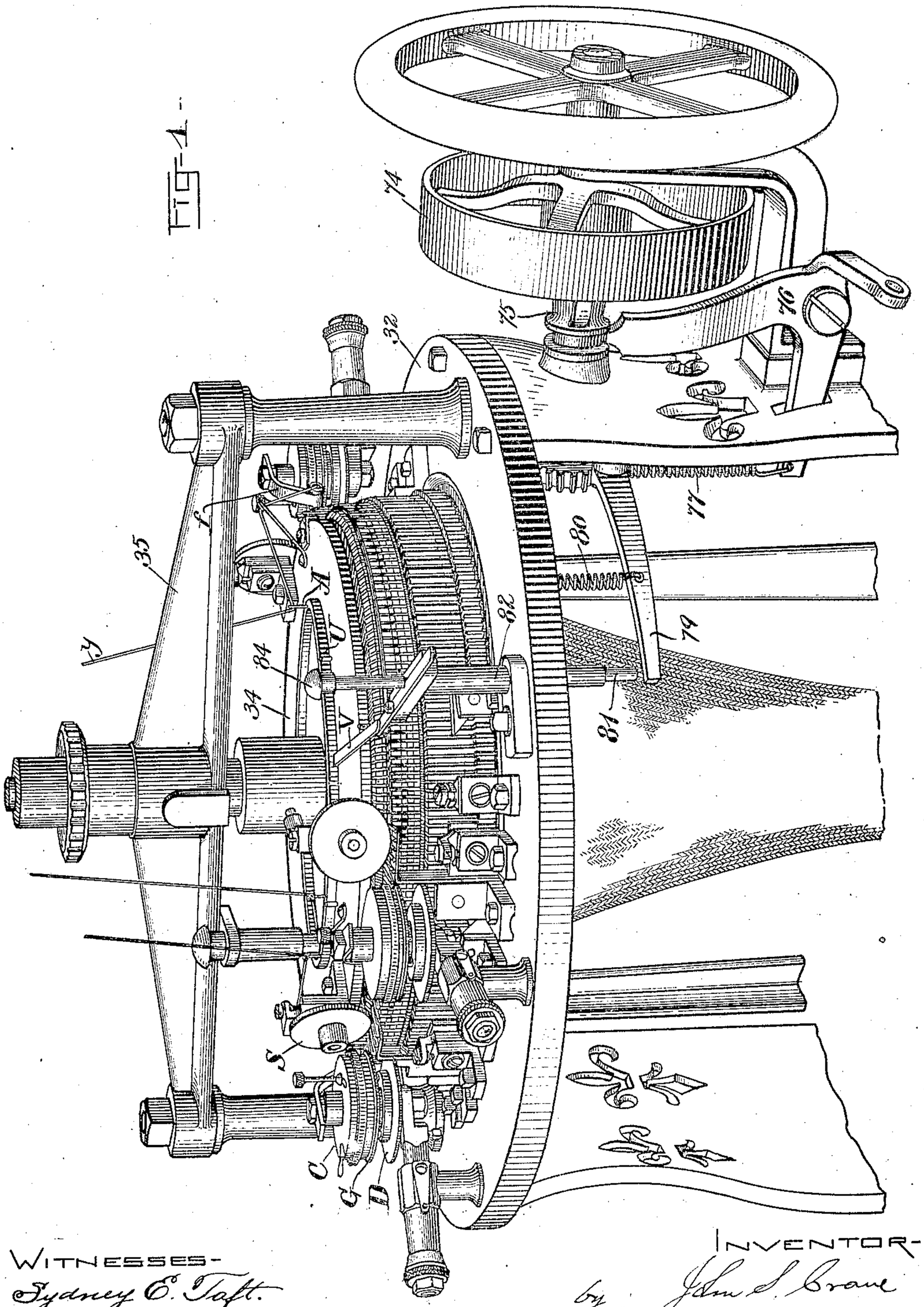
No. 880,013. PATENTED FEB. 25, 1908.

J. S. CRANE.

STOP MOTION FOR KNITTING MACHINES.

APPLICATION FILED MAR. 31, 1903. 5 SHEETS—SHEET 1.

FIG-1-



WITNESSES-
Sydney E. Taft.
M. E. Torrance.

INVENTOR-
by John S. Crane
Wilbur T. Browne
his attorney

No. 880,013. PATENTED FEB. 25, 1908.

J. S. CRANE.

STOP MOTION FOR KNITTING MACHINES.

APPLICATION FILED MAR. 31, 1903. 5 SHEETS—SHEET 2.

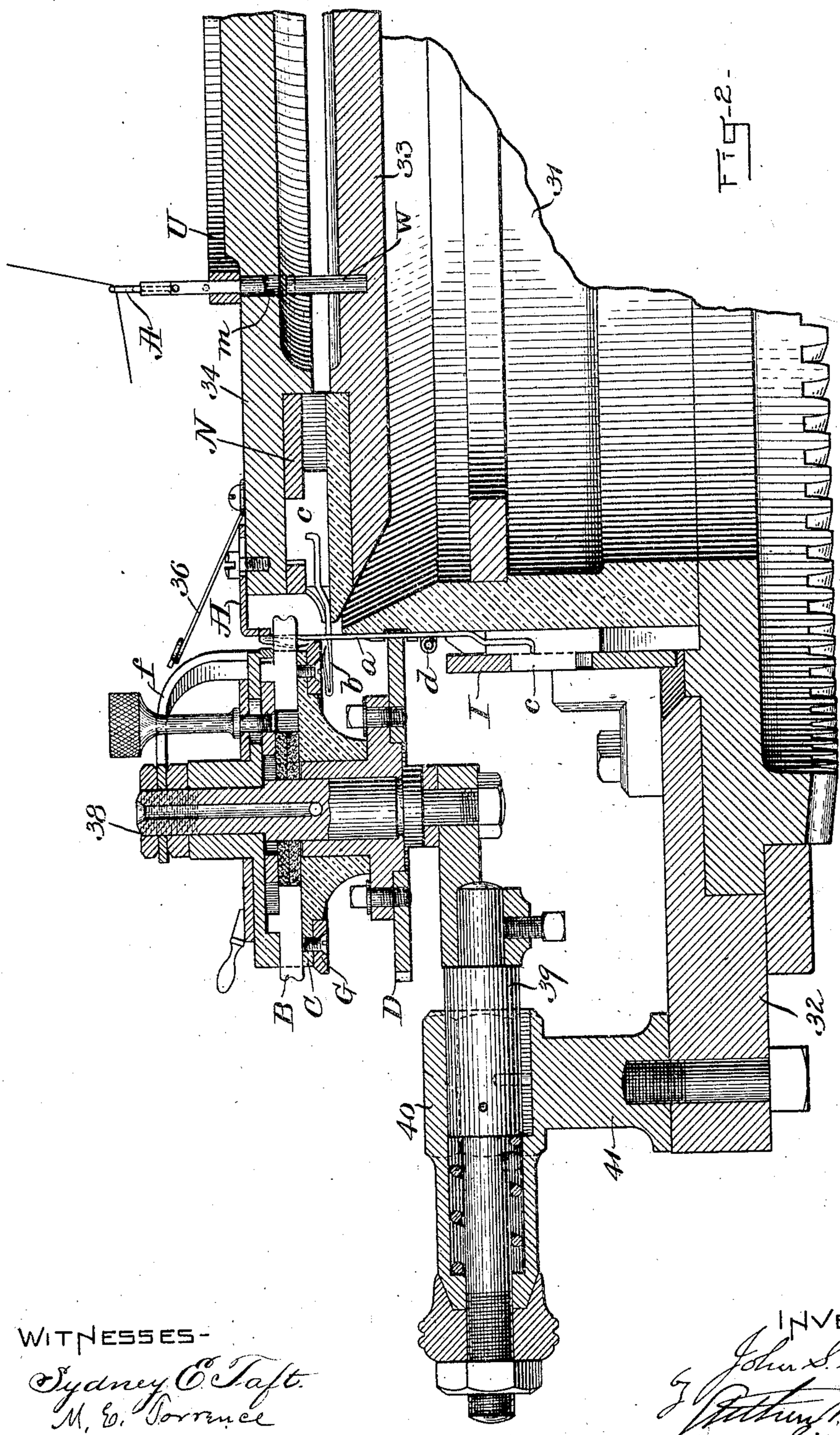


FIG-2-

Scale
Two Inches.

WITNESSES-
Sydney C. Taft.
M. E. Torrance

INVENTOR-
John S. Crane
by Pattison & Brown
his attorneys

No. 880,013. PATENTED FEB. 25, 1908.

J. S. CRANE.

STOP MOTION FOR KNITTING MACHINES.

APPLICATION FILED MAR. 31, 1903. 5 SHEETS—SHEET 3.

FIG-3-

WITNESSES-

Sydney E. Taft.

M. E. Torrence.

INVENTOR

John S. Crane

by William A. Browne

his attorney

No. 880,013. PATENTED FEB. 25, 1908.

J. S. CRANE.

STOP MOTION FOR KNITTING MACHINES.

APPLICATION FILED MAR. 31, 1903. 5 SHEETS—SHEET 4.

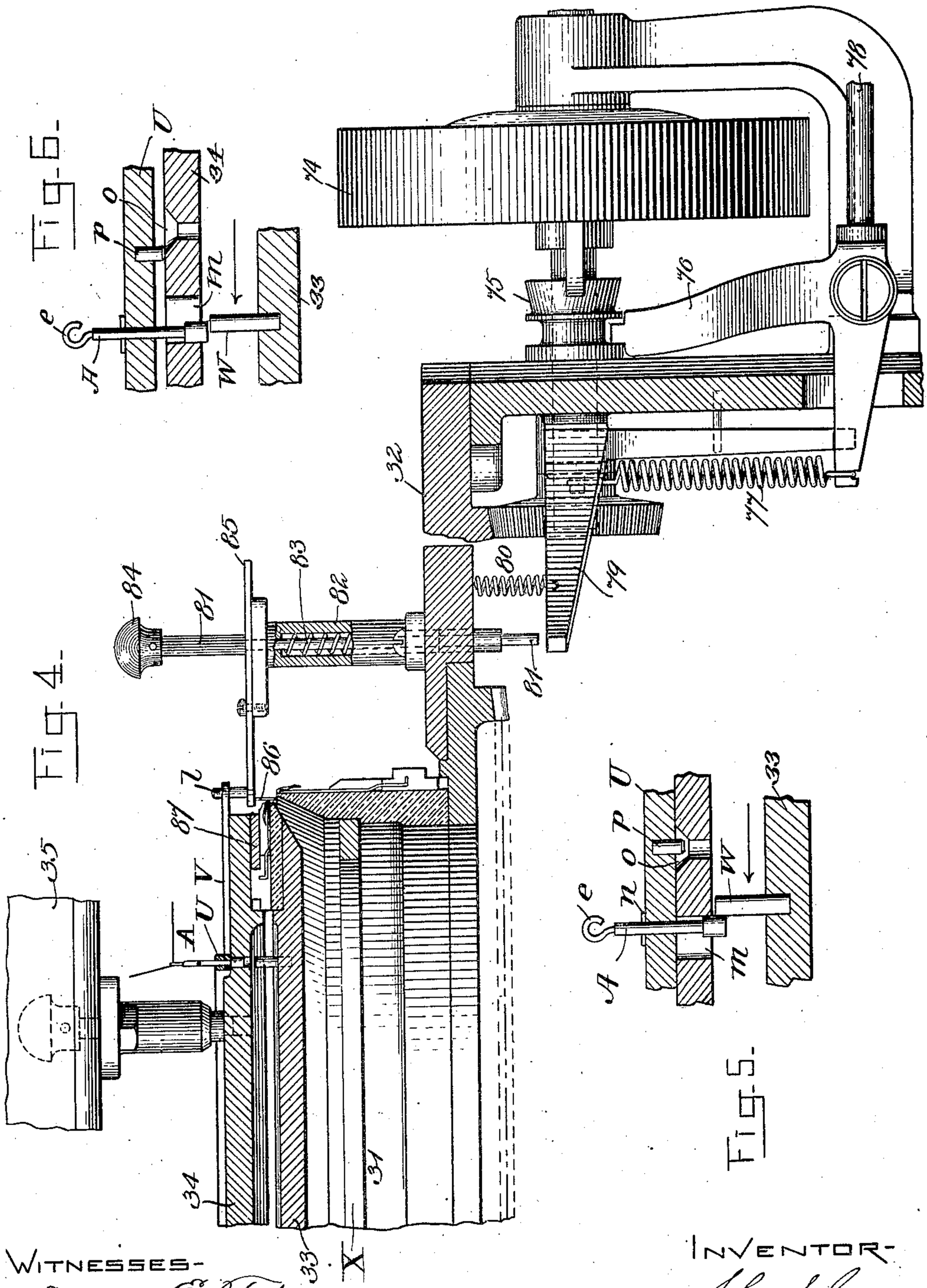


Fig. 4.

Fig. 6.

Fig. 5.

WITNESSES-

Sydney C. Taft.

M. B. Torrence.

INVENTOR-

John S. Crane

by Nathan H. Brownell

his attorney

No. 880,013. PATENTED FEB. 25, 1908.

J. S. CRANE.

STOP MOTION FOR KNITTING MACHINES.

APPLICATION FILED MAR. 31, 1903.

5 SHEETS—SHEET 5.

Fig. 8.

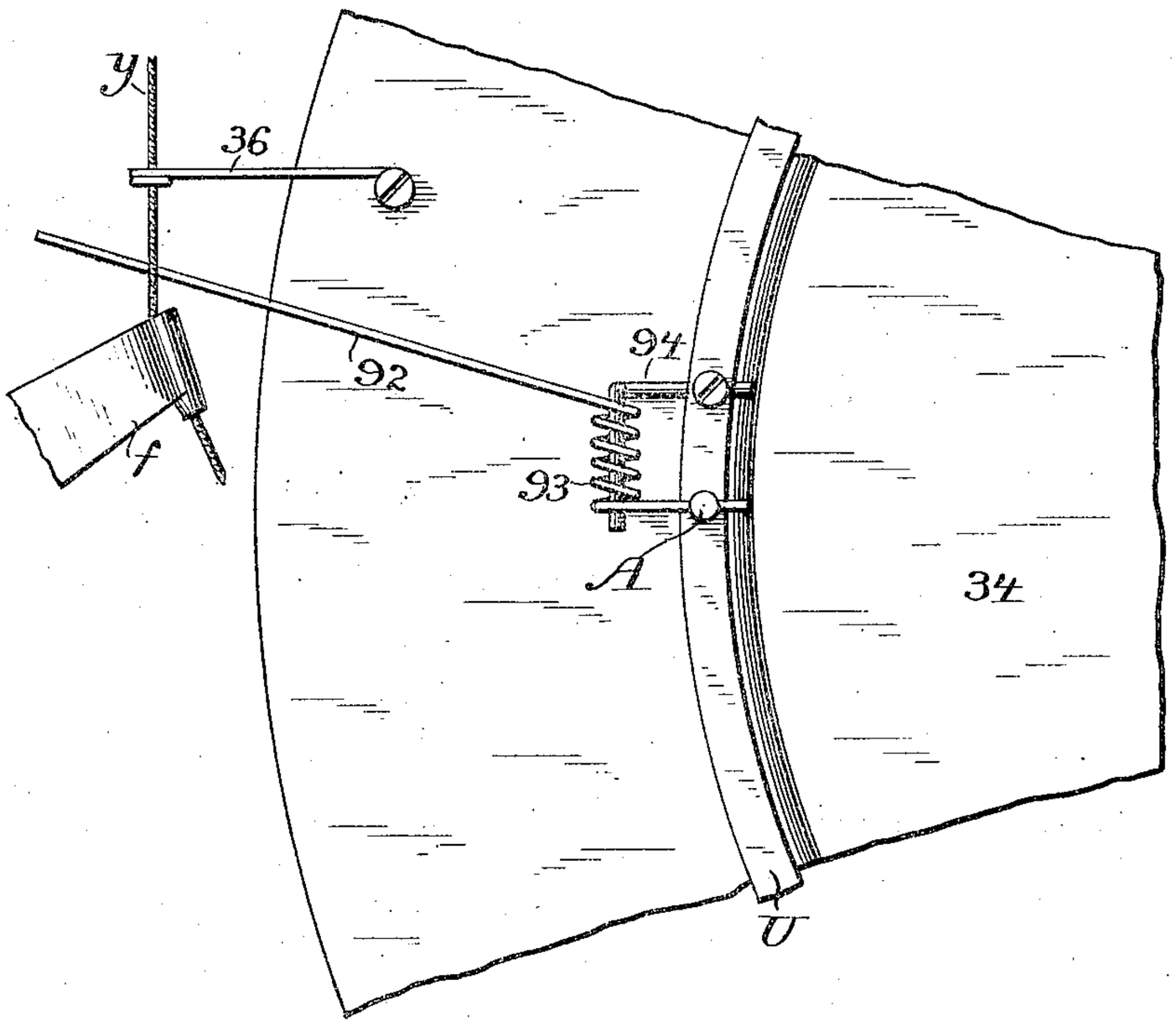


Fig. 9.

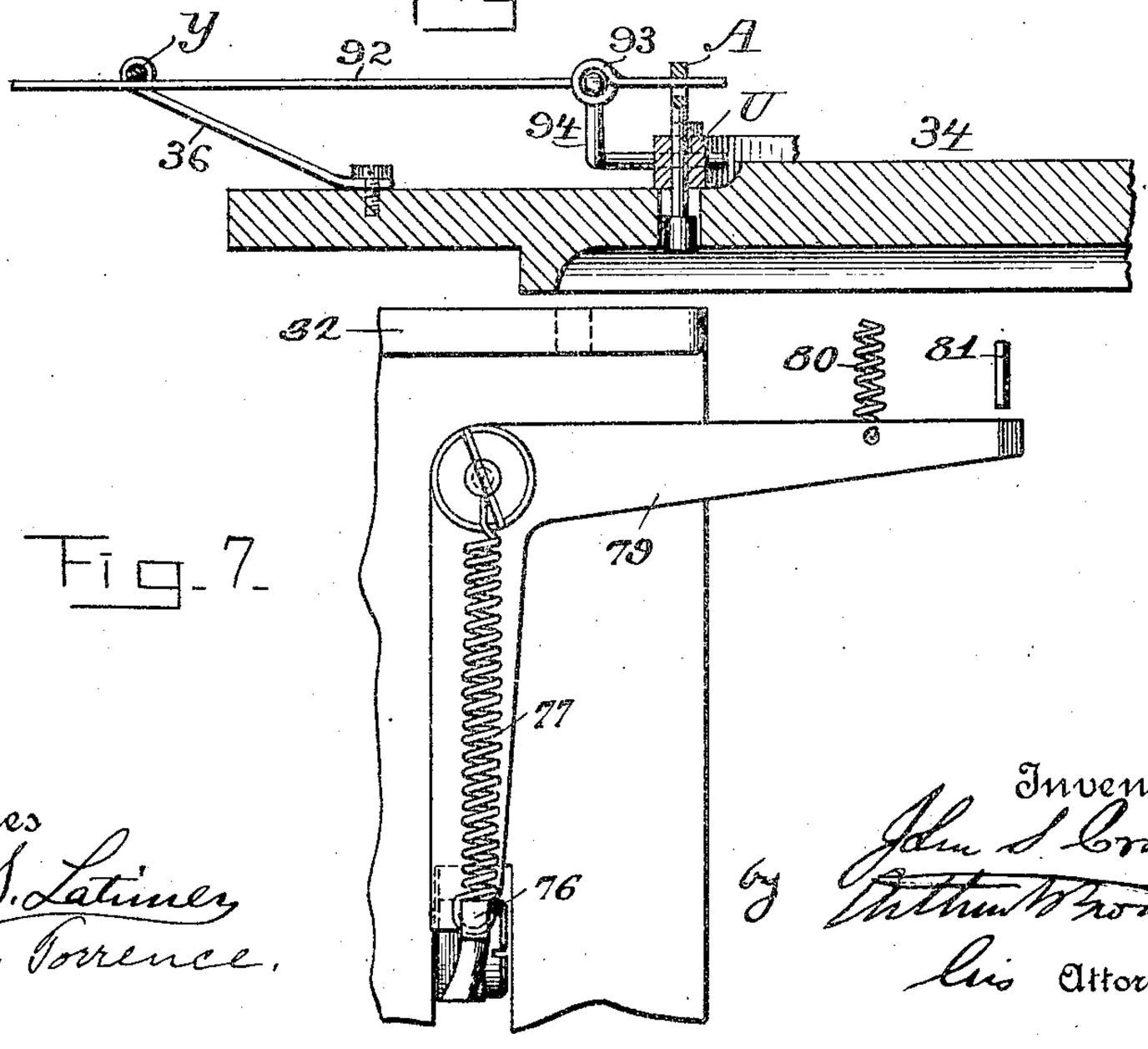


Fig. 7.

Witnesses
Jos. S. Latimer
M. E. Torrence.

Inventor
John S. Crane
by Arthur W. Brown
his Attorney

UNITED STATES PATENT OFFICE.

JOHN S. CRANE, OF LACONIA, NEW HAMPSHIRE.

STOP-MOTION FOR KNITTING-MACHINES.

No. 880,013. Specification of Letters Patent. Patented Feb. 25, 1908.

Application filed March 31, 1903. Serial No. 150,361.

To all whom it may concern:

Be it known that I, JOHN S. CRANE, a citizen of the United States, residing at Lakeport, in the city of Laconia, county of Belknap, and State of New Hampshire, have invented certain new and useful Improvements in Stop-Motions for Knitting-Machines, of which the following is a specification.

The object of the present invention is to supply to a knitting machine a stop-motion of such delicacy and accuracy of operation as to stop the knitting of the machine whenever the yarn breaks or other accident occurs, thus avoiding, in the knitted fabric, such imperfections as have usually heretofore been cured by mending. This renders possible the production of a very high grade of fabric, showing no material faults. The present improvements have been embodied in a circular multiple-feed ribbing knitting machine having two sets of independent spring needles, and are illustrated in the accompanying drawings which show sufficient of such a machine to enable the improvements to be understood.

In the drawings, Figure 1 is a perspective view of the head of the machine. Fig. 2 is a vertical section of a portion of the machine in a vertical radial plane. Fig. 3 is a plan view of a portion of the machine, partly in horizontal section, illustrating the clutch shifting connections. Fig. 4 is a vertical section of a portion of the machine in the plane indicated by the line 4—4 in Fig. 3. Fig. 5 is a detail vertical section, along a line concentric with the dial, passing through one of the gravity detectors and showing the position of the parts when a yarn has just been broken. Fig. 6 is a section similar to Fig. 5, but showing the parts in the position which they assume after the machine has been stopped as the result of the breakage of one of the yarns. Fig. 7 is a detail side view illustrating a portion of the stop-motion mechanism. Figs. 8 and 9 are views illustrating a modified form of yarn-detectors used in the stop-motion.

Figs. 2, 5, 6, 8 and 9 are drawn to the standard scale which appears beneath Fig. 2. Figs. 3, 4 and 7 are drawn to a scale one-half the size of the standard scale. Fig. 1 is not drawn to scale, but is drawn approximately one-third size as compared with the standard scale.

The improvements are illustrated in the drawings as embodied in a machine of the type wherein the needles and their carriers rotate, and their actuating devices and the feeds are mounted on fixed supports, and the following description will be based upon the specific organization and construction illustrated, omitting all consideration of possible modifications until the specific mechanism has been fully described.

The main needles *a* are carried by the carrier or cylinder 31, which is supported by and journaled in the bed-plate 32, as best shown in Fig. 2. The ribbing needles *b* are carried by the rotating carrier or dial 33. The manner in which the cylinder and dial are mounted and rotated is well-known and requires no description. The knitting cams for the main needles and the yarn feeds are mounted on the bed-plate 32, and the knitting cams for the ribbing needles are mounted upon and beneath a normally stationary cam or cap-plate 34, which covers the dial 33 and (see Fig. 1) is supported by the usual overhanging fixed yoke 35. The needles *a* and *b* are secured to jacks *c* which coöperate with the actuating cams, and the needles with their jacks slide in grooves in the cylinder 31 and dial 33, respectively. The needles *a* are maintained in their grooves by an encircling spring band *d*. In these several respects the machine is like a well-known type of circular knitting machine.

The machine which has been selected to illustrate an embodiment of the present improvements is equipped with a plurality both of yarn feeds and needle actuating devices, but as these several sets of mechanism are just alike it will suffice to refer to a single set. Fig. 1 sufficiently illustrates how the several yarn feeds are disposed, three being shown, and the general arrangement of such multiple feeds and needle actuating devices being well-known in the art.

The thread or yarn *y* comes from any suitable supply (see Fig. 1) to and through the eye *e* (Figs. 5 and 6) of a yarn detector A (which is the primary device of the yarn stop-motion), thence through a yarn guide 36 (Fig. 2) secured to the stationary cap-plate 34, and thence through a fixed yarn guide *f* carried by the frame of the feeding sinker wheel (see Figs. 1 and 2) which delivers the yarn between the needles on one side and the sinkers on the other. The sinkers B B are mounted to slide in a rotating feed-wheel C. This feed-wheel turns on a vertical bearing or post 38, secured by in-

tervening adjustable connections, shown in Fig. 2, to a slide 39, which slides radially, with reference to the axis of the needle cylinder 31, in a tubular guideway 40, of a bracket 41, secured to the bed-plate 32.

The feed-wheel C is rotated through the instrumentality of a gear D which meshes with the shanks of the main needles *a* so that as the cylinder is rotated the needles act as teeth on the cylinder to impart rotation to the gear.

The drawings also illustrate pressers G and S for the two sets of needles. Certain of the knitting cams for both sets of needles are illustrated at I and N. The present improved stop-motion is shown applied to a knitting machine having these characteristics.

In making a high grade knit fabric it is important that no defects should appear, which in common fabrics are cured by mending, and accordingly the present improvements provide automatic stopping devices which stop the machine on the breakage or undue slackening of any one of the several yarns, and on the occurrence of any bunches or holes in the fabric.

The machine selected for illustration is driven from the belt-pulley 74 (Figs. 1, 3 and 4) by a friction-clutch of well-known character which comprises a loose sliding cone 75, the clutch being such that when the cone is farthest from the pulley the machine is driven, and when nearest the pulley the machine is stopped. This sliding cone is moved out and in by a bell-crank shipper-lever 76, being moved out by a spring 77 to stop the machine (Fig. 4) and being moved in to start it again by the handle 78 (Fig. 3). This shipper-lever 76 is caught and held in its inner position by the catch-lever 79 (Fig. 7) which is moved automatically to catch the lever 76 by the spring 80 (Figs. 4 and 7). The free end of the upper horizontal arm of this catch lever 79 stands normally (*i. e.*, when the machine is running) just below the knock-off pin 81 (Fig. 4) which slides vertically in a tubular guideway 82 secured to the bed-plate 32. This knock-off pin is forced downward quickly by a spring 83 and is lifted by a knob 84. It is held uplifted by a swinging shipping-latch or knock-off 85 (Figs. 3 and 4) which enters beneath a shoulder thereof. Anything which swings the knock-off away from the knock-off pin 81 frees it and permits the spring 83 to thrust it suddenly down, thus tripping the catch lever 79, releasing the shipper-lever 76, and permitting it to be moved by its spring 77 to stop the machine.

In order to stop the machine in case of any bunch, hole or enlargement of the fabric as formed, the knock-off shipping-latch 85 is provided with a depending feeler 86 (Fig. 4) which extends into the angle between the dial and cylinder verges, where it just clears the freshly knit edge or fell of the fabric. In case of an imperfection in the fabric which causes its upward projection, this feeler is encountered, the knock-off or shipping-latch 85 is moved and the machine is stopped. In order that the feeler may not encounter the needles either when standing still or when the knock-off swings, the ribbing needles are drawn in slightly by the cam 87 (Fig. 3) and the main needles are drawn down slightly by the cam, which is shown back of the guide 82 in Fig. 1. This feeler 86 and its auxiliary cams are well-known in the art.

The train of shipping-mechanism is set in operation to stop the machine, when a yarn breaks or becomes unduly slack, by the following means: A loose stop-ring or detector carrier U rests on the cap-plate 34 (Fig. 1), concentric with the axis of the dial 33, and the cylinder 31, being held loosely in place by the pins *k* on the cap-plate (Fig. 3). Through this ring extend the gravity-detectors A, there being one detector for each yarn, and hence as many detectors as there are yarn feeds. As the several detectors are just alike a description of one will suffice for all. The stop-ring or detector-carrier also carries a single hammer V secured thereto which extends radially outward above the cap-plate (Figs. 1 and 3), terminating just behind a pin *l* carried by the shipping-latch or knock-off 85 (Figs. 3 and 4). It is, therefore, evident that forward rotation of the stop-ring or detector-carrier in the direction in which the dial rotates will trip the knock-off and hence stop the machine.

Each detector A fits slidingly in a hole in the detector-carrier, as best shown in Figs. 5 and 6, and passes thence downwardly through an elongated slot *m* in the cap-plate 34, which is concentric with the dial. When a yarn is intact its detector A is held up, as shown in Fig. 4, a shoulder on it preventing it from being pulled upwardly through the hole in the detector-carrier. In case, however, a yarn breaks or becomes unduly slack by reason of insufficient tension, the detector drops (being prevented from dropping too far by the pin *n*), thus bringing its lower end into the path of an upwardly projecting abutment W on the rotating dial 33, as shown in Fig. 5, and coupling the detector-carrier to the rotating dial. As a consequence the detector, and with it the detector-carrier, moves with the dial, thus through the hammer V stopping the machine. The slot *m* in the cap-plate permits the travel of the detector, and hence of the detector-carrier, sufficiently far to actuate the knock-off. It is desirable to stop the rotation of the detector-carrier by the dial as soon as the knock-off 85 has acted, because the momentum of the moving parts of the machine (owing to the high speed at which the machine is run) carries the dial a considerable distance, and, since the detector-

carrier carries with it all of the detectors for the several yarn-feeds, an equal travel of the detector-carrier would endanger the breakage of all the still intact yarns, thus necessitating the mending of several or all of the yarns at the same time, which might also cause a noticeable defect in the fabric. The machine is, therefore, so constructed that the detector-carrier is automatically uncoupled from the dial as soon as the stopping mechanism has been set in operation. As shown in Figs. 5 and 6, the cap-plate 34 has a cam consisting of a beveled recess *o* in its upper surface for each detector A, and with this recess coöperates a depending lug *p* on the detector-carrier. Ordinarily this lug lies in the recess, as shown in Fig. 5, so that the detector-carrier rests on the surface of the cap-plate. When, however, the detector-carrier is moved by the dial, the lug *p* rides upwardly on the beveled bottom of the recess *o*, thus elevating the detector-carrier, as shown in Fig. 6, thereby uncoupling the detector A from the pin or abutment W on the dial, so that during the further continuation of the movement of the dial the detector-carrier stands still. Consequently the angular displacement of the detector-carrier is slight.

The single detector-carrier suffices for all the detectors and hence for all of the yarn-feeds which may be employed, so that but a single train of stopping devices actuated by the single hammer V is sufficient. There need be but a single abutment or pin W on the dial, but the more such pins there are the more promptly will the stopping mechanism be set in motion. The detector-carrier and its detectors are very simple and effective and are within sight and convenient reach of the attendant of the machine. In re-starting the machine after mending the broken yarn it is very simple to restore the detector-carrier and it is certainly in proper place when it drops down upon the cap-plate, owing to its lugs *p* re-entering their respective recesses *o*.

Numerous modifications may be made without departing from the invention, for example, Figs. 8 and 9 illustrate a preferred form of yarn detectors. The detectors A, shown in Figs. 2, 4, 5 and 6, hang directly from the yarns and this requires too heavy tension on light yarns. In Figs. 8 and 9 an intermediate multiplying-lever 92 is interposed between the yarn *y* and the detector A so that very little strain is borne by the yarn. As shown, the lever is coiled at 93 to constitute a pivot about the pin 94 which is secured to ring U by a set-screw. Any modifications of the specific mechanism hereinbefore described, such as have just been suggested, come within the scope of this invention as it is defined in the subjoined claims.

I claim as my invention:

1. A knitting machine having a drive-shaft, a plurality of yarn feeds, a rotating dial, a stationary plate, a loose stop-ring or detector-carrier resting on the plate, guides on the plate for centering said stop-ring or carrier concentrically with the axis of said rotating dial, an abutment on said dial rotating therewith, a knock-off operatively connected with said drive-shaft to stop the knitting-machine when moved in the proper direction, a hammer attached to said stop-ring or carrier and coöperating with said knock-off, and a plurality of gravity detectors, each having a thread-eye through which passes one of the yarns on its way to one of the yarn feeds, each of said detectors being mounted to slide vertically in a guide-way in said stop-ring or carrier, said detectors being normally upheld by their respective yarns out of the path of said rotary abutment, but each detector on the breaking or slackening of its yarn dropping by gravity into the path of said abutment, whereby the stop-ring or carrier is coupled to the dial and rotates therewith, thus causing said hammer to actuate said knock-off and thereby stop the machine, in combination with a cam on the said stationary plate, and a stud on said stop-ring or carrier which encounters said cam when the stop-ring or carrier is rotated, whereby the stop-ring or carrier is lifted and uncoupled from the dial after the knock-off has been set in operation, thus preventing undue motion of the stop-ring or carrier due to the momentum of the moving parts of the machine.

2. A knitting machine having a drive-shaft, a plurality of yarn feeds, a rotating dial, a stationary plate, a stop-ring or detector-carrier supported by the plate and movable thereon both rotatively and to and from the same, an abutment on said dial rotating therewith, a knock-off operatively connected with said drive-shaft to stop the knitting machine when moved in the proper direction, a hammer attached to said stop-ring or carrier and coöperating with said knock-off, and a plurality of gravity detectors, each having a thread eye through which passes one of the yarns on its way to one of the yarn feeds, each of said detectors being mounted to slide vertically in a guide-way in said stop-ring or carrier, said detectors being normally upheld by their respective yarns out of the path of said rotary abutment, but each detector on the breaking or slackening of its yarn dropping by gravity into the path of said abutment, whereby the stop-ring or carrier is coupled to the dial and rotates therewith, thus causing said hammer to actuate said knock-off and thereby stop the machine, in combination with a cam on the said stationary plate, and a stud on said stop-ring or carrier which encounters said cam when the stop-ring or carrier is rotated, whereby the stop-ring or carrier is lifted and uncoupled

from the dial after the knock-off has been set in operation, thus preventing undue motion of the stop-ring or carrier due to the momentum of the moving parts of the machine.

3. A knitting machine having, in combination, a drive-shaft, a plurality of yarn feeds, a rotating dial, a stationary plate, a rotatable stop-ring or detector carrier supported by said plate, an abutment on said dial rotating therewith, a knock-off operatively connected with said drive-shaft to stop the knitting machine when moved in the proper direction, a hammer attached to said stop-ring or carrier, and coöperating with said knock-off, and a plurality of gravity detectors, each having a thread-eye through which passes one of the yarns on its way to one of the yarn feeds, each of said detectors being mounted to slide vertically in a guide-way in said stop-ring or carrier, said detectors being normally upheld by their respective yarns out of the path of said rotary abutment, but each detector on the breaking or slackening of its yarn dropping by gravity into the path of said abutment, whereby the stop-ring or carrier is coupled to the dial and rotates therewith, thus causing said hammer to actuate said knock-off and thereby stop the machine.

4. A knitting machine having, in combination, a drive-shaft, a knock-off controlling the rotation of said shaft, a plurality of yarn feeds, an abutment, a plurality of detectors, for the yarns, a carrier for said detectors, said detectors being normally held by their yarns out of the reach of said abutment, but so that when a yarn breaks or becomes unduly slack its detector moves to couple said detector-carrier and said abutment whereby the carrier and the abutment move together and thus operate the knock-off to stop the machine, and means for subsequently and automatically uncoupling the carrier and abutment.

5. A knitting machine having, in combination, a drive-shaft, means controlling the rotation of said shaft, a yarn feed, an abutment, a detector for the yarn, a carrier for said detector, said detector being normally held by its yarn out of the reach of said abutment, but so that when the yarn breaks or becomes unduly slack its detector moves to couple said detector-carrier and said abutment whereby the carrier and the abutment move together and thus operate the shaft controlling means to stop the machine, and means for subsequently and automatically uncoupling the carrier and abutment.

6. A knitting machine having, in combination, a drive-shaft, a knock-off controlling the rotation of said shaft, a yarn feed, a normally movable abutment, a detector for the yarn, a carrier for said detector co-acting with said knock-off, said detector being normally held by its yarn out of the reach of said movable abutment, but so that when the yarn breaks or becomes unduly slack its detector moves to couple said detector-carrier and said abutment whereby the carrier and the abutment move together and thus operate the knock-off to stop the machine.

7. A knitting machine having, in combination, a drive-shaft, means controlling the rotation of said shaft, a yarn feed, an abutment, a detector for the yarn, a carrier for said detector, said detector being normally held by its yarn out of the reach of said abutment, but so that when the yarn breaks or becomes unduly slack its detector moves to couple said detector-carrier and said abutment, whereby the carrier and the abutment move together and means in connection with one of said members thereupon to operate the shaft-controlling means to stop the machine, and means for subsequently and automatically uncoupling the carrier and abutment.

8. A knitting machine having, in combination, a drive-shaft, means controlling the rotation of said shaft, an abutment disposed beneath said carrier, a yarn feed, a detector for the yarn, and a carrier for said detector said detector being normally held by its yarn out of the reach of said abutment, but when the yarn breaks or becomes unduly slack its detector moves to couple said detector-carrier and abutment, whereby the carrier and the abutment move together and thus operate the shaft-controlling means to stop the machine.

9. A knitting machine having, in combination, a drive-shaft, a controller for said shaft, operating means for said controller, a yarn detector in normally fixed relation to said controller operating means, a member having movement relative to the detector during knitting, said detector being normally detained in one position by engagement with the yarn but acting when released by breakage or slack in the yarn to engage the member moving relative thereto, and means connecting the controller operating means and the detector thereupon actuated by the detector to actuate said controller operating means.

10. A knitting machine having, in combination, a drive-shaft, a controller for said shaft, operating means for said controller, a yarn detector in normally fixed relation to said controller operating means, a member having movement relative to the detector during knitting, said detector being normally detained in one position by engagement with the yarn but acting when released by breakage or slack in the yarn to engage the member moving relative thereto, means connecting the controller operating means and the detector thereupon actuated by the detector to actuate said controller operating means,

and means automatically disengaging the detector and relatively moving member after a pre-determined interval.

11. A knitting machine having, in combination, a drive-shaft, a controller for said shaft, operating means for said controller, a yarn detector in normally fixed relation to said controller operating means, a member having movement relative to the detector during knitting, said detector being normally detained in one position by engagement with the yarn but acting when released by breakage or slack in the yarn to engage the member moving relative thereto, means connecting the controller operating means and the detector thereupon actuated by the detector to actuate said controller operating means, and a stop to limit the movement of said connecting means.

12. A knitting machine having, in combination, a drive-shaft, a knock-off controlling the rotation of said shaft, a hammer for operating said knock-off, a yarn detector in normally fixed relation to the hammer, a member having movement relative to the detector during knitting, said detector being normally detained in one position by engagement with the yarn but acting when released by breakage or slack in the yarn to engage the member moving relative thereto, and means connecting the hammer and detector thereupon actuated by the detector to operate the hammer.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN S. CRANE.

Witnesses:
C. L. PULSIFER,
C. H. PERKINS.