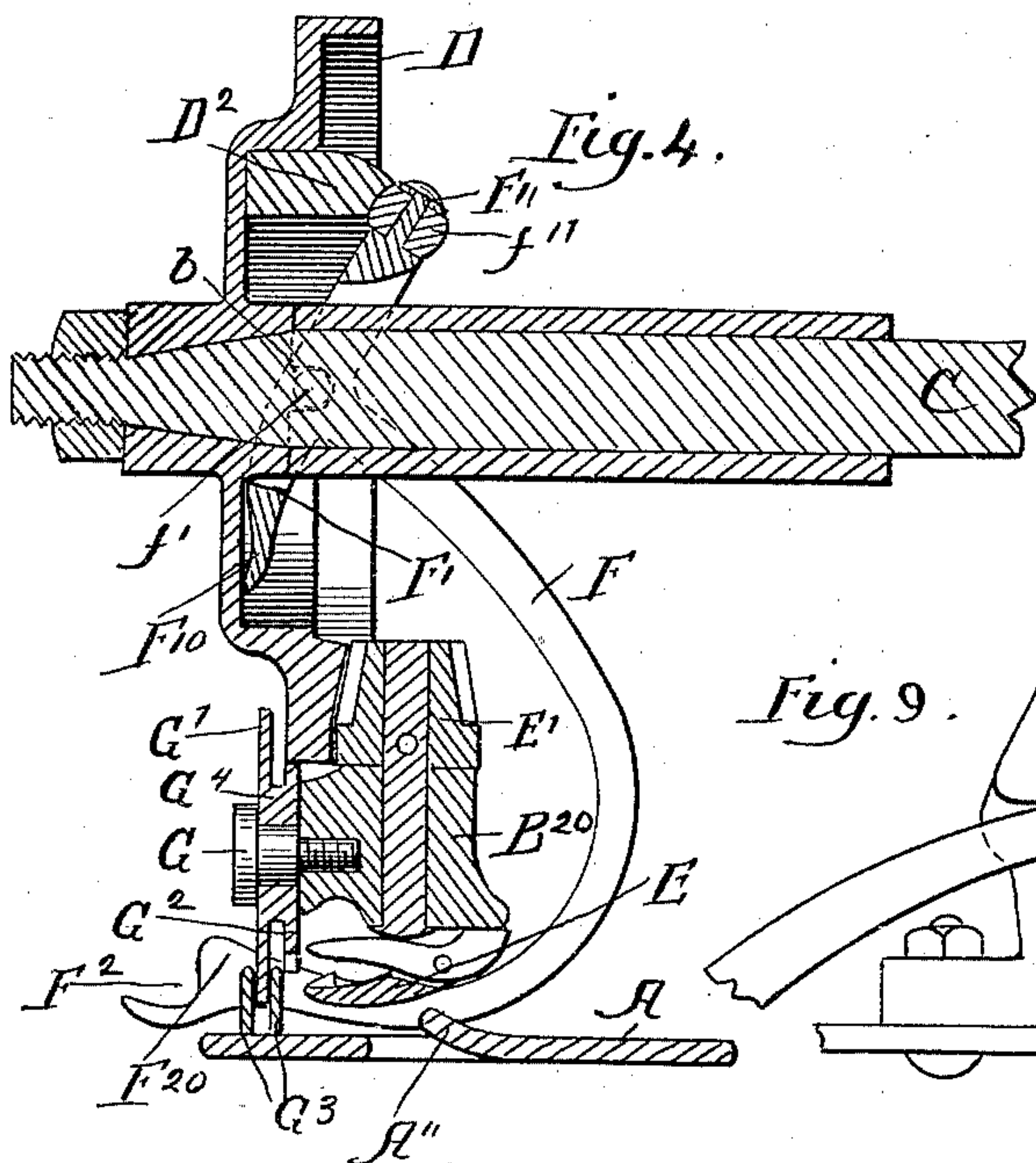


Fig. 9.

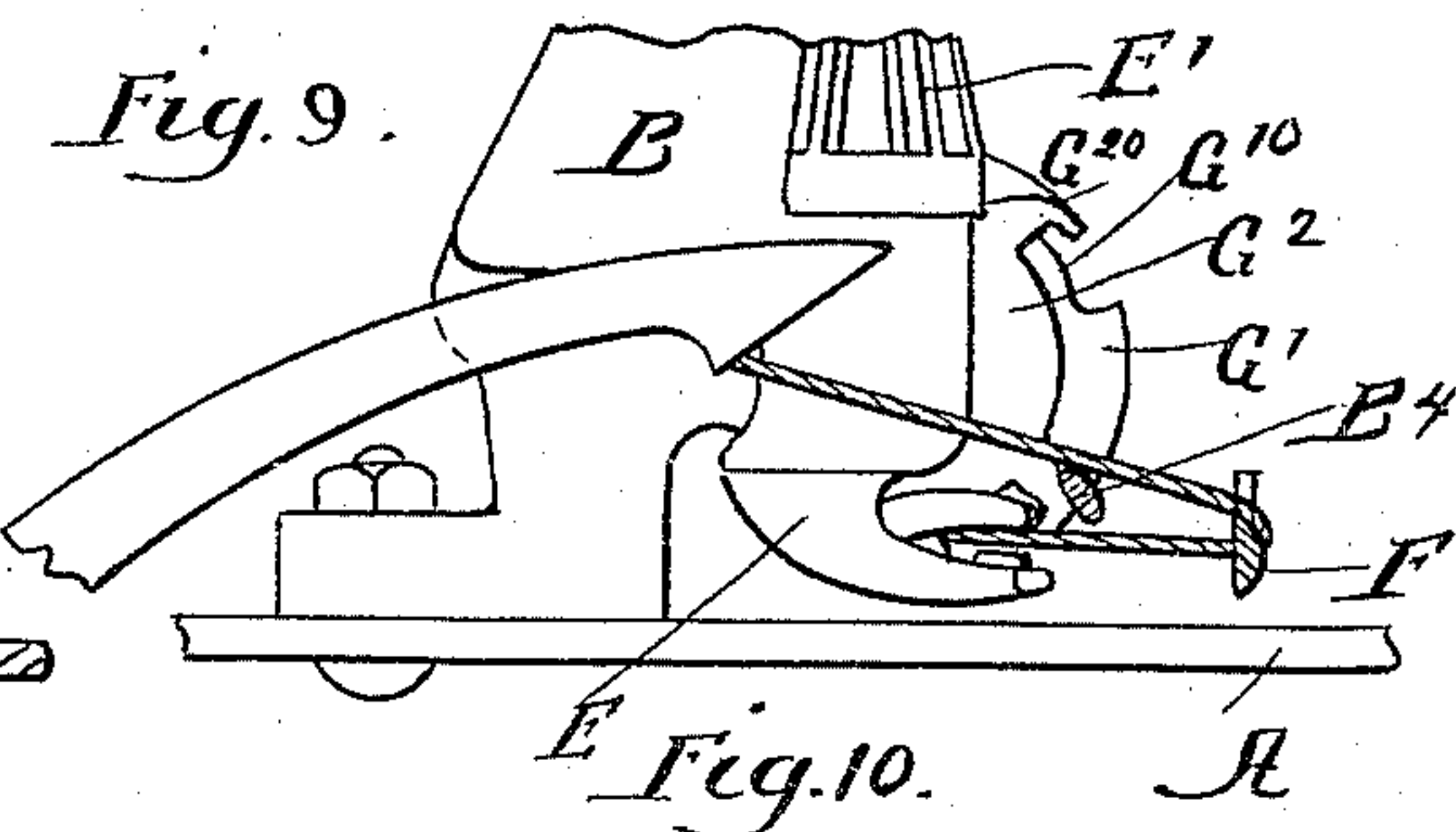


Fig. 10.

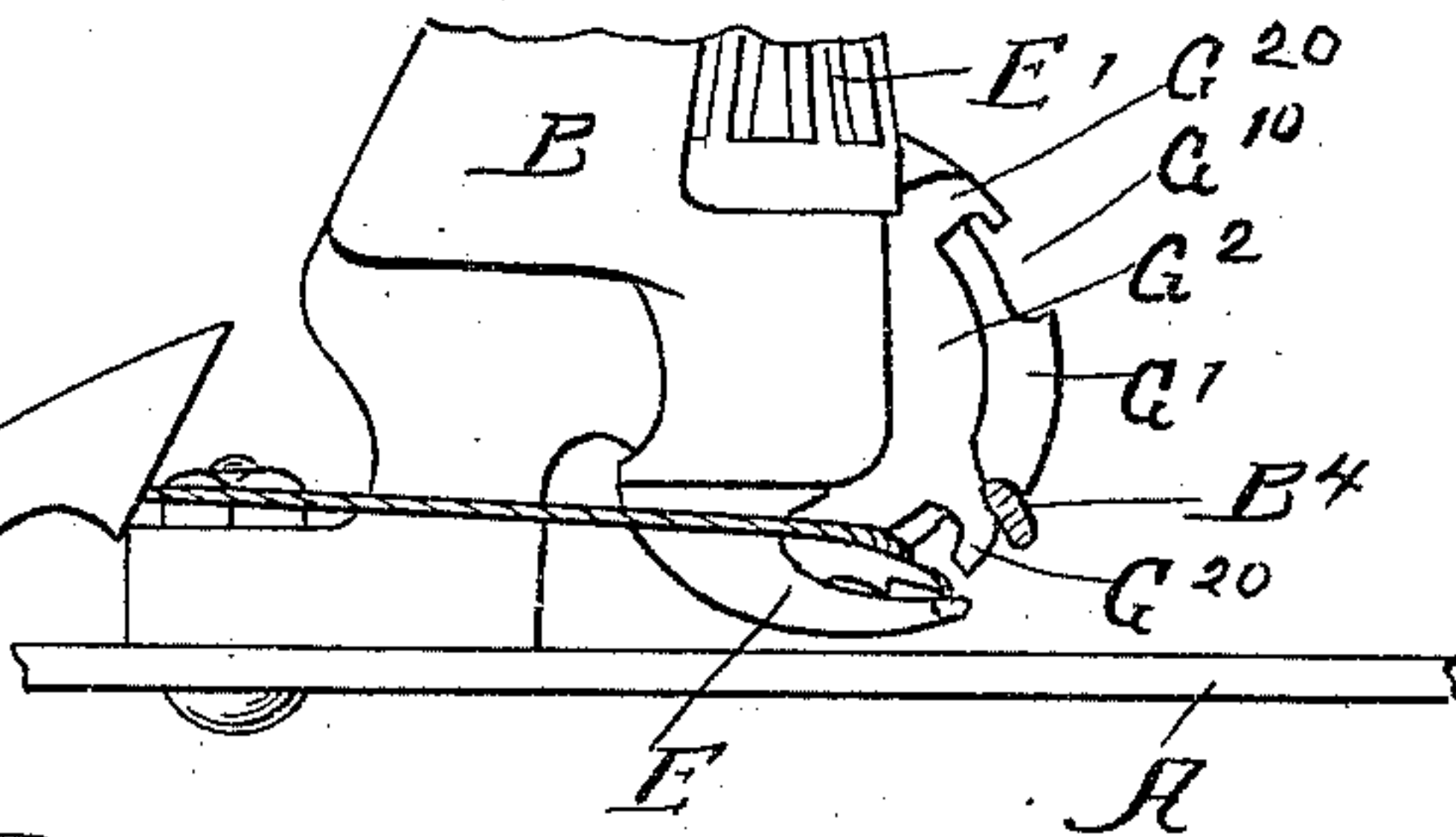


Fig. 11.

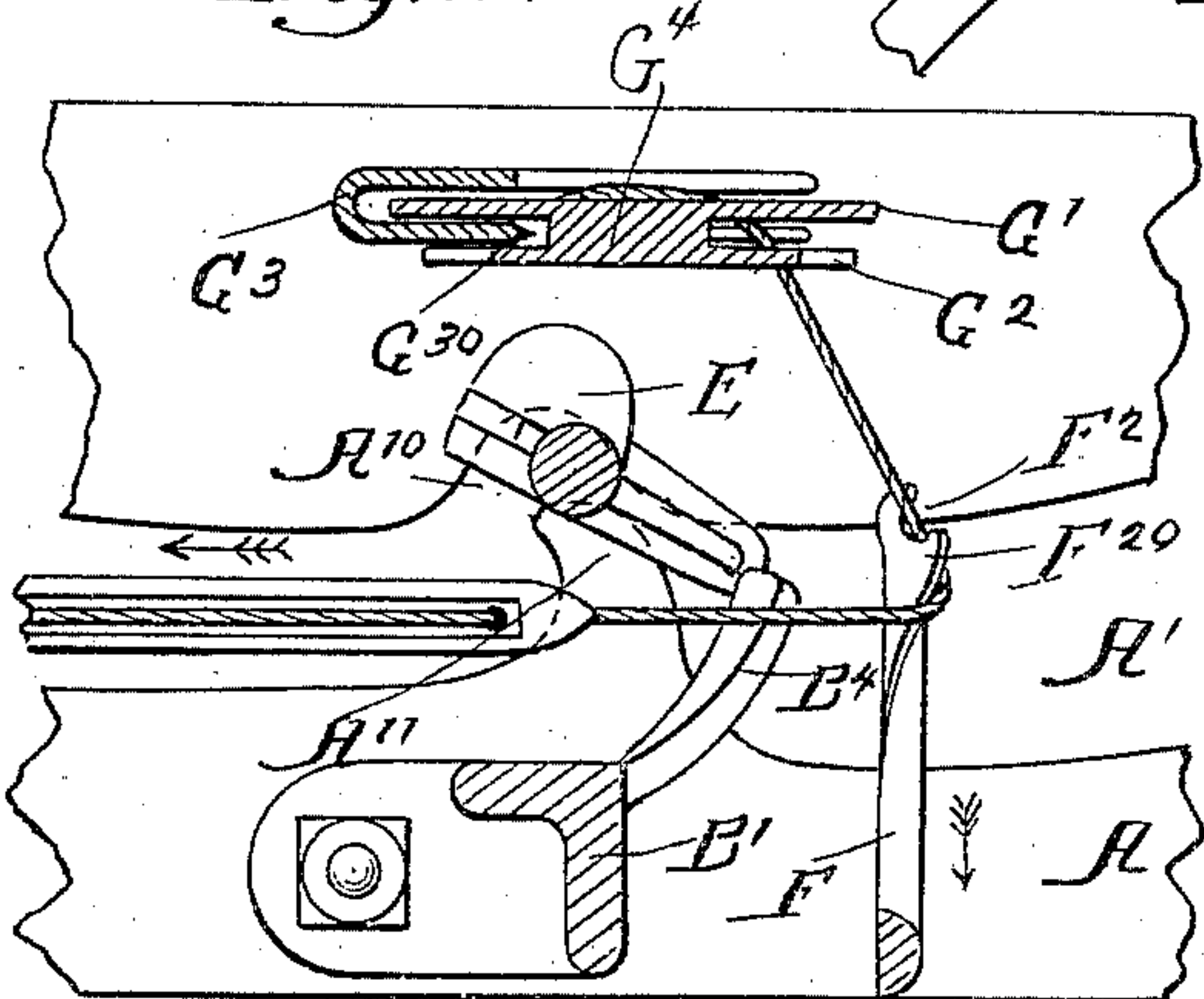
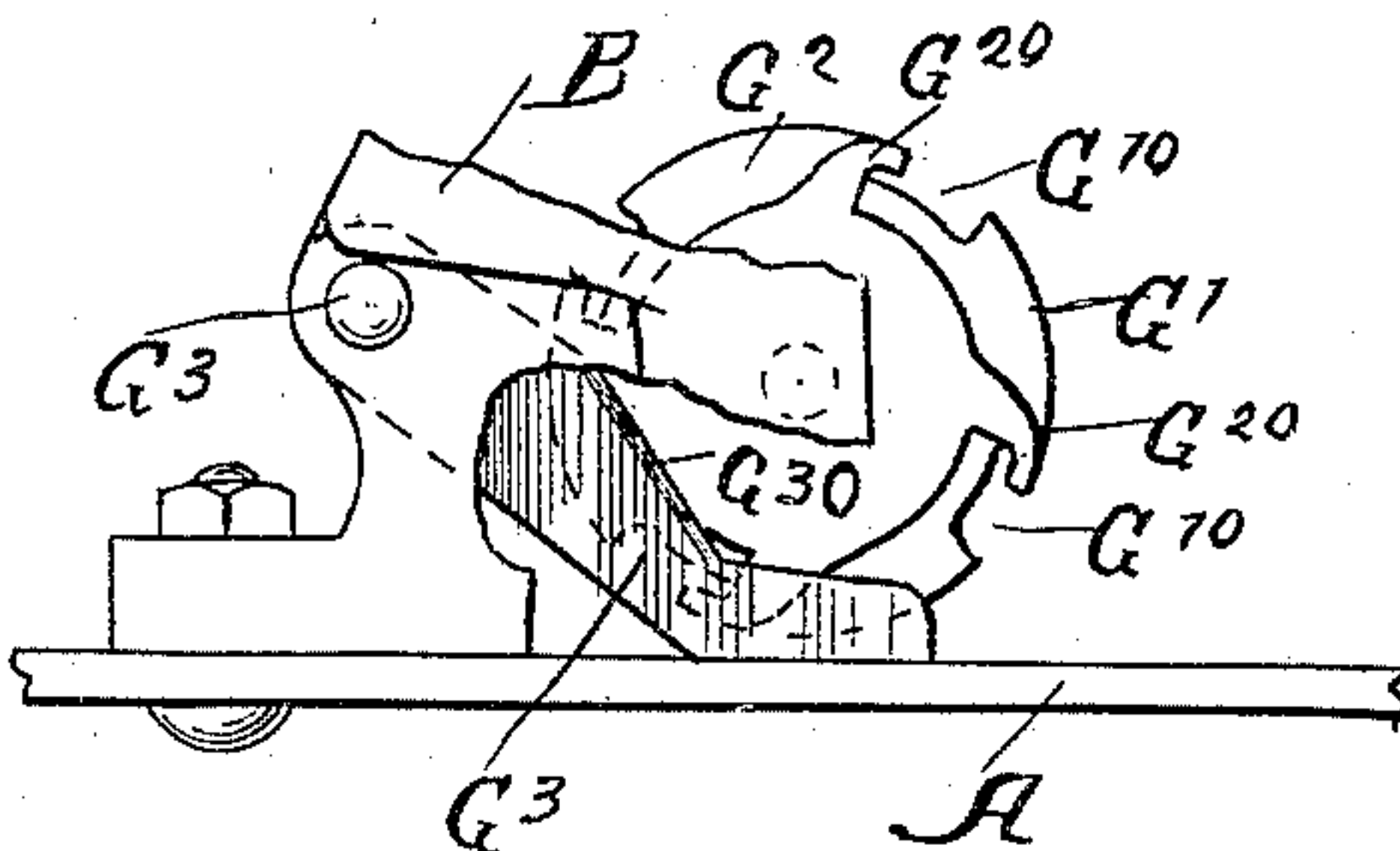


Fig. 12.



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Fig. 5.

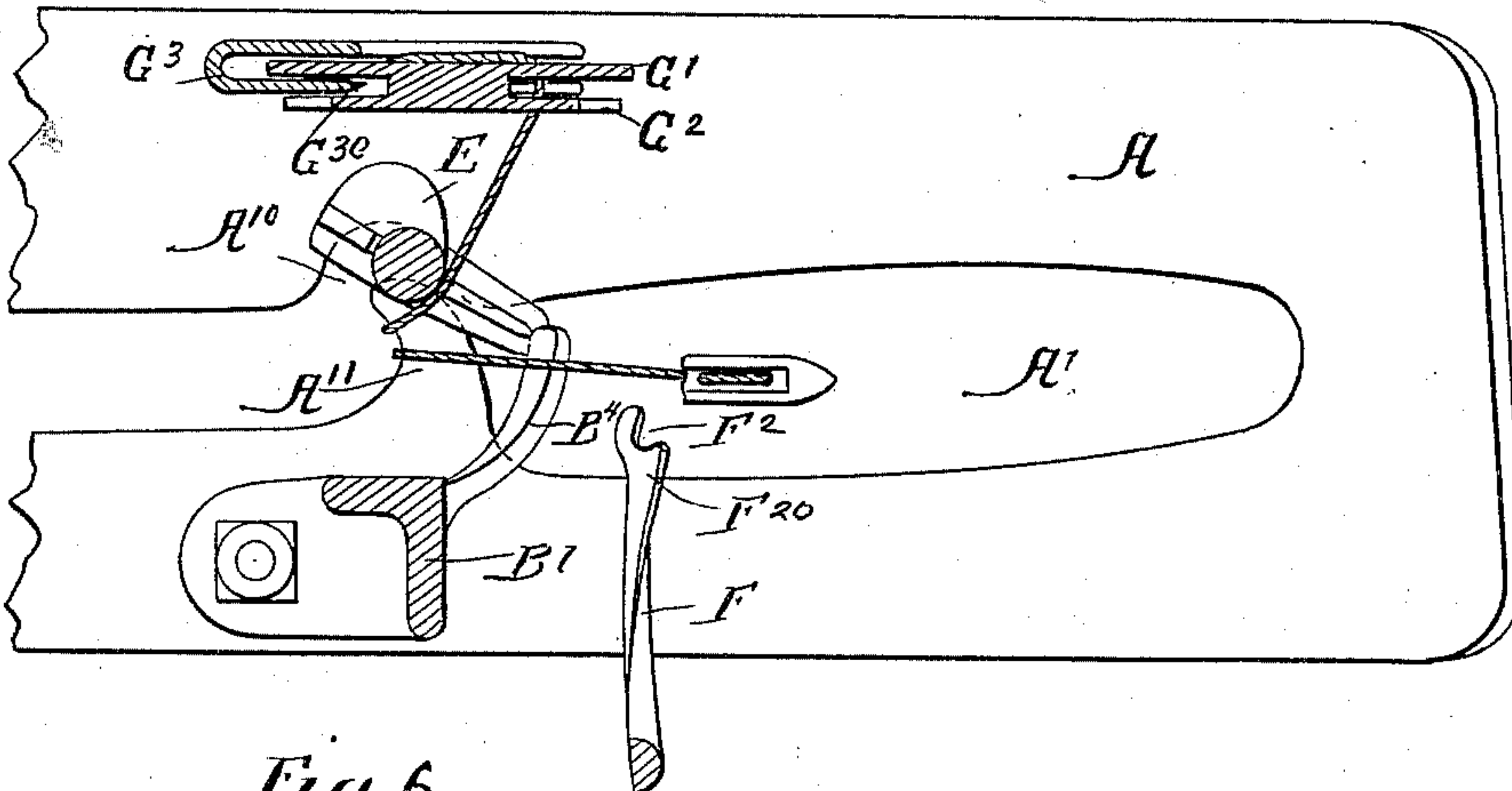


Fig. 6.

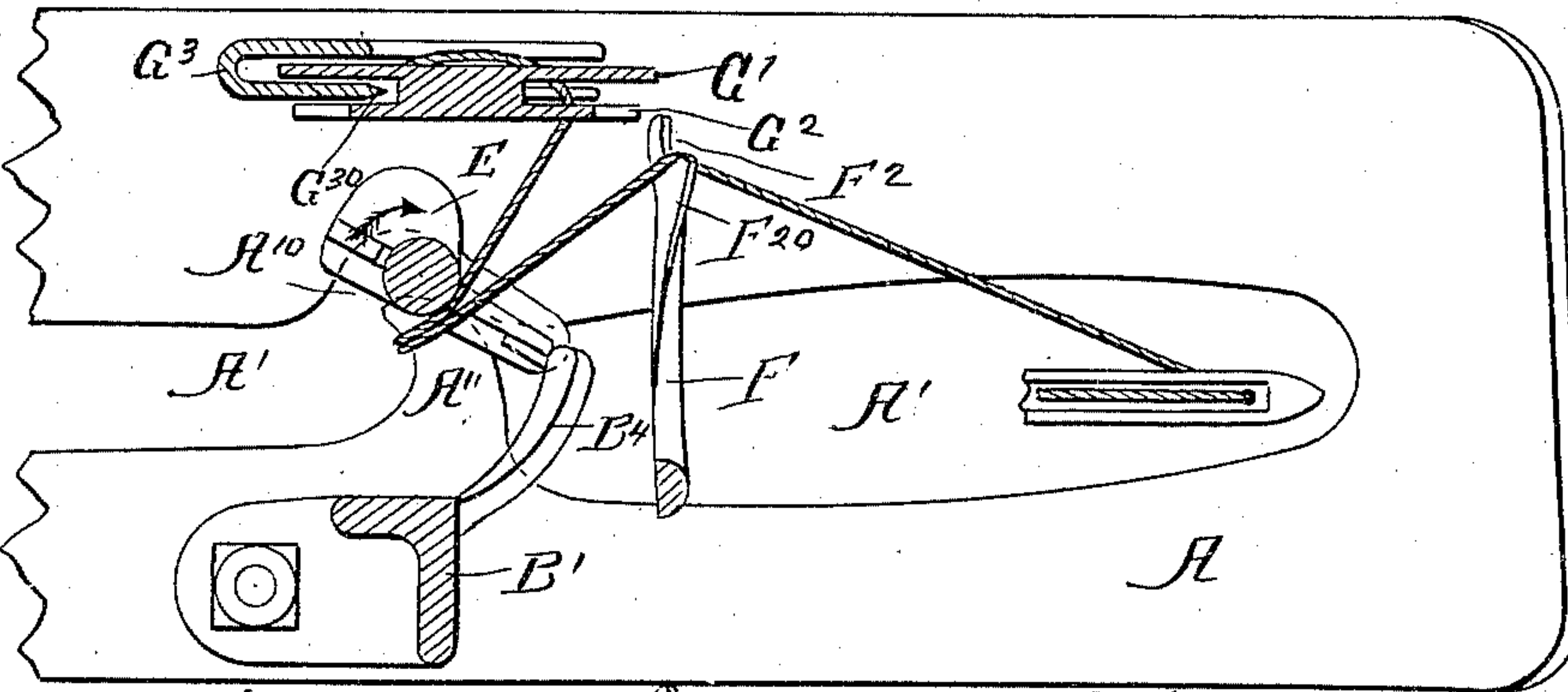


Fig. 7.

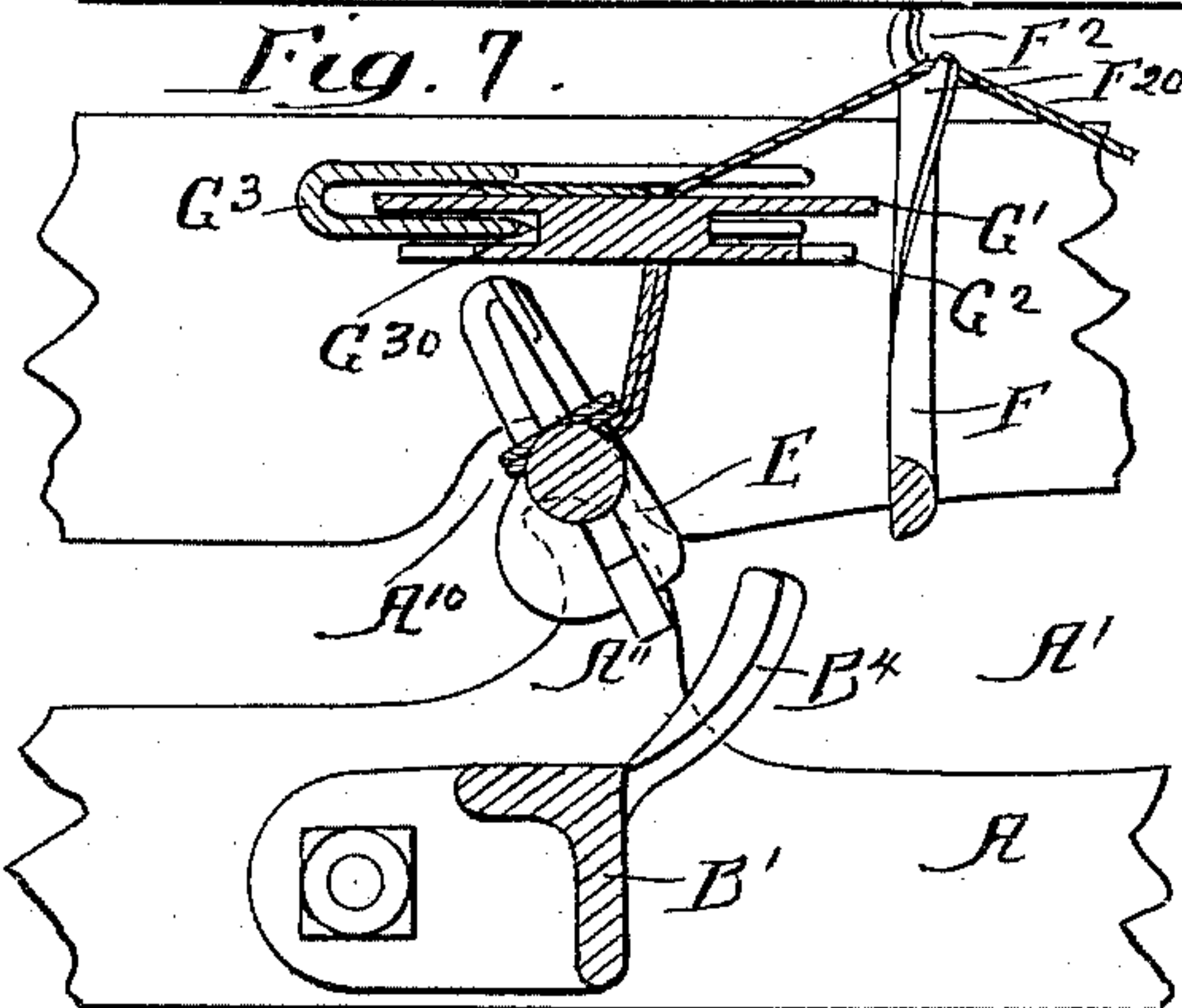
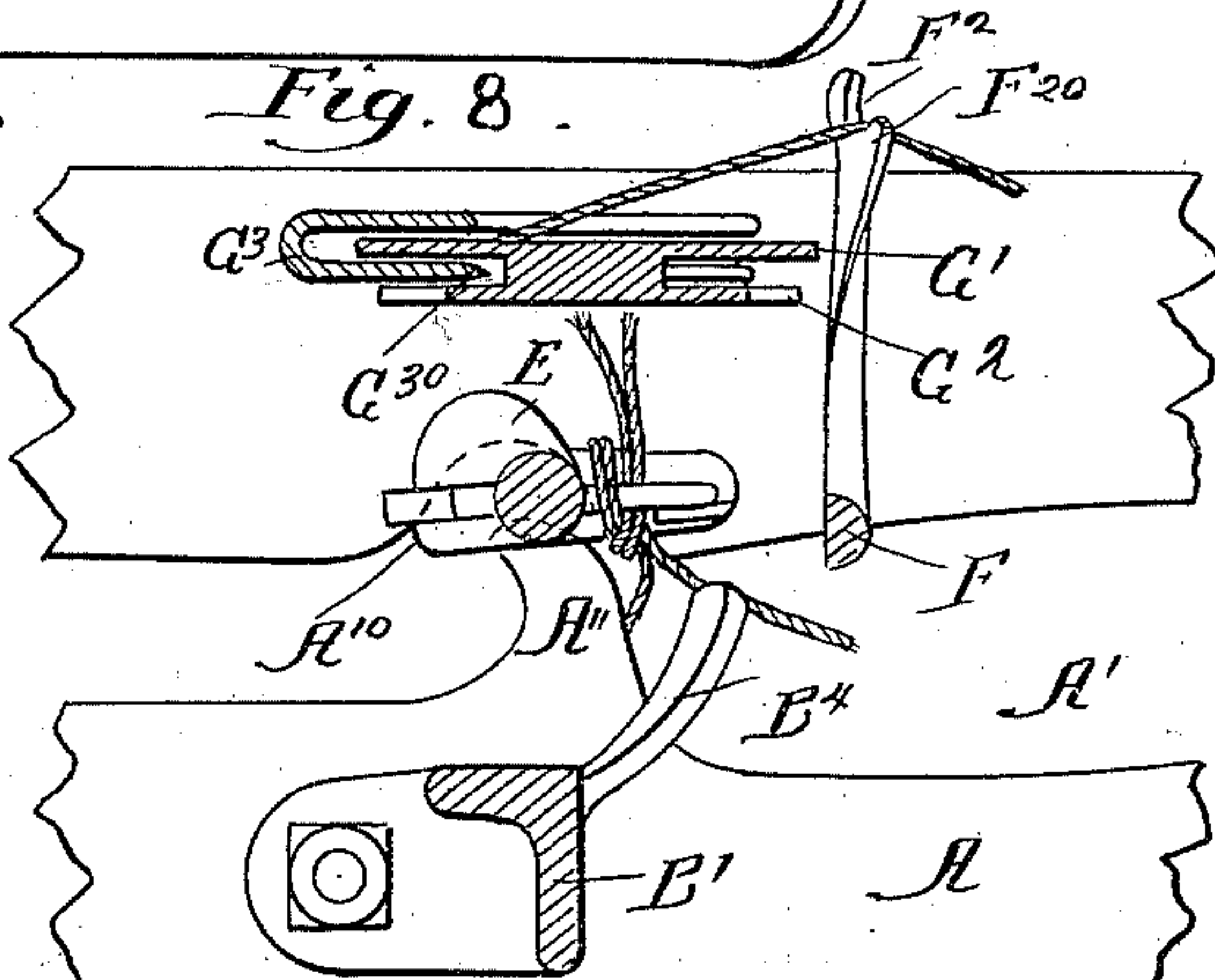


Fig. 8.



Witnesses:
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his attorneys

UNITED STATES PATENT OFFICE.

ANDREW STARK, OF CHICAGO, ILLINOIS.

CORD-KNOTTER FOR GRAIN-BINDERS.

SPECIFICATION forming part of Letters Patent No. 445,788, dated February 3, 1891.

Application filed July 3, 1890. Serial No. 357,616. (No model.)

To all whom it may concern:

Be it known that I, ANDREW STARK, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Cord-Knotters for Grain-Binders, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide simplified mechanism for tying knots in binding grain with cord, a special purpose being to insure the greatest possible certainty of operation, so that there shall be no danger of missing knots whatever the condition of the cord or the grain.

In the drawings, Figure 1 is an outer side elevation of my improved knotter, the breast-plate being in section at a vertical plane outside the knotter. Fig. 2 is a rear elevation. Fig. 3 is a sectional front elevation, section being made at the line 3 3 on Fig. 1. Fig. 4 is a section at the line 4 4 on Figs. 2 and 3. Fig. 5 is a sectional detail plan of the breast-plate and knotting and holding devices, section being made at the horizontal plane indicated by the line 5 5 on Fig. 1, except as to the tucker, which is cut at the line 5^a, the position of the parts being that of rest as to the knotting mechanism, the needle being in the position reached just before any action of the knotting devices commences, and before the needle has fully "come home." Fig. 6 is a similar view of the same parts, the position being that occupied at the instant the needle has reached the limit of its motion or come home, the tucker having started and moved across the plane of the path of the needle and engaged the cord on its way, the knotter-bill being just about to start its rotary motion. Fig. 7 is a similar detail of the same parts in the position occupied after the knotter has made half its revolution. Fig. 8 is a similar view of the same parts, the position being that occupied at the instant of cutting the cord, the knot being completed and ready to be discharged from the bill. Fig. 9 is a sectional elevation, looking rearward, showing the parts in the position occupied after the needle has partly receded, showing how it lays the strand of cord with respect to the knot-

ting devices preparatory to the next bundle. Fig. 10 is a detail similar to Fig. 9 in so far as it extends, but showing the position of the parts an instant later than they are shown in Fig. 9, illustrating the effect of the strand placed by the needle in its recession in closing the bill. Fig. 11 is a sectional plan of the parts shown in Fig. 9 in substantially the same position as in said figure, section being made at substantially the same plane as Fig. 5, indicated by the line 5 5 on Fig. 1. Fig. 12 is a detail elevation of the cord-holder, disk, and clamp and knife, and the immediately-supporting parts of the frame, looking from the vertical plane of the needle toward the holder. Fig. 13 is a bottom plan of the knotter-spindle bearing, the adjacent supporting-arm of the bearing being cut in section at the plane of the end of the bearing.

A is the breast-plate.

B is the knotter-frame.

C is the knotter-driving shaft.

D is the knotter-cam wheel.

E is the knotter-bill.

E' is the knotter-pinion, fixed on the shaft or spindle of the knotter-bill and actuated by the gear-segment D' on the wheel D.

G is a stud axle or bolt rigid with the knotter-frame, on which the holder-disk G' G² is journaled.

G³ is the holder-shoe, pivoted at g³ on the frame B, and G³⁰ is a knife-edge on one of the flanges of the shoe for cutting the cord.

F is the tucker-arm, which terminates at the upper end in a yoke F', which encircles the shaft C and the bearing of said shaft in the frame B, and has two interiorly-projecting trunnions f' f' in horizontal line at its opposite sides, which are lodged in notches in the end of the bearing of the shaft C, whereby the tucker is pivoted on a horizontal pivot to the frame, the hub of the cam-wheel D, when placed on the shaft and up against the end of the bearing, serving to retain the trunnions in said notches. At the upper and lower end of the yoke F' it has exterior projections F¹⁰ and F¹¹, respectively, which are engaged alternately by the cam D² on the cam-wheel D, whereby the said yoke and tucker-arm are rocked back and forth once as the cam-wheel makes each revolu-

tion. The friction between these projections and the cam may be diminished by anti-friction rollers, as f^{11} , shown on the upper projection, this projection receiving the greatest pressure and most needing such provision for diminishing friction.

The lower end of the tucker-arm F is provided with a hook or notch F^2 , open rearward—that is, forward in the direction of the operating movement of the arm, as will hereinafter appear. The purpose of said hook is to engage and tuck the cord around the knotter-bill and into the holder, as more fully explained hereinafter.

The breast-plate has the usual slot or opening A' for the passage of the needle and the cord, said slot being deflected at the vicinity of the knotter-bill—that is, the breast-plate having an indentation A^{10} in the edge of the slot upon the side of the plane of the needle upon which the knotter-bill stands, and having from the other side of the slot a projection or finger A^{11} , which extends across the plane of the path of the needle and cord toward and partly into the indentation A^{10} .

The knotter-frame B comprises two limbs B' B^2 , the former on the forward and the latter on the rear side of the plane of the needle, leaving the recess B^3 between them, through which the needle of the binder passes as it carries the cord to the knotter-bill. From the limb B' of the frame B the arm or finger B^4 projects rearward and outward across the plane of the path of the needle, terminating at a point outward from the finger A^{11} of the breast-plate and above the level of that finger, being also above the level of the knotter-bill, the end of said finger B^4 overhanging the point of the knotter-bill at the position of rest of the latter. The purpose of this finger B^4 will appear as the description of the knotting operation proceeds. The limb B^2 has the bearing B^{20} for the knotter-bill spindle or shaft, and the lower end of said bearing for about ninety degrees about the axis of the spindle is in a plane at right angles to said axis, and may be called horizontal, and the remainder is cut away to form a sloping approach to the said horizontal portion, the whole end of the bearing constituting a cam-surface b^{50} for opening and holding open the knotter-bill, the said horizontal part of such cam, which occupies ninety degrees, holding the bill open through so much of its revolution. The oscillating jaw is pivoted to the fixed jaw of the bill and operates freely in relation thereto without any spring either to open or close it, its movement in opening and closing being controlled entirely by the cam-surface forming the end of the bearing B^{20} , said cam, as stated, causing it to open at a certain time and holding it open for a certain portion of its revolution, and being cut away to permit the bill to close, but containing no provision for closing it positively after the heel of the oscillating jaw passes the portion which thus detains it open. The bearing B^{20}

is flared outward at the lower end on the forward side of the needle, so that in that direction it extends forward past the rearwardly-projecting end of the finger B^4 . This flared or projecting portion of said bearing is indicated by the letter B^{21} in the drawings. The tucker-arm F is bowed forward between the yoke F' and the notch or hook F^2 , said bowed portion extending around the path of the needle—that is, the upper portion of the arm being above that path and the lower portion, having the hook F^2 , being below the level of the path of the needle, and at certain of its positions wherein the hook is rearward of the path said lower portion of the arm being below the path of the needle, so that the needle passes or stands between the upper and lower portions of said arm within the bow.

The holder comprises the two disks G' and G^2 , separated by a slight interval and connected by the neck G^4 . It is journaled, as stated, on the stud axle or bolt G on the frame D, rearward from the knotter-bill spindle-bearing, said axle being at right angles to said spindle-bearing, the holder-disk therefore revolving in a plane parallel to the knotter-bill axis and on the opposite side of said bill from the path of the needle. I do not consider it material that the axis of the holder should be strictly at right angles to that of the bill, nor that the revolution of the disk should be at a plane parallel to that of the needle, considerable variations from these exact directions being not inconsistent with the general mode of action of the combination. The rear disk G' of the holder has the notches G^{10} , (as illustrated there are four such notches,) in which the cord is laid, as hereinafter described, by the tucker, and the shoe G^3 clasps the disk G' on the under side, forming, as it were, a trough or channel in which said disk revolves, the point of the shoe projecting outward—that is, in the direction of the binding-stroke of the needle, or in the direction of the discharge of the bundle—nearly to the plane of movement of the tucker-arm F.

The forward flange of the shoe is sharpened at a portion a short distance back from its extremity, said sharpened edge G^{30} serving as the knife to sever the cord at the proper point in the operation, its exact location being determined by the fact that the cutting must not be effected until the knotter-bill has closed upon the ends of the cord, and being therefore such that the cord which is carried against it by the notched and toothed disks G' and G^2 , as more particularly hereinafter explained, will not have reached it until the knotter-bill has closed. Practically, and as illustrated, the sharpened edge is located a little inward from a vertical plane through the axis of the holder. Projecting from the rear side of the cam-wheel D is the stud-pin D^4 , which is in proper position to engage the notches G^{10} on the disk G' of the holder to rotate the holder a certain portion of a revo-

lution for each complete revolution of the cam-wheel. Just behind the stud D^4 the rim of the cam-wheel D is cut out to form a notch D^5 , which occupies several degrees of the periphery of the cam-wheel. Into this notch the teeth G^{20} of the disk G^2 of the holder pass as the holder is revolved by the engagement of the pin D^4 in the notch G^{10} , and the farther edge of the notch G^5 engages the tooth G^{20} on the back after the pin D^4 has passed clear of the notch G^{10} , and gives a further movement to the holder-disk in the same direction in which it was actuated by the pin D^4 . The angular extent of the notch D^5 is such that there is an interval between the time the pin D^4 leaves the notch G^{10} and the time the farther edge of the notch D^5 engages the tooth G^{20} , and during this interval the holder halts in its rotary movement. The extremities of consecutive teeth G^{20} on the disk G^2 are at such distance that they may simultaneously contact the periphery of the cam-wheel D , so that when the rotation of the cam-wheel has carried the notch D^5 clear of the tooth G^{20} , which was engaged in it, and left the extremity of that tooth trailing on the periphery of the cam-wheel the next tooth is also stopped by the periphery of the cam-wheel, and thereby the holder is locked against rotary motion until the next revolution of the cam-wheel brings the pin D^4 again into engagement with the notch G^{10} .

The detail form and relation of the parts will be made more fully apparent in the course of the following description.

The operation of this structure is as follows: The parts being in the position shown in Figs. 1, 2, and 3, one end of the cord being grasped in the holder and running thence forward and grainward around and over the knotter-bill and over the finger A^{11} to the needle-eye, (this position of the cord being shown in Fig. 5,) the needle rises and carries the second strand of the cord around the bundle, laying it upon the finger A^{11} , the needle passing through the aperture B^3 in the frame and laying the cord also onto the finger B^4 . If the cord should chance to have been crowded rearward against the limb B^2 of the knotter-frame, it will have been guided forward by the flaring flange B^{21} at the end of the knotter-bill bearing B^{20} , as stated. This position of the parts, including the needle and of the cord, is shown in Fig. 5. At this stage the cam D^2 encounters the yoke F' at the end having the anti-friction roll f^{11} on the projection F^{11} , and as the cam-wheel revolves that end of the yoke is rocked away from the plane of the cam-wheel, rocking the tucker-arm on its pivot and swinging its lower hooked or notched end rearward across the plane of the movement of the needle and causing its notch F^{20} to engage in the cord running from the needle-eye back over the finger B^4 to the bundle and deflecting said cord rearward, thereby slipping it off of the finger B^4 and lodging it on the knotter-bill, or if it has, as

will frequently be the case, already been slipped off from the finger B^4 in the process of packing the bundle and is lodged on top of the knotter-bill, pushing said strand of cord farther toward the spindle of the bill, wrapping it partly around the same, the position of the cords and of the other parts mentioned being then as shown in Fig. 6. At this instant the knotter-bill, with the cord thus tucked close up against its spindle, begins its revolution, revolving in the direction of the arrow shown in Fig. 6, gathering the cords which rest on it and on the finger A^{11} , and carrying them off from said finger, wrapping them around the knotter-bill at the same time, so that by the time the knotter-bill has completed half a revolution said cords are wrapped around both the jaws of the bill, as seen in Fig. 7. In the meanwhile the cam D^2 has continued to actuate the tucker-arm and its lower end has been caused to swing still farther rearward, carrying the cord engaged in its notch past the holder and laying it into the notch G^{10} of the disk G' and between the teeth G^{20} of the disk G^2 , from between which the other end of the cord already runs to the knotter-bill. At this stage the pin D^4 engages a notch G^{10} of the disk G' , (as illustrated it is the notch opposite the one in which the cord is being laid that is thus engaged,) and begins to rotate the holder, which carries the cord engaged in the first-mentioned notch down into the shoe G^3 , wherein it is folded over the edge of the disk G' and grasped between said disk and the two flanges of the shoe on the opposite sides of the disk with so short a bite that with very slight pressure it is securely held in the holder. I prefer, however, to make the holder-shoe of sheet-steel and of sufficient length, so that the two flanges may have enough elasticity to permit cord of considerably varying thickness to be carried in by the holder and grasped and held therein with sufficient firmness to insure the operation as designed; but no spring is employed to force the shoe onto the flange or give it pressure thereon. While the cord is being thus carried into the shoe by the notch G' , the tooth G^{20} , which is following and driving it, forces it upon the inclined edge of the forward flange of the shoe, this edge being smooth and adapted to permit the cord thus to slide up upon it as it is forced by the tooth G^{20} , and the second cord thus about overtakes the first cord by the time the pin D^4 has passed clear of the notch G^{10} . During this time the knotter-bill has revolved farther with its upper jaw held open by the engagement of its heel under the cam-face at the end of the bearing B^{20} , in a manner that is familiar and need not be particularly set out, and standing thus open receives between it the two cords running from the holder to the knot on the bill, and while the holder halts for an instant in the interval after the engagement of the pin D^4 and before the engagement of the end of the notch D^5 with the

holder-tooth, the knotter-bill, making a little farther rotary movement, draws the cord tight between the holder and the bill, and causes the cord wound around the bill, and thus drawn tight, to force the jaws of the bill together, making them grasp the ends of the cord which have entered between them. The two cords are caused to be with certainty in proper position to be received between the open jaws at the instant noted, by the height of the flange of the holder-shoe, onto which the cords have been driven by the tooth G^{20} of the holder-disk G^2 , the point at which the cords pass out of the holder being obviously at this stage the angle of intersection of the driving-edge of the tooth G^{20} and the guiding-edge (which is the upper edge) of the forward flange of the shoe, and this point is therefore definitely and absolutely fixed by the construction and timing of the machine. The knotter-bill having moved the distance which it has time to move after the holder ceases to be actuated by the pin D^4 , and having thus drawn the cords tight and caused them to force the bill shut, the rear edge of the notch D^5 comes into engagement with the rear face or edge of the tooth G^{20} , and again actuates the holder a short distance, causing the forward or driving edge of the tooth G^{20} and the rear (which is the cord-receiving) edge of the notch G^{10} , said edges being in line transversely to the plane of the disk to carry the cord lodged across said two edges against the sharpened edge D^{30} of the forward flange of the shoe—that is, against the cord-severing knife, which, it will be observed, is a fixed knife—and thereby causes both cords to be cut, the knotter-bill meanwhile continuing to draw the cords taut, and, immediately after they are severed, completing its revolution and coming to rest in the initial position, pointing outward more or less directly. The bundle now hanging from the knotter-bill, from which the knot is ready to be stripped off, and being pressed by the dischargers to eject it from the machine, readily pulls the knot off the bill and completes it in that process. The knotter-bill is of a form which is shown and described in my pending application, numbered 332,512, filed December 4, 1889, in respect to the spur or tooth e , projecting up from the lower or fixed jaw at the forward side of the oscillating jaw, which, as the knot is pulled off, engages the ends and pulls them through the loop, causing the knot to be a fast knot and not a bow knot, as explained in my said application. It will be observed that the cords having been cut on the forward side of the disk G' and at the upper edge of the shoe the ends on the opposite side of the knife from the knot are left still firmly grasped in the holder, being doubled over the edge of the flange G' and into the shoe. As the action of the mechanism continues and the needle recedes, it carries the cord, which is still lodged in the notch F^2 , back and folds it around the projection F^{20} , which forms the

guard of said notch at the forward side, before the eye of the receding needle has passed back of the position of the finger B^4 . The cam-wheel continuing its rotation causes the cam D^2 , engaging the lower end of the yoke F' , to rock the tucker-arm F back toward its original position, and the cord lodged on the tucker-arm—that is, folded around the projection F^{20} —is in that movement of the tucker-arm carried so far forward that as the needle recedes farther it lays the cord onto the finger B^4 . This finger at this stage overhangs the point of the bill, which has come to rest, and the cord thus lodged on the finger B^4 and carried thence back over the finger B^{11} as the needle farther recedes is caused to slide off from the finger B^4 and lodge upon the upper or oscillating jaw of the bill and close it, thereby avoiding all danger which might otherwise exist that the cord thus carried by the receding needle might be lodged between the jaws of the bill, if, as will frequently be the case at this juncture, they stand open, there being no spring or other device to close them after they are released and partially pulled open by the escaping knot.

I do not limit myself to the employment of a fixed knife to sever the cord, the essential characteristic of the knife being its position on the farther side of the knotter-bill from the plane of the needle's movement and substantially or approximately in line transversely with the shank of the bill. I do not design to be limited to the particular device shown for deflecting the cord across the plane of the needle's movement on the farther side of the knotter-bill and holder, the essential feature being that the device employed shall take the cord between the eye of the needle and the bill and deflect it, as described. I do, however, prefer as simple and convenient means for these purposes the fixed knife and the deflecting-arm, respectively.

I claim—

1. In combination with the needle, the knotter-bill having its axis at one side of the plane of the needle's movement, and a cord-deflecting device which moves from the side of said plane opposite the knotter-bill across said plane at a position beyond the knotter-bill toward the discharge side to deflect the cord against the knotter-bill shank at said discharge side of the bill, substantially as set forth.

2. In combination with the needle, the knotter-bill having its axis at one side of the plane of the needle's movement, the holder receiving the cord at a point farther from said plane than the knotter-bill axis and on the same side of said plane, a cord-deflecting device operating from the side of said plane opposite the knotter-bill axis across said plane and past the knotter-bill, and cord-receiving notch of the holder to carry the cord to the holder, substantially as set forth.

3. In combination with the needle, the knotter-bill, a fixed finger projecting transversely

to the plane of the needle's movement between the path of the needle's eye and the knotter-bill at a point dischargeward from the knotter-bill axis, and a cord-deflecting arm moving across the plane of the needle in a path also located dischargeward from the bill near to said fixed finger to take the cord lodged thereon by the needle in its advance, substantially as set forth.

4. In combination with the needle and the knotter-bill, said knotter-bill having its vibrating jaw freely pivoted to the fixed jaw, the knotter-bill bearing having a cam-surface adapted to engage the heel of said vibrating jaw to open and hold it open during part of its revolution, the jaw being otherwise free from actuation by the mechanism, the fixed finger located dischargeward from the bill's axis and projecting across the plane of the needle's movement between the path of the needle's eye and the bill from that side of said plane toward which the bill points when at rest to receive the cord as the needle recedes and cause it to be lodged on top of the freely-pivoted jaw of the knotter-bill to close the same, substantially as set forth.

5. In combination with the needle and with the knotter-bill located at one side of the plane of the needle's movement, the holder located and operating in a plane substantially parallel to that of the needle's movement and on the opposite side of the knotter-bill axis from the plane of the needle, and a cord-deflecting arm operating across both said planes from the side of the plane of the needle's movement which is opposite the knotter-bill to the side of the plane of the cord-holder movement opposite the knotter-bill, thus carrying the cord onto the bill and into the holder, substantially as set forth.

6. In combination with the needle and the knotter-bill, the holder on the opposite side of the knotter-bill from the plane of the needle's movement, mechanism which rotates the holder to cause it to carry the cord away from the discharge side of the machine, and a fixed knife against which the cord is carried by said movement of the holder, whereby the cord is wrapped around the knotter-bill by the movement of the holder carrying the cord into it up to the moment of cutting, substantially as set forth.

7. In combination with the needle and the cord-holder operating in substantially parallel planes and the knotter-bill between said planes, mechanism which actuates the bill, and mechanism which revolves the holder grainward on the side whereat it carries the cord to the shoe, said mechanisms timed to give the holder its said cord-actuating movement while the bill is revolving stubbleward on the side toward the holder, substantially as set forth.

8. In combination with the needle and the knotter-bill and the knotter-actuating cam-wheel revolving in a plane parallel to the path

of the needle, the cord-holder actuated directly by said cam-wheel and revolving in a plane substantially parallel to that wheel, substantially as set forth.

9. In combination, substantially as set forth, the cam-wheel, the knotter-bill, a fixed cord-severing knife, and a holder-disk adjacent to the knife and located substantially parallel to the cam-wheel, said cam-wheel having abutments which engage the holder-disk and rotate it in two stages with an interval for each knotting operation, the first to carry the cords to the shoe before they are received between the jaws of the bill, the second to carry the cord in the holder-notches against the knife after the bill has revolved to take in the cords between its jaws.

10. In combination with the holder having two disks, and the cam-wheel having two abutments which engage the disks respectively each once in each revolution of the cam-wheel, the position of said abutments and of their respective engaging points on the disks being so located that said abutments actuate the holder at different times, the actuation of the one ceasing and being followed by an interval of rest of the holder before the actuation of the other commences, substantially as set forth.

11. In combination with the holder having two disks, the cam-wheel having two abutments which engage the disks respectively each once in each revolution of the cam-wheel, said abutments and their respective points of engagement on the disks being so situated relatively that the actuation caused by one of the abutments is followed by an interval of rest before that caused by the other commences, the knotter-bill, and the mechanism which actuates it, timed to cause the bill to receive the cords between its jaws and accomplish a portion of its rotation after so receiving them in said interval of the movement of the holder, substantially as and for the purpose set forth.

12. In combination with the needle, the knotter-bill, the holder on the opposite side of the knotter-bill from the plane of the needle's movement, and mechanism which moves the holder to carry its cord-notch in its cord-actuating movement substantially to a plane transverse to that of the needle's movement and containing the knotter-bill axis, substantially as set forth.

13. In combination with the needle, the knotter-bill, and the holder on the opposite side of the knotter-bill from the plane of the needle's movement, a cord-severing knife operating to cut the cord at a point in a plane substantially transverse to the plane of the needle's movement and containing the knotter-bill axis, as and for the purpose set forth.

14. In combination with the needle, the knotter-bill, a knife located on the opposite side of the knotter-bill from the plane of the needle's movement and having its cord-cut-

ting point substantially in a plane at right
angles to the plane of the needle's movement
and containing the knoter-bill axis, and
means for carrying the cord away from the
5 discharge side of the machine to the knife,
substantially as set forth.

In testimony whereof I have hereunto set

my hand at Chicago, Illinois, in the presence
of two witnesses, this 26th day of June, 1890.

ANDREW STARK.

Witnesses:

CHAS. S. BURTON,
JEAN ELLIOTT.