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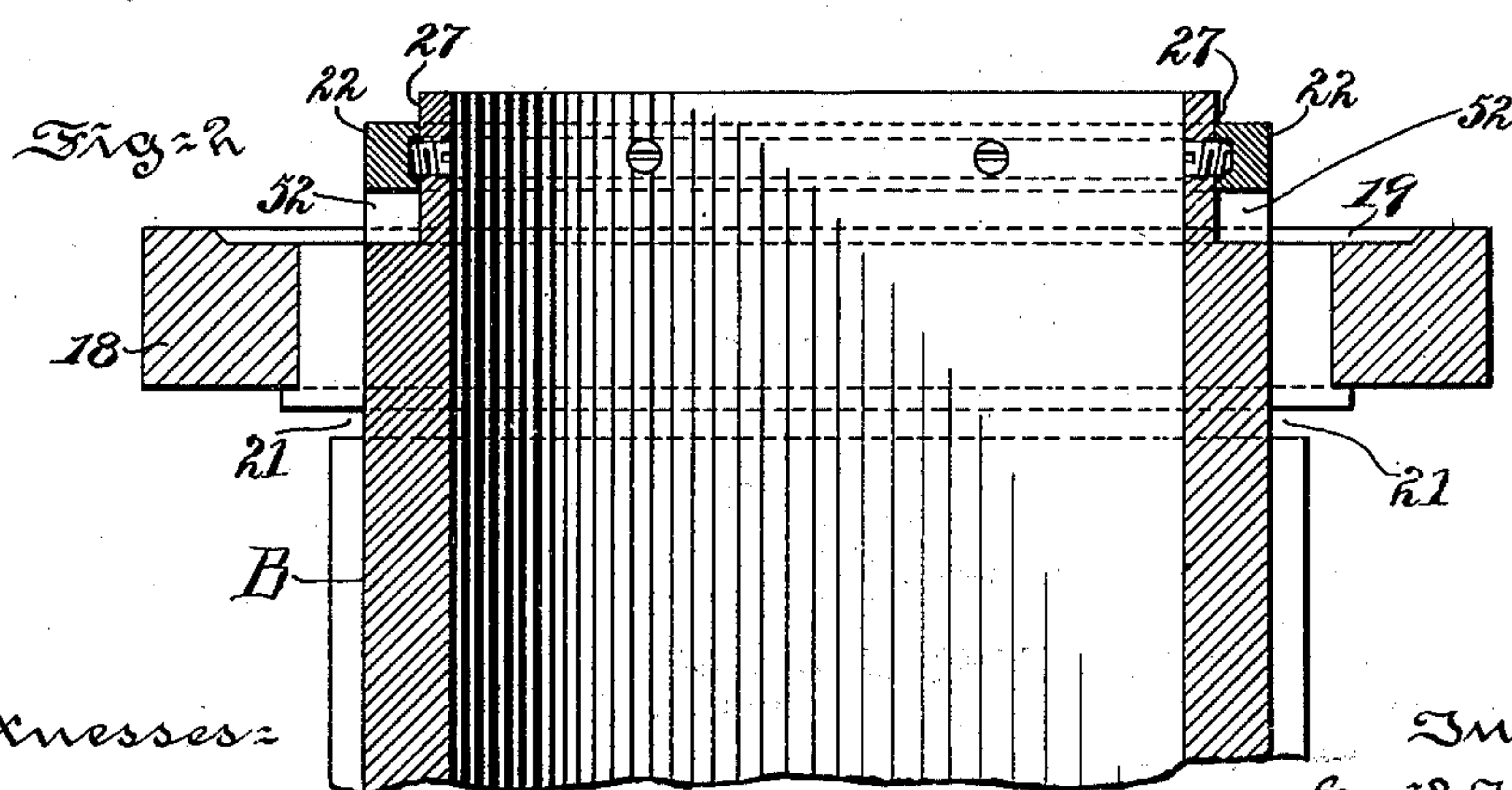
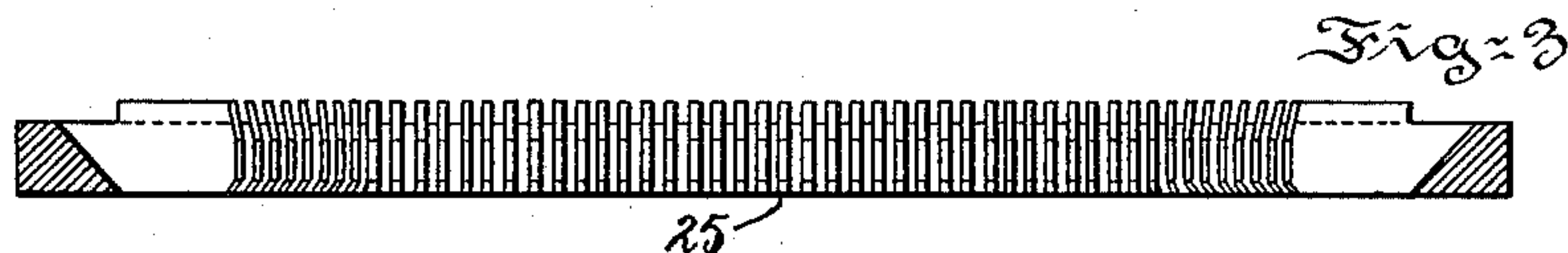
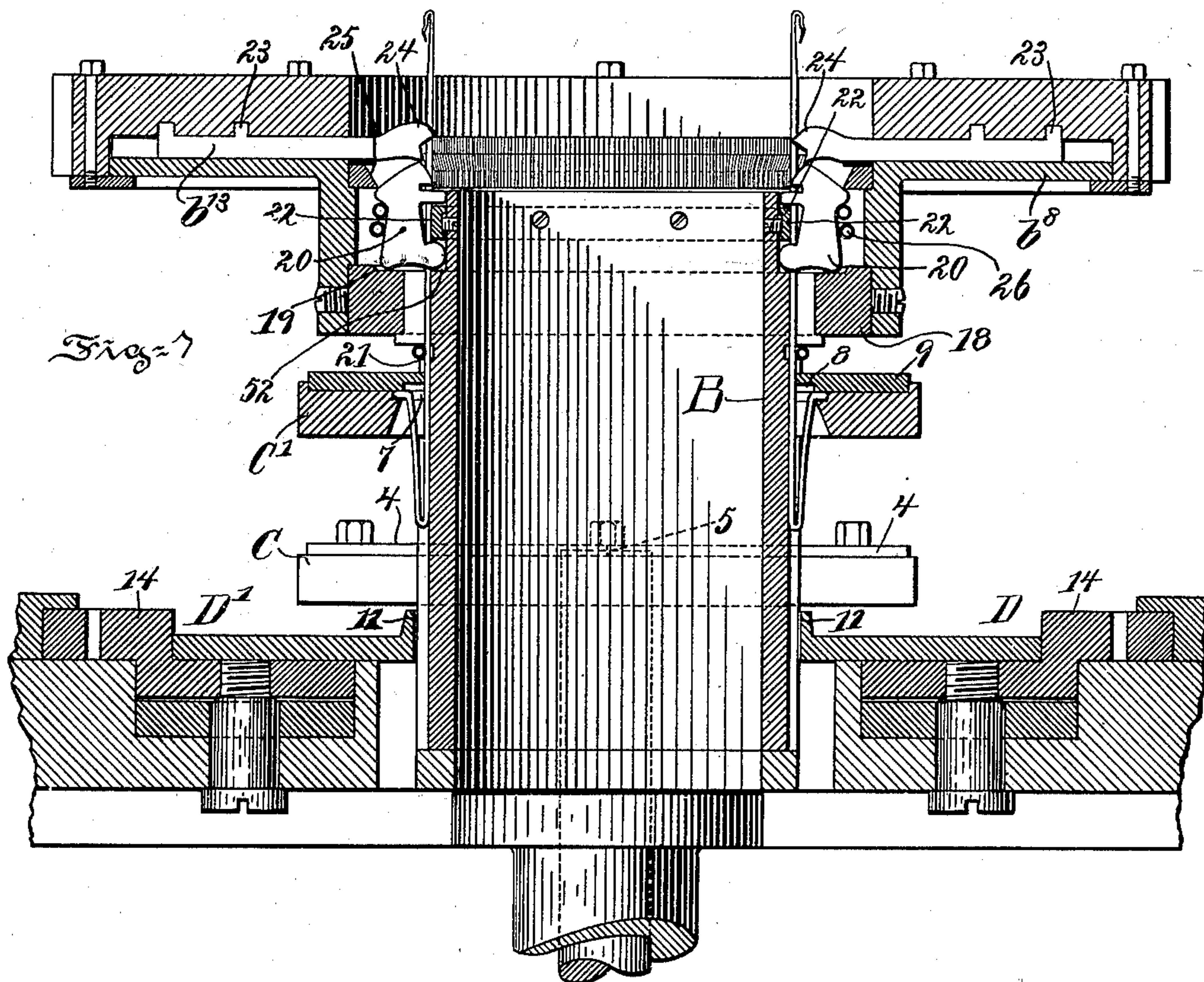
Patented Aug. 21, 1900.

E. J. FRANCK.
KNITTING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.)

5 Sheets—Sheet 1..



Witnesses:
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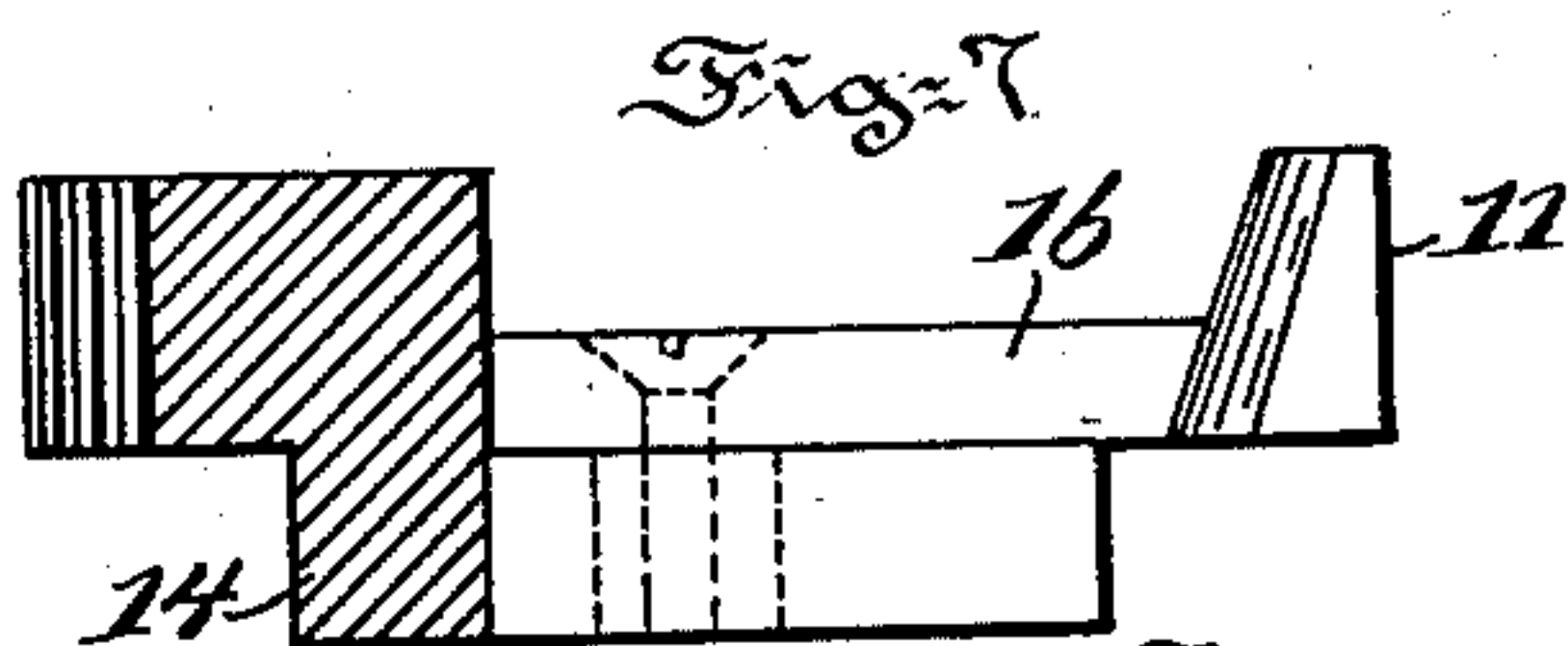
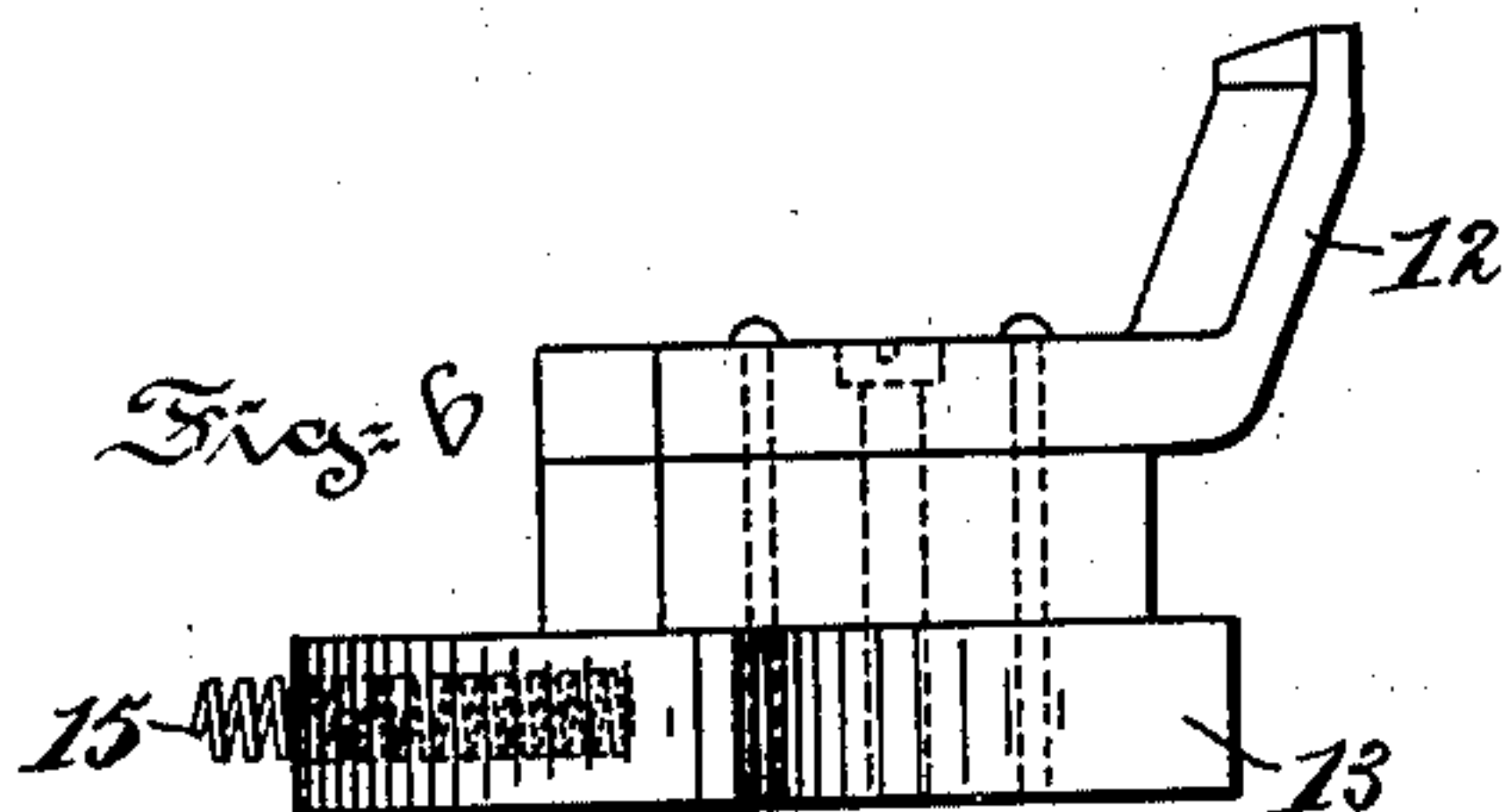
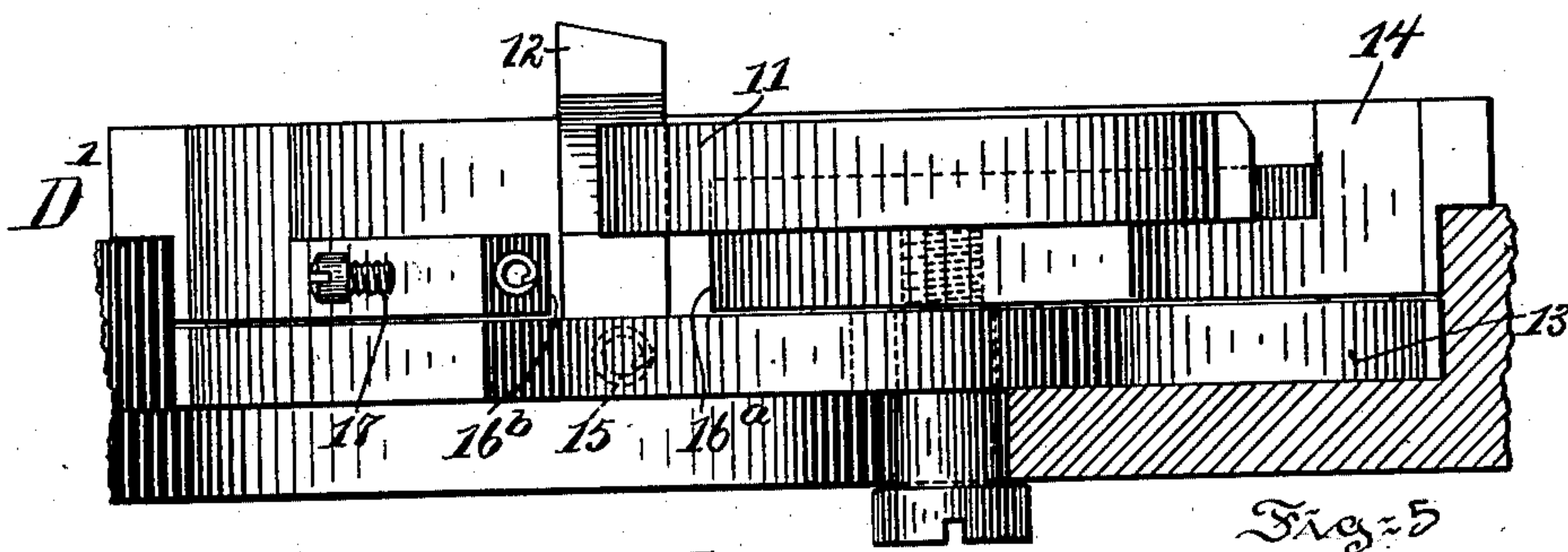
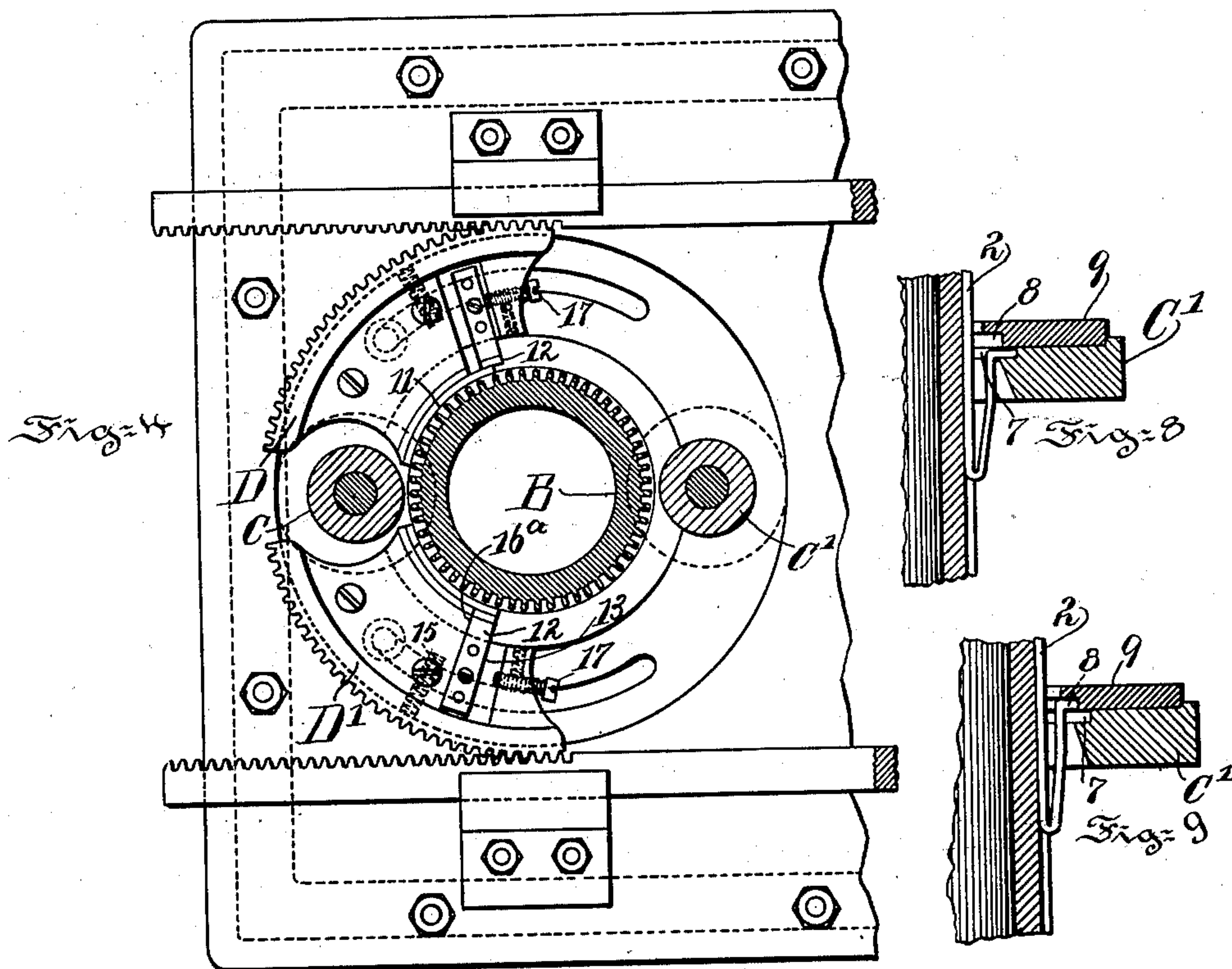
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5 Sheets—Sheet 2.



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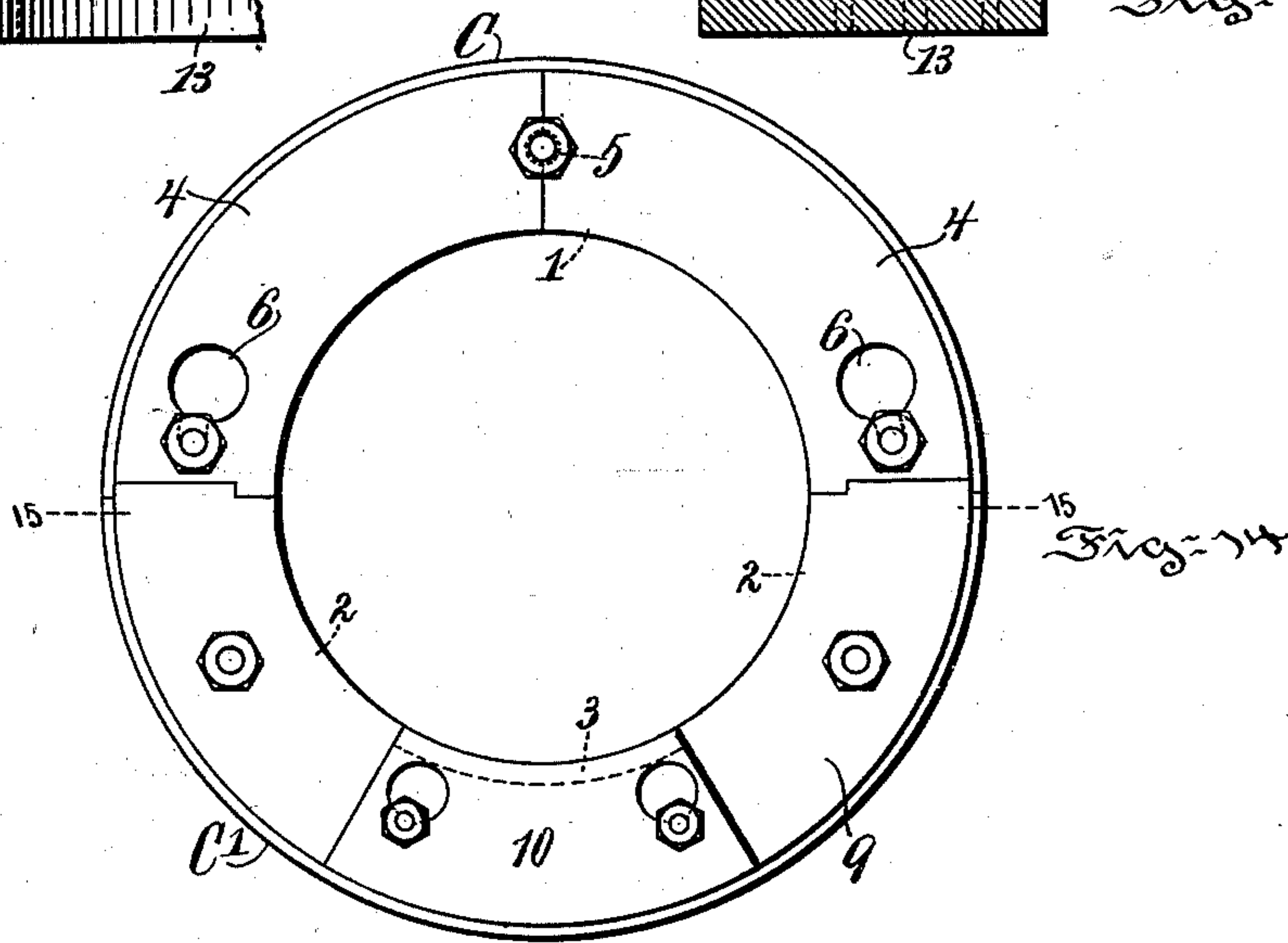
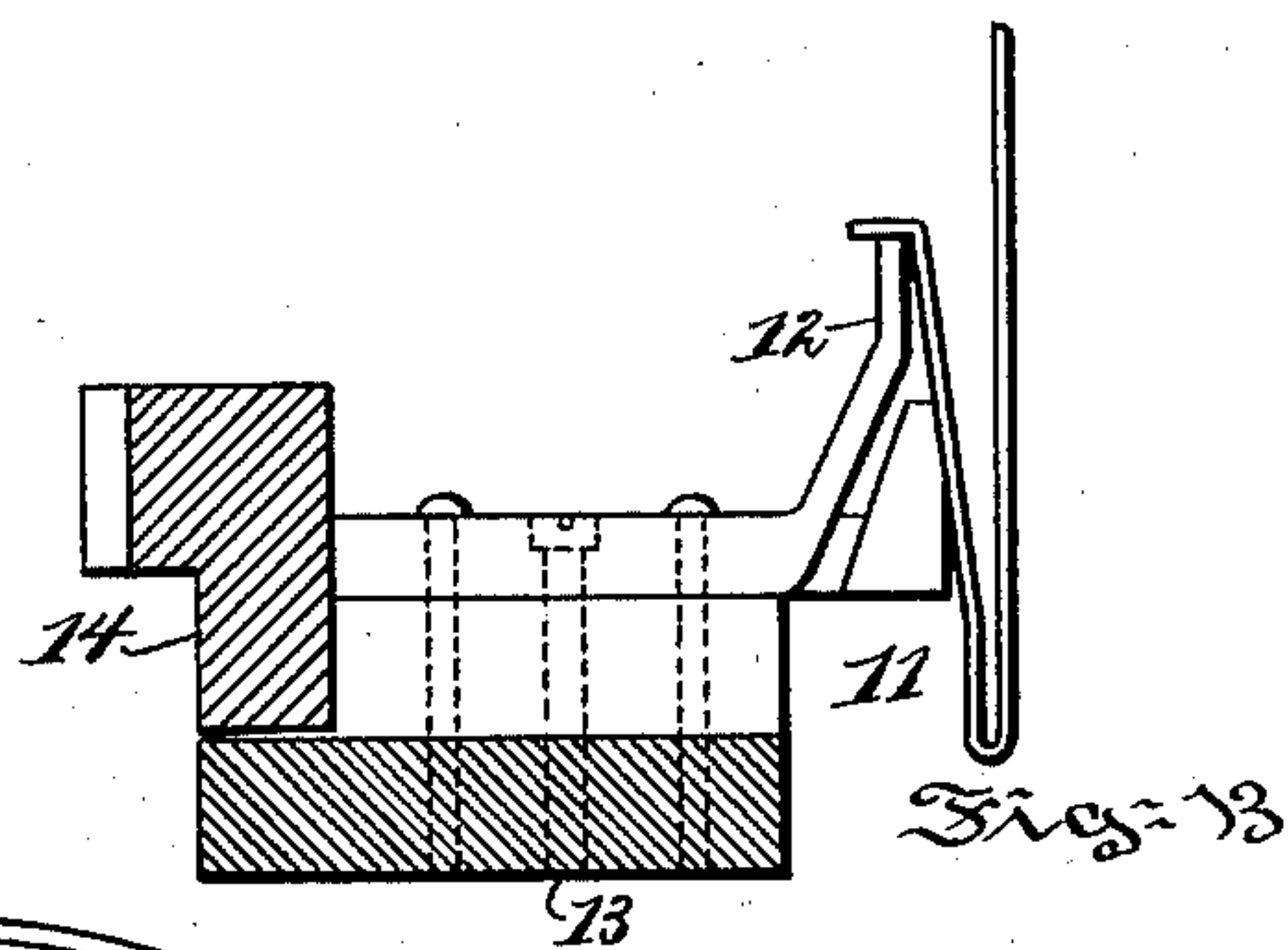
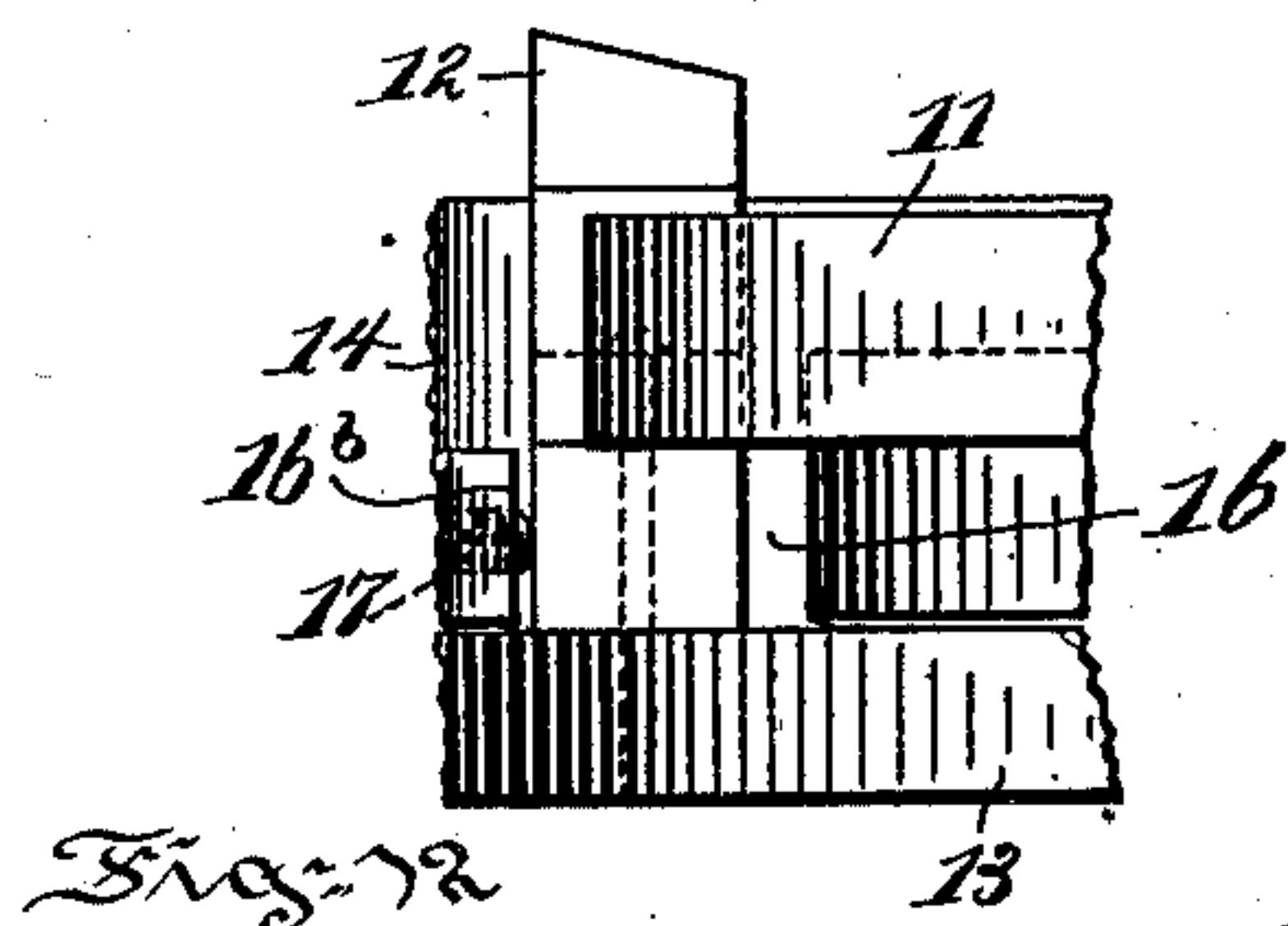
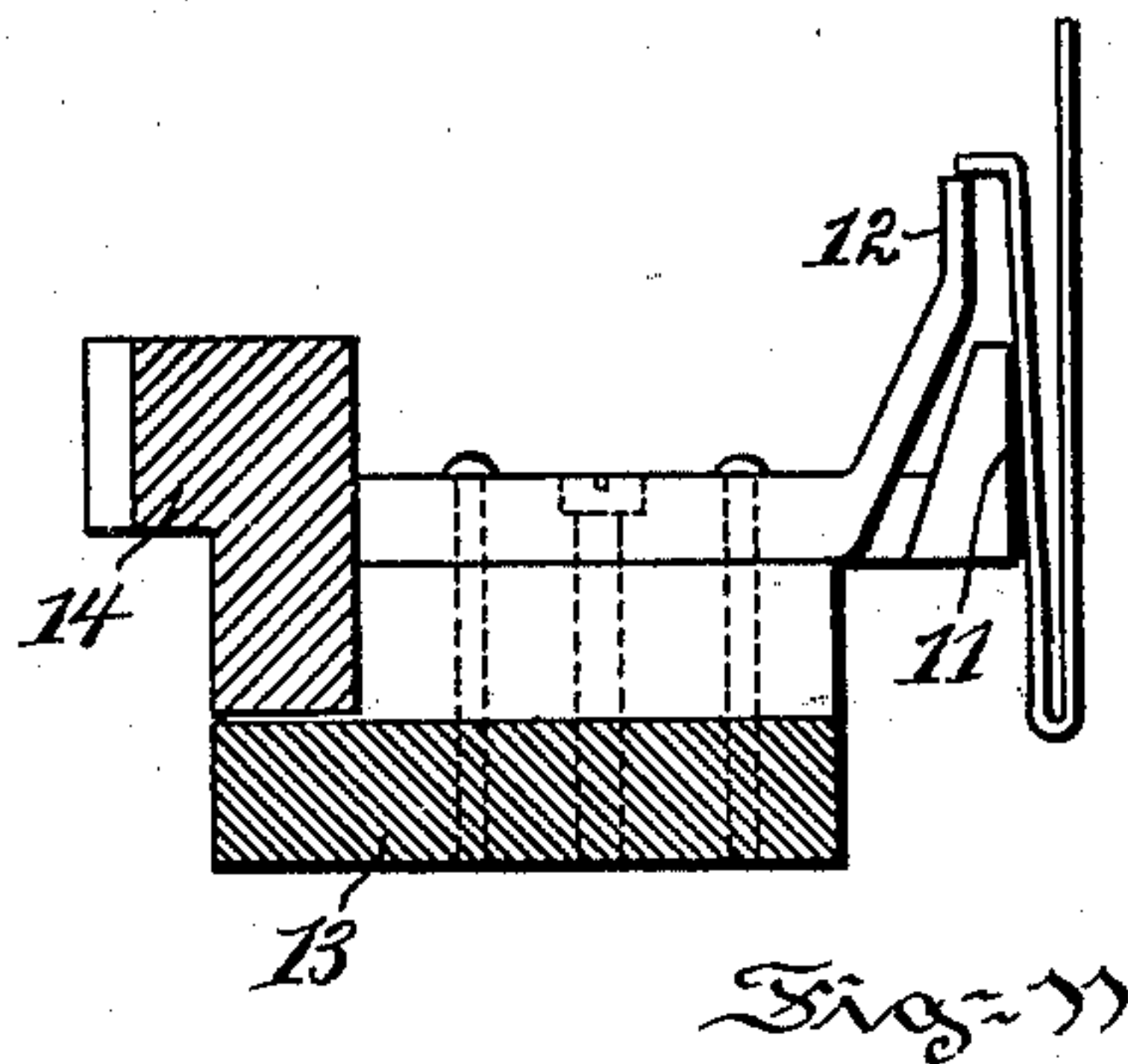
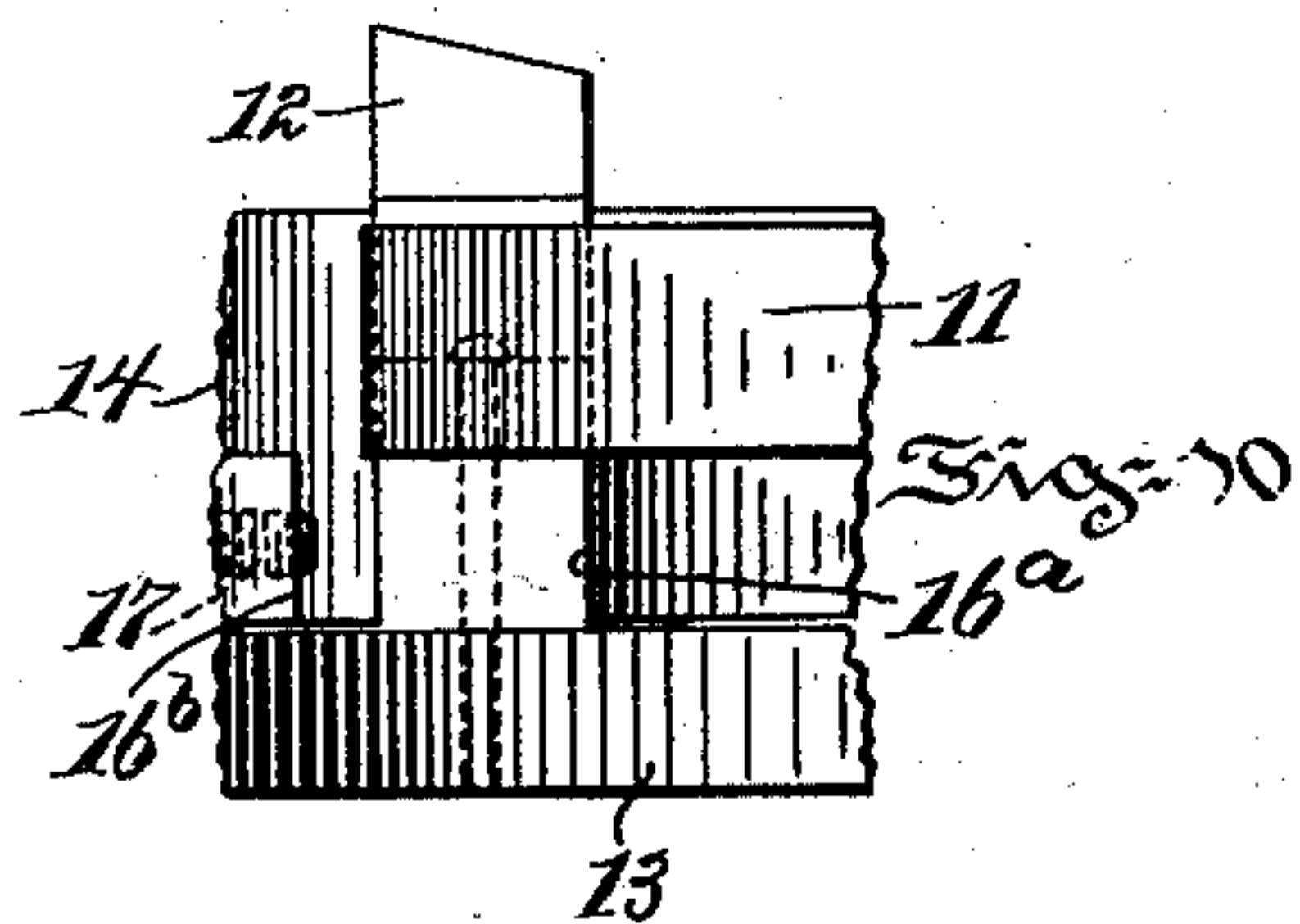
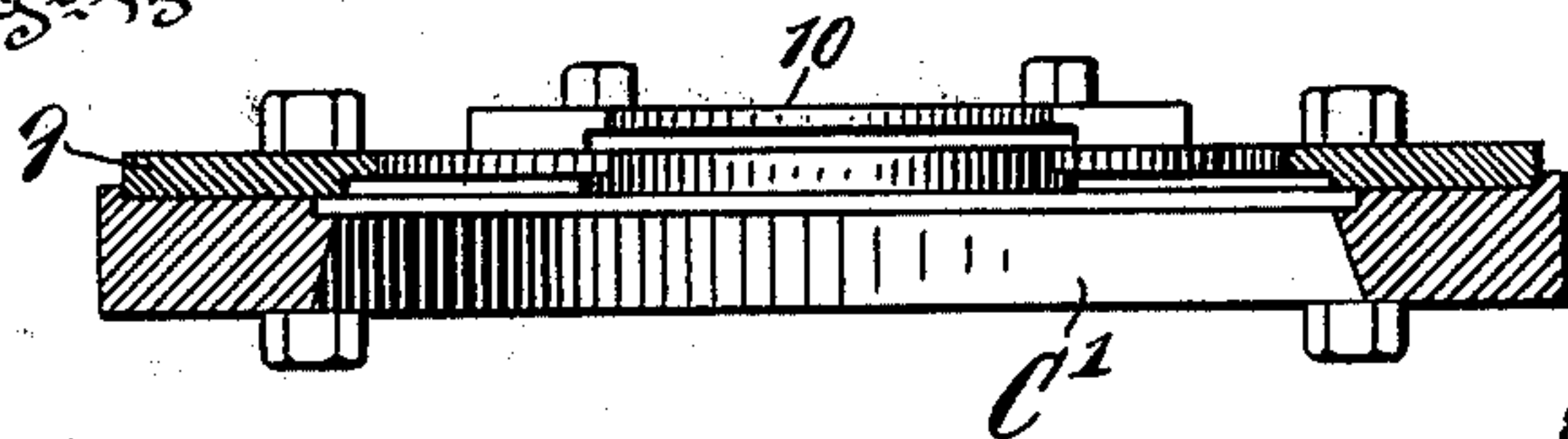


Fig. 15



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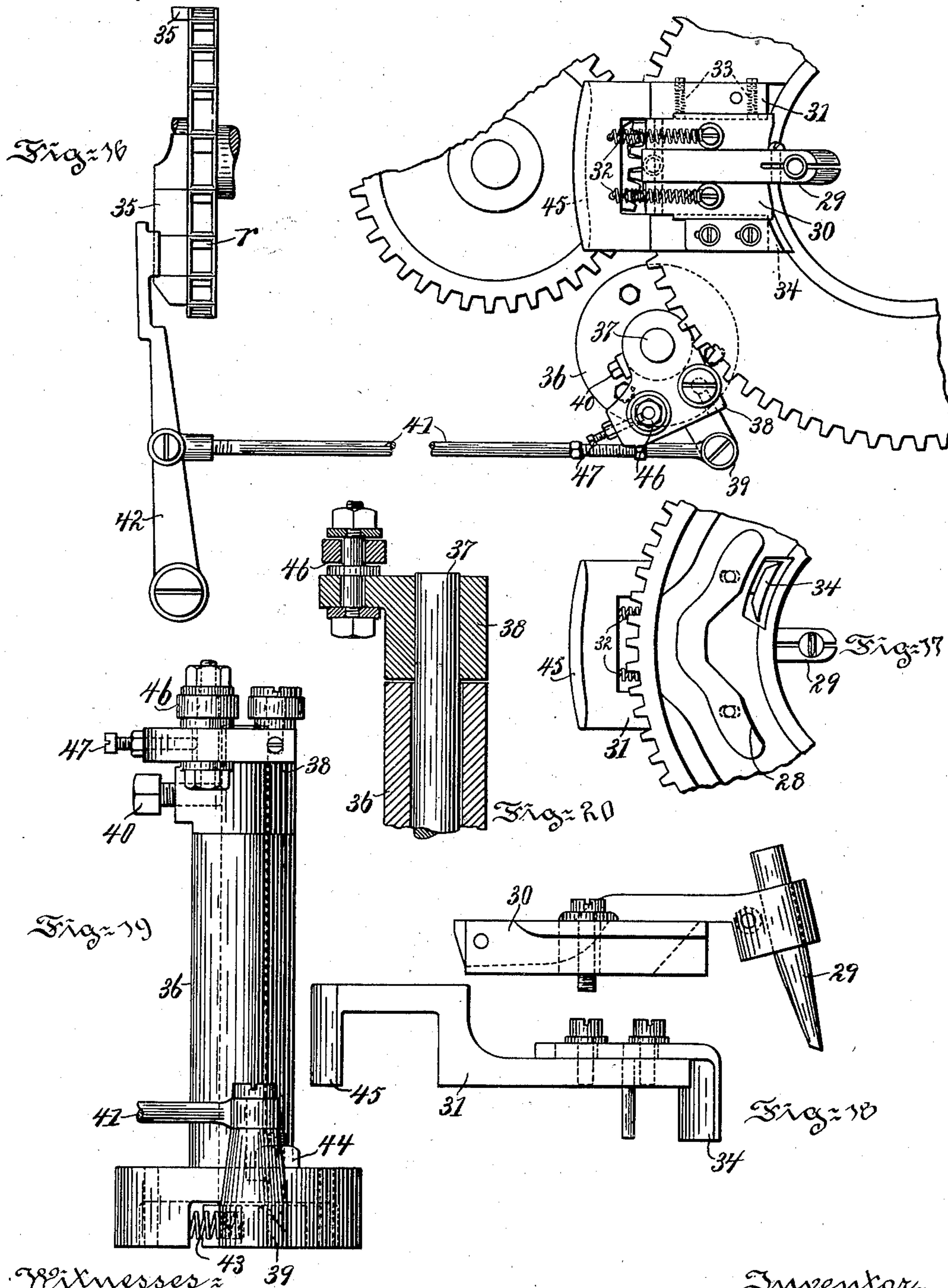
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(Application filed Apr. 28, 1898.)

(No Model.)

5 Sheets—Sheet 4.



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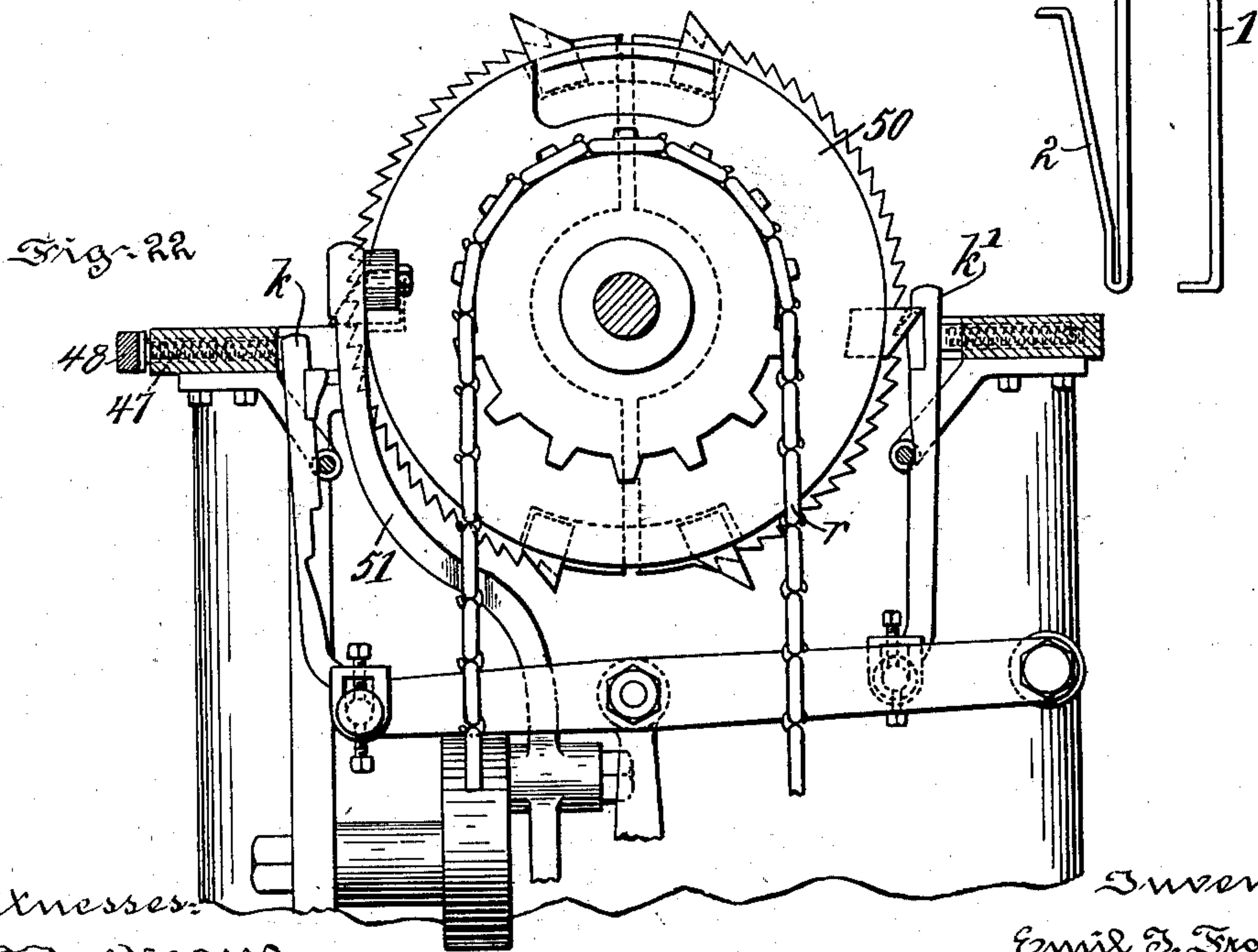
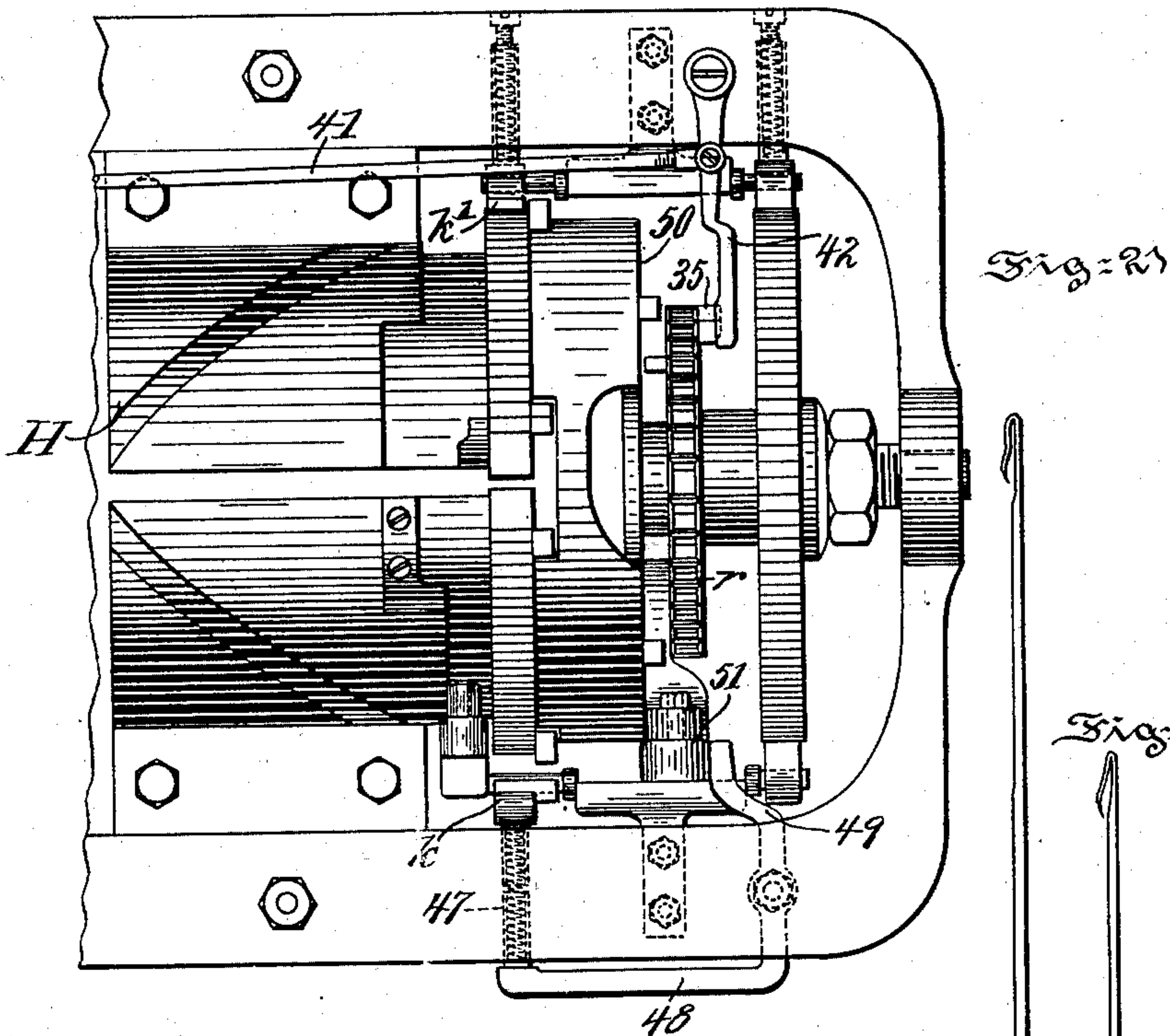
Patented Aug. 21, 1900.

E. J. FRANCK.
KNITTING MACHINE.

(Application filed Apr. 28, 1898.)

(No Model.)

5 Sheets—Sheet 5.



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UNITED STATES PATENT OFFICE.

EMIL J. FRANCK, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 656,538, dated August 21, 1900.

Application filed April 28, 1898. Serial No. 679,068. (No model.)

To all whom it may concern:

Be it known that I, EMIL J. FRANCK, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Knitting-Machines, of which the following is a specification.

My present invention relates to improvements applicable in whole or in part to knitting-machines of the general type described in Letters Patent No. 500,121, of June 27, 1893; No. 502,292, of August 1, 1893, and more especially No. 536,616, of April 2, 1895, all issued to me.

Objects of my present invention are, first, to tuck while fashioning, whereby the formation of holes in the work is prevented; second, to make the various parts at the top of the needle-cylinder more durable and easier of repair and to improve the operation of the web-holders and sinkers and permit of the application of a transfer-frame; third, to provide for loosening and tightening the stitches, so as to fashion tubular work; fourth, to provide shipper mechanism which shall be simple in construction, positive in action, and adapted to work comparatively slowly and without undue shocks and jars, and, fifth, to provide means for releasing unnecessary tension on some of the working parts and for the general simplification and improvement of the machines to which reference has been made. To these ends my invention comprises the improvements hereinafter described and claimed.

Before referring to the accompanying drawings I would say that in the latter I have shown my invention in application to the machine fully illustrated in my Letters Patent No. 536,616 and have only illustrated in the accompanying drawings so much of said machine as is necessary for an understanding of my present invention.

In the accompanying drawings, Figure 1 is a sectional view of the needle-cylinder and its accessories, illustrating parts embodying features of my invention. Fig. 2 is a similar view drawn to a larger scale and illustrating details of construction. Fig. 3 is a sectional view of the presser-ring. Fig. 4 is a top or plan view showing the needle-cylinder in sec-

tion and illustrating the needle-strippers. Fig. 5 is a view drawn to an enlarged scale and taken from the center of the needle-cylinder in the direction of one of the needle-strippers D, Fig. 4, and showing a portion of the bed in section and the tucking mechanism in elevation. Fig. 6 is a view of the tucking-finger detached looking from the left to the right in Fig. 5. Fig. 7 is a sectional view illustrating the part 14 shown in Fig. 5. Figs. 8 and 9 are sectional views illustrating positions of the needle bits and carrier. Figs. 10 to 13 are face and sectional views illustrating how the tucking operation is accomplished by means of the finger shown in Fig. 6. Figs. 14 and 15 are respectively a plan and a sectional view of the needle-carriers. Fig. 16 is a plan view illustrating mechanism for actuating the sinker-cam, so as to produce tight and loose stitches. Fig. 17 is a view of the under side of the sinker-cam. Fig. 18 is a side view showing certain of the parts illustrated in Fig. 16 detached. Fig. 19 is an elevational view of a part of the mechanism that shifts the sinker-cam. Fig. 20 is a sectional view of the upper part of the part shown in Fig. 19. Figs. 21 and 22 are respectively plan and end elevational views illustrating shipper and pawl-release mechanism, and Fig. 23 is a view illustrating the type of needles used in the machine.

The needle-cylinder B is fixed and grooved upon its exterior and in the direction of its length for the needles, which may be conveniently divided into groups. The needles 1, Fig. 23, may extend half-way around the cylinder—for example, around the upper half, as shown in Fig. 14. The fashioning-needles 2 are located on the other half of the cylinder, and between the fashioning-needles 2 is a group 3 of needles like the needles 1. The bits of the needles 1 are connected with the carrier C by means of removable plates 4. The carriers are reciprocated upward and downward and serve to actuate the needles, as is fully described in my patents. The plates 4 are notched in the form of a semi-circle, as at 5, and provided with generally pear-shaped slots, as 6. A screw is accommodated by the notches 5, and other screws are accommodated by the pear-shaped slots 6. The described arrangement of screws and

slots affords means by which the plates 4 can be applied and detached without the removal of the screws for the purpose of putting in and taking out needles. Near the ends of the carrier C' is located a deep groove 7 and above it a shallow groove 8, Figs. 1, 8, and 9, for the reception of the spring-bits of the fashioning-needles 2, that are divided into two sets, one on each side of the machine.

On top of the plate 9 is mounted a grooved plate 10, Figs. 14 and 15, that serves to clamp the needles 3, which might be called the "heel-needles," to place on the carrier C'. The adjacent ends of the plates 4 and 9 may be shaped as shown in Fig. 14. When the bit of a fashioning-needle is in the groove 7, as shown in Fig. 8, such needle makes full strokes and performs regular knitting. However when the bit of a fashioning-needle is in the groove 8, as shown in Fig. 9, it is carried downward, but not to its full stroke, so that it does not throw off its stitch or stitches, although when the carrier rises it gets into the groove 7 and is thus carried up to the full limit of its upward stroke, so as to receive an additional stitch or stitches. When several stitches are collected on one needle and then all thrown off at the same time in the widening and narrowing operations or fashioning, there is produced what is designated "tucking," which serves to close up openings that are frequently formed by automatic fashioning-machines.

In my present as in my patented invention use is made of strippers D and D' for detaching and attaching the fashioning-needles from and to their carrier. These strippers are shown in plan in Fig. 4 and in detail, upon an enlarged scale, in Figs. 5 to 13 and are provided with a curved edge or fashioning-plate 11, which when opposite the fashioning-needles compresses their spring-bits, and thus clears them from the grooves 7 and 8, so that they remain out of action until the removal of the stripper. These strippers are also provided with a finger or tucker 12, which when opposite the fashioning-needles compresses their bits to a less extent than the edge 11 and sufficiently to lift the bits out of the groove 7 as the needle-carrier descends and into the groove 8. The finger 12 is brought into position for engaging the bits of the fashioning-needles only when the latter are being brought back into action after having been out of action for fashioning. Such position of the finger is shown in Fig. 12.

In Fig. 10 the finger is shown back of the edge 11. Each of the strippers D and D' comprises two similar segment-like pieces or plates 13 and 14, placed the one above the other and adapted to slide in circular ways in the bed of the machine under the influence, for example, of rack-and-pinion mechanism such as is described in my said patents. As shown, the bed is slotted for the accommodation of a bolt that is attached to the part or plate 14.

15 are springs that operate to prevent an overthrow or excessive movement of the parts of the strippers. The finger 12 extends from the plate 13 up through an opening 16 in the part 14, so that the parts 13 and 14 are allowed a range of motion in respect to each other which corresponds with the space or clearance afforded the finger in the opening 16.

17, Figs. 4 and 5, is a set-screw that may be caused to project from one of the side walls of the opening 16, and thus limit the range of motion of the parts 13 and 14 in respect to each other. Incidentally it may be stated that the finger 12 and edge 11 are made of hard metal and secured by means of screws or otherwise to the parts that carry them. When the stripper D', Fig. 4, is being advanced in a counter-clockwise direction, as in Fig. 4, the side wall 16^a, Fig. 5, engages the shank of the finger 12, and thus pushes the part 13 along and also causes the finger to lie behind the edge 11, Figs. 10 and 11, so that the edge 11 operates to throw out the fashioning-needles. The described motion of the stripper D' is continued until the forward part of the edge 11 has advanced slightly beyond the fashioning-needles—that is, generally speaking, opposite a few of the needles 10, with which, however, it does not engage. To effect the widening operation, the part 13 of the stripper D' is moved in a clockwise direction, with the result that the part 14 at first moves independently of the part 13 until the side wall 16^b or the set-screw 17, projecting from it, collides with the shank of the finger 12, as shown in Fig. 12, and thus causes the parts 14 and 13 to move together. The result of this change in relative position between the parts 13 and 14 is to cause the finger to lie beyond the edge 11, as shown in Figs. 12 and 13. Since the finger is now out from behind the edge 11, it operates upon the bits of the fashioning-needles in the manner described, so that in their descent they are lifted out of the groove 7 into the groove 8, and thus prevented for a time from throwing off stitches, whereby when they do throw off stitches by reason of the strippers having moved out of range of them there is produced in the work what is called "tucking." The movements of the stripper D are like the movements of the stripper D', and the construction and operation of the strippers are also alike.

18 is a ring dished, as at 19, to accommodate the web-holders 20. The tops of the webs on the needle-cylinder that lie between the needle-grooves are engaged by the ring 18, which may be shrunk onto them. As shown, the parts of the webs that are engaged by the ring 18 project somewhat farther out from the cylinder than do the rest of the webs, and all the webs are notched, as at 21, for the reception of a spring that encompasses the needles and holds them to place. The top of the needle-cylinder is circular and of less exterior diameter than the rest of it. The web-holder guide-ring 22, which upon its under

side is radially grooved or slotted, as at 52, for the reception of the toes of the web-holders, is applied, for example, by means of screws to the top of the needle-cylinder. The sinker-bed b^8 is applied to the ring 18 and is provided with sinkers b^{13} , that work in radial grooves in it. Each sinker has a couple of lugs 23 and is rounded on top, as at 24, whereby a transfer-frame may be conveniently used.

25 is the presser-ring, of which the teeth extend inward and upward. It rests in a seat in the sinker-head, and the tops of the web-holders 20 work between its teeth, while the sinkers b^{13} work between the portions of its teeth which extend upward. There are springs 26 around the web-holders which tend to force them inward. Each of the web-holders is provided with a rounded toe loosely fitted and seated in one of the slots 52 of the web-holder guide-ring 22 and with a heel adapted to the dished portion 19 of the ring 18, which serves to limit the upward throw of the web-holders. Each of the web-holders is also provided with a finger adapted to collide with the top portion 27 of the needle-cylinder, which operates as a stop for limiting the range of inward movement of the web-holders, it being understood that the web-holders turn on the rounded toes as pivots.

From the foregoing description it is obvious that the sinker-head can be detached from the guide-ring 18 by the simple operation of loosening the screws (shown in Fig. 1) without removing the web-holders, since the latter are held to place by the springs 26, guide-ring 18, and notched web-holder guide-ring 22. Moreover, the sinkers and web-holders are guided in the described slots, so that when a needle is taken out, for example, for repairs and then replaced the web-holder cannot get into the wrong position in respect to the needle. Incidentally it may be remarked that the beards of the needles are closed by the points of inwardly and radially projecting teeth of the presser-ring 25 in both ascending and descending. The sinker-head is provided with circular grooves in which the projections 23 of the sinkers travel and with a cam 28, located near the thread-carrier 29, Fig. 16, and adapted to produce reciprocation of the sinkers. On the sinker-head is attached a guide-block 30, which is, generally speaking, U-shaped, and between the arms of which is pivoted the thread-carrier 29. The delivery end of the thread-carrier is elliptical, whereby the yarn is laid near to the sinkers, so that that there is less breakage and less mending to be done at the heels and toes when stockings are being fabricated. The cam 28 is adjusted radially in respect to the center of the sinker-head, whereby the throw of the sinkers is increased or diminished, so that the stitch is tightened or loosened. In making hosiery the stitch is tight at the calf and foot portions and loose at the leg portion, whereby the stocking is to a certain extent shaped or fashioned.

31 is a sinker-cam carrier. It is of U shape, and its arms are guided by the guide-block 30, which may be provided at its sides with flanges overlying these arms. There are interposed between the block 30 and carrier 31 suitable springs 32, that balance the centrifugal effect due to the rotation of the machine. There are also other springs 33, that operate by friction and prevent sudden and undesired movements of the cam-carrier. The cam 28 is located above the sinkers and between the projections thereof and is engaged by pins which depend from the carrier 31 and work in slots in the top part of the sinker-head, which slots are indicated by dotted lines in Fig. 17.

34 is a stop that projects through the top plate of the sinker-head and is adjustably connected with one of the arms of the cam-carrier 31, for example, by means of set-screws and their complementary slots, as shown in Fig. 18. This stop 34 engages the inside one of the projections 23 on each of the sinkers, and thus prevents an overthrow of the sinkers by the cam 28, it being understood that this stop is to be adjusted to compensate for wear of the outside projections on the sinkers due to the action of the cam 28 thereon.

I shall now proceed to describe means for automatically adjusting the cam 28 to tighten or loosen the stitch, as required. The pattern-chain r with which machines of the class described in my said patents are commonly provided is equipped with cams 35, which are intended to operate the sinker-cam 28 at the required time. At some suitable point on top of the machine is located a socket 36, that carries a bell-crank lever 37. The arms 38 and 39 of this bell-crank lever may be shifted in respect to each other and clamped to place by means of a set-screw 40. The lower arm 39 is connected to one end of a link 41, of which the other end is connected to a cam-lever 42. The link 41 is preferably provided at its ends with right and left hand screws and suitable jam-nuts by means of which its length may be adjusted. 43 is a spring that operates upon the arm 39 and tends to hold the cam-lever to place in contact with its cam 35. 44 is a screw equipped with a jam-nut and provided with a conical point that operates as an adjustable back-stop for the arm 39. The arm 38 is provided with two rollers or projections between which a lip 45 on the cam-carrier 31 runs. The journal of one of these rollers 46 is fitted to a slot in the arm 38 and is provided with a nut and washer for clamping it to place. To insure accuracy in adjustment, there is provided a screw 47 equipped with a jam-nut and adapted to have its point limit the position of the journal of the roller.

The described adjustments not only afford means for properly positioning the rollers in respect to the lip that passes between them, but also for compensating or taking up wear upon the parts. When the cam 35 collides

with the lever 42, the latter is shifted toward the left in Fig. 16, and the bell-crank lever is turned by the link 41 slightly in a clockwise direction. The lip 45 is drawn by the rollers outward and carries with it the cam 28, so that the stitch is tightened. A reverse motion of the cam-lever causes a reverse motion of the cam 28.

Machines of the class described in my said patents are provided with a drum, as H, and with reciprocating pawls, as k and k' , the pawl k being sometimes thrown out of action. The pawl k is normally held up to its work by a spring 47, which upon such occasions is in compression. The outer end of the spring 47 is acted upon by one arm of a bell-crank lever 48, of which the other arm 49 is controlled by a cam connected with the drum H, as will be hereinafter set forth: The drum H is provided at its outer end with a crown-cam 50. The belt-shipper mechanism (not shown) is controlled by a shipper-lever 51, provided with a roller that runs on the edge of the crown-cam 50, so that when the roller on the shipper-lever drops into a groove or low part like that shown in Fig. 21 on the cam 50 the shipper mechanism is caused to operate by a spring or weight, as will be understood from my said patents. The arm 49 of the bell-crank lever is held in contact with the shipper-lever 51, so that when the latter falls into a low part of the cam 50 the arm 48 swings outward, releasing the spring 47, thus permitting the pawl k to clear its ratchet-wheel and become inoperative.

The described cam 50 and shipper-lever 51 are simple in construction and positive in action and operate with a degree of slowness that is desirable for shipper mechanism for machines of the class described. By throwing the tension off the spring 47 by means of the bell-crank lever 48 49, as described, unnecessary wear and noise are obviated and the machine improved.

It will be obvious to those skilled in the art to which my invention appertains that modifications may be made in details without departing from the spirit thereof. Hence I do not limit myself to the precise construction and arrangement of parts hereinabove set forth and illustrated in the accompanying drawings; but,

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

1. In a knitting-machine of the type recited, the combination with the spring-bits of the fashioning-needles, of, a needle-carrier having deep and shallow grooves for the reception of said bits, whereby the needles may accomplish full and partial strokes, substantially as described.

2. In a knitting-machine of the type recited, the combination with the spring-bits of the fashioning-needles, of, a needle-carrier having grooves the one above the other for the reception of said bits, and means for reciprocating the carrier vertically, substantially as described.

3. In a knitting-machine of the type recited, the combination of the spring-bits of the fashioning-needles, a needle-carrier having two grooves for the reception of said bits, and a needle-stripper having a finger for transferring the needle-bits from groove to groove, substantially as described.

4. In a knitting-machine of the type recited, the combination of the spring-bits of the fashioning-needles, the carrier provided with grooves for the reception of said bits, the finger for transferring the bits from groove to groove, the edge for lifting the bits out of both grooves, and means for shifting the finger and edge in respect to each other, substantially as described.

5. The combination in a knitting-machine of the type recited, of, the spring-bits of the fashioning-needles, the needle-carrier provided with grooves, the superposed segmental plates movable in respect to each other and to the bed of the machine and whereof one is provided with an edge and with a slot and whereof the other is provided with a finger projecting through said slot, and means for shifting the first-mentioned plate whereby the finger is caused to lie behind and beyond the edge to bring it out of and into range of the bits, substantially as described.

6. The combination in a knitting-machine of the type recited, of, the spring-bits of the fashioning-needles, the needle-carrier provided with grooves, the superposed segmental plates movable in respect to each other and to the bed of the machine and whereof one is provided with an edge and with a slot and whereof the other is provided with a finger projecting through said slot, means for shifting the first-mentioned plate whereby the finger is caused to lie behind and beyond the edge to bring it out of and into range of the bits, and a screw carried by the slotted plate and projecting into range of the finger to afford means for adjusting the relative movement of said plates, substantially as described.

7. The combination in a knitting-machine of the type recited, of, the spring-bits of the fashioning-needles, the grooves of the carrier, the ways on the bed-plate, the segmental plates movable in said ways and in respect to each other and respectively provided with a finger and an edge, and springs interposed between said ways and plates to prevent excessive movement of the latter, substantially as described.

8. The combination in a knitting-machine of the type recited, of, an axially-grooved needle-cylinder, a dished ring mounted on the webs of said cylinder, a sinker-bed applied to said dished ring, web-holders seated on said dished ring, and a spring encircling the web-holders whereby the sinker-bed may be removed without detaching the web-holders from the cylinder, substantially as described.

9. The combination in a knitting-machine

of the type recited, of, an axially-grooved needle-cylinder of reduced diameter at its upper end, a dished ring 18, mounted on said cylinder, a web-holder guide-ring 22, mounted on the upper end of said cylinder, a presser-ring of which the teeth extend inward, web-holders working between the teeth of the presser-ring seated on the dished ring and guided by the ring 22, and springs encircling the web-holders, substantially as described.

10. The combination in a knitting-machine of the type recited, of, a presser-ring of which the teeth extend inward and upward, spring-needles whose beards cooperate with the inner ends of said teeth, web-holders working between said teeth, means for supporting the web-holders, sinkers working between the upwardly-extending parts of said teeth, and means for supporting said sinkers, substantially as described.

11. The combination in a knitting-machine of the type recited, of, an axially-grooved needle-cylinder provided with rings 18 and 22, a sinker-bed detachably applied to the ring 18, a presser-ring seated in the sinker-bed and provided with inwardly and upwardly extending teeth, web-holders guided by the rings 18 and 22, and working between the teeth of the presser-ring, springs encircling the web-holders, sinkers working between the upwardly-extending parts of the teeth of the presser-ring, and needles whose beards cooperate with the ends of the teeth on the presser-ring, substantially as described.

12. In a knitting-machine of the type recited, a presser-ring provided with inwardly and upwardly extending teeth, substantially as described.

13. In a knitting-machine of the type recited, a revoluble sinker-cam ring, sinkers, a sinker-cam radially adjustable in respect to the sinker-cam ring, and means for automatically shifting said cam while the sinker-cam ring is moving to increase and diminish the throw of the sinkers and thereby tighten and loosen the stitches and fashion tubular work, substantially as described.

14. In a knitting-machine of the type recited, a sinker-bed and its sinkers, a movable sinker-cam, a cam-carrier radially adjustable in respect to the sinker-bed and provided with a lip, a stop in range of the sinkers and carried by the cam-carrier, and mechanism substantially as described for operating on the lip and shifting the carrier.

15. In a knitting-machine of the type recited, a revoluble sinker-bed and its sinkers, a movable sinker-cam, a cam-carrier radially adjustable in respect to the sinker-bed, a spring for balancing centrifugal force exerted on the carrier and cam, and means substantially as described for shifting the carrier.

16. In a knitting-machine of the type recited, a sinker-bed and its sinkers, a guide-block provided with a thread-carrier and attached to the bed, a U-shaped cam-carrier having its arms straddling said block, a cam

carried by the carrier, and means substantially as described for shifting the carrier.

17. In a knitting-machine of the type recited, a sinker-bed and its sinkers, a guide-block attached to the bed, a U-shaped cam-carrier having its arms astride of said block, springs interposed between said block and arms, a cam carried by the carrier, and means substantially as described for shifting the carrier.

18. In a knitting-machine of the type recited, a revoluble sinker-bed and its sinkers, a sinker-cam movable radially in respect to the bed and connected with a lip, an arm provided with rollers or projections that cooperate with the lip, and means responding to changes in the pattern-chain and adapted to shift said arm, substantially as described.

19. The combination in a knitting-machine of the type recited, of, a revoluble sinker-bed and its sinkers, a sinker-cam movable radially in respect to the bed and connected with a lip, a socket supported on top of the machine, a bell-crank lever rotatably mounted in said socket and having one of its arms equipped with projections or rollers adapted to said lip and having the other of its arms attached to a link, and a pattern-chain and its accessories for shifting said link, substantially as described.

20. The combination in a knitting-machine of the type recited, of, a revoluble sinker-bed and its sinkers, a sinker-cam movable radially in respect to the bed and connected with a lip, a socket supported on top of the machine, a bell-crank lever rotatably mounted in said socket and having one of its arms equipped with projections or rollers adapted to said lip and having the other of its arms attached to a link, means for adjusting said arms in respect to each other, and a pattern-chain and its accessories for shifting said link, substantially as described.

21. The combination in a knitting-machine of the type recited, of, a revoluble sinker-bed and its sinkers, a sinker-cam movable radially in respect to the bed and connected with a lip, a socket supported on top of the machine, a bell-crank lever rotatably mounted in said socket and having one of its arms equipped with projections or rollers adapted to said lip and having the other of its arms attached to a link, a screw, as 44, for limiting the range of motion of said lever, and a pattern-chain and its accessories for shifting said link, substantially as described.

22. The combination in a knitting-machine of the type recited, of, a revoluble sinker-bed and its sinkers, a sinker-cam movable radially in respect to the bed and connected with a lip, a socket supported on top of the machine, a bell-crank lever rotatably mounted in said socket and having one of its arms equipped with projections or rollers adapted to said lip and having the other of its arms attached to a link, a spring operating upon one of said arms and tending to shift the link

in one direction, and a pattern-chain and its accessories for shifting the link in the other direction, substantially as described.

23. In a knitting-machine of the type recited, the combination of a drum, a reciprocating pawl, a cam on the drum, a spring for holding said pawl up to its work, and a pivoted bell-crank lever controlled by said cam and operating to press upon said spring to put said pawl into action and to release said spring to permit the pawl to work free, substantially as described.

24. The combination in a knitting-machine of the type recited, of, a reciprocating pawl, a spring for controlling said pawl, a drum, a crown-cam on the end of said drum, a bell-crank lever operating upon said spring, and a shipper-lever coöperating with the cam and

operating upon the bell-crank lever, substantially as described.

25. The combination in a knitting-machine of the type recited, of, an axially-grooved needle-cylinder having a cylindrical top of reduced diameter, a web-holder guide-ring applied to the top of the cylinder and having radial notches in its under face, web-holders fitted in the notches, and a spring encompassing the web-holders, substantially as described.

In testimony whereof I have hereunto signed my name in the presence of two witnesses.

EMIL J. FRANCK.

Witnesses:

W. F. JACKSON,
K. M. GILLIGAN.