

(No Model.)

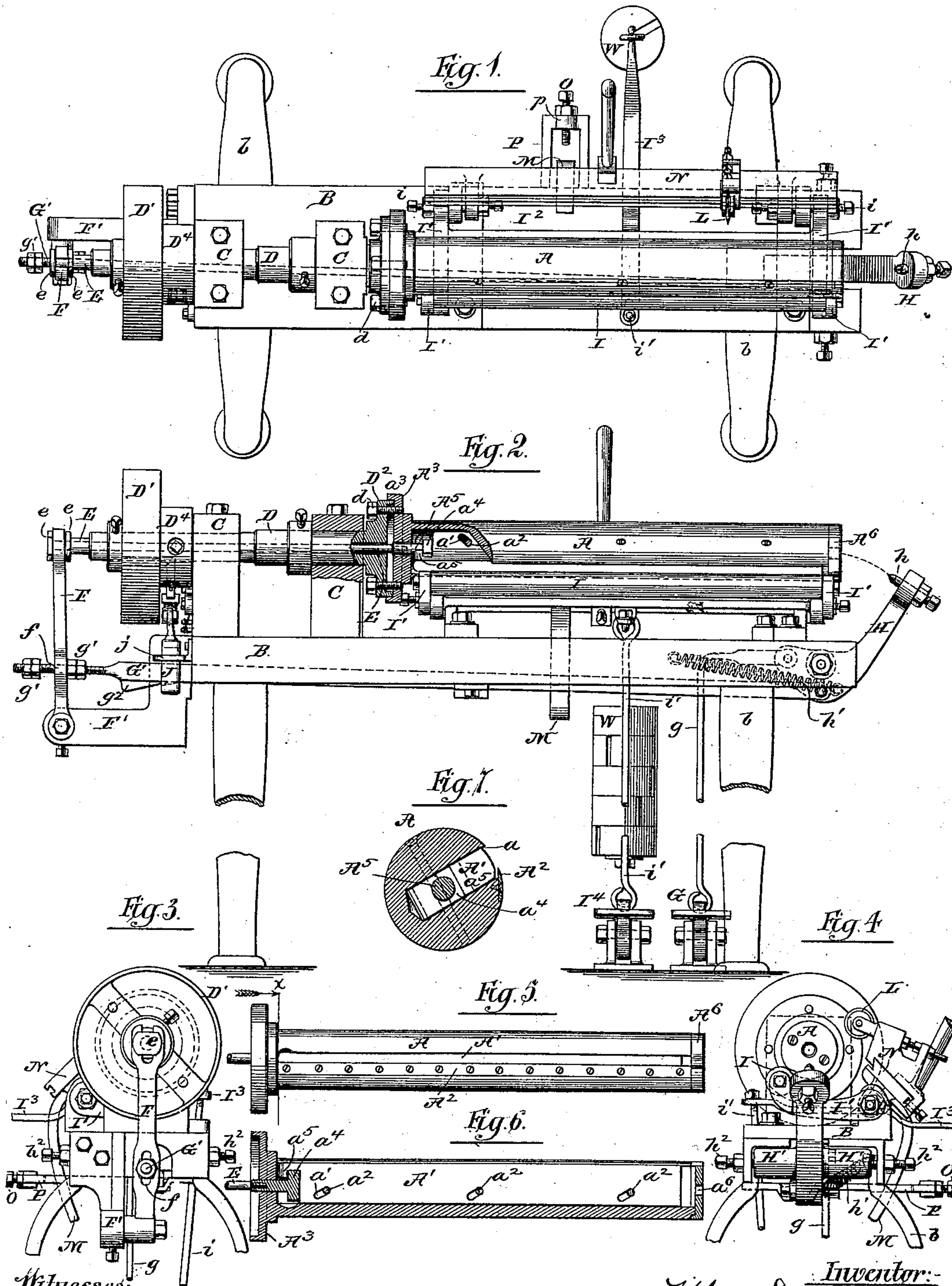
3 Sheets—Sheet 1.

M. D. KNOWLTON.

MACHINE FOR MAKING PAPER TUBES.

No. 337,165.

Patented Mar. 2, 1886.



Witnesses:
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Richard J. O. Rye.

Inventor:
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(No Model.)

3 Sheets—Sheet 2.

M. D. KNOWLTON.

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Fig. 8.

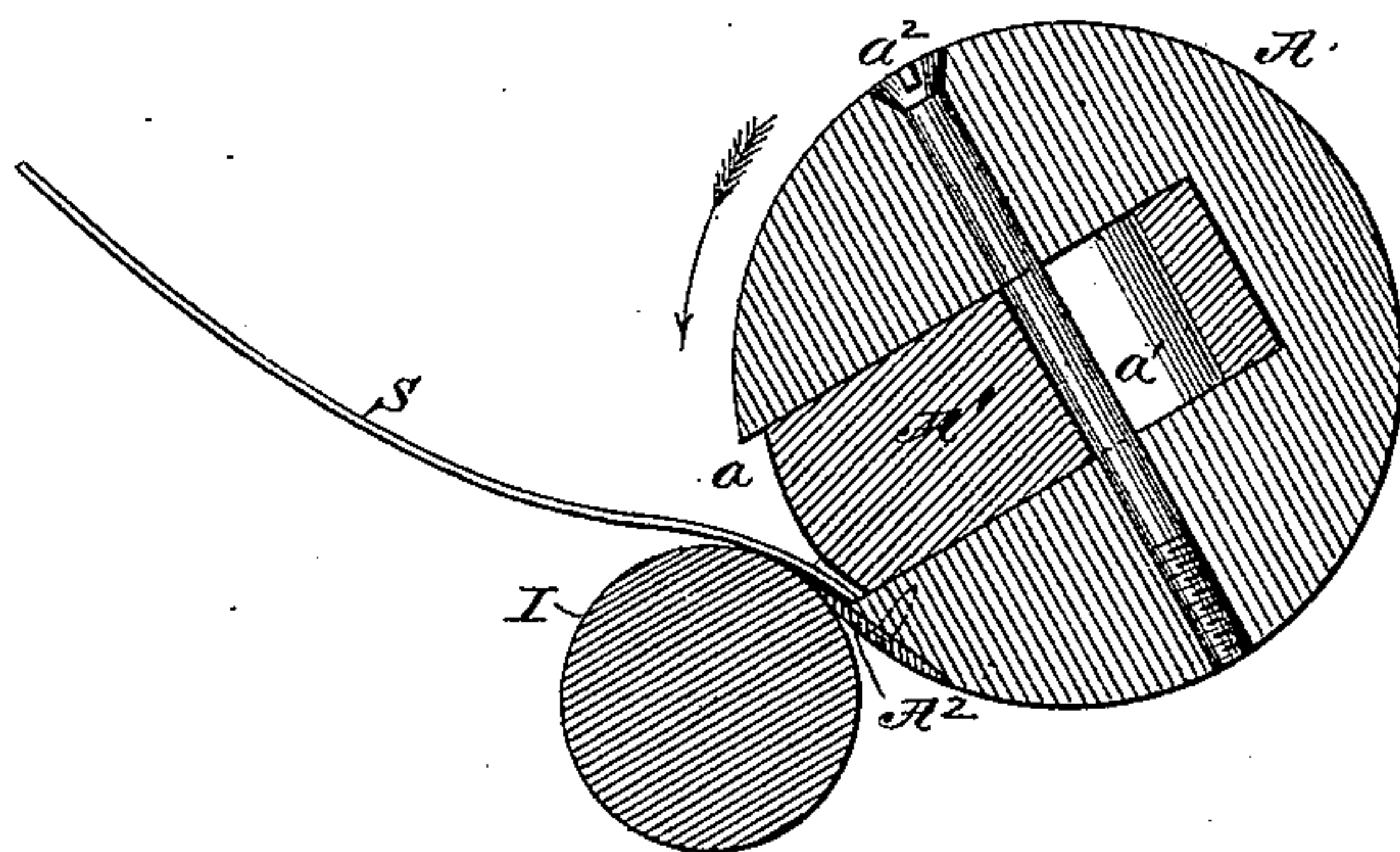


Fig. 9.

Fig. 10.

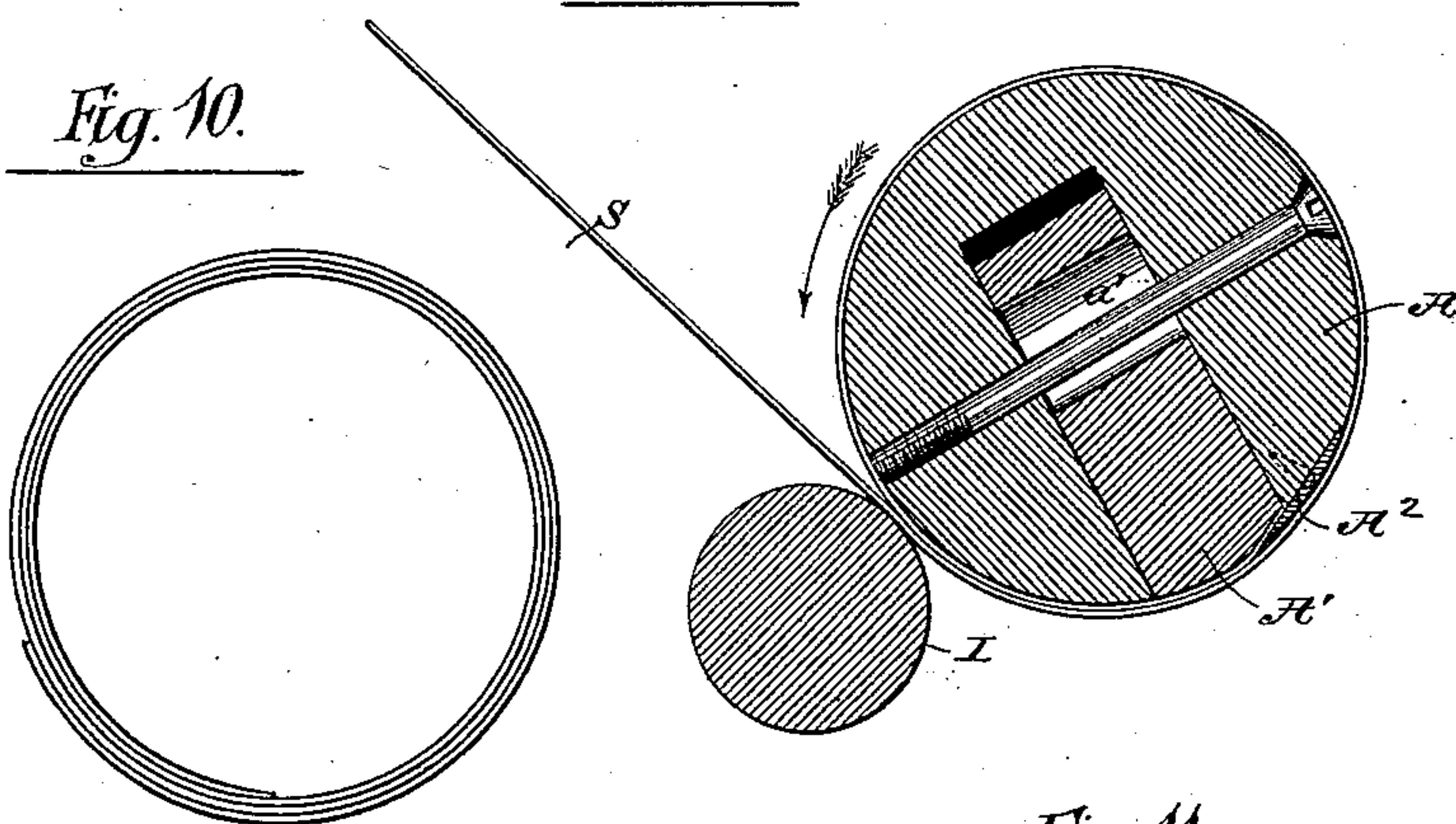
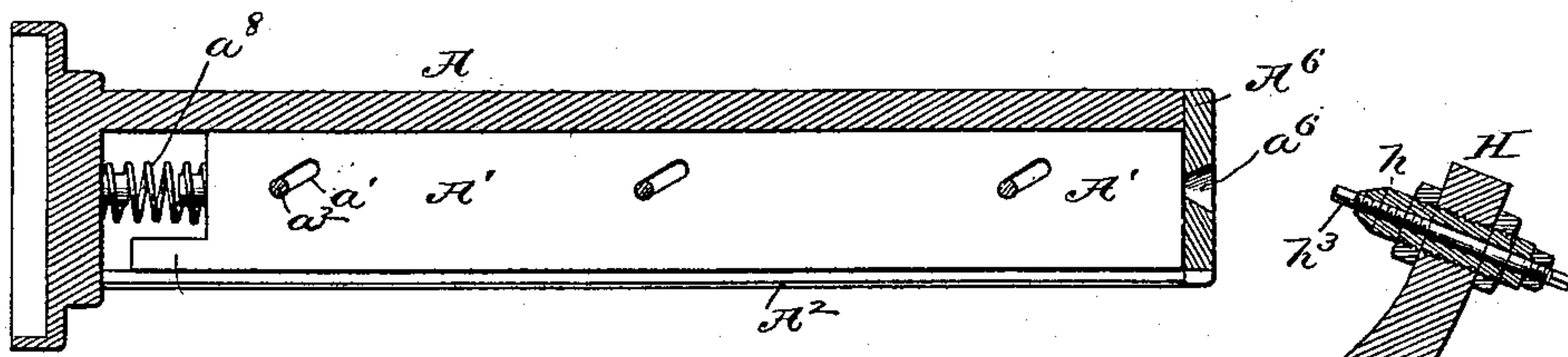


Fig. 11.



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(No Model.)

3 Sheets—Sheet 3.

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Fig. 12.

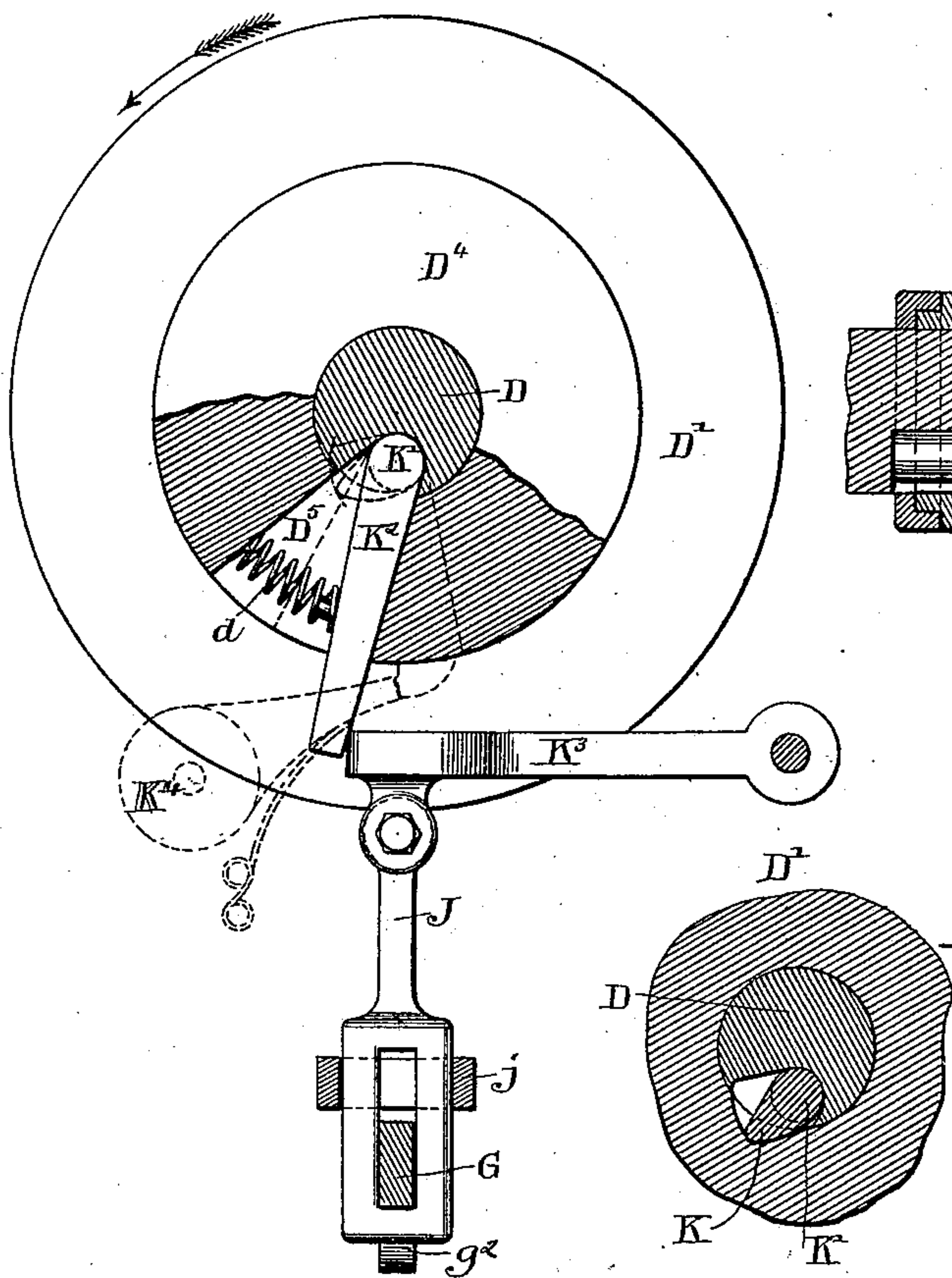


Fig. 13.

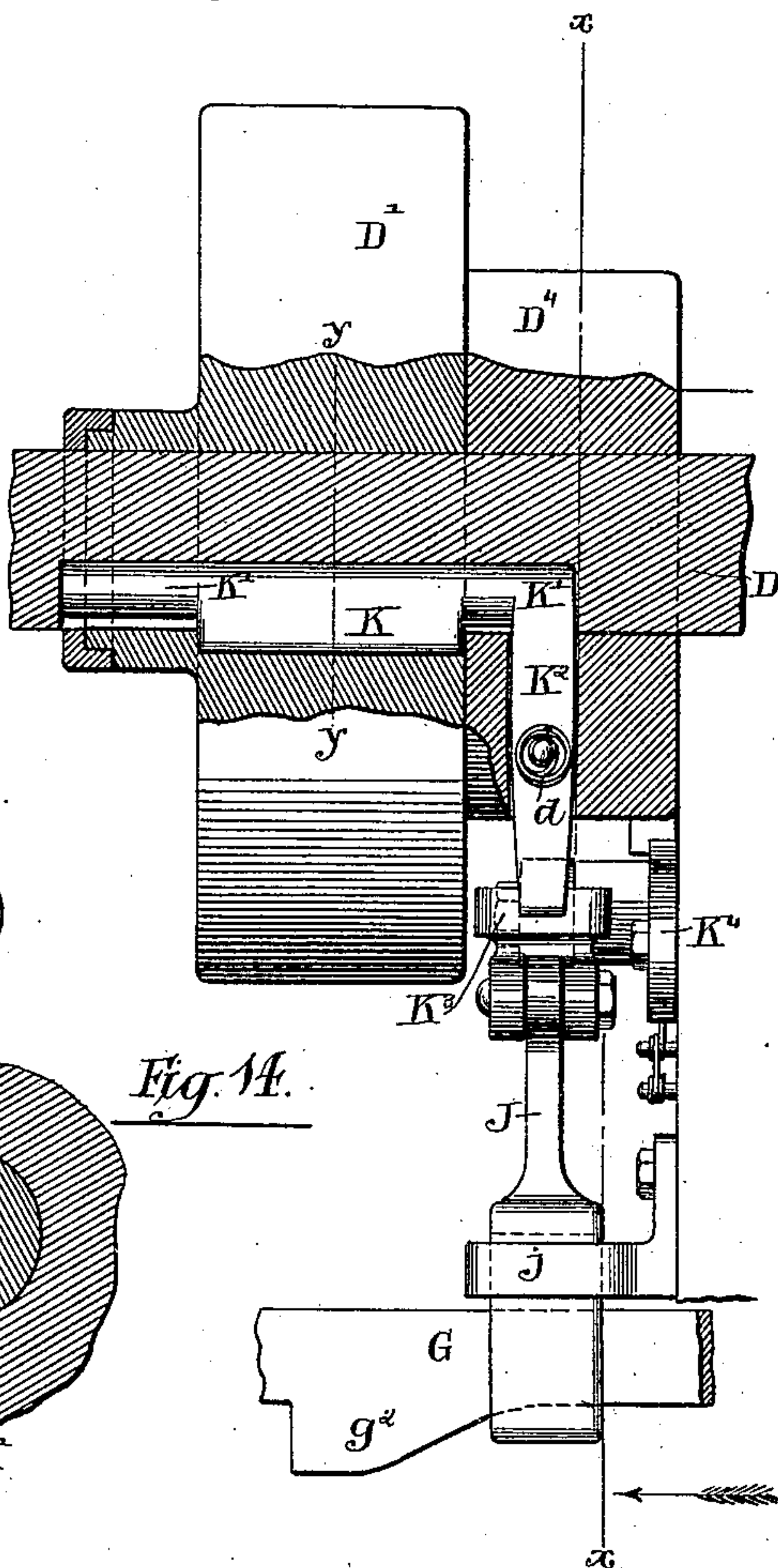
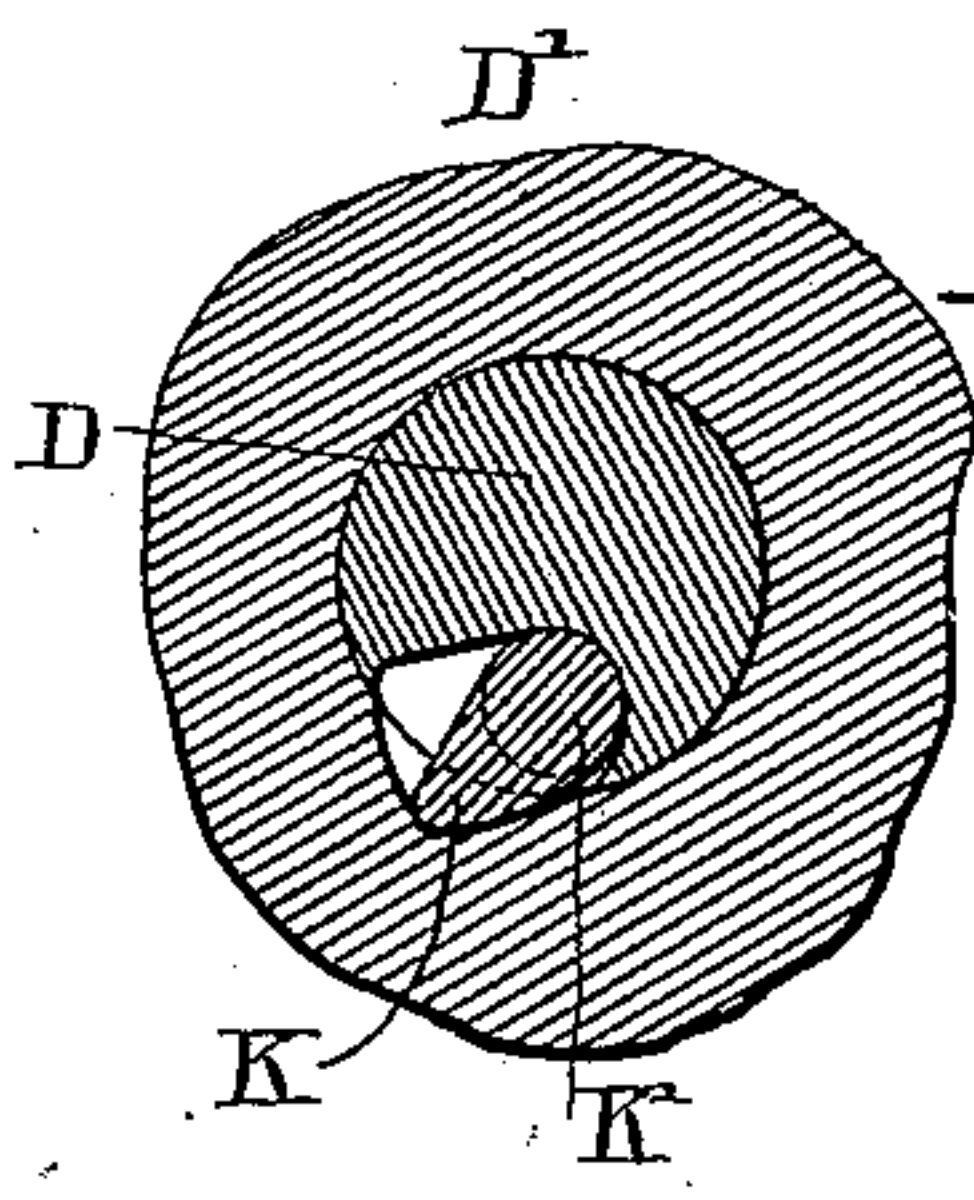


Fig. 14.



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UNITED STATES PATENT OFFICE.

MARK D. KNOWLTON, OF CHICAGO, ILLINOIS.

MACHINE FOR MAKING PAPER TUBES.

SPECIFICATION forming part of Letters Patent No. 337,165, dated March 2, 1886.

Application filed March 20, 1885. Serial No. 159,565. (No model.)

To all whom it may concern:

Be it known that I, MARK D. KNOWLTON, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Machines for Making Paper Tubes; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to mandrels for forming paper tubes, and also to machines for operating tube-forming mandrels which have gripping devices for grasping the edge of a sheet that is to be formed into a tube.

In the accompanying drawings a tube-forming mandrel containing my improvements in such devices is shown in a machine organized for its better operation.

Referring to said drawings in the following description, Figure 1 is a top or plan view of the machine for operating my improved mandrel and containing such mandrel, together with adjunctive devices. Fig. 2 is a side elevation of the entire machine with certain parts of the mandrel and its support broken away in order to reveal certain details of construction. Fig. 3 is an end view of the head of the machine or of the left-hand end of Figs. 1 and 2. Fig. 4 is a view of the opposite end of the machine in elevation, and with the mandrel-centering device thrown out of engagement with the free end of the mandrel. Fig. 5 is a side elevation of a mandrel containing my improvements detached. Fig. 6 is a longitudinal section of the mandrel through the slot which contains the gripping-slide thereof. Fig. 7 is a transverse section of the mandrel at one end, as in the line *xx* of Fig. 5, looking in the direction of the arrow. Fig. 8 is an enlarged transverse section of the mandrel and of a pressing-roller employed in conjunction therewith in the machine illustrated in the preceding figures. Said Fig. 8 shows the gripping slide retracted, and the lip, which is employed in connection with said grip to grasp the edge of the paper, in that position with reference to the pressing-roller in which the mandrel is stopped in the machine when brought to rest to admit the edge of the sheet of paper which is to be formed into a tube.

Fig. 9 is a section corresponding with Fig. 8, but showing the gripping-slide advanced and grasping the edge of the paper sheet between itself and the overhanging lip referred to, and also showing the mandrel as having made something more than one revolution in winding the paper thereon. Fig. 10 is a top view of a completed tube composed of several folds as it appears in end view after having been withdrawn from the mandrel. Fig. 11 shows a modification of the mandrel. Fig. 12 is an enlarged sectional view illustrating the construction of the clutch device for connecting the loose driving-pulley with the rotating shaft of the machine, taken upon line *xx*, Fig. 13. Fig. 13 is a side elevation of the parts shown in Fig. 12, the shaft and parts immediately adjacent thereto being shown in section. Fig. 14 is a detail section through the shaft and adjacent portion of the loose pulley, taken upon line *yy* of Fig. 13.

Inasmuch as the mandrel is capable of being used by itself or independently of the machine herein illustrated for its operation, or may be operated by other devices than those shown in said machine, said mandrel will be first and separately described. It consists of a cylinder, *A*, of any desired length and diameter, having a deep longitudinal slot or groove, *a*, therein, into which is fitted a radially-movable grip or gripping-slide, *A'*. Overhanging one edge of the slot *a* a metal strip, *A²*, is fastened to the body of the cylinder, forming, as viewed endwise or in section, as shown in Figs. 7, 8, and 9, a lip against which the grip or slide *A'* may be made to outwardly bear. In order to provide for the radial movement of the slide *A'* within the groove in the mandrel, said slide is made shallower than the depth of said groove, and is provided with inclined surfaces by which, through an endwise movement of the slide, the latter will be borne outwardly or inwardly, as the case may be. A desired construction of such inclined surfaces is plainly shown in side view in Figs. 2 and 6 and in section in Figs. 8 and 9, consisting of two or more oblique slots, *a'*, cut through the slide *A'*, through which slots pass the pins or screws *a²*, having their supports in the walls of the mandrel, as plainly shown in Figs. 2, 8, and 9. The lip *A²* is preferably made as thin as practicable, consistent with the neces-

sary strength, to meet forcible outward pressure on the part of the slide A', and the latter is desirably beveled beneath said strip, so that when the edge of the sheet S of paper is inserted beneath said lip and the slide is forced outward against the same said slide will have its remaining outer surface flush, or substantially so, with the cylindric surface of the mandrel. Of course the extent of such outward movement of the slide A' will depend somewhat upon the thickness of the paper-board, which is to be formed into tubes upon the mandrel, and if with the same slide somewhat thicker paper is used said slide will fail to extend outward perfectly flush with the curved surface of the mandrel. Generally a certain thickness of paper will be used for mandrels or tubes of a certain range of diameters, and the slides will be beveled to correspond; but, if desired, different slides having different bevels may be used with the same mandrel for different thicknesses of paper, or slightly different thicknesses of paper may be used with the same mandrel and slide without practical objection.

The slide A' may be operated by any sort of a projection from its end, either by hand or otherwise. Having grasped the edge of a sheet, S, between the slide and the lip A², as shown in Figs. 8 and 9, a rotation of the mandrel in the direction indicated by the arrows in said figures of the drawings will wrap the sheet about the mandrel as many times as it is desired to give thicknesses or folds to the tube. The upper surface of the paper sheet is glued in that portion which comes in contact with an inner fold of the tube with the result of holding the folds permanently together and forming a tube of the character illustrated in Fig. 10. After the tube has been formed the slide A' is retracted, and the tube is slipped off the free end of the mandrel either entire or cut into short lengths, as will be hereinafter further described.

Owing to the thinness of the lip A² the sheet is not broken or far bent out of the circle of the mandrel by being inserted beneath said lip, and, as a result, when the tube is withdrawn from the mandrel that portion of the sheet which was inserted between the lip and slide of the mandrel springs outwardly by its own resiliency, so as to lie closely in contact with the outer fold, as shown in Fig. 10. In this respect tubes formed upon the mandrel constructed as described differ as a product from the tubes made upon other mandrels, in which the edge of the sheet is caught by the mandrel preliminary to the operation of winding. The width of the slide A', particularly in mandrels of the large sizes, is preferably greater than would be necessary for the sole purpose of gripping the sheet, and is desirably about one-fourth to one-third the diameter of the mandrel, in order that when it is retracted the tube will be slackened enough to allow of its being easily slipped off the mandrel.

The machine herein shown for operating the mandrel described consists of the following devices:

B is a bed supported on legs b.

C C are two uprights secured near one end of the bed, and constructed to afford bearings for the shaft or spindle D, upon the outer end of which is located a loose driving-pulley, D', and upon the inner end of which is located a face-plate, D², to which the mandrel A is fastened axially in line with the spindle. For the purpose of affording attachment of the mandrel A to the face-plate D², said mandrel is provided with a head, A³, having a marginal flange, a³, which sets over the margin of the face-plate D², to insure concentricity of the mandrel with said face-plate and its actuating-spindle D. Bolts d pass through the face-plate D², and are tapped into the head A³, and firmly hold the mandrel substantially rigid and in line with the spindle. The spindle D is provided with a collar or clutch-plate, D⁴, adjustably fixed thereon adjacent to the continuously-rotating driving-pulley D', and suitable stop devices, one form of which is herein shown in Fig. 2, and will be hereinafter briefly explained, are used to communicate motion from the loose pulley D' to the clutch-plate D⁴ and spindle D. The spindle D is hollow, and through its axial opening passes a longitudinally-movable rod, E, which at its inner end is screwed into a short bolt, A⁵, fitted to slide lengthwise in an axial hole in the closed end of the mandrel, as shown in Figs. 2 and 6. This short bolt A⁵ is provided with a head, a⁴, which projects behind and engages a lip, a⁵, on the adjacent end of the slide A', as also indicated in Figs. 2 and 6. By this connection, obviously, a longitudinal movement of the rod E will give a corresponding movement to the slide A, while at the same time allowing said slide to move radially of the mandrel by the action of the guide-pins a².

F is a lever for the actuation or longitudinal movement of the rod E, said lever F being in the present case pivoted at its lower end to a bracket, F', which is fastened to the end of the bed B. The upper end of the lever F is slotted, as shown in Figs. 1 and 3, to straddle the rod E, and acts upon the said rod in both directions through the medium of collars e e on the rod, one or both of said collars being preferably adjustably fitted upon the threaded end of said rod E.

The lever F, as here shown, is vibrated by means of a foot-lever, G, at the right-hand end of the machine, or in position convenient for the operator, who stands about centrally opposite the mandrel A. Said foot-lever G, in the construction herein shown, is also made to simultaneously throw into engagement with the free end of the mandrel a centering-lever, H, by which said mandrel, when at work, may be firmly supported at its free end in order to prevent its vibration. For this purpose the outer or free end of the mandrel is provided with a cap, A⁶, having a central socket or hole,

a^6 , and the lever H is provided with an adjustable centering-pin, h , adapted to engage with the cavity of the cap A^6 . Said lever H is provided with a hub or bosses, H' , at its lower end, into the ends of which enter the adjustable pivot-pins h^2 , Fig. 4, on which the said lever swings to and away from the end of the mandrel, as plainly indicated in Fig. 2. For the purpose of connecting said lever H with the lever F and of actuating both simultaneously by a single movement of the same foot-lever G, the lower end of the lever H is constructed essentially as a bell-lever, as indicated in Fig. 2. With the upper arm of said crank is pivotally connected the foot-lever rod g , while the lower arm thereof is pivoted to the rod G' , which is connected with the lever F. In order to produce the short movement of the mandrel slide A' at about the same time that the centering-pin h engages with the mandrel-cap A^6 , the rod G' is passed loosely through a slot or hole at f in the lever F, and is screw-threaded to receive the double nuts g' , which may be adjusted to strike the lever F near the termination of the several movements of the rod G' , and to thereby cause the slide A' to grasp the paper at the last moment before the said mandrel is set in motion and at about the time of the engagement of the centering-pin h with the free end of the mandrel.

A spring applied to the foot-lever or to one of the moving parts connected therewith may be used to hold said foot-lever normally raised and the centering-lever H and the slide A' retracted. Such a spring is indicated at h' , Fig. 4, and in dotted lines of Fig. 2, wherein it is shown connected at one end with the lower part or arm of the lever H, and at the other end with a stationary point on the machine-bed at the left-hand of said lever.

The clutch device by which the loose driving-pulley D' engages the collar D^4 and sets the mandrel in motion is also operated by the same foot-lever G, and will be so adjusted as to set said mandrel in motion after the mandrel-slide has gripped the edge of the sheet to be formed into a tube and the centering-lever H has engaged with the mandrel-cap. The clutch and stop for this purpose may be of any desired construction, of which many forms are familiarly known in power-presses and other machines.

The stop-clutch shown in Fig. 2 is of a well-known form, and comprises a movable lug or stop, K, located in a recess in the shaft D, said lug or stop being attached to a rock-shaft, K' , located in the shaft parallel with the axis thereof, and provided with an arm, K^2 , projecting outwardly through a recess, D^5 , in the collar D^4 , whereby the rock-shaft may be actuated. Said recess is made of segmental form, so as to allow an oscillatory movement in the arm, and a spring, d , is applied between one wall of the recess and the arm to hold the latter in position to cause engagement of the stop or lug with the pulley.

K^3 is a horizontally-arranged plate pivoted

to the machine-frame at one end, and sustained at its free end by a vertically-movable arm, J, by means of which the plate may be lifted into the path of the arm, or depressed, so as to allow the arm to pass over it. In the operation of the parts of the clutch device mentioned the spindle will obviously continue to revolve while the plate K^3 is depressed; but the pulley will be released from the spindle, and the motion of the latter arrested, if the said plate is lifted into position to engage the arm.

In Figs. 12 and 13 of the drawings the parts are shown in full lines with the clutch device engaged, and the arm K^3 at the moment before the spindle is released from the pulley. The dotted lines in said figure show the position of the collar and shaft after their motion has been arrested by the action of the said plate and arm. When the spindle has been stopped in the manner set forth, the spring d will obviously be compressed, and the arm K^2 being engaged with the plate K^3 , said spring will obviously tend to rotate the collar D^4 and the spindle backward; and in order to cause the shaft under all circumstances to positively stop and remain immovably in the same place, a spring-pawl, K^4 , is preferably arranged upon the frame in position to engage a stop or projection upon the collar D^4 , at the termination of the forward movement of the shaft, so as to hold the collar and shaft from backward rotation. This pawl and stop is shown in full lines in Fig. 13, and in dotted lines in Fig. 12. The arm J may have a vertical movement through the guide j , and is constructed with a slot giving passage to the rod G' . Upon this rod is a projection, g^2 , which actuates the arm J at the proper moment to throw the clutch into engagement.

I is a presser-roller intended to closely press the paper-board against the mandrel during the operation of forming the tube, and it is therefore adjustable to and from said mandrel. For this purpose it is rotatably mounted in the arms I' , which are pivoted to lugs at i on the bed, and are rigidly joined to each other by the bar I^2 . A lever, I^3 , fastened to the bar I^2 , and extending backward beyond the pivotal axis of the presser-frame, carries a weight, W, which obviously operates to normally force the roller I upwardly against the mandrel, or against the paper being wound thereon. The roller is depressed by a foot-lever, I^4 , connected by a rod, i' , with the front end of the lever I^3 . This foot-lever is operated only when the tube has been completed and is to be withdrawn from the mandrel.

With reference to the position of the presser-roller I, which is preferably in front of and below the axis of the mandrel, as shown in Figs. 4, 8, and 9, the clutch and stop devices for actuating the mandrel are desirably adjusted to bring the mandrel to rest with the free edge of the lip A^2 in contact with the presser-roller, as shown in Fig. 8. The mandrel and roller in these positions together serve

as a ready and certain guide for directing the edge of the paper-board into the space between the said lip and the mandrel-slide.

For cutting the tube into short lengths, or for trimming its end on the mandrel after it has been otherwise completed, the familiar device of one or more rotary cutters, L, adjustably mounted on a rocking frame, L', is employed. This frame is preferably made adjustable, so as to work in sufficiently-close relation to the surfaces of mandrels of different sizes to sever the tubes, but without marring the mandrels. The devices for this adjustment consist of a depending arm, M, fastened to the under side of the bar N of the cutter-supporting frame, and an adjustable stop, O, fixed to the bed B, against which stop the bar M will strike when the cutters are thrown forward, so as to thereby limit the forward throw of said cutters. The stop consists, as here shown, of a screw-bolt, O, threaded through the cross piece *p* of the plate P, which is secured to the machine-bed, said plate being provided with an aperture, *p'*, through which the arm M depends.

The operation of the machine will be manifest from the foregoing description, but may be briefly stated. A mandrel of proper diameter having been secured in the face-plate D², and its slide-operating pin A⁵ having been connected properly with the rod E, and said rod retracted to draw the mandrel-slide inward, the edge of a paper or straw board sheet which is to form the tube is inserted beneath the gripping-surfaces, as shown in Fig. 8. The foot-lever G is then depressed, by which movement the center support, H, is swung up into engagement with the free end of the mandrel, the mandrel-slide A' is forced out to catch the edge of the sheet S, and the clutch engages the drive-pulley D' with the collar D⁴ and sets the mandrel in motion. The presser-roller I is in operation, and wraps the sheet closely upon the mandrel during the rotation of the latter. The glue applied to the sheet S causes the folds thereof thus formed to adhere, and when the entire sheet has been wrapped on the mandrel the tube is completed. The foot is then lifted from the lever G, whereupon the spring *h*² or its equivalent throws off the arm H, draws out the rod E, retracts the mandrel-slide A', releasing the edge of the sheet, and releases the driving-clutch, so that the mandrel may stop in the proper position, as shown in Fig. 8, and previously referred to. The foot-lever I⁴ is then depressed to retract the presser-roller I, after which the tube may be slipped off the free end of the mandrel, either entire or after having been cut by the cutters L. The withdrawal of the tube is made easy by the slight flattening thereof that may take place opposite the retracted slide A', which, as already stated, is in the larger mandrels made wide enough to give this effect. In the smaller sizes of mandrel said slide need be little or no wider than

the lip A² than is sufficient to give admission to the sheet S beneath the said lip.

Fig. 11 of the drawings shows a modification in the former described devices for operating the mandrel-slide A' in the machine. In said Fig. 11 the rod E is dispensed with and the slide A' is thrown out by the lever H, (which also upholds the free end of the mandrel,) and is retracted by a spring. To this end the pin upon lever H, which affords a center for the mandrel operates to push the slide A' lengthwise. In this construction the slide or grip A' is shown, as before, as having a longitudinal movement and inclined slots by which to get the desired radial motion of said slide, and the said longitudinal movement is produced directly by the centering-pin on the lever H. A desirable form of this centering-pin for this purpose is shown in Fig. 11, consisting of a hollow tapered pin, *h*, adjustably secured in the said lever H, and an inner thrust-pin, *h*³, which is also adjustable. Such adjustability is obtained by threading the thrust-pin through the center pin, *h*, and applying thereto a set-nut. The hole or cavity *a*⁶ in the cap-plate of the mandrel is in this case countersunk or tapered, to properly seat the end of the pin, and extends through the cap to admit the thrust-pin *h*³. When the lever H is lifted, the pin *h* strikes the end of the slide A' and forces it lengthwise and outwardly into gripping action, and on the lowering of said lever the slide A' recedes by the operation of a spring, *a*⁸, interposed between the opposite end of the slide and the adjacent head of the mandrel, or otherwise arranged for the purpose.

It is to be understood that the desired radial or lateral movement of the gripping-slide is not necessarily accompanied by a longitudinal motion of said slide, but that any of the well known devices for producing lateral motion of a similar part may be employed as the equivalent of the contrivances here shown. When the tube is withdrawn from the mandrel, the edge of the sheet which was grasped springs out into contact with the exterior adjacent fold, and presents no shoulder, except at its very edge.

I claim as my invention—

1. A tube-forming mandrel consisting, essentially, of a cylinder provided with a longitudinal slot, a lip or ledge overhanging one side of said slot, and a radially-movable slide located in said slot beneath the lip, substantially as set forth.

2. A tube-forming mandrel consisting, essentially, of a cylinder provided with a longitudinal slot, *a*, a lip, A², overhanging one margin of said slot, and a radially-movable slide, A', fitted to said slot and beveled beneath the lip, said slot and slide being materially wider than the lip, substantially as and for the purposes set forth.

3. A tube-forming mandrel comprising a cylinder provided with a longitudinal slot, a

lip overhanging one margin of said slot, and an outwardly and inwardly movable slide located in the slot and acting in opposition to the lip, in combination with suitable means for supporting and rotating the mandrel and means for actuating the slide, substantially as and for the purposes set forth.

4. In combination with a tube-forming mandrel provided with a slot, a lip, and a radially-movable slide located in the slot, a suitably-supported spindle, D, constructed to connect with the mandrel and provided with a collar, D⁴, and adjacent loose pulley, D', a rod, E, passing through the spindle into engagement with the mandrel-slide, and an external lever engaged with the rod E, substantially as described.

5. In combination with a mandrel having a slot, lip, and movable slide, as set forth, a suitable support for the mandrel, means for intermittently rotating the mandrel, and means for actuating the slide operated by a foot-lever, substantially as described.

6. In combination with the mandrel having a slot, slide, and lip, as set forth, a hollow spindle, D, supporting the mandrel, a rod, E, passing through the spindle and engaged with the slide, and a foot-lever and connections for operating the rod E and mandrel-slide, substantially as described.

7. In combination with the tube-forming

mandrel A, rotatably mounted and provided with a slot, a lip, and a slide, as set forth, of a movable presser, I, guiding the edge of the sheet which is to be formed into the space beneath the lip of the mandrel, when said mandrel is brought to rest with its lip adjacent to the presser, substantially as described.

8. In combination with a tube-forming mandrel, A, provided with a slot, lip, and slide, as set forth, a spindle, D, supporting the mandrel and provided with a loose pulley, D', and adjustable collar D⁴, a suitable stop-clutch mechanism for intermittently engaging the pulley with the collar, and a presser, substantially as described.

9. In combination with the spindle-rod E, for actuating the mandrel-slide, and with a movable support, H, for the free end of the mandrel, a single foot-lever, G, and connections leading from said foot-lever to both the rod E and the support H, actuating both by the same movement of the foot-lever, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

MARK D. KNOWLTON.

Witnesses:

M. E. DAYTON,
OLIVER E. PAGIN.