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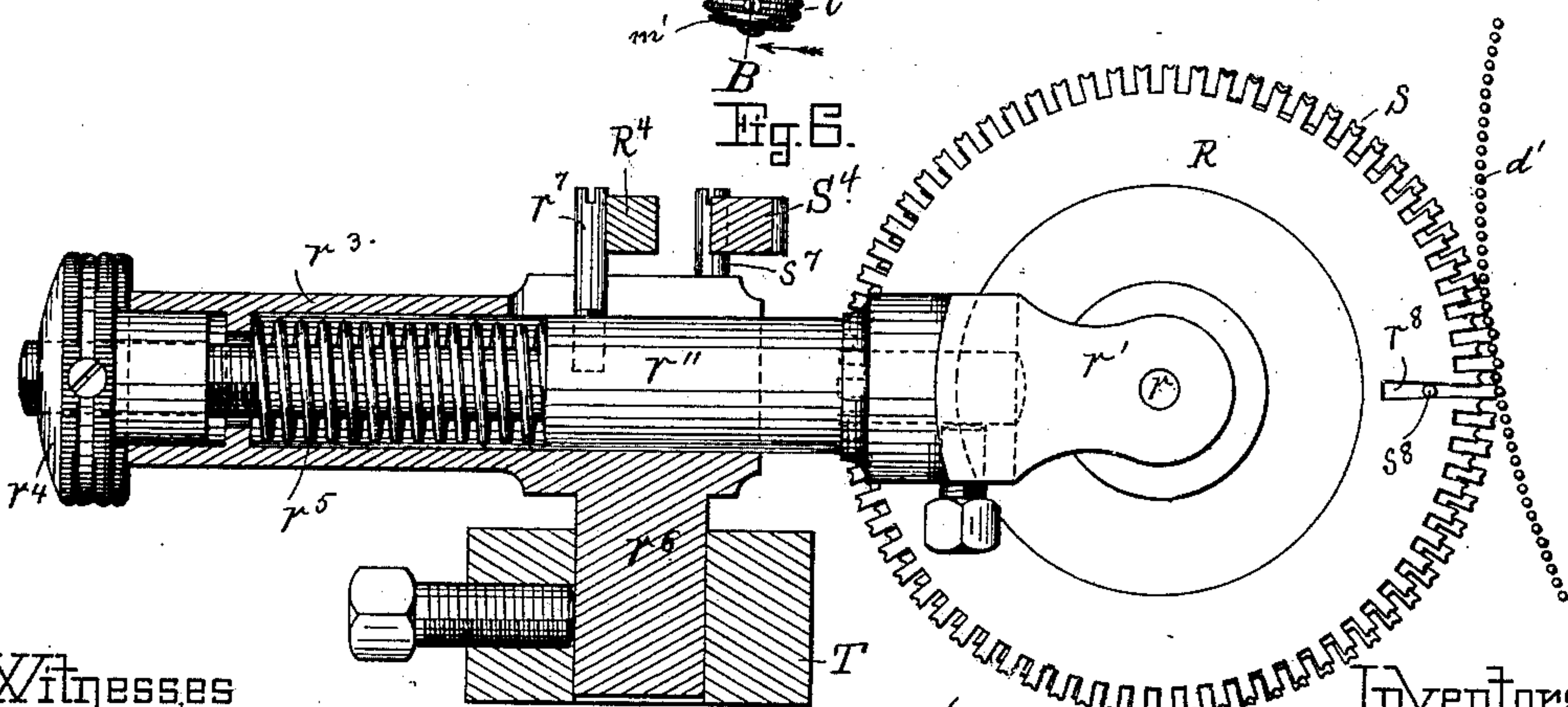
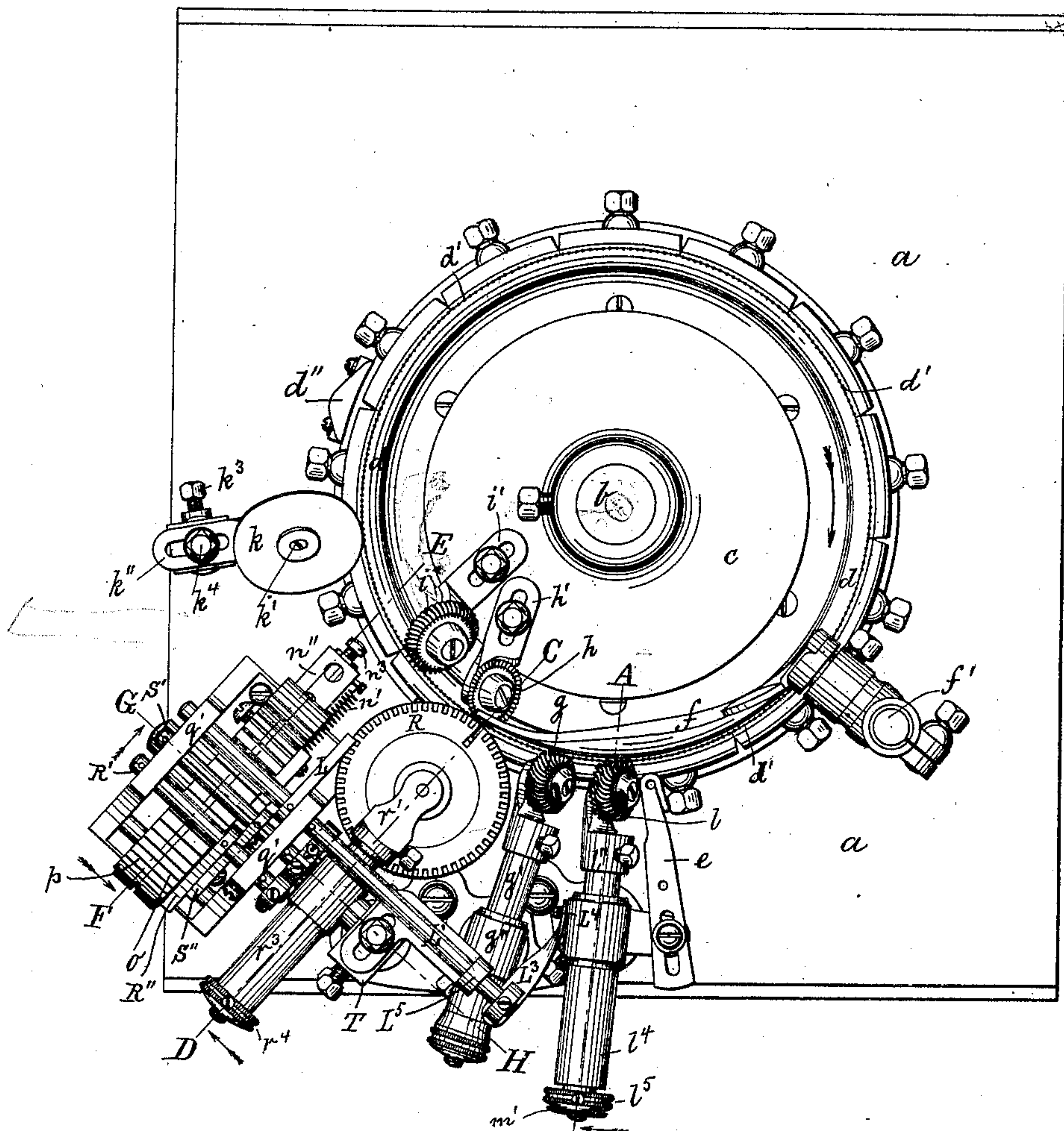
3 Sheets—Sheet 1.

D. F. SULLIVAN & W. J. GRAHAM.
CIRCULAR KNITTING MACHINE.

No. 358,900.

Patented Mar. 8, 1887.

Fig. 1.



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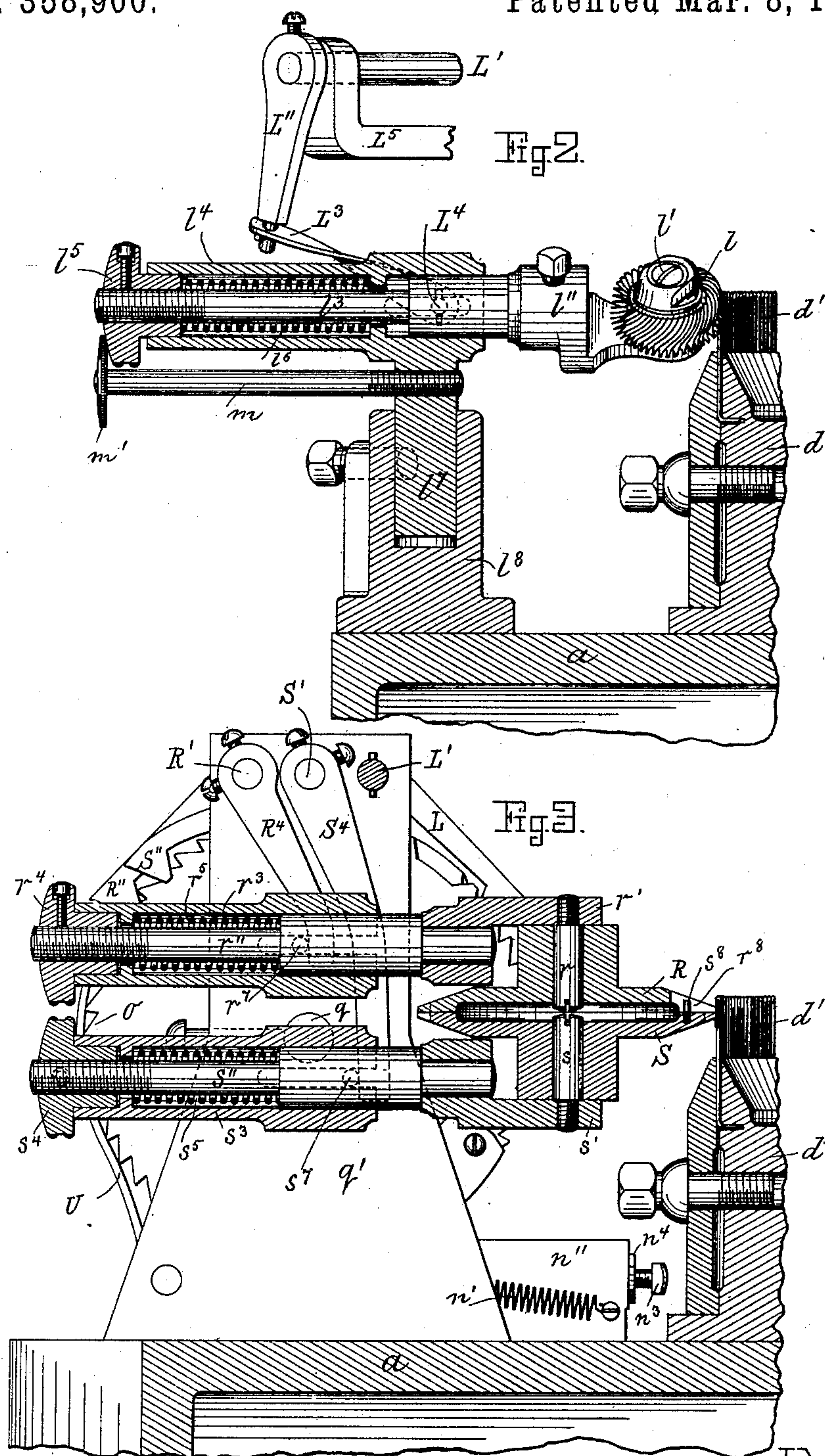
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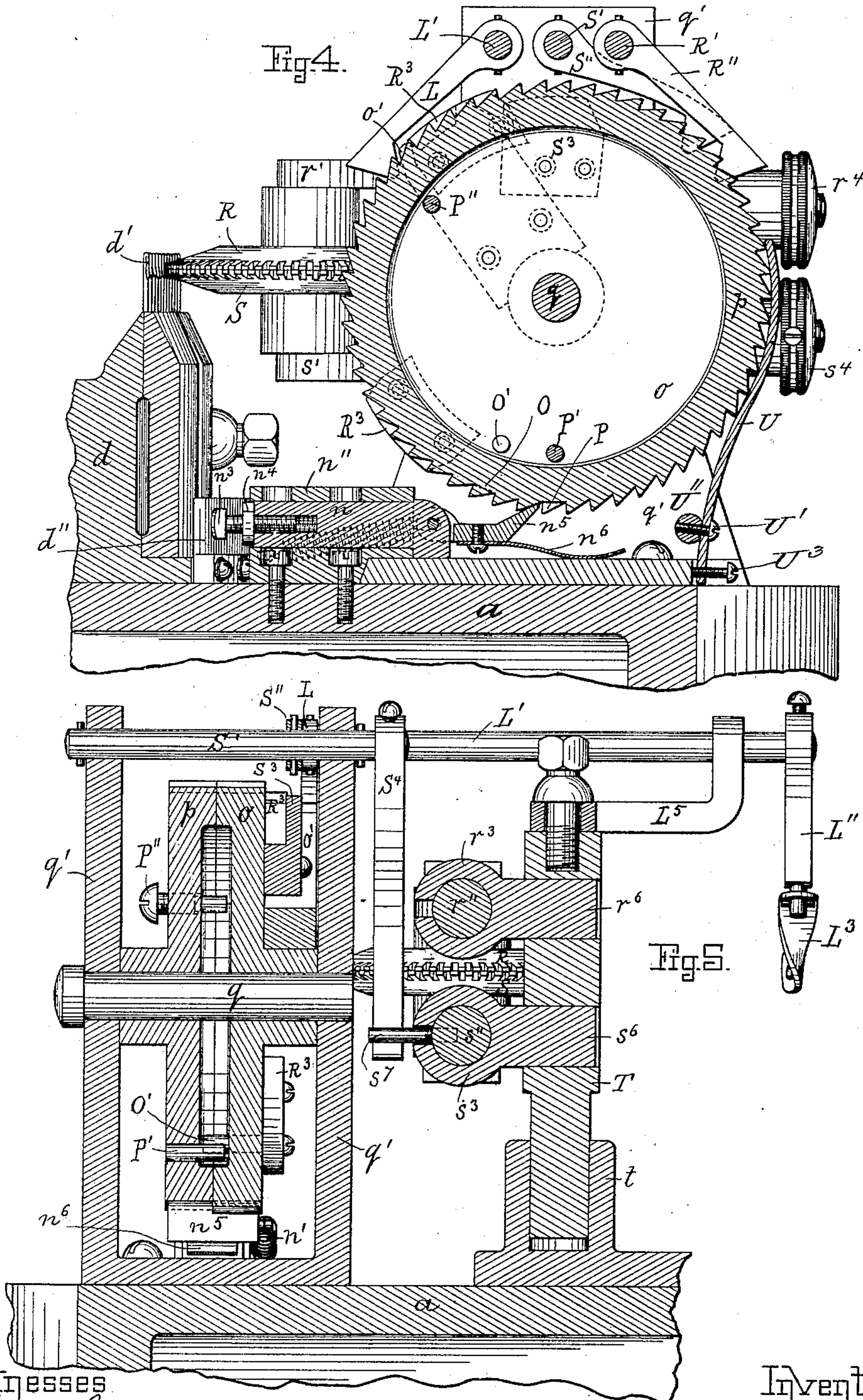
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UNITED STATES PATENT OFFICE.

DANIEL F. SULLIVAN AND WILLIAM J. GRAHAM, OF LOWELL, MASS.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 358,900, dated March 8, 1887.

Application filed September 13, 1886. Serial No. 213,379. (No model.)

To all whom it may concern:

Be it known that we, DANIEL F. SULLIVAN, a citizen of the United States, and a resident of Lowell, in the county of Middlesex and State of Massachusetts, and WILLIAM J. GRAHAM, a citizen of Great Britain, and a resident of Lowell, in the county of Middlesex and State of Massachusetts, have jointly invented new and useful Improvements in Circular-Knitting Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to improvements in knitting-machines; and it consists, in combination with the rotary needle-cylinder, of improved presser-wheels and automatic means for moving them to and from the needle-cylinder or circle for the purpose of automatically making the desired changes in the stitch during the progress of the work.

The invention further consists in automatic means for moving the stitch-wheel, during the operation of the machine, to and from the circle or needle-cylinder, as will hereinafter be more fully shown and described, reference being had to the accompanying drawings, where—

Figure 1 represents a plan view of the knitting-machine and its automatic attachments. Fig. 2 represents an enlarged partial section on the line A B in Fig. 1, showing the stitch-wheel and its automatic adjusting device. Fig. 3 represents an enlarged partial longitudinal section on the line C D in Fig. 1, showing the improved presser-wheel and its automatic adjusting device. Fig. 4 represents an enlarged section on the line E F in Fig. 1, showing the ratchet cam-wheel and pawl for its automatic operation. Fig. 5 represents an enlarged partial cross-section on line G H in Fig. 1; and Fig. 6 represents an enlarged sectional plan view of the improved presser-wheels, showing supporting means for the presser-wheels and connected parts.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.

a is the stationary bed or frame of a circular-knitting machine, as usual, having the stationary post or spindle *b*, to which is secured the stationary plate *c*, as shown in Fig. 1.

d is the rotary circle or needle-cylinder, as usual, said cylinder being rotated in the ordinary manner, in the direction shown by arrow in Fig. 1, by the usual mechanism for this purpose. Such mechanism, not forming subject-matter of our invention, is, however, not shown in the drawings.

d' d' d' are the barbed needles, secured, as usual, to the circle or needle-cylinder *d*.

e in Fig. 1 represents the adjustable thread or yarn guide, located, as usual, on the outside of the circle *d*.

f is the horn or "push-back," located on the inside of the circle *d*, for the purpose of keeping the work down from the stitch-wheel and dividing-wheel, such horn or push-back being adjustably secured to the post *f'*, attached to the bed or frame *a* in the ordinary way.

g is the dividing-wheel, as usual, to even the loops formed by the stitch-wheel *l*, such dividing-wheel being journaled loosely on a pin attached to the yielding bar *g'*, which latter is guided in the stationary sleeve *g''* in the ordinary way, and we wish to state that such dividing-wheel forms no part of our present invention.

h is the landing-wheel, as usual, for throwing the stitches over the barbs of the needles *d' d'*, such landing-wheel being loosely journaled on a stud or pin attached to the plate *h'*, that is adjustably secured to the stationary plate *c* in the ordinary way.

i is the finishing or cast-off wheel, as usual, for throwing off the work from the needles *d' d'* after the stitches are made, such wheel *i* being likewise loosely journaled on a stud or pin attached to the plate *i'*, that is adjustably secured to the stationary plate *c* in the ordinary way, as shown in Fig. 1.

In addition to the usual cast-off wheel, *i*, we provide the machine with an additional wheel, *k*, located outside of the needle-cylinder, for the purpose of aiding in throwing off the work from the barbed needles *d' d'*. This additional wheel *k* is made in the form of a smooth circular disk that is loosely journaled on a pin or stud, *k'*, on the slotted plate *k''*, that is adjustably secured by means of screws *k³ k⁴*, or equivalent devices, to a suitable post attached to the bed *a*, as shown in Fig. 1. As the needle-cylinder rotates it imparts a rotary motion

to the outside cast-off wheel, k , said wheel being arranged inclined to a horizontal plane, and as it rotates it causes the stitches not already disengaged from the needles by the internal cast-off wheel, i , to be raised and thrown over the needles.

l in Figs. 1 and 2 is the stitch-wheel for forming the loop and carrying the yarn under the barbs of the needles $d' d'$, as is usual in knitting-machines of this kind, said stitch-wheel being loosely journaled on a pin or stud, l' , secured to the bearing-piece l'' , that is adjustably secured to the spindle l^3 , that is guided in the sleeve l^4 . (Shown in Fig. 2.) To the outer end of spindle l^3 is secured in an adjustable manner the flanged nut l^5 , screwed on the outer screw-threaded end of spindle l^3 , as shown in Fig. 2, and by means of a coiled spring, l^6 , located within the sleeve l^4 and pressing against the inner end of nut l^5 , the stitch-wheel l is normally pushed out, as usual in machines of this kind. The sleeve l^4 has a downwardly-projecting vertical rod, l^7 , that is adjustably secured to the hollow post l^8 , attached to the bed a , as shown in Fig. 2, and to limit the outward throw of the stitch-wheel l we employ an adjusting-screw, m , the inner end of which is made adjustable in a screw-threaded perforation in the rod l^7 , its outer end having a flange or head, m' , against which the nut l^5 is brought to bear by the influence of the coiled spring l^6 when the stitch-wheel l is thrown out to its limit of motion in this direction. In addition to this usual arrangement for normally throwing out the stitch-wheel l , we make use of an automatic throwing-in device to throw in the stitch-wheel for one course, and thereby to form a slack stitch to enable the work to be transferred from one machine to another, and this automatic throwing-in device is constructed as follows:

To the exterior circumference of the needle-cylinder d we secure a cam face or projection, d'' , (shown in Figs. 1 and 4,) which once during the revolution of the cylinder d comes in contact with and actuates the pawl-bar n , that is movable against the influence of a spring, n' , in a guide-piece, n'' , secured to bed a , as shown in Fig. 4.

For the purpose of properly adjusting and regulating the throw of the pawl-bar n an adjustable set-screw, n^3 , is screwed into its outer end, as shown in Fig. 4, and it is on the head of said set-screw n^3 that the cam projection d'' acts to move the pawl-bar n .

n^4 is a set-nut on screw n^3 , to secure the latter firmly in position on the end of pawl-bar n after being adjusted thereon, as shown in Fig. 4.

n^5 is a pawl hinged to the inner end of the pawl-bar n , which pawl is by means of the yielding spring n^6 held in contact with the toothed surfaces of the ratchet-wheels o and p , which are loosely journaled side by side on the spindle q , located in the standards or bearings $q' q'$, as shown in Figs. 1, 4, and 5.

On the side of the ratchet-wheel o is secured

the cam or projection o' , (shown in Figs. 4 and 5,) that actuates a pawl or lever, L , secured to the rock-shaft L' , that is located in bearings in the standards $q' q'$, as shown in Figs. 1, 4, and 5, said rock-shaft having secured to its outer end the lever or arm L'' , the lower end of which is pivoted or connected to the link L^3 , having its inner end hinged to a pin, L^4 , that projects from the bearing-piece l'' through a slotted perforation in the side of sleeve l^4 , as shown in Figs. 1, 2, and 5. Thus it will be seen that when the lever L is raised by contact with the cam o' it causes the shaft L' to rock and the stitch-wheel l to be thrown in automatically against the influence of spring l^6 , for the purpose set forth, the said wheel l being thrown out to its normal position by the influence of spring l^6 as soon as the cam or projection o' ceases to act on the arm or lever L .

Heretofore in knitting-machines of this kind a single presser-wheel has been used. We make use of a double presser-wheel, by which the capacity of the machine for doing various kinds of work is materially increased.

Our improved duplex presser-wheel consists of a pair of toothed or serrated wheels, R and S , one arranged above and in contact with the other, as shown in Figs. 1, 3, 4, 5, and 6. The wheel R is loosely journaled on a stud or pin, r , secured to the bearing-piece r' , and the wheel S is similarly journaled on an independent pin, s , secured to its bearing-piece s' , as shown in Fig. 3. The bearing-pieces $r' s'$ are secured, respectively, to the independent spindles $r'' s''$, located within the respective sleeves $r^3 s^3$. The spindles $r'' s''$ are screw-threaded in their outer ends, as shown in Fig. 3, and provided with regulating-nuts $r^4 s^4$, by which the inward movement of spindles $r'' s''$ is regulated and adjusted, such inward motion of said spindles and their respective wheels $R S$ being caused by means of the coiled springs $r^5 s^5$, located, respectively, on the spindles $r'' s''$ within the sleeves $r^3 s^3$, as shown in Fig. 3. Each of the sleeves $r^3 s^3$ is provided with a cylindrical side projection, r^6 and s^6 , (shown in Fig. 5,) such projections being secured, by means of set-screws or equivalent devices, in perforations in the vertically-adjustable post T , the lower end of which fits into and is secured to hollow post t , that is attached to the bed a , as shown in Fig. 5.

L^5 is an outer bearing for the rock-shaft L' , such bearing being shown in Figs. 1 and 5 as secured to the post T .

The automatic mechanism for throwing out the toothed presser-wheels RS from the barbed needles $d' d'$ is constructed as follows:

In bearings in the standards $q' q'$ are located the rock-shafts R' and S' , to which are respectively secured the pawls or levers $R'' S''$. (Shown in Fig. 4.) Said pawls are raised or rocked automatically when brought in contact with the respective cams or projections $R^3 S^3$, secured to the side of the ratchet-wheel o , as shown in Figs. 4 and 5.

To the rock-shafts $R' S'$ are secured, respect-

ively, the levers $R^1 S^1$, the lower ends of which lie in contact with the pins or projections $r^1 s^1$, secured, respectively, to the spring-pressed spindles $r'' s''$, and made to project through slotted openings in the sleeves $r^3 s^3$, as shown in dotted lines in Fig. 3 and full lines in Fig. 5. It will thus be seen that the wheels $R S$ will be automatically drawn out against the influence of the respective springs $r^5 s^5$ whenever the projections $R^3 S^3$ on ratchet-wheel o come in contact with the pawls or levers $R'' S''$, and in this manner the said wheels $R S$ are automatically drawn out independently or simultaneously, and also automatically pushed in in the same manner. To permit of the lateral adjustment of one wheel relative to the other, and still keep them locked together in their rotary movement, we provide the wheel S with a pin, s^8 , fitting in a slot, r^8 , in the wheel R , as shown in Figs. 3 and 6; or other suitable device may be used to keep the wheels from rotating independently of each other without departing from the essence of our invention. When the wheels R and S are located concentrically one above the other, the teeth of one wheel come above (or below) the spaces of the other, and as the peripheral distance between the center lines of a tooth and a space is equal to the distance between the center lines of the needles $d' d'$ it follows that when both wheels are in they serve the purpose of a common presser to close every beard or barb on all the needles. When the bottom wheel, S , only is in, it closes every other barb or beard on the needles, as may be desired, for forming a tuck or raised stitch on the fabric, and when the top wheel, R , is in, the same operation takes place on alternate needles not touched by the bottom wheel, and by this construction and arrangement of presser-wheels we obtain, as it were, three distinct pressers in one and the same device.

U in Figs. 3 and 4 is an adjustable friction-spring secured in its lower end to any suitable part of standards $q' q'$, or a brace, U'' , thereon, and having its upper end pressing against the toothed peripheries of ratchet-wheels $o p$, so as to hold the latter stationary, except when moved by the pawl n^5 . As shown, the said spring U is secured near its lower end, by means of a screw, U' , to a bar, U'' , attached to standards $q' q'$, and said spring has a screw-threaded perforation in its lower end, through which passes the set-screw U^3 , (shown in Fig. 4,) the inner end of which bears against a stationary part of the bed. By adjusting said set-screw U^3 the pressure of the upper end of the spring U against the toothed wheels $o p$ can be regulated.

For the purpose of effecting any desired changes in the automatic operations of the stitch and presser wheels, we make on the periphery of the ratchet-wheel p a cut-away space, P , (shown in Fig. 4,) and a similar cut-away space, O , (shown in dotted lines in Fig. 4,) is made on the circumference of the ratchet-

wheel o . P' is a pin secured to the ratchet-wheel p , and O' is a similar pin secured to the ratchet-wheel o , as shown in Figs. 4 and 5. The pawl n^5 in its action upon the two ratchet-wheels o and p will impart an intermittent rotary motion simultaneously to both wheels until the cut-away space P on wheel p comes in the path of the pawl n^5 , when the latter can of course no longer impart a motion to said wheel p , and it remains still, while the other wheel, o , continues to intermittently rotate, causing its pin or projection O' to come in contact with the pin P' on wheel p , and to push it along with wheel p , so that the pawl n^5 can again act on the serrated surface on it, by which intermittent motion is again imparted to wheel p , and both wheels o and p now move together until the cut-away space O on wheel o comes in the path of pawl n^5 , causing wheel o to remain stationary until, by the continued motion of wheel p , its pin P' comes in contact with pin O' on wheel o , and thus again sets the latter in motion, and in this manner the wheels $o p$ are intermittently rotated and held stationary for the purpose of automatically throwing out the respective presser-wheels and stitch-wheel at the proper times, according to the nature of the work that is to be done. By inserting another pin, P'' , in ratchet-wheel p at any desired place in the path of the pin O' on wheel o , any desired change in the automatic motion of presser-wheels and stitch-wheel may be obtained.

Having thus fully described the nature, construction, and operation of our invention, we wish to secure by Letters Patent, and claim—

1. A knitting-machine having the cylinder d and a cam or projection, d'' , thereon, in combination with the stitch-wheel l and intermediate connecting mechanism, substantially as described, for automatically operating the said stitch-wheel to and from the needles, as set forth.

2. The combination of the rotary cylinder or needle-circle d with a loosely-rotating cast-off wheel, k , arranged on the outside of and bearing against the outside of the needles $d' d'$, as and for the purpose set forth.

3. In combination with the needle-cylinder d and its cam or projection d'' , and intermediate connecting mechanism, as described, to the presser-spindles $r'' s''$, the pressers $R S$, having a locking device by which one is prevented from rotating independent of the other, as described, and the independent yielding spindles $r'' s''$, and their respective springs $r^5 s^5$, for each of the respective pressers $R S$, as and for the purpose set forth.

4. The needle-cylinder d and its cam or projection d'' , the spring-pressed pawl n^5 , block n and its spring n' , the loosely-mounted ratchet-wheels $o p$, having the cut-away spaces $O P$, pins $O' P' P''$, and cam o' on wheel o , in combination with the yielding stitch-wheel l , the spindle l^3 , and spring l^6 , rock-shaft L' , arms or levers $L L''$ thereon, and link L^3 , connected to

spindle l^3 , for automatically throwing in the stitch-wheel l , as herein set forth.

5 5. The needle-cylinder d and its projection or cam d'' , the spring-pressed pawl n^5 , its block n , and spring n' , the loosely-mounted ratchet-wheels o p , having cut-away spaces O P , and pins O' P' P'' , and cams R^3 S^3 on wheel o , in combination with the yielding pressers R S , the respective spindles r'' s'' , and springs r^5 s^5 ,
 10 rock-shafts R' S' , arms or levers R'' R^4 S'' S^4 , springs r^5 s^5 , and pins r^7 s^7 on the respective spring-pressed spindles r'' s'' , for automatically throwing out said pressers, as herein set forth and described.

6. The stitch-wheel l and its spring-pressed 15 spindle l^3 and regulating-nut l^5 , in combination with the regulating-screws m m' , to limit the outward motion of said stitch-wheel, as set forth.

In testimony whereof we have signed our 20 names to this specification, in the presence of two subscribing witnesses, on this 7th day of September, A. D. 1886.

DANIEL F. SULLIVAN.
 WILLIAM J. GRAHAM.

Witnesses:

SAMUEL B. WYMAN,
 GEO. H. STEVENS.