No. 616,344. Patented Dec. 20, 1898.

D. McGENNISS.

CIRCULAR KNITTING MACHINE.

(Application filed Apr. 4, 1898.)

(No Model.) 5 Sheets—Sheet 1.

FIG. 1.

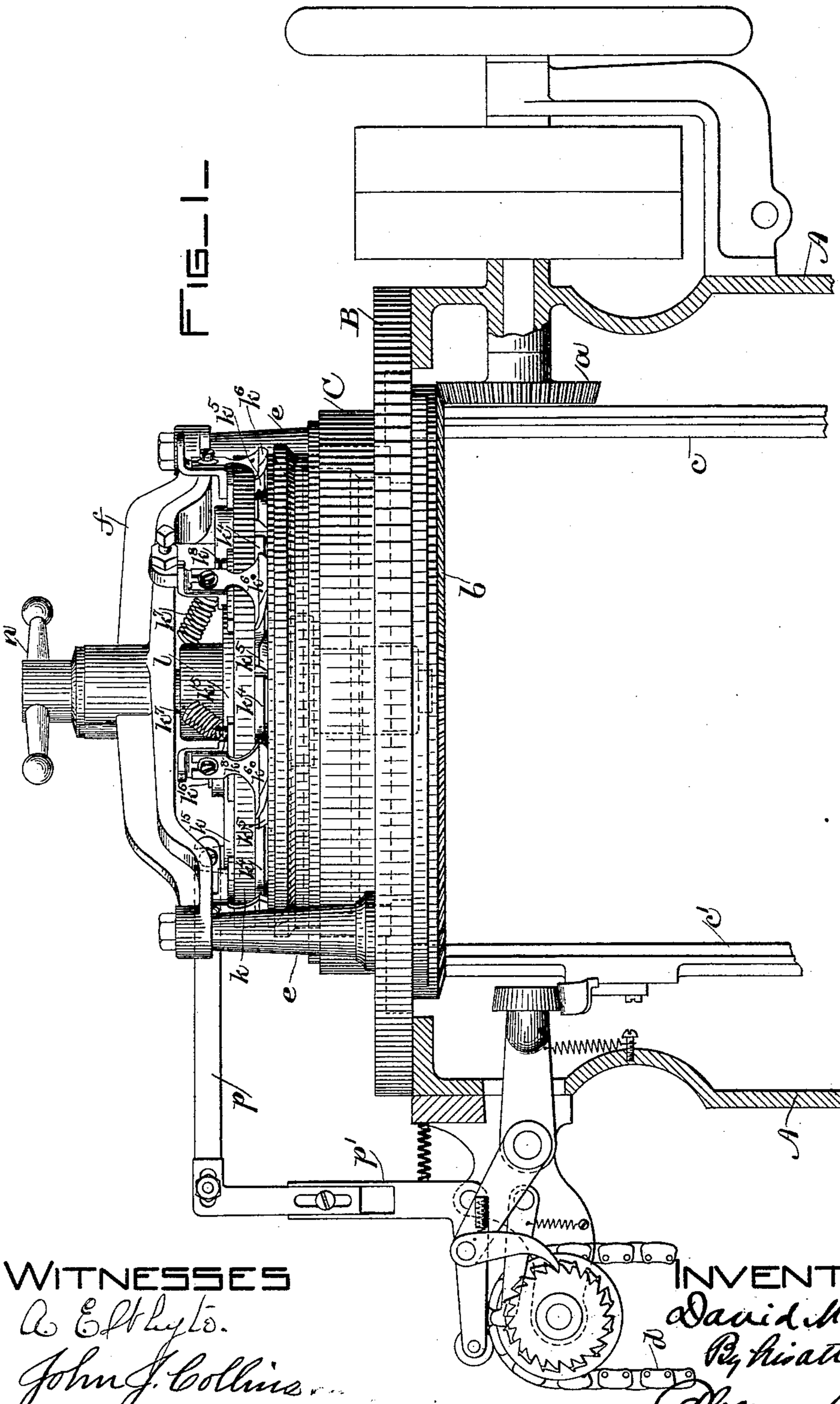

FIG. 7.

WITNESSES

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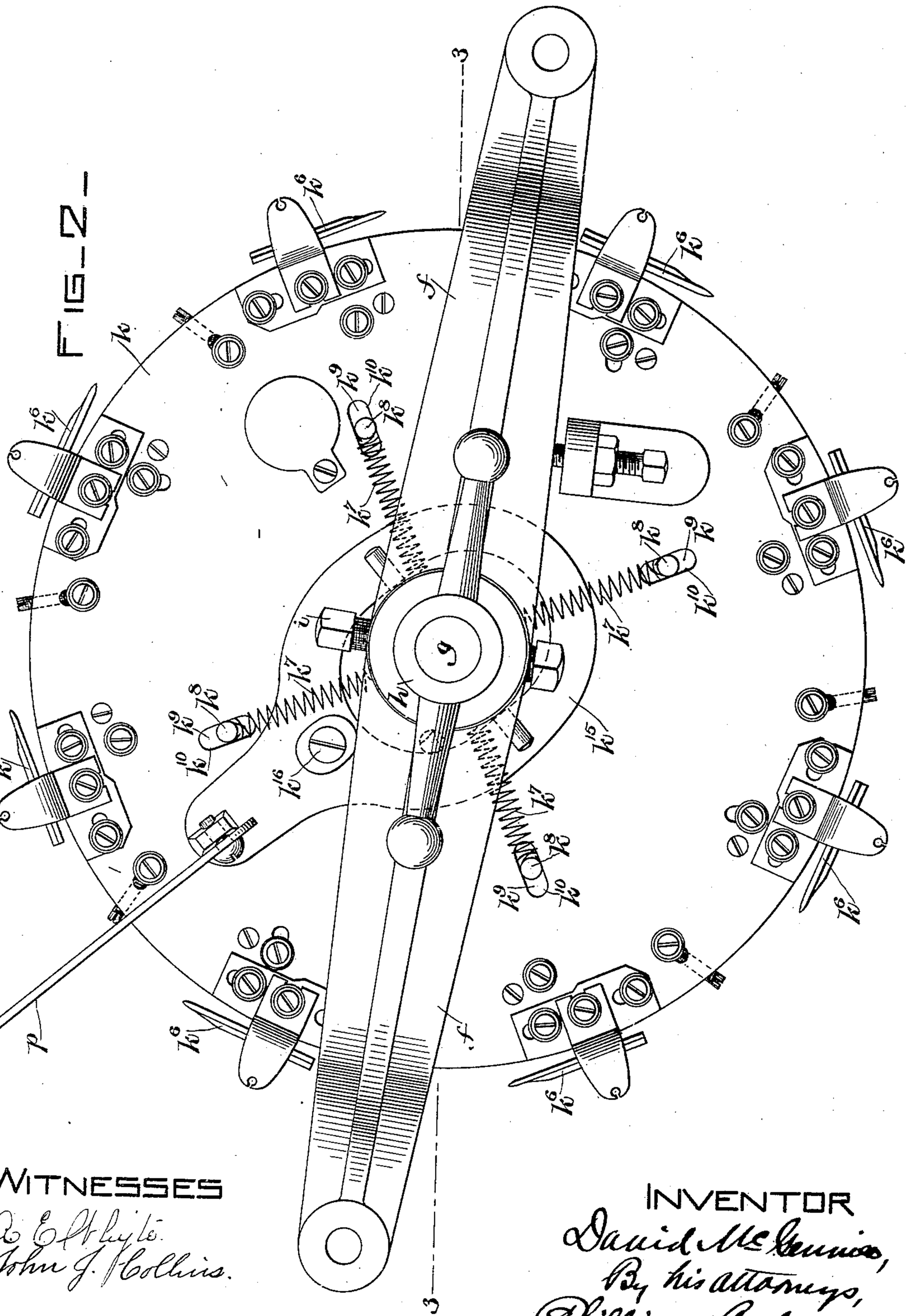
(No Model.)

5 Sheets—Sheet 2.

FIG. 2.



WITNESSES

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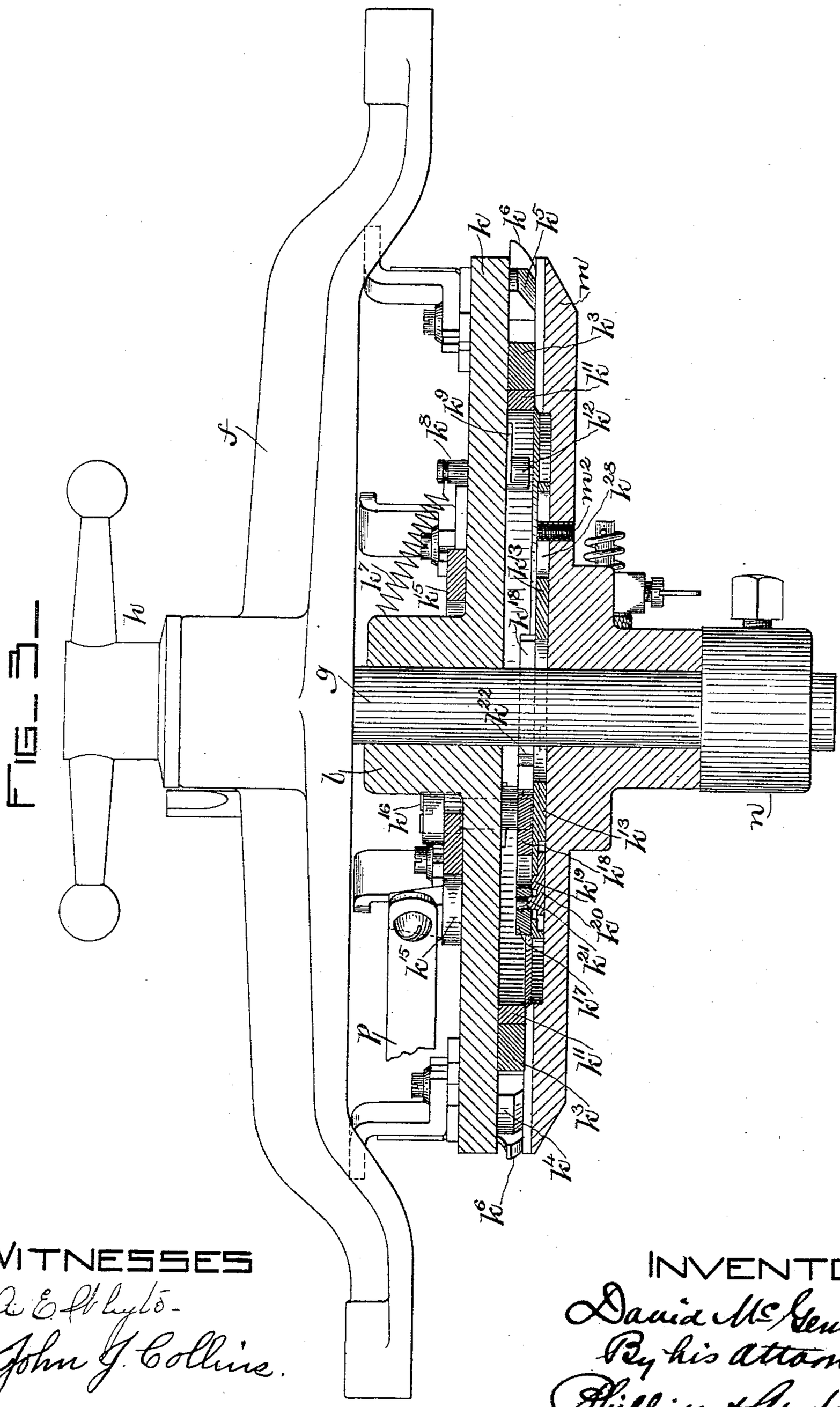
(No Model.) 5 Sheets—Sheet 3.

FIG. 3.



WITNESSES

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No. 616,344. Patented Dec. 20, 1898.

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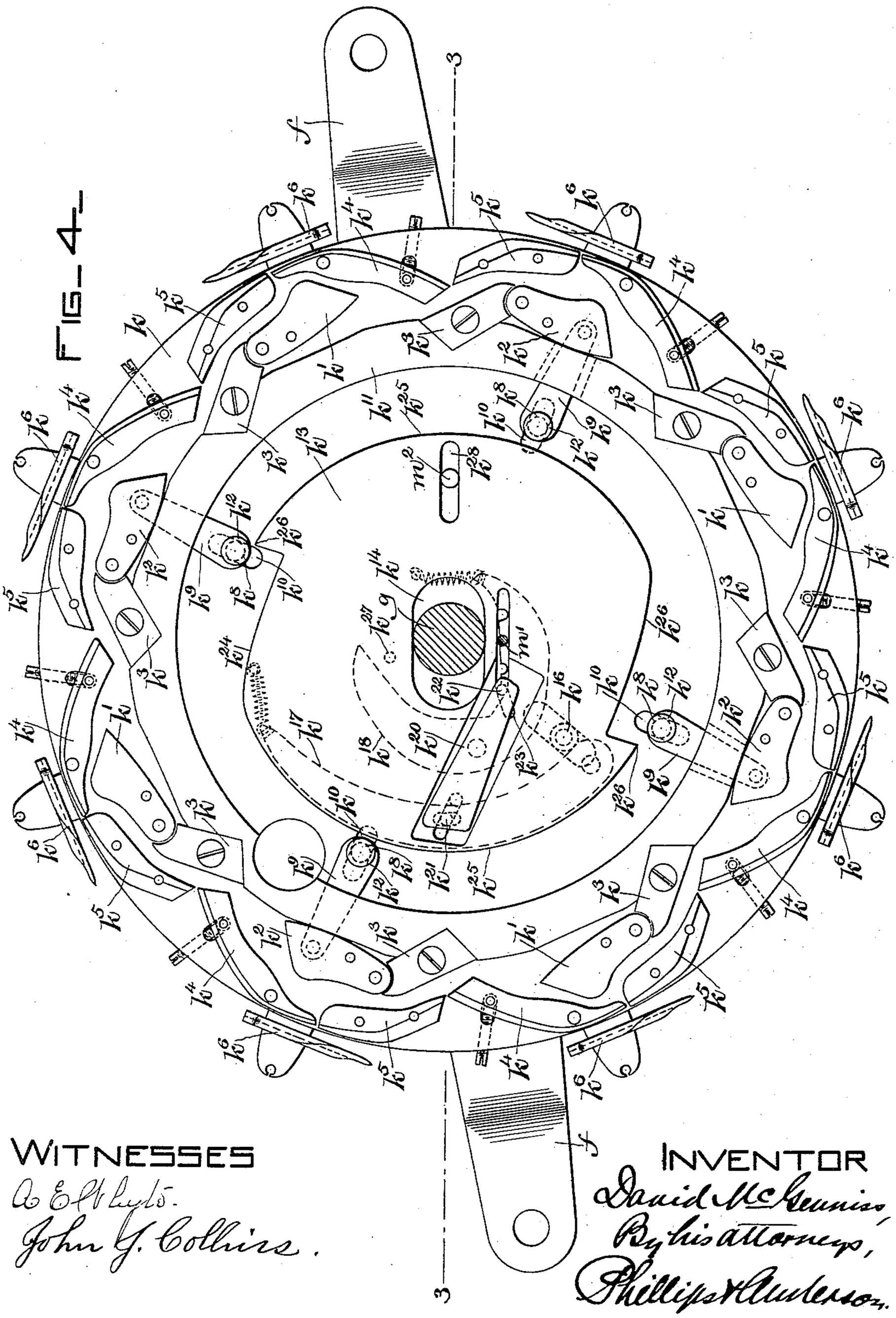
CIRCULAR KNITTING MACHINE.

(Application filed Apr. 4, 1898.)

(No Model.) 5 Sheets—Sheet 4.

FIG. 4.



WITNESSES

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No. 616,344. Patented Dec. 20, 1898.

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CIRCULAR KNITTING MACHINE.

(Application filed Apr. 4, 1898.)

(No Model.) 5 Sheets—Sheet 5.

FIG. 6.

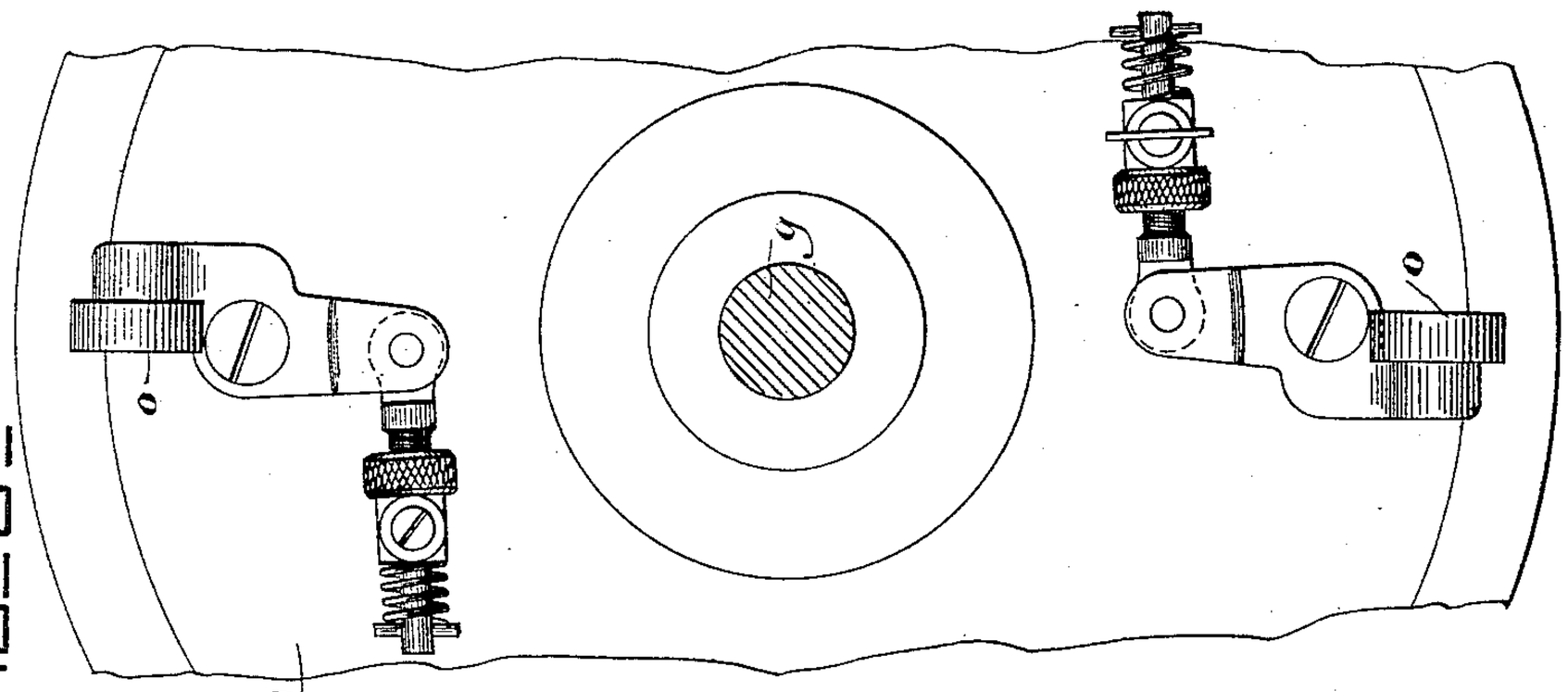
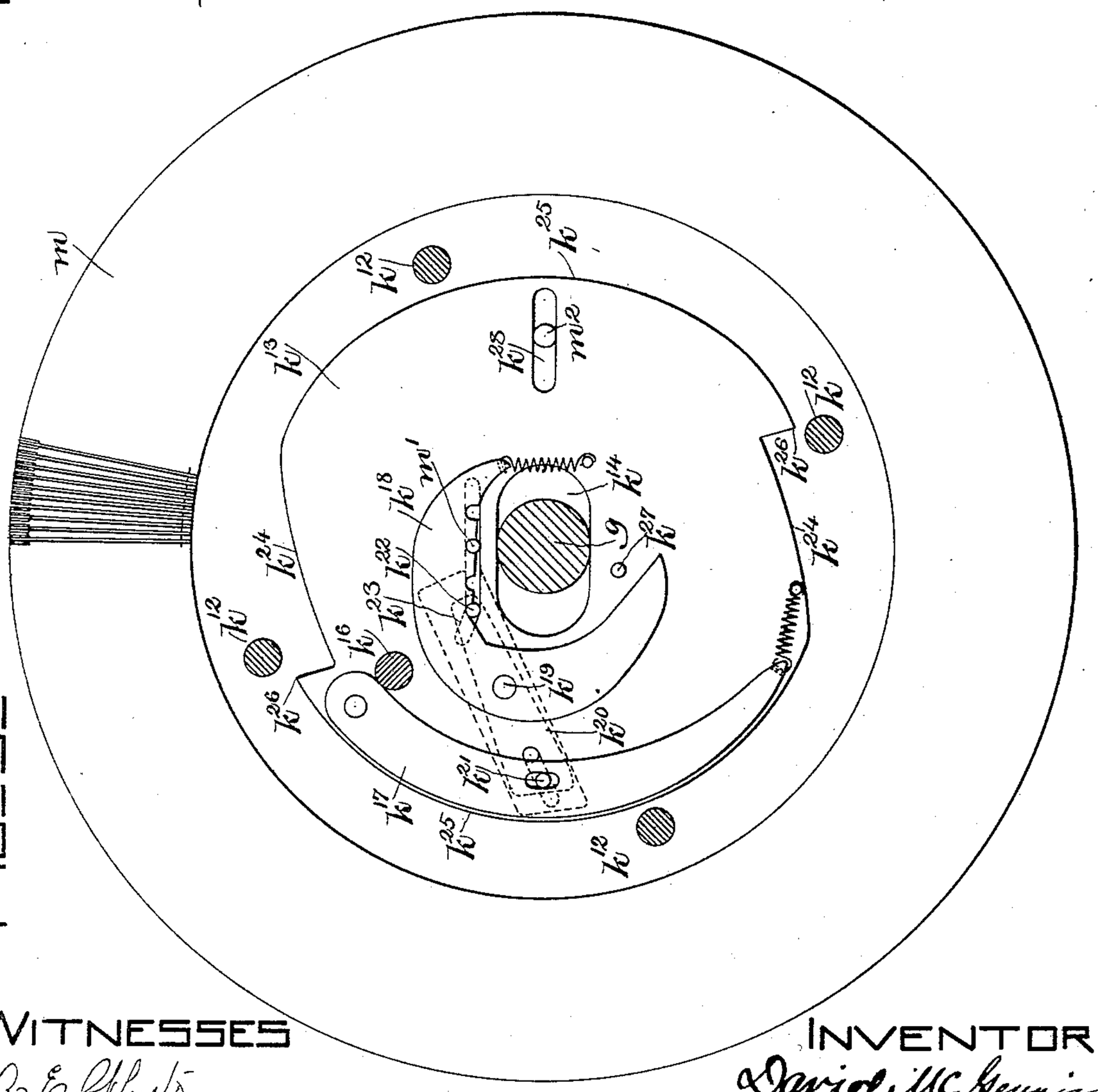


FIG. 5.



WITNESSES

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CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 616,344, dated December 20, 1898.

Application filed April 4, 1898. Serial No. 676,350. (No model.)

To all whom it may concern:

Be it known that I, DAVID MCGENNISS, a citizen of the United States, residing at Easthampton, in the county of Hampshire and State of Massachusetts, have invented certain new and useful Improvements in Circular-Knitting Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to circular-knitting machines, and more particularly to those provided with two sets of needles so operated as to produce plain or tuck rib fabric. I may, however, employ only one set of needles so operated as to produce plain or tuck stitch fabric.

As the sleeves and legs of knitted garments have been heretofore commonly produced a tubular knitted blank has been formed having alternate sections throughout the tube of stitches of different character, a comparatively long section for the body portion of the sleeve being formed with one kind of stitch, usually a tuck-rib stitch, and shorter sections being formed integrally with the longer sections for the wristbands and anklets of a different stitch, usually termed "plain-rib" stitch. The tubular blanks are usually produced of indefinite length, and in the formation of sleeves for undershirts or like garments a section is cut from the tubular blank consisting of a short section of plain stitch and a long section of tuck-stitch. This blank was cut to form sleeves and legs for underwear, but involved a considerable waste of fabric, and my improved knitting-machine has produced a new form of blank whereby the waste is almost entirely eliminated. The blank produced by this machine is formed with a body of tuck-rib fabric having at intervals on opposite sides of the body blocks of plain-rib fabric from which the cuffs of the sleeves and legs are to be formed. The tuck-rib tube is a one-and-one-rib fabric, the stitches of one wale being tuck or two-thread stitches and those of the next wale being plain or one-thread stitches, the machine herein described making a tube of which the stitches formed by the dial-needles are tuck and those formed by the cylinder-needles plain.

For a more particular description of my improved blank and the method of making garments from the same reference may be had to my copending application, Serial No. 666,101, filed January 8, 1898.

It is to be understood that my invention is not limited to a machine adapted to make a tuck-rib tube with plain-rib blocks therein, but contemplates the making of a blank tube formed with a body of one character of stitch having blocks therein of a different character of stitch—as, for example, the making of a blank with plain-stitch tube having blocks therein of tuck-rib fabric or the making of a blank with a tube of plain reinforced fabric adapted to be fleeced and having blocks therein of unreinforced fabric made of any desired kind of rib-stitch; but I do not claim to be the first to make a machine to make a tube with reinforced blocks therein, as I am aware that such machines are old and well known.

In the drawings accompanying this specification I have shown the preferred form of my invention, in which similar letters of reference designate corresponding parts, and in which—

Figure 1 is a side elevation of the upper part of the knitting-machine, with a portion of the supporting-framework in cross-section. Fig. 2 is a plan of the dial-cap and support therefor. Fig. 3 is a cross-section of the dial-cap, dial, and connected parts on the line 3 3, Figs. 2 and 4. Fig. 4 is a plan of the dial-cap and connected parts viewed from beneath. Fig. 5 is a plan of the dial and connected parts. Fig. 6 is a plan of a portion of the under side of the dial, showing the usual means for driving the dial from the needle-cylinder. Fig. 7 shows a piece of pattern-chain.

In the drawings, A represents the frame giving support to the bed-plate B, which supports the cam-cylinder C, which carries the cams for operating the cylinder-needles. Supported within the cam-cylinder is the needle-cylinder for carrying the cylinder-needles, the heels of which project into the cam-cylinder and are adapted to be operated by engagement of the cams therewith. The needle-cylinder is driven from the bevel-gear *a*

on the main driving-shaft by means of a corresponding bevel-gear *b* carried by the needle-cylinder. Depending from the needle-cylinder is the take-up for the knitted fabric, of which only part of the arms *c c'* are shown. The arm *c'* carries a cam adapted to actuate by intermediate mechanism the driving mechanism for the pattern-chain. Supported upon opposite sides of the bed-plate are two posts *e e*, which carry the crosstree *f*, from which are hung the dial-cap, dial, and connected parts. The parts so far described are or may be all as is common in this class of machines.

Rigidly supported in the center of the crosstree and depending vertically therefrom is the dial-shaft *g*, which is adjustable vertically in the usual manner to vary the length of the stitches by the hand-nut *h* and held in its adjusted position by the set-screw *i*. Upon the dial-shaft is secured the dial-cap *k* by means of a set-screw which passes through the hub *l* of the dial-cap. Rotatably mounted upon the dial-shaft below the dial-cap is the dial *m*, which is slotted radially in its outer upper portion for the reception of the dial-needles. The dial is supported by means of a collar *n*, fastened by a set-screw to the dial-shaft and rotated by the needle-cylinder by means of the usual driving-lugs projecting inward from the inner surface of the needle-cylinder, which engage the lugs *o*, pivotally supported upon the lower side of the dial.

Upon the lower surface of the dial-cap are mounted eight sets of knitting-cams. The number, however, is entirely immaterial, except that there must be an even number, and there must be the same number in the cam-cylinder. Of these four sets are fixed and alternately with them four have loose throwing-out cams. In case there were some other number of sets of knitting-cams then alternate throwing-out cams would be loose. By reference to Fig. 4 it will be seen that there are provided in the form illustrated four fixed throwing-out cams k' and four loose throwing-out cams k^2. The remaining cams are fixed, k^3 designating the thrust-cams, k^4 the draft-cams, and k^5 the guard-cams, the office of the last-named being simply to prevent the needles from jumping on sudden contact with the thrust-cams during fast running of the machine. The thread-guides are designated k^6 and lead the thread to both the cylinder and the dial needles at the same time.

During the knitting of the tube of tuck-rib the loose throwing-out cams will be held in their inner or retracted positions by the springs k^7, attached to pins k^8, carried by straps k^9 and movable in radial slots k^{10}, cut in the dial-cap inside of the cams, the straps passing under a ring k^{11} and being pivoted at their outer ends to the upper sides, respectively, of the loose throwing-out cams. In other words, the loose throwing-out cams are normally held in their retracted positions, so that when a needle is moved out by the adjacent thrust-cam it will take thread, but not move far enough to allow the loop already held by the hook to slide over the latch of the needle. So when the needle is drawn in again by the draft-cam the loop and thread just taken will both be held in the hook of the needle, and as the next throwing-out cam is fixed in the outer position the needle will be forced farther out than before and so that both threads will pass behind the latch and, on the needles being drawn in, be cast off on the thread just taken in the hook.

Opposite the pin k^8 and supported on the strap k^9, before referred to, is a cam-pin k^{12}, adapted to be engaged by the cam-disk k^{13}, by means of which at predetermined intervals the loose throwing-out cams are moved to their outer positions, so that plain rib will be knit around a portion of the circumference of the tube. If all the throwing-out cams were held out to the same position as that occupied by the fixed throwing-out cams, the needles would all be moved out, so that the loops would all pass behind the latches at every successive reciprocation of the needles and plain stitches made by all of the needles.

The cam-disk and associated parts and the mechanism for moving it will now be described. This cam-disk consists of a disk mounted in the dial-cap and provided in its center with a slot k^{14}. The size of the disk is such that when it is in its central position it will not engage any of the cam-pins k^{12}. In this position the dial-shaft will occupy the center of the slot. Upon the upper side of the dial-cap is a yoke k^{15}, which is connected by a strap *p* with a bell-crank arm *p'*, pivoted at one side of the machine and carrying upon its outer end a bowl adapted to be engaged by the pattern-chain *d*, before referred to. This pattern-chain *d* has links of three heights, the low links being lettered *d'* and the medium-height links being lettered d^2 and the high links being lettered d^3. When the low links are passing under the bowl of the bell-crank arm, the yoke k^{15} will be shifted to the left of the position shown in Fig. 2, and when the medium-height links are under the bowl of the bell-crank lever the yoke will be shifted to its middle position, as shown in Fig. 2, and when the high links are under the bowl the yoke will be shifted to the right of the position shown in Fig. 2. This yoke carries a shifting-pin k^{16}, which projects downwardly through the dial-cap into a position to engage two cam-levers pivoted upon the upper side of the cam-disk. The outer of these two cam-levers, k^{17}, is pivoted at one end and held in its normal position, as shown in Fig. 5, by a spring connected to its extreme end. The inner cam-lever k^{18} is pivoted upon the pin k^{19} and held in its normal position, as shown in Fig. 5, by a spring connected to one of its ends. When the yoke is moved to the left of the position shown in Fig. 2, it will move the shifting-pin k^{16} outwardly, and the pin, engaging the cam-lever k^{17} upon the cam-disk, will move the disk to the left of the

position shown in Fig. 5. This motion of the cam-disk is normally prevented by the stationary locking-pin m', fixed in and projecting upwardly from the dial, and which engages one of three notches in the cam-lever k^{18}; but when the cam-lever k^{17} is moved outwardly it carries a connecting-slide k^{20}. This slide is placed in a recess in the under side of the cam-disk and carries at its two ends pins k^{21} and k^{22}. The pin k^{21} projects upwardly through a slot in the cam-disk and engages a slot in the cam-lever k^{17}, so that when the cam-lever k^{17} is moved outwardly it moves the connecting-slide outwardly. The pin k^{22} upon the other end of the slide projects upwardly through an inclined slot k^{23} in the cam-disk, and as the slide is moved outwardly the pin is forced by the inclination of the slot away from the center of the disk and in such direction as to cause it to engage and rock the cam-lever k^{17}, to thereby release the cam-lever from engagement with the locking-pin m', whereby on the further rotational movement of the cam-disk against the shifting-pin k^{16} the cam-disk will be permitted to move and be moved to the left of the position shown in Fig. 5. This slide is in effect a connection between the two levers k^{17} and k^{18}, so that the operation of the lever k^{17} will cause the releasing of the lever k' from engagement with the pin m'. When the yoke is moved to the right of the position shown in Fig. 2, the shifting-pin k^{16} will be moved toward the center of the dial and engage the cam-lever k^{18}. The first result of this contact is to oscillate the cam-lever k^{18} and to release it from engagement with the locking-pin m', unlocking and permitting the further rotational movement of the cam-disk against the shifting-pin k^{16} to move the cam-disk to the left of the position shown in Fig. 5. The radius of curvature of the cam-pin-engaging portions of the cam-disk is such that when it is in its extreme right or left position it will engage the cam-pins k^{12} on the inclined surfaces k^{24}, force them outwardly, and during the sweeping of the surfaces k^{25} past the cam-pins it will hold them stationary and at the same distance from the center until shoulders k^{26} are reached and the pins are permitted to be retracted by their springs. The three notches in the lever k^{18} serve to hold the cam-disk in its three positions, namely—the right, the left, or the middle position. When the cam-disk is moved to the left, it results in the formation of a block of plain rib upon the side of the tuck-rib tube toward which the cam-disk is moved, and when the cam-disk is moved in the opposite direction it results in the knitting of a block of plain rib in the opposite side of the tuck-rib tube, and when it is in its middle position it is inactive and allows all of the loose throwing-out cams to be held by their springs in their inner positions, so that the tube will be formed of tuck-rib stitch. It will be seen that the pin k^{27} projecting upwardly from the surface of the cam-disk will prevent more than a certain amount of oscillation of the cam-lever k^{18}. When the cam-lever shall have been moved by its engagement with the shifting-pin k^{16} or by the engagement of the cam-lever k^{17} with the shifting-pin indirectly through the slide k^{20}, so that the pin m' is disengaged from the notch which it occupied therein, any further movement of the cam-lever or either of them against the shifting-pin k^{16} will result in sliding the cam-disk to the right or to the left, as the case may be. This cam-disk is held from rotation with relation to the dial by a guide-pin m^2, fixed in the dial and projecting upwardly to engage the radial guide-slot k^{28} cut in the cam-disk. Thus the two slots k^{14} and k^{28}, the one occupied by the dial-shaft and the other by the guide-pin m^2, completely constrain the movements of the cam-disk to right-line movements in the direction of the slots. So it is seen that the cam-disk rotates constantly with the dial, and the result is, as before indicated, that each cam-pin k^{12} is moved out in turn as the dial and cam-disk revolve; but to whichever side of the dial the cam-disk is shifted the group of needles on that side will knit plain stitch as the cam-disk comes in contact with the cam-pin k^{12}, and the remainder of the tube will be tuck-stitch. It must of course be understood that as the dial and its needles and the cylinder and its needles are both revolving in the same direction and at the same rate of speed the fabric is carried with them and that the cam-disk preserves a constant relation, so far as rotation is concerned, to the fabric.

Throughout the specification and claims I have used the expression "plain stitch" to distinguish from tuck-stitch, both of which indicate the character of the stitch, whether the fabric be ribbed or plain. I have also used the expression "set of needles" to designate the needles all of which are operated upon by one series of cams—as, for instance, the dial-needles constitute one set of needles and the cylinder-needles constitute another set of needles; but I do not specifically limit myself to such arrangement of the needles, for both sets of needles might be supported on dials or on cylinders or on cones, as desired. By the expression "group of needles" I have designated those needles of a set of needles which operate in a different manner from the remainder of the needles of the set—as, for example, the dial-needles which knit the block of plain stitch in the tube of tuck-stitch constitute a group of needles. By the expression "similar needles," wherever I have used those words in the claims, I desire to limit the combination to one in which the needles are all alike, to sharply distinguish from machines which employ needles some of which have their heels in one place on the shank and some in a different position, adapting them for actuation by different sets of actuating-cams, or which employ needles differing from each other in other respects.

My invention is applicable to the cylinder-needles as well as the dial-needles by making such changes as are necessitated by the change of location. I do not, therefore, limit my claims to the precise form of machine described.

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

1. In a circular-knitting machine, the combination with similar needles and means for actuating them, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of the needles to knit a block in the tube of a different character from the remainder of the tube.

2. In a circular-knitting machine, the combination with needles and means for actuating them, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of the needles to knit a block in the tube of a different character of stitch from the remainder of the tube, and locking means to lock the stitch-changing device in different positions.

3. In a circular-knitting machine, the combination with similar needles and means for actuating them, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of the needles to knit a block in the tube of a different character of stitch from the remainder of the tube, and pattern-controlling mechanism for throwing the stitch-changing device into and out of operation.

4. In a circular-knitting machine, the combination with needles and means for actuating them, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of the needles to knit blocks in the tube of a different character of stitch from the remainder of the tube, and pattern-controlling mechanism for throwing the stitch-changing device into operation on one side of the tube, to actuate one group of needles out of operation and into operation on the opposite side of the tube to actuate another group of needles successively.

5. In a circular-knitting machine, the combination with needles and means for actuating them, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of the needles to knit a block in the tube of a different character of stitch from the remainder of the tube, pattern-controlling mechanism for throwing the stitch-changing device into and out of operation to actuate the group of needles, and locking means to lock the stitch-changing device in different positions.

6. In a circular-knitting machine, the combination with similar needles and means for actuating them to knit tuck-stitch, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of them to knit a block of plain stitch in the tube.

7. In a circular-knitting machine, the combination with needles and means for actuating them to knit tuck-stitch, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of the needles to knit a block of plain stitch in the tube, and locking means to lock the stitch-changing device in different positions.

8. In a circular-knitting machine, the combination with similar needles, and means for actuating them to knit tuck-stitch, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of them to knit a block of plain stitch in the tube, and pattern-controlling mechanism for throwing the stitch-changing device into and out of operation.

9. In a circular-knitting machine, the combination with needles and means for actuating them to knit tuck-stitch, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of them to knit blocks of plain stitch in the tube, and pattern-controlling mechanism for throwing the stitch-changing device into operation on one side of the tube, to actuate one group of needles out of operation and into operation on the other side of the tube to actuate another group of needles successively.

10. In a circular-knitting machine, the combination with needles and means for actuating them to knit tuck-stitch, of a stitch-changing device for changing the actuating means for the needles to cause a certain group of them to knit a block of plain stitch in the tube, pattern-controlling mechanism for throwing the stitch-changing device into operation to actuate the group of needles and out of operation, and locking means to lock the stitch-changing device in different positions.

11. In a circular-knitting machine, the combination with similar needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, and a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit a block of plain stitch in a tube of tuck-stitch, substantially as described.

12. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to

cause the group to knit a block of plain stitch in a tube of tuck-stitch, and locking means to lock the stitch-changing device in different positions, substantially as described.

13. In a circular-knitting machine, the combination with similar needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit a block of plain stitch in a tube of tuck-stitch, and pattern-controlling mechanism for throwing the stitch-changing device into and out of operation, substantially as described.

14. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of certain groups of needles to cause the groups respectively to knit at intervals and on opposite sides of the tube-blocks of plain stitch in a tube of tuck-stitch, and pattern-controlling mechanism for throwing the stitch-changing device into operation on one side of the tube, out of operation and into operation on the other side of the tube successively, substantially as described.

15. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit a block of plain stitch in a tube of tuck-stitch, pattern-controlling mechanism for throwing the stitch-changing device into and out of operation, and locking means to lock the stitch-changing device in different positions, substantially as described.

16. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, and a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, substantially as described.

17. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, and locking means to lock the cam-disk in different positions, substantially as described.

18. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions, and the loose throwing-out cams being held normally in retracted positions, a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, and pattern-controlling mechanism for throwing the cam-disk to right, left or middle positions, to cause it to operate, respectively upon groups of needles on opposite sides of the dial, or to remain inoperative, substantially as described.

19. In a circular-knitting machine, the combination with the needles, of means for actuating them provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions, and the loose throwing-out cams being held normally in retracted positions, a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, pattern-controlling mechanism for throwing the cam-disk to the right, left or middle positions, to cause it to operate, respectively, upon groups of needles on opposite sides of the dial, or to remain inoperative, and locking means to lock the cam-disk in its several positions, substantially as described.

20. In a circular-knitting machine, the combination with a set of needles and a set of similar needles, arranged to coöperate in the production of a knitted fabric, means for actuating the first set of needles, means for actuating the set of similar needles, and a stitch-changing device for changing the actuating means of the latter set of needles to cause them to knit a block in the tube of a different character of stitch from the remainder of the tube.

21. In a circular-knitting machine, the combination with two sets of needles arranged to coöperate in the production of a knitted fabric, means for actuating one set of needles, means for actuating the other set of needles, a stitch-changing device for changing the actuating means of the latter set of

needles to cause them to knit a block in the tube of a different character of stitch from the remainder of the tube, and locking means to lock the stitch-changing device in different positions.

22. In a circular-knitting machine, the combination with a set of needles and a set of similar needles, arranged to coöperate in the production of a knitted fabric, means for actuating the first set of needles, means for actuating the set of similar needles, a stitch-changing device for changing the actuating means of the latter set of needles to cause them to knit a block in the tube of a different character of stitch from the remainder of the tube, and pattern-controlling mechanism for throwing the stitch-changing device into and out of operation.

23. In a circular-knitting machine, the combination with two sets of needles arranged to coöperate in the production of a knitted fabric, means for actuating one set of needles, means for actuating the other set of needles, a stitch-changing device for changing the actuating means of the latter set of needles to cause them to knit a block in the tube of a different character of stitch from the remainder of the tube, pattern-controlling mechanism for throwing the stitch-changing device into and out of operation, and locking means to lock the stitch-changing device in different positions.

24. In a circular-knitting machine, the combination with a set of needles and a set of similar needles, arranged to knit rib-stitch, of means for actuating the first set of needles to make plain stitch and means for actuating the set of similar needles to make tuck-stitch, and a stitch-changing device for changing the actuating means of the latter set of needles to cause them to knit plain stitch for a portion of the circumference of the tube.

25. In a circular-knitting machine, the combination with two sets of needles arranged to knit rib-stitch, of means for actuating one set of needles to make plain stitch and means for actuating the other set of needles to make tuck-stitch, a stitch-changing device for changing the actuating means of the latter set of needles to cause them to knit plain stitch for a portion of the circumference of the tube, and locking means to lock the stitch-changing device in different positions.

26. In a circular-knitting machine, the combination of a set of needles and a set of similar needles, arranged to knit rib-stitch, means for actuating the first set of needles to make plain stitch, and means for actuating the set of similar needles to make tuck-stitch, a stitch-changing device for changing the actuating means of latter set of needles to cause them to knit plain stitch for a portion of the circumference of the tube, and pattern-controlling mechanism for throwing the stitch-changing device into and out of operation.

27. In a circular-knitting machine, the combination of two sets of needles arranged to knit rib-stitch, means for actuating one set of needles to make plain stitch, and means for actuating the other set of needles to make tuck-stitch, a stitch-changing device for changing the actuating means of the latter set of needles to cause them to knit plain stitch for a portion of the circumference of the tube, pattern-controlling mechanism for throwing the stitch-changing device into and out of operation, and locking means to lock the stitch-changing device in different positions.

28. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to knit plain stitch, of a set of similar dial-needles and means for actuating them to knit tuck-stitch and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, and a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the dial-needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, substantially as described.

29. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to knit plain stitch, of a set of dial-needles and means for actuating them to knit tuck-stitch and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the dial-needles to cause the group to knit blocks of plain stitch on a tube of tuck-stitch, and locking means to lock the stitch-changing device in different positions, substantially as described.

30. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to knit plain stitch, of a set of similar dial-needles and means for actuating them to knit tuck-stitch and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the dial-needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, and pattern-controlling mechanism for throwing the stitch-changing device into and out of operation, substantially as described.

31. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to knit plain stitch, of a set of dial-needles and means for actuating them to knit tuck-stitch and provided

with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a stitch-changing device for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the dial-needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, pattern-controlling mechanism for throwing the stitch-changing device into and out of operation, and locking means to lock the stitch-changing device in different positions, substantially as described.

32. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to make plain stitch, of a set of similar dial-needles and means for actuating them to knit tuck-stitch, and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions, and the loose throwing-out cams being held normally in retracted positions, and a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, substantially as described.

33. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to make plain stitch, of a set of dial-needles and means for actuating them to knit tuck-stitch and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions and the loose throwing-out cams being held normally in retracted positions, a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, and locking means to lock the cam-disk in different positions, substantially as described.

34. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to make plain stitch, of a set of dial-needles and means for actuating them to knit tuck-stitch and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions, and the loose throwing-out cams being held normally in retracted positions, a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, and pattern-controlling mechanism for throwing the cam-disk to right, left or middle positions, to cause it to operate, respectively, upon groups of needles on opposite sides of the dial, or to remain inoperative, substantially as described.

35. In a circular-knitting machine, the combination with a set of cylinder-needles and means for actuating them to make plain stitch, of a set of dial-needles and means for actuating them to knit tuck-stitch, and provided with alternate fixed and loose throwing-out cams, the fixed throwing-out cams being held in outer positions, and the loose throwing-out cams being held normally in retracted positions, a movable cam-disk for moving the loose throwing-out cams to outer positions during the passage by them of a certain group of the needles to cause the group to knit blocks of plain stitch in a tube of tuck-stitch, pattern-controlling mechanism for throwing the cam-disk to the right, left or middle positions, to cause it to operate respectively, upon groups of needles on opposite sides of the dial, or to remain inoperative, and locking means to lock the cam-disk in its several positions, substantially as described.

36. In a dial knitting-machine, the combination with a dial, similar dial-needles, dial-cap and needle-actuating cams to cause the needles to knit tuck-stitch, of a movable cam-disk to throw the needle-actuating cams into position to knit plain stitch, and means for moving the cam-disk, substantially as described.

37. In a dial knitting-machine the combination with a dial, dial-needles, dial-cap and needle-actuating cams to cause the needles to knit tuck-stitch, of a movable cam-disk to throw the needle-actuating cams into position to knit plain stitch, means for moving the cam-disk and locking means to lock the cam-disk in different positions, substantially as described.

38. In a dial knitting-machine, the combination of a dial, dial-needles, dial-cap, and needle-actuating cams to cause the needles to knit tuck-stitch, of a locking-pin, a movable cam-disk to throw the needle-actuating cams into position to knit plain stitch, the said cam-disk carrying two pivoted cam-levers operatively connected together, one being provided with locking-pin-engaging portions and adapted when oscillated to be disengaged from or to engage the locking-pin, and a shifting-pin adapted to engage the cam-levers to unlock the cam-disk and move it to the desired position, substantially as described.

39. In a dial knitting-machine, the combination with a dial, dial-needles, dial-cap, and needle-actuating cams to cause the needles to knit tuck-stitch, of a locking-pin, a movable cam-disk to throw the needle-actuating cams into position to knit plain stitch, the said cam-disk carrying two pivoted cam-levers operatively connected together, one being provided with locking-pin-engaging portions and adapted when oscillated to be disengaged from or to engage the locking-pin, a shifting-pin adapted to engage the cam-levers to unlock the cam-disk, and pattern-controlling mechanism for moving the shifting-pin, substantially as described.

40. In a dial knitting-machine, the combi-

nation with a dial, dial-needles, dial-cap and needle-actuating cams to cause the needles to knit tuck-stitch, of a movable cam-disk to throw the needle-actuating cams into position to knit plain stitch, the said cam-disk being provided with the two opposite operative faces and adapted to be moved to opposite sides of the dial to cause opposite groups of needles to knit plain stitch, whereby blocks of plain stitch will be knit in opposite sides of a tuck-tube, and means for moving the cam-disk, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

DAVID McGENNISS.

Witnesses:
EMIL C. KOENIG,
ARTHUR A. KOENIG.