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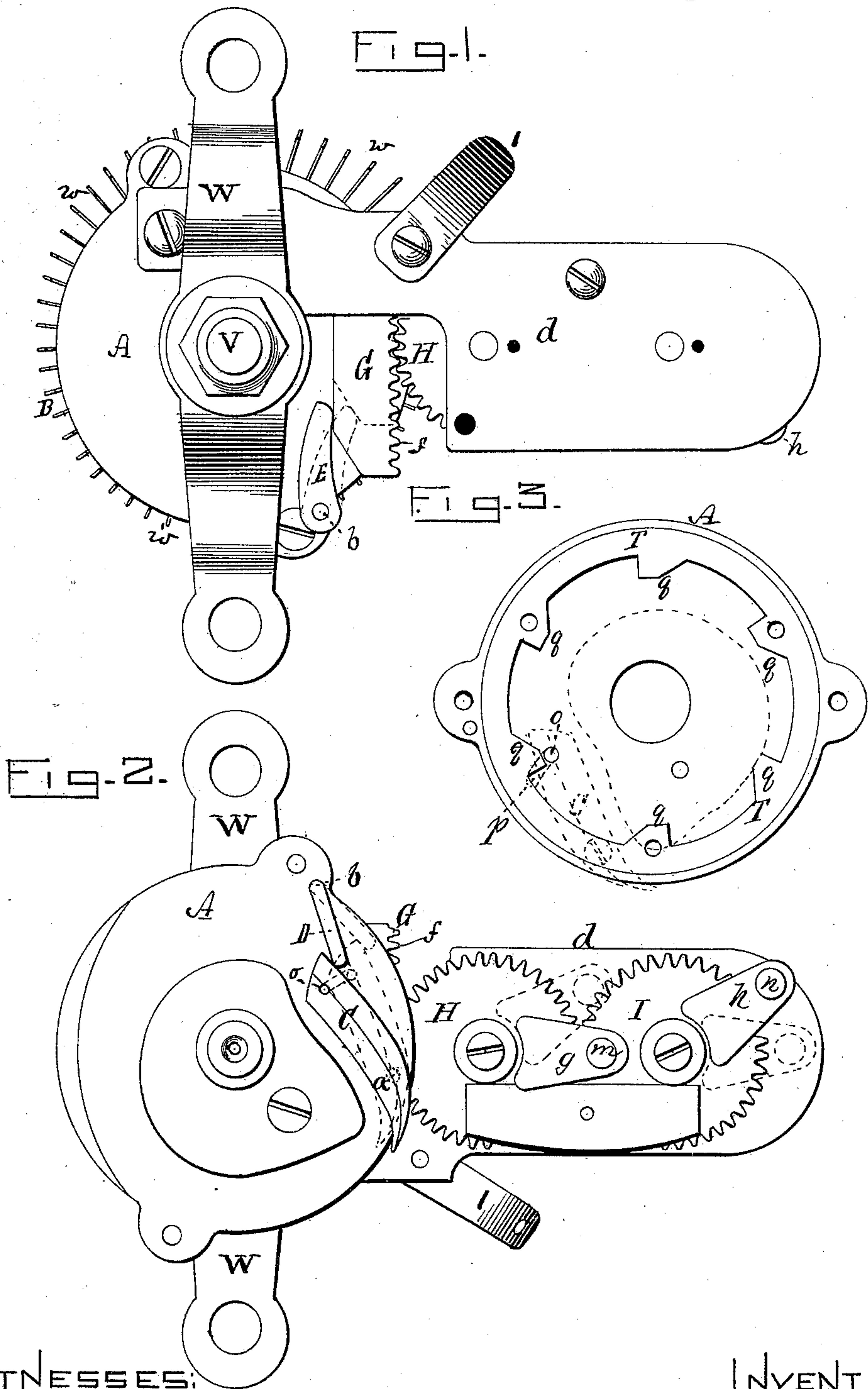
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W. H. PEPPER & A. T. L. DAVIS.

CIRCULAR KNITTING MACHINE.

No. 401,791.

Patented Apr. 23, 1889.



WITNESSES:
Morris F. Clark.
Charles H. Rauber.

INVENTOR.
Wm. H. Pepper
Albert T. L. Davis,
By their attorney,
J. E. Mowbray

(No Model.)

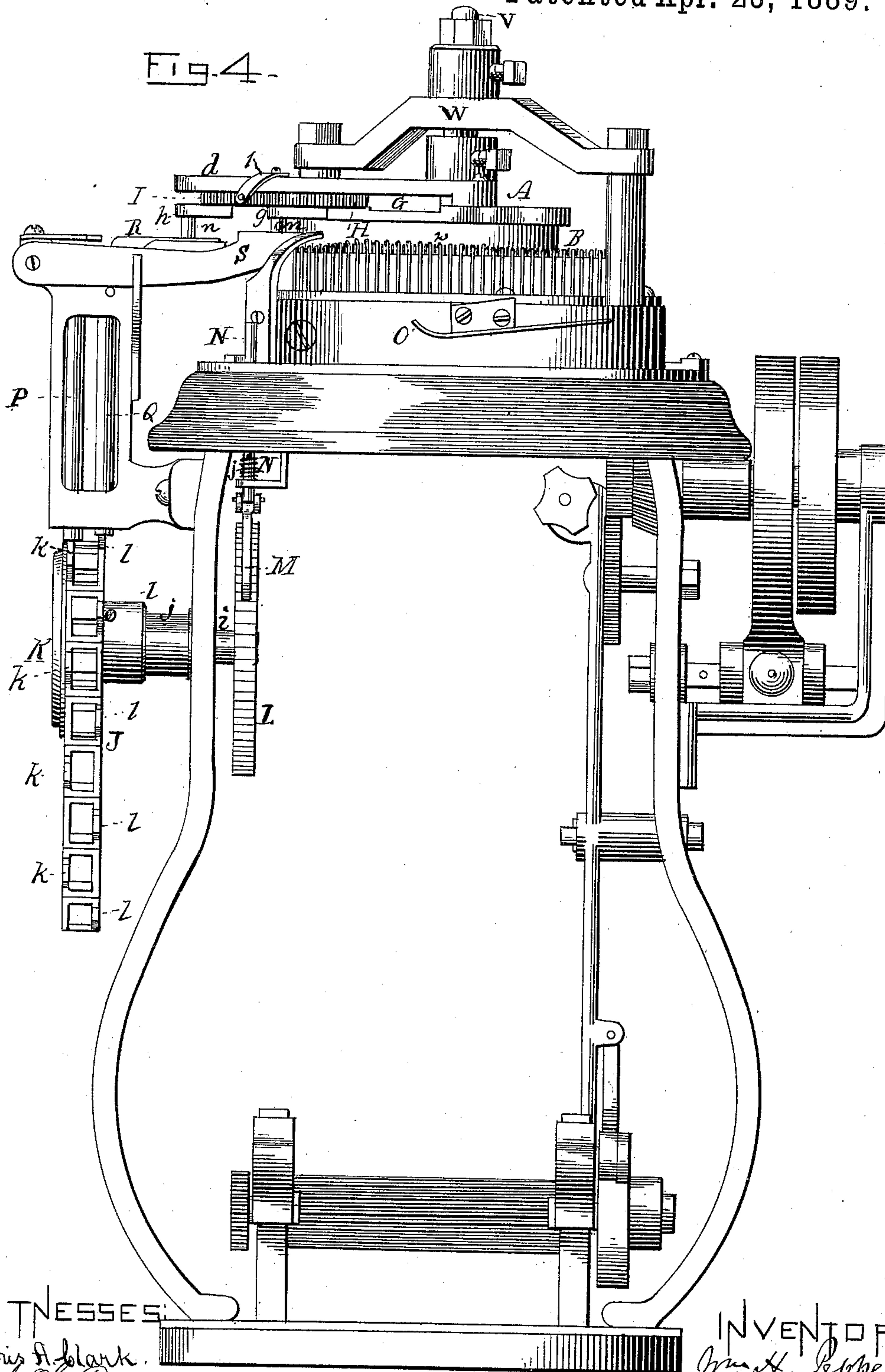
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WITNESSES:

Foris A. Clark.
Charles H. Raeder

INVENTORS.

Wm. H. Pepper.
Albert T. L. Davis.
By their attorney,
J. S. Brown

(No Model.)

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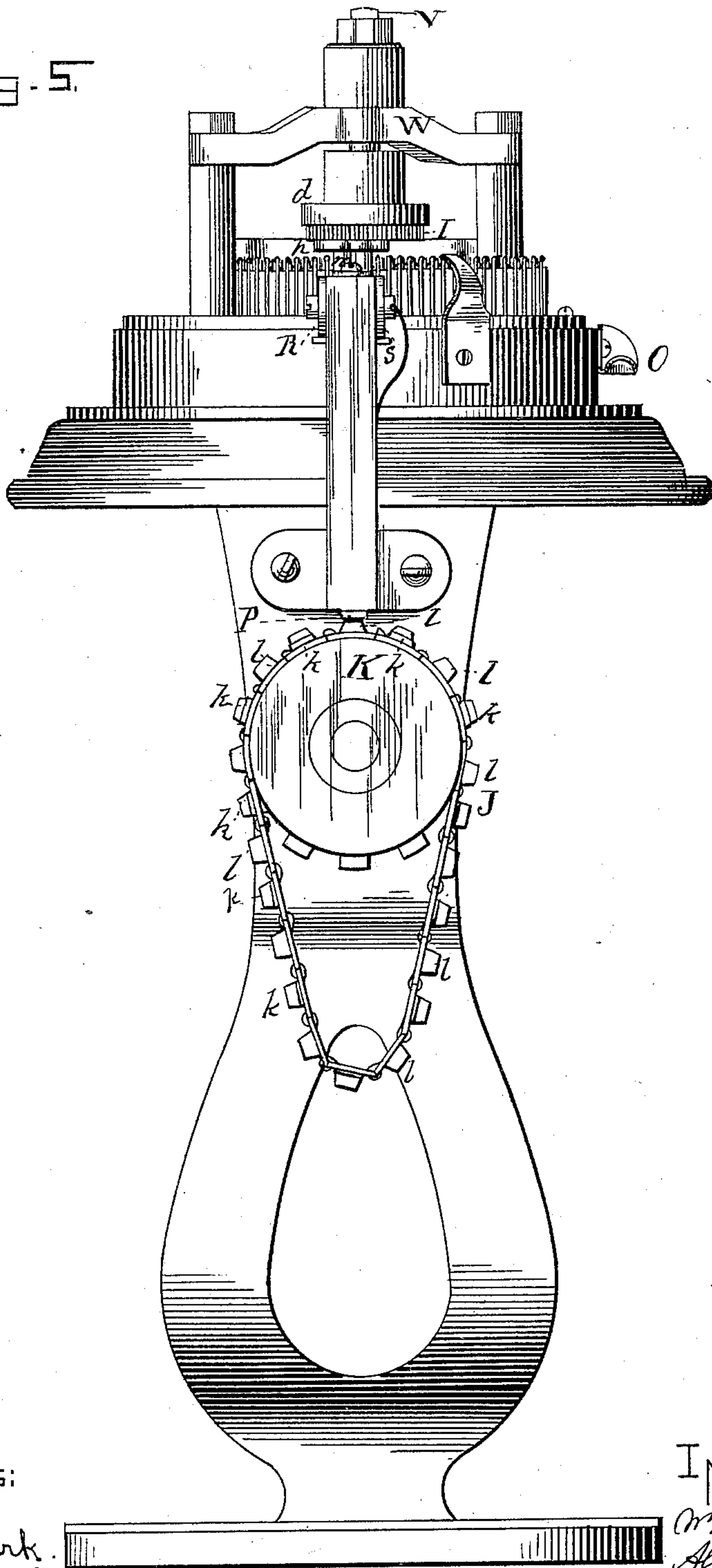
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Fig. 5.



WITNESSES:

Norris A. Clark.
Charles H. Raeder.

INVENTOR:

W. H. Pepper,
A. T. L. Davis,
By their attorney,
J. S. Brown.

(No Model.)

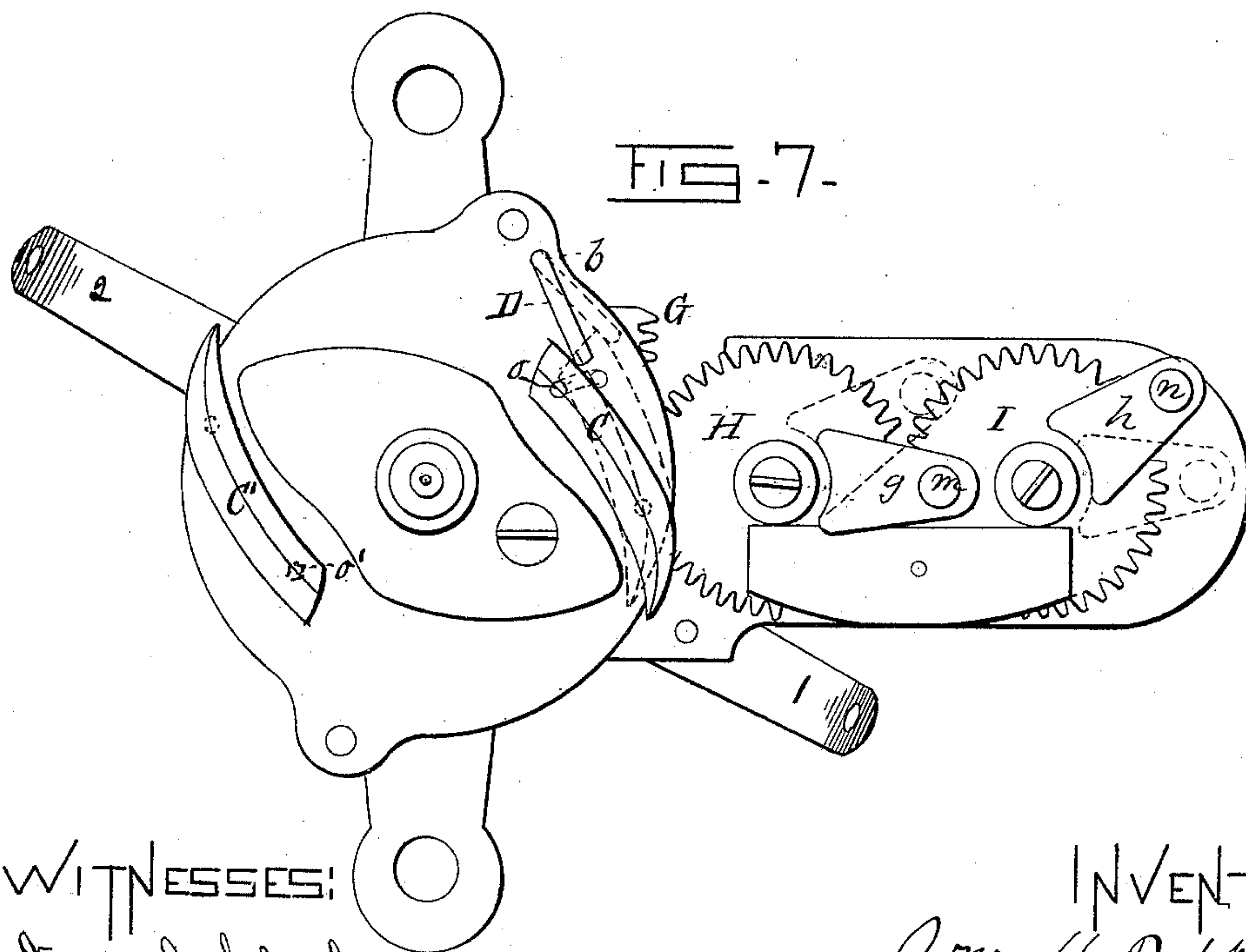
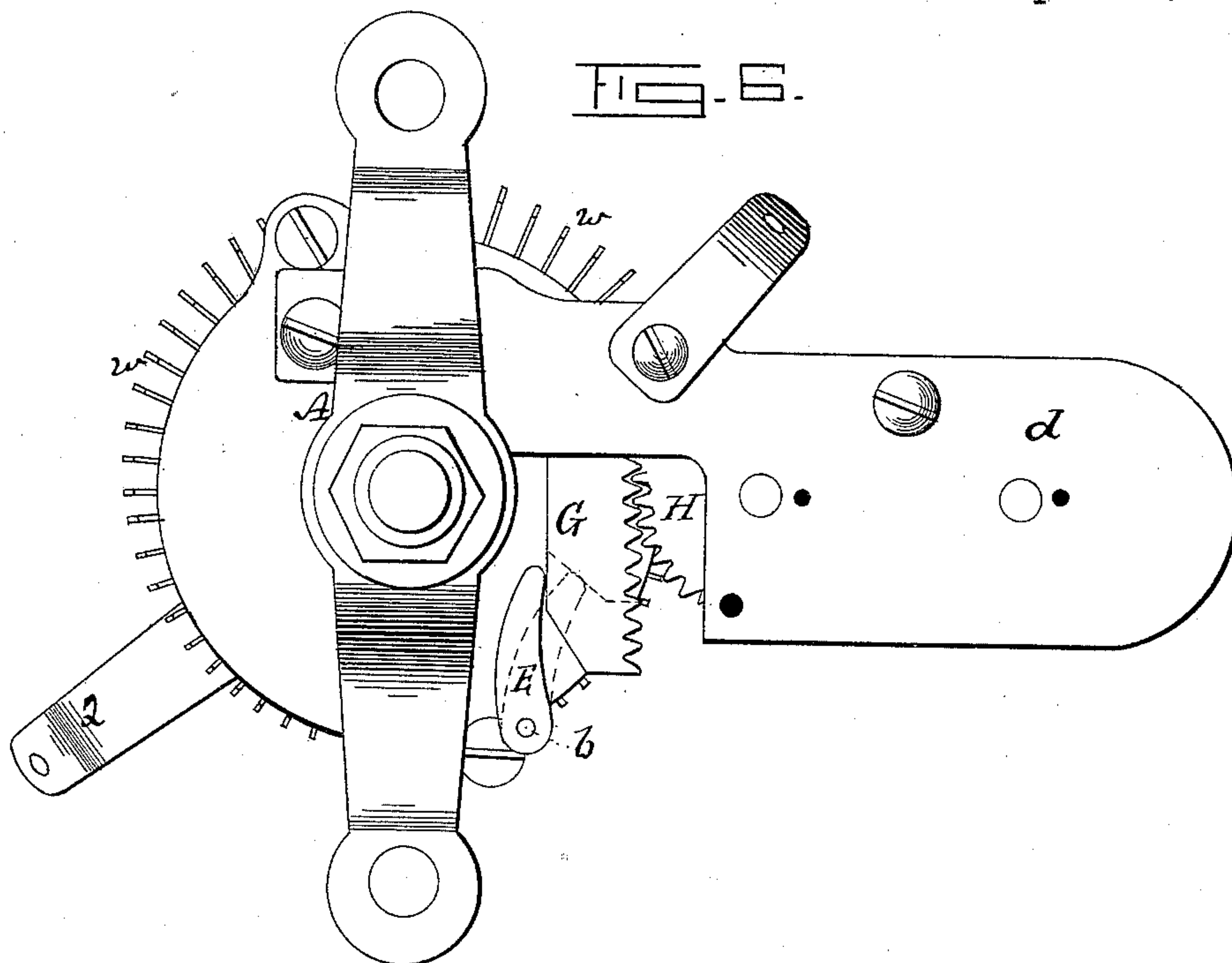
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WITNESSES:
Morris A. Clark,
Charles H. Rader.

INVENTOR:
Wm. H. Pepper,
Albert T. L. Davis,
By their attorney,
J. B. Brown.

(No Model.)

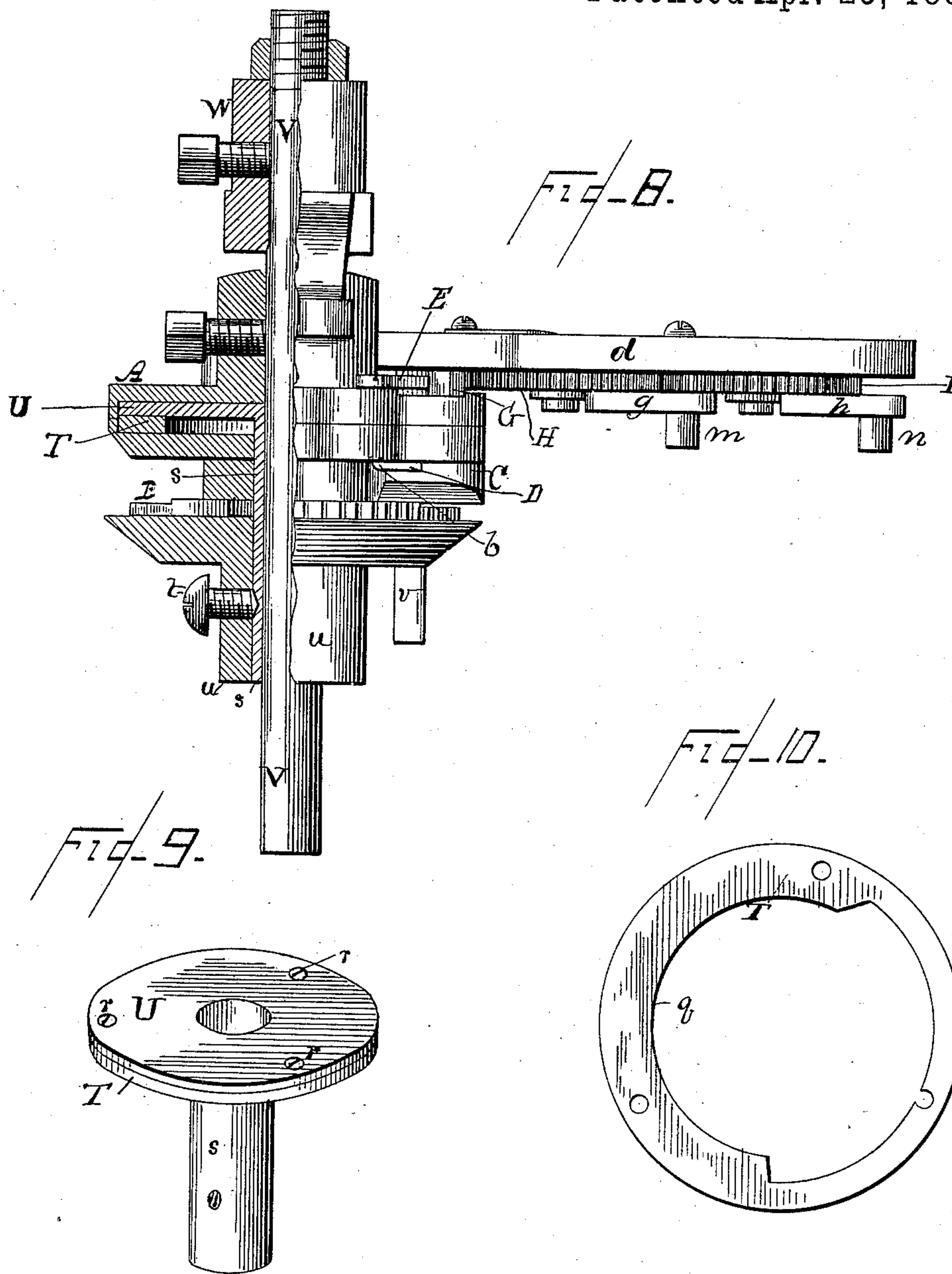
5 Sheets—Sheet 5.

W. H. PEPPER & A. T. L. DAVIS.

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Patented Apr. 23, 1889.



Witnesses,
Louis A. Clark,
Hugh D. Crosby.

Inventors,
Wm. H. Pepper,
Albert T. L. Davis,
By their Attorney,
J. S. Brown.

UNITED STATES PATENT OFFICE.

WILLIAM H. PEPPER AND ALBERT T. L. DAVIS, OF LAKE VILLAGE, NEW HAMPSHIRE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 401,791, dated April 23, 1889.

Application filed June 5, 1886. Serial No. 167,762. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM H. PEPPER and ALBERT T. L. DAVIS, of Lake Village, in the county of Belknap and State of New Hampshire, have invented certain Improvements in Circular-Knitting Machines; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

Our improvements relate to circular-knitting machines having both cylinder and dial needles for knitting ribbed work; and the improvements consist in appliances or combinations of mechanism, substantially as hereinafter set forth, and pointed out in the claims, whereby goods may be knit in various patterns by combining or alternating simple ribbed work with "tuck-stitch" rib-work, and either with one color of yarn or with a combination of different-colored yarns, all automatically controlled by a pattern-chain or equivalent pattern mechanism.

In the accompanying drawings, Figure 1 represents a top view of the cap, yoke, and portion of the dial-needles of a knitting-machine provided with our improvements as applied to a machine knitting with a single thread; Fig. 2, an under side view of the cap with its cams and parts of the yoke of the machine with the improvements applied thereto; Fig. 3, a view of one of the cam-rings in place in the cap for moving the drawing-in cam of the machine as applied in these improvements; Fig. 4, a front view of a knitting-machine provided with the cap and appliances shown in the above-mentioned figures, and provided with a pattern mechanism for controlling the movements of the said appliances; Fig. 5, a side view of the machine; Fig. 6, a top view of the cap of a knitting-machine having two feeds for knitting with two colors of yarn at the same time, and provided with the same appliances as in the single-feed machine shown in the above-mentioned figures; Fig. 7, an under side view of the same; Fig. 8, a partial side view and part central vertical section of the cap and parts immediately connected therewith, including the dial; Fig. 9, a perspective view of the disk to which the cam in the cap is attached, showing the sleeve

which extends from this disk down within the dial for attachment thereto; Fig. 10, a view of a modified form of the cap-cam.

Like letters designate corresponding parts in all of the figures.

The tuck-stitch being produced in a cylinder and dial or rib-knitting machine by laying the thread or yarn twice successively upon the dial-needles and then knitting off the stitches with these double threads or yarns, we provide for automatically moving the drawing-in cam or cams of the dial-needles alternately out and in to produce this tuck-stitch work by means represented in the drawings, as follows:

First, referring to Figs. 1, 2, and 3, wherein a single thread-guide is shown, A represents the cap, *w* the dial-needles, and C a single drawing-in cam for the dial-needles swinging on a pivot, *a*, at one end. An arm or lever, D, under the cap and outside of the movable end of the drawing-in cam, has a pivot, *b*, extending up through the cap and turning therein; and to the upwardly-projecting end of the pivot an arm, E, is secured and extends along the upper side of the cap in the direction substantially as shown in Fig. 1. The lever D and its actuating-arm E are so arranged that when they are in the position shown by full lines in Figs. 1 and 2 the drawing-in cam C is moved into position for fully operating the dial-needles, and when they are in the position shown by dotted lines in the same figures the drawing-in cam may be thrown or moved out into a position where it does not act to draw the dial-needles entirely in. In order to move the cam into its fully-operative position automatically, we employ a wedge or cam-acting slide, G, arranged to have a longitudinally-sliding movement on the top of the cap, so as to alternately force the arm E inward, as indicated by full lines in the drawings, and away from the position of the said arm, as shown by dotted lines in the figures referred to. When the slide is moved into the dotted-line position shown, and the lever-arm E is free to be moved outward, together with the lever D, the drawing-in cam C is drawn outward into partially-inoperative position by the elastic drawing outward of the stitches of the knit web upon the dial-

needles, the butts of which consequently push outward against the said drawing-in cam. The slide G is connected with a pattern-chain by means of the device shown in Figs. 1 and 2, and the general views, Figs. 4 and 5. A pinion, H, is pivoted to an arm, *d*, projecting outward from the dial-cap and geared into rack-teeth *f* on the adjacent edge of the slide. This pinion H also gears into another pinion, I, also pivoted to the under side of the arm *d*, outside of the first pinion. The two pinions H I therefore turn in opposite directions, so that two arms, *g h*, attached, respectively, to the said pinions underneath the same and extended outward from the machine, if moved laterally in the same direction will reverse—one the motion of the other—and consequently will move the slide geared to the inner pinion in opposite directions. In order to effect this lateral movement of the arms *g h*, first one and then the other, we make use of a pattern mechanism in connection with the revolving movement of the dial-cap which carries the arm *d* and the said pinions and their arms around with it at every round of stitches knit upon the web.

Figs. 4 and 5 show a pattern mechanism arranged in connection with the pinions H I and their respective arms substantially in the following manner: A pattern-chain, J, is mounted on a sprocket-wheel, K, secured to a horizontal shaft, *i*, revolving in a suitable bearing or bearings, *j*, on the side of the machine-frame. On the inner end of the same shaft is secured a ratchet-wheel, L, upon which works a pawl, M, attached to a slide, N, having an up-and-down movement in a stationary part of the machine, as shown, or otherwise, sufficient to work the pawl for moving the ratchet-wheel one tooth at every revolution of the machine. The downward operative movement of the slide N is or may be effected by a cam, O, attached to a revolving part of the machine in a position to act on the slide when it is brought in contact therewith. The slide is again raised after each downward movement by a counter-spring, *j*. Suitable cam projections, *k l*, on the pattern-chain pass alternately under the lower ends of two vertically-sliding rods, P Q, the upper ends of which, respectively, strike the under edges of two tappet-arms, R S, the former adapted, when raised by cam projections *k k* on the pattern-chain lifting the slide-rod P, to strike a pin or projection, *n*, on the arm *h* of the outer pinion, I, and the latter tappet-arm similarly adapted to strike a pin or projection, *m*, on the arm *g* of the inner pinion, H, when raised by cam projections *l l* on the pattern-chain, lifting its slide-rod Q. Thus arranged, when a cam projection, *k*, on the pattern-chain lifts the rod P, the next time that the dial-cap bearing the arm *d* turns round in the operation of knitting the arm *h* of the outer pinion, I, will strike the tappet-arm R and turn the said pinion far enough to move the slide G outward as far as required to

move the drawing-in cam into fully-operative position before the pin *m* of the said arm *g* will pass clear of the said tappet-arm, and when a cam projection, *l*, on the pattern-chain lifts the slide-rod Q similarly the arm *g* of the inner pinion, H, will strike the tappet-arm S and turn the said pinion far enough to move the slide G back, and allow the drawing-in cam to be drawn outward by the stitches of the web, so that it will not operate to cast off the stitches from the dial-needles. When these cam projections *k l* alternate at every link of the pattern-chain, or at every step-by-step movement thereof, as indicated on the upper part of the pattern-chain shown in Fig. 5, then the stitches are cast off from the dial-needles at every other round or revolution of the knitting-machine, and consequently tuck-stitches are produced in the work. Then, if a series of cam projections, thus alternating at every revolution of the machine, end with an outer cam projection, *k*, and the cam projections are then omitted for any number of revolutions of the machine, thus knitting simple ribbed work; and again, a series of alternating cam projections on the pattern-chain intervene, succeeded by a number of plain chain-links without cam projections, as before, there will be produced alternate lengths of tuck-stitch work, and of simple ribbed work; and these lengths can be varied in strips or bands of different characters at will by the simple change in the number and distances of the cam projections on the pattern-chain.

In order to further increase the capability of a knitting-machine for producing figured work, another feature of our invention consists in the employment of a cam ring or circle located in or on the dial-cap, as shown in Figs. 3 and 8, the former showing such a cam-ring, T, for directly controlling the outward and inward movements of the drawing-in cam for knitting work striped with alternate stripes of simple ribbed work and tuck-stitches. A pin or stud, *o*, projects upward from the movable end of the drawing-in cam through a slot, *p*, in the lower part of the dial-cap into a space in or over the cap-disk, where the cam-ring T is located and held stationary by suitable means, such as that shown in Figs. 8 and 9, consisting of a disk, U, to which the cam is secured by screws *r r*, the said disk having a sleeve, *s*, which extends downward around the revolving spindle V, that carries the dial-cap A, and is rotated by the yoke W, the said sleeve at its lower end being attached inside of the dial B by a screw, *t*, passed inward through the hub *u* of the dial, and the dial being held from turning by a projecting lug, *v*, which strikes against any fixed part of the machine, or any equivalent means. Thus the cam-ring does not turn with the dial-cap as the knitting-machine revolves. The stud turns round with the dial-cap inside of the cam-ring, the interior of the cam-ring proper being of sufficient diameter to allow the stud to play outward and inward with

the regular operative movements of the drawing-in cam; but at regular or any desired distances apart are formed any desired number of inwardly-projecting cams q upon the interior edge of the cam-ring, reaching inward, so as to free the stud o sufficiently to bring the drawing-in cam C into fully-operative position for casting off the stitches of the dial-needles.

One edge of each cam q is inclined, so that the pin o will pass around it with little friction. Thus constructed and arranged, the cam-ring has its cams opposite to a certain number of dial-needles and the spaces between its cams opposite to certain others of the dial-needles, alternating with the cylinder-needles. The needles opposite to the ring-cams q will always knit simple ribbed stitches in the work, since the drawing-in cam is always held in fully-operative position thereby, so that those needles cast off the stitches at every round knit; but the needles opposite to the spaces between the said ring-cams may knit either simple ribbed stitches or tuck-stitches, according as the drawing-in cam is controlled by other means.

In the present invention the other means described for controlling the drawing-in cam is the slide G and the pattern mechanism effecting its movements, as above described. The combined action and effect of the two devices together will be as follows: The dial-needles controlled by the ring-cams will always knit longitudinal or vertical stripes of simple ribbed stitches, and the intermediate dial-needles will knit tuck-stitches when there are alternating cam projections k l on the pattern-chain for all the successive revolutions of the machine, as above set forth, thereby making longitudinal tuck-stitch stripes alternating with the simple ribbed-stitch stripes knit with the ring-cam needles; but where there are no cam projections on the pattern-chain and the drawing-in cam is held in fully-operative position, as above set forth, then the dial-needles controlled by the pattern mechanism knit simple ribbed-stitch work, which, alternating with the same kind of work made by the ring-cam needles, make simple ribbed-stitch work all around the knit tube. Thus by simply arranging the pattern-chain so as to knit alternate lengths of ribbed-stitch work and tuck-stitch work, with the dial-needles controlled by it, a tube will be knit having a portion or portions of its length knit in transverse or horizontal stripes, each stripe being made up of alternating sections of the two kinds of stitches and another portion or portions of its lengths knit all around with transverse stripes of ribbed-stitch work.

In Fig. 3 we show a cam-ring having six cams and six intermediate spaces, so that with it six ribbed-stitch longitudinal stripes and six tuck-stitch longitudinal stripes may be knit. It is obvious that any other desired number of stripes may be knit by making

the corresponding number of ring-cams and intermediate spaces.

In Fig. 10 we show a cam-ring having but one cam and one space or depression on its inner edge, each occupying about one-half of the circle of the ring. With such a cam-ring a single tuck-stitch stripe may be knit on the legs of children's stockings to go over the knees, the tuck-stitches making heavier and more durable work than ribbed stitches.

We make a further improvement in the knitting-machine, organized as above set forth, by employing two or more feed-guides for knitting with two or more colors of yarn at the same time, whereby variations in color are added to variations in stitches to give greater variety to the work.

In Figs. 6 and 7 we show top and bottom views, respectively, of a dial-cap having two thread-guides, 1 2, two drawing-in cams, and two throw-out cams for knitting with two yarns of different colors. The additional drawing-in cam C' is stationary, and, with the exception of these added parts for knitting in the additional thread, all the parts are just the same as described for the single-thread machine; but the pattern-chain is provided only with cam projections for changing from striped tuck-stitch and plain ribbed work to all plain ribbed work, and vice versa. No shifting is required with this construction for knitting the tuck-stitches, since each thread is knit upon the needles on both sides and knit off only on one side, thus making tuck-stitches without further mechanism or operation, the additional drawing-in cam C' being permanently arranged to knit off the stitches on that side.

We claim as our invention—

1. The combination of the cap A , dial B , dial-needles w , thread-guide 1, drawing-in cam C , lever D , lever-arm E , slide G , pattern-chain J , and means, substantially as described, for actuating the said slide from the pattern-chain, substantially as and for the purpose herein specified.

2. The combination of the cap A , dial B , dial-needles w , two thread-guides, 1 2, movable drawing-in cam C , lever D , lever-arm E , slide G , pattern-chain J , means, substantially as described, for actuating the said slide from the pattern-chain, and stationary drawing-in cam C' , substantially as and for the purpose herein specified.

3. The combination of the cap A , drawing-in cam C , pivoted to the said cap and provided with a pin or projection, o , and a cam-ring, T , substantially as and for the purpose herein specified.

4. The combination of the cap A , dial B , dial-needles w , thread-guide 1, drawing-in cam C , provided with a pin or projection, o , and a cam-ring, T , substantially as and for the purpose herein specified.

5. The combination of the cap A , drawing-in cam C , provided with a pin or projection,

o, cam-ring T, slide G, a device connecting the cam and slide, pattern mechanism, and means, as described, intermediate between the slide and pattern mechanism, substantially as and for the purpose herein specified.

5 6. The combination of the cap A, dial B, dial-needles *w*, thread-guide 1, drawing-in cam C, provided with a pin or projection, o, cam-ring T, slide G, a device connecting the

cam and slide, pattern mechanism, and means, 10 as described, intermediate between the slide and pattern mechanism, substantially as and for the purpose herein specified.

WM. H. PEPPER.

ALBERT T. L. DAVIS.

Witnesses:

THOMAS HAM,

E. H. BLAISDELL.