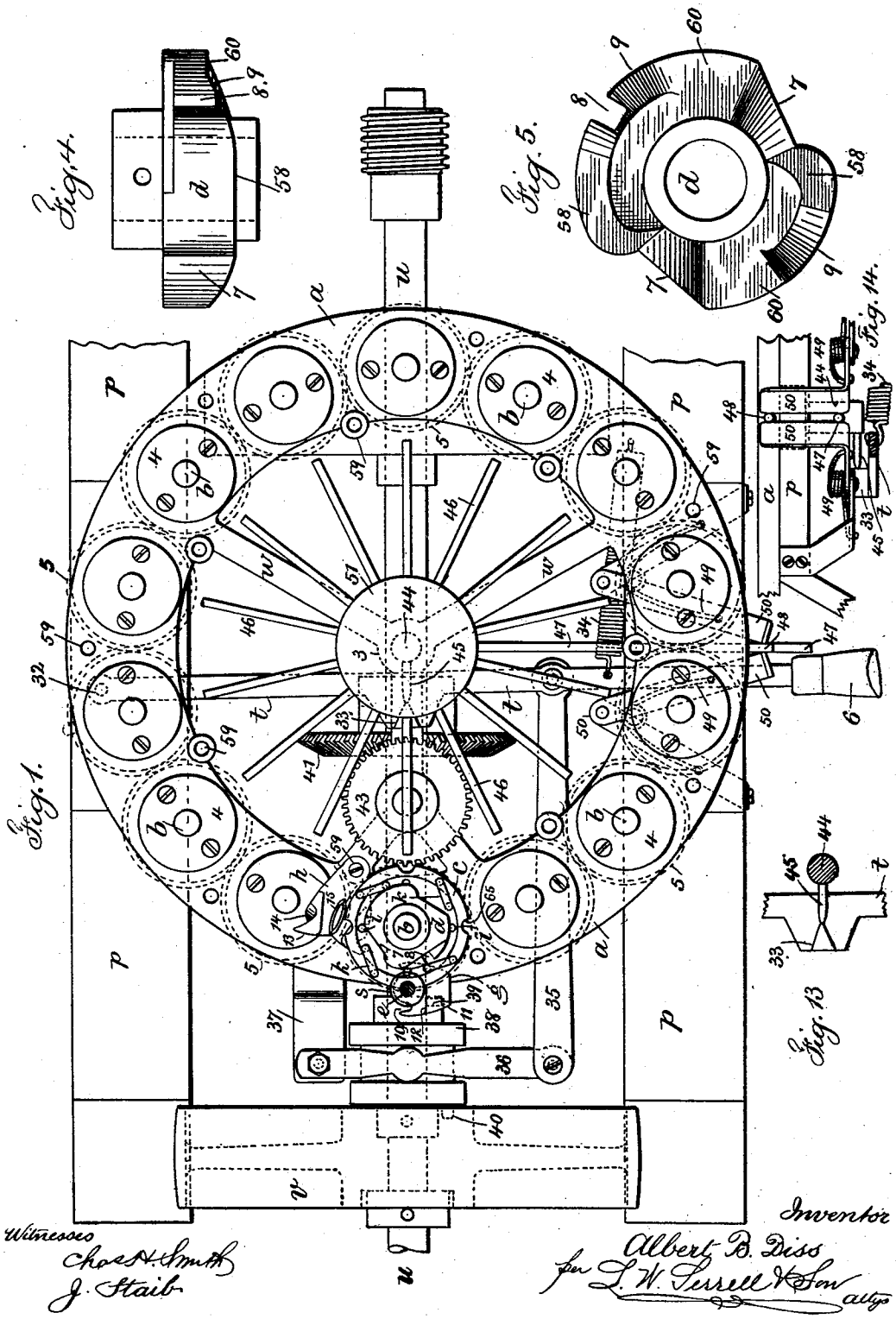
No. 696,094. Patented Mar. 25, 1902.

A. B. DISS.

BRAIDING MACHINE.

(Application filed Nov. 24, 1900. Renewed Aug. 12, 1901.)

(No Model.) 3 Sheets—Sheet 1.



Witnesses:
Chas. A. Smith
J. Stair.

Inventor
Albert B. Diss
per L. W. Serrell & Son
Attys

No. 696,094. Patented Mar. 25, 1902.

A. B. DISS.

BRAIDING MACHINE.

(Application filed Nov. 24, 1900. Renewed Aug. 12, 1901.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 7.

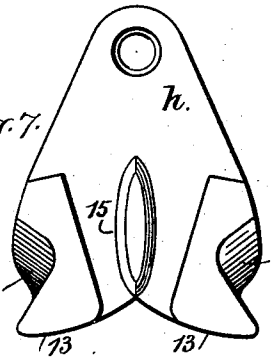


Fig. 9.

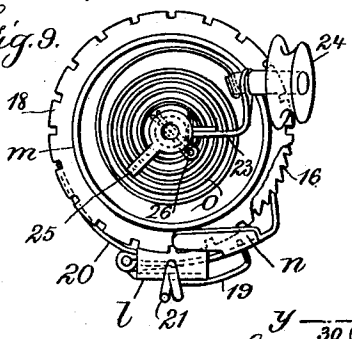


Fig. 2.

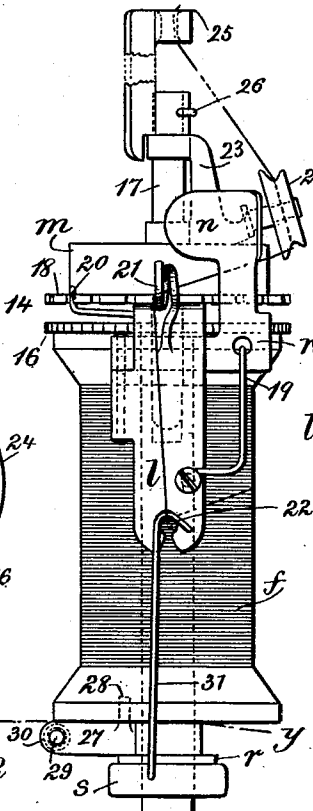


Fig. 10.

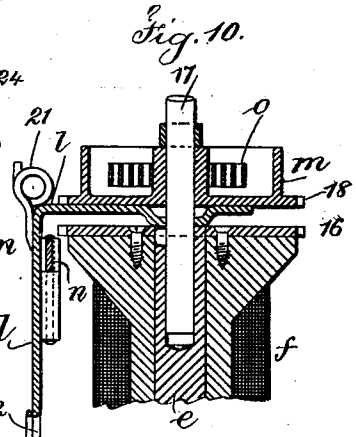
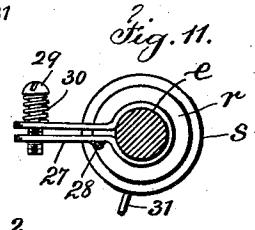
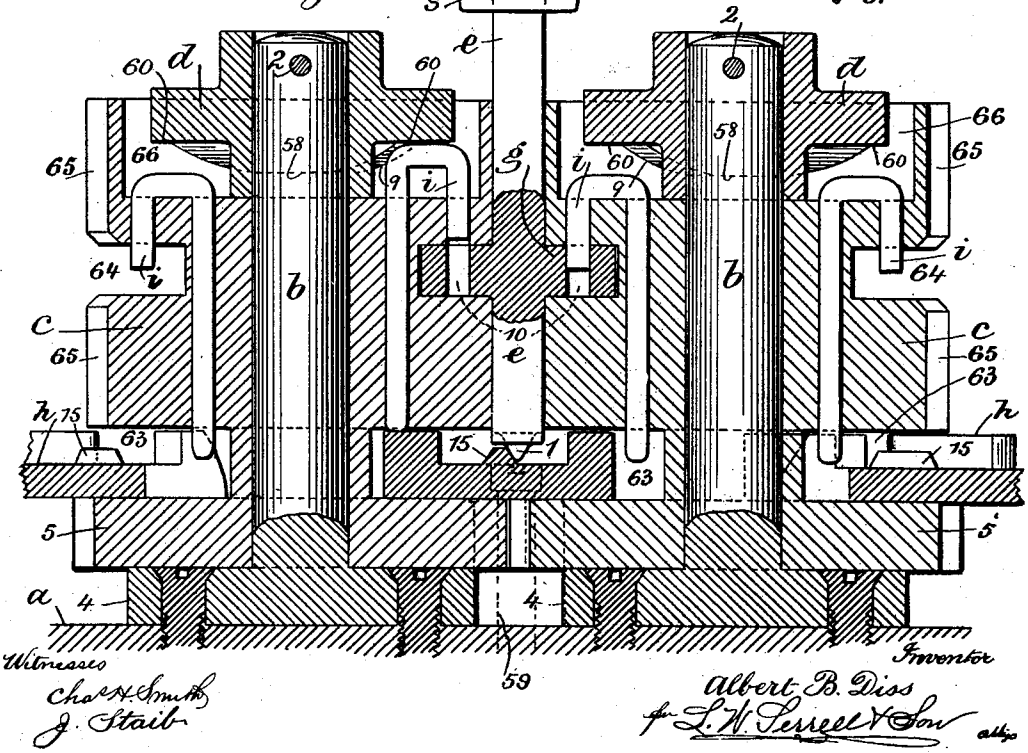


Fig. 11.





Witnesses
Chas. A. Smith
J. Stair

Inventor
Albert B. Diss
by L. W. Serrell & Son
Atty

No. 696,094. Patented Mar. 25, 1902.

A. B. DISS.

BRAIDING MACHINE.

(Application filed Nov. 24, 1900. Renewed Aug. 12, 1901.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 12.

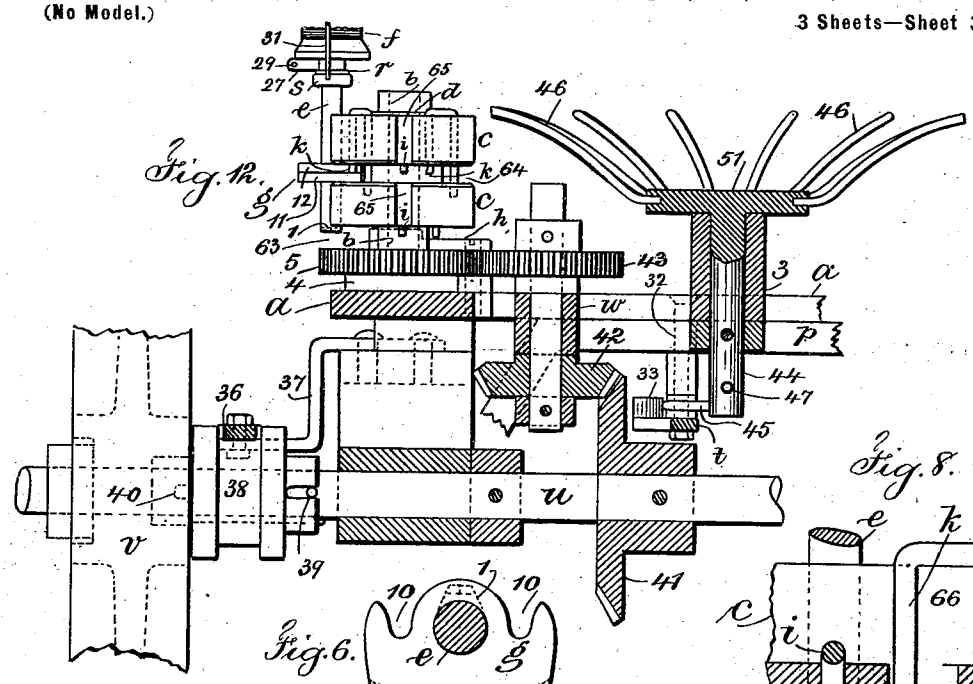


Fig. 8.

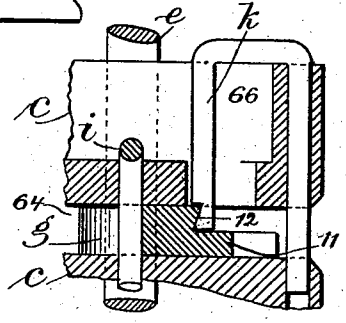
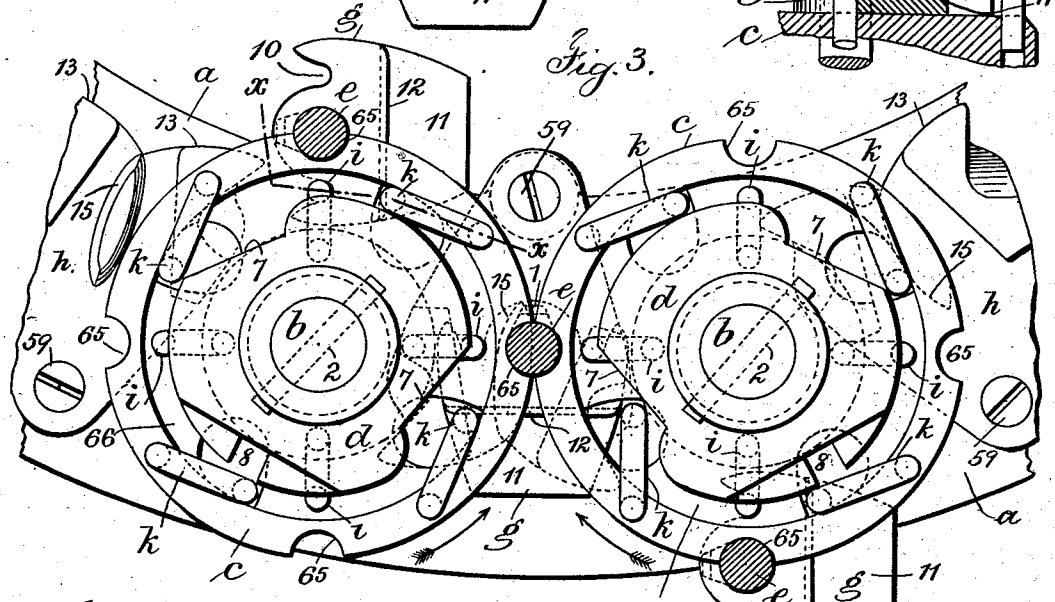


Fig. 6.

Fig. 3.



Witnesses
Chas. H. Smith
J. Staib.

Inventor
Albert B. Diss.
per L. W. Serrell & Son
Atty.

UNITED STATES PATENT OFFICE.

ALBERT B. DISS, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE UNITED STATES BRAID MACHINE MANUFACTURING COMPANY, OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

BRAIDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 696,094, dated March 25, 1902.

Application filed November 24, 1900. Renewed August 12, 1901. Serial No. 71,754. (No model.)

To all whom it may concern:

Be it known that I, ALBERT B. DISS, a citizen of the United States, residing at the borough of Brooklyn, in the city and State of New York, have invented an Improvement in Braiding-Machines, of which the following is a specification.

In braiding-machines as heretofore constructed there have been revolving heads carried by a suitable support and connected by gears to revolve in opposite directions, and the spindles carrying the bobbins of thread were made with exchange devices and there were transfer devices connected with the revolving heads for engaging the exchange-plates, so as to take the spindle from one revolving head to the next in order that the path of the spindle might be reversed, and in such movement each spindle passed around a half-circle in one direction and around the other half-circle in the opposite direction. My present invention relates to a device of this character; and the objects of the same are to simplify the parts, to make the movement of some parts more positive, and to provide for the quick stopping of the machine upon the breaking of a thread and to be able to readily start the same again.

In carrying out my invention and in connection with the devices usually employed in braiding-machines adapted to the making of tubular or flat braid I employ devices for positively holding, releasing, and transferring the exchange-plates and spool-spindles in connection with the respective heads and from one head to the other; also, devices for periodically and progressively supplying thread, applying tension thereto, and holding the thread-spool in place upon the spool-spindle; also, devices for stopping the motion of the mechanism upon the breaking of a thread, and which devices are adapted for readily starting up the machine again, all of which devices are hereinafter more particularly described.

In the drawings, Figure 1 is a plan representing the frame of the machine, the circular platform for supporting the revolving heads, one of said revolving heads complete, and the devices connected in a fixed relation to the bed of the machine. Fig. 2 is a vertical section through the said platform and two of the revolving heads and connected parts and an elevation of the spool-spidle, the bobbin of thread, and the thread mechanism connected therewith. Fig. 3 is a plan of the revolving heads shown in Fig. 2 and section of the spool-spindles operating simultaneously in connection with the heads. Fig. 4 is an elevation, and Fig. 5 an inverted plan, of the stationary cam employed in connection with the revolving heads. Fig. 6 is a plan of the exchange-plate and section of the spool-spindle. Fig. 7 is a plan of the switch. Fig. 8 is a partial vertical section through the upper end of one of the revolving-heads at one side, showing the exchange-plate in position and the engagement thereof by the locking and stop pin and at the line $x\,x$ of Fig. 3. Fig. 9 is a plan of the thread mechanism and of the devices mounted upon the spool-spindle. Fig. 10 is a vertical section through the upper end of the spool-spindle and the devices mounted thereon and adjacent thereto. Fig. 11 is a sectional plan at $y\,y$ of Fig. 2 through the spool-spindle, showing the friction devices connecting the spindle to the bobbin of thread. Fig. 12 is a longitudinal section and partial elevation illustrating the power devices for operating the machine and the devices for stopping and starting the same with reference to Fig. 1. Fig. 13 is a detached plan and partial section of the devices for holding the machine in a normal position of operation and which when moved act to stop the machine, and Fig. 14 is an elevation of the devices for holding in a normal position the means for stopping the motion of the machine upon the breaking of a thread. Figs. 2 to 11, inclusive, are of larger size for clearness over and above Figs. 1, 12, 13, and 14.

Devices for positively holding, releasing, and transferring the exchange-plates and spool-spindles.—The main side frames p support the circular or ring-shaped platform a. At spaced-apart intervals upon said platform a I secure the bases 4 of pivot-posts b by screws or in any other suitable manner. Revolving heads are mounted upon these pivot-posts, one upon each post, and said heads are made

with integral gears 5 at the base, and the gears 5 mesh with one another around the platform. One of these gears meshes with a gear 43 on a short shaft, to the lower end of which is connected a bevel-wheel 42, and the bevel-wheel 42 meshes with a bevel-wheel 41 on the shaft *u* of the machine, said shaft being rotated by a belt-wheel *v*, the particular operative devices being hereinafter more particularly set forth. The revolving heads *c* are all made alike—that is to say, with an annular groove 63 in the base of the head between the head proper and the gear 5, with another annular groove 64 about midway of the head—and said heads are provided with semicircular vertical recesses 65 at spaced-apart intervals, there being by preference four of such vertical recesses on each head. A cavity 66 is made in the top of the head and in which the spindle *b* projects, and I employ a cam *d*, fixed in its relation to the spindle and secured by a pin 2. The construction of this cam is shown especially in Figs. 2, 3, 4, and 5, the periphery and under surface of each cam being the portions shaped to cause the operation of adjacent parts. The periphery of each cam is provided with inclines 7 on opposite portions, with a peripheral notch 8 with opposite under cam-faces 9, and with flat intermediate faces 60, and with flat projecting faces 58, and said cams are connected to the pivot-posts, so as to be adapted to positively insure the operation of the parts with the rotation of the heads. The spool-spindles *e* are made alike, as are also the devices for periodically and progressively supplying thread.

e represents the spool-spindle, *f* the bobbin of thread, and *g* the exchange-plate connected to or made in one with the spindle. The spool-spindle *e* is provided at the lower end or base with a finger 1, serving a purpose hereinafter described. The exchange-plate (shown specially in Figs. 2, 3, and 6) is made with one portion thicker than the other, the thicker portion being adjacent to the spindle. The thicker portion is provided with edge notches 10 at opposite sides of the spindle *e*, the face of the exchange-plate between the notches being curved and concentric to the spindle, and the straight edge 12 of the exchange-plate between the thin back 11 and the thicker portion is undercut.

The switch *h*, Figs. 2, 3, and 7, is provided with curved edge cam-faces 13, with converging cam portions 14 and a central elliptical cam projection 15, the projection 15 being central of the switch and the raised corners having the cam-faces 13 and the cams 14. These switches *h* are pivoted at 59 to the platform *a* and occupy radial positions in alternate directions.

In connection with each revolving head I employ four locking-pins *i* and four stop-pins *k*, said pins being in elevation of the shape shown in Figs. 2 and 8 and in plan of the shape shown in Fig. 3. Fig. 3 also shows the position of said locking and stop pins, in which the locking-pins *i* are each composed of a long and short member, the long member passing through the head vertically, with the bent portion in the recess 66, and the short member passing through the upper part of the head, and when the pin is in its lowermost position the point of the short member projects into the annular groove 64. These pins *i* have simply a vertical movement, dropping by gravity when released. The stop-pins *k* (shown especially in Fig. 8) each has a bent portion and two members, one of which is slightly longer than the other. The longer member passes through the upper portion of the head and forms a pivot upon which the pin swings. This member is shown as extending across the annular groove 64, with the lower end passing into an opening in the lower portion of the head; but I do not limit myself in this respect. The lower end of the shorter member of the stop-pin *k* is notched to fit the undercut edge 12 of the exchange-plate *g*. This notched shorter member of the pin *k* passes down through the recess 66 from the upper face of the revolving head and through a circular opening formed in the head at the base of said recess and into the annular groove, the lower notched end of said pin passing into said groove the depth of the notched portion, so as to be adapted to engage the undercut edge 12 of the exchange-plate.

Fig. 3 shows two of the revolving heads, one of the switches pivoted at one side of the platform *a*, and parts of two of the switches pivoted to opposite sides of the platform *a*. This figure also shows three spool-spindles *e* and exchange-plates *g*, with arrows showing the direction of the movement of said heads. The thicker portions of the exchange-plates *g* fit closely in the annular grooves 64. The lower ends of the locking-pins *i* pass into one of the edge notches of the exchange-plates, so as to hold the exchange-plates, with the spindle *e*, in the vertical recesses 65 upon the surfaces of the heads, the shorter notched ends of the stop-pins *k* coming behind the thicker portions of the exchange-plates into the undercut edges, so as to hold the exchange-plates in opposite directions. It will be noticed by reference to Fig. 3 that the exchange-plate at the inner side of the platform *a* and also the exchange-plate at the outer side of the platform *a* are both positively held in this manner, the shorter notched end of the stop-pins *k* being between the inner surface of the heads and the adjacent surface of the cams *d*, so that said pins are immovable at this point. The spindle *e* and exchange-plate *g* between the revolving heads and in line with their pivot-posts are in the act of being exchanged from one revolving head to the next. In this position it will be noticed that the notches 10 of the exchange-plate are vertically in line with the lower shorter ends of the locking-pins *i* and that the right-hand lock-

ing-pin is in engagement with the notch 10, that the undercut edge 12 of the said exchange-plate is engaged by the notched end of the stop-pin *k* at the left hand, and it will also be noticed (see Fig. 2) that the longer end of the locking-pin *i* at the right hand is not in proximity to the switch *h*, but has dropped by gravity, but that the locking-pin at the left-hand side has been raised by the converging cam 14 at the left-hand side of the switch *h*, so that the lower end of the longer member rests upon the surface of the thickened portion of said switch, the said left-hand locking-pin being raised so that its lower end while above the notch 10 is out of contact with the exchange-plate. In this position the bent part of the left-hand locking-pin *i* is adjacent to one flat face 60 of the stationary cam *d*. With the further movement of the parts and when the switch passes from under this locking-pin if the pin does not drop by gravity it is forced down by the under cam-faces 9. This position will be appreciated by reference to the section Fig. 2 and the plan Fig. 3. It will also be noticed that the right-hand locking-pin *i* holds the exchange-plate and that one peripheral incline 7 of the right-hand cam *d* is about to swing the free end of the right-hand stop-pin *k* in behind the undercut edge 12 of this exchange-plate, so as to hold the exchange-plate to the right-hand head in transferring the same from the left-hand head. In this transference there is no necessary movement of the stop-pin *k* on the left-hand head, as the exchange-plate simply passes away therefrom. It will also be noted in this connection that the finger-base 1 of the spindle *e* is upon the right-hand side of the elliptical cam projection 15 in the center of the switch. This assures the spindle passing from the left to the right hand head. While not shown in the drawings, it is to be understood that it is preferable around each head to employ one less spindle than there are vertical recesses 65 and sets of locking and stop pins *i k*. By further referance to Fig. 3 it will be noticed that the exchange-plate within the platform *a* is approaching the left-hand switch *h*, so as to move the same preparatory to exchanging the spindle from the head holding the same to the next left-hand head. (Not shown in Fig. 3.) As this exchange-plate continues its movement the lower end of the spool-spindle *e* will strike the convex or cam surface 13 of the switch *h* and swing the switch toward the right hand from the position shown in full lines, Fig. 3, and as the exchange-plate continues its movement the base of the spindle *e* will pass between the raised portion and the elliptical projection 15, with the finger-base 1 bearing upon the said cam projection 15 in a similar position to that shown by the section in Fig. 2, but on the opposite side of the cam projection. In this manner the holding tendency of the switch *h* upon the spindle *e* and the exchange-plate *g* will be toward the revolving head next adjacent to the left hand. (Shown in Fig. 3.)

The notch 8 in each cam *d* is placed toward the outer edge of the platform *a* and is employed to facilitate the removal of any one of the exchange-plates and spindles. This is accomplished by swinging the short arm of a stop-pin *k* into the notch and so removing its notched end from behind the undercut edge 12 of the exchange-plate, so that the exchange-plate can be turned on the spindle and the notched portion 10 backed away from the locking-pin *i*. The parts can be returned into engagement in the reverse order. The sides of the exchange-plates are curved, so that when in place on the heads the curves of the exposed sides are concentric to the periphery of the heads, and in width the exchange-plates are slightly less than the combined depth of two annular grooves. Therefore when an exchange-plate passes between adjacent heads its true position is maintained or its position corrected by the projecting portion coming into contact with the base of a groove 64, which will turn the exchange-plate until its passage is unobstructed.

Devices for periodically and progressively supplying thread, applying tension thereto, and holding the thread-spool.—The thread-bobbin *f* receives through it the spool-spindle *e*, and upon the upper end of the thread-bobbin a tooth-disk 16 is secured, the disk being of a size agreeing with the end of the thread-bobbin and the teeth projecting. The upper end of the spindle *e* is made hollow and notched, and fitted therein is a short shaft 17, having a pin in the said recess, so as to prevent the shaft turning in the spindle, which becomes its support. I provide a bracket-plate *l*, formed of portions at right angles to one another, one portion occupying a vertical position and the other a horizontal position. The horizontal part is perforated for the shaft 17, which passes through the same, and the vertical part of the said plate has a thread-notch 22 in the lower end and on one side is provided with a hinge-joint, to the pin of which is connected a pawl-plate *n*. Secured to this bracket-plate *l* is a spring 19, the free end of which bears upon the pawl-plate *n*, and also connected to this bracket-plate is a thread-guide 21 in the form of a loop of wire. The head *m* is a saucer-shaped form of metal with a notched flange 18 and a center hub fitting around the shaft 17. The head *m* is loose upon the shaft and while resting upon the bracket-plate *l* is separate therefrom. This pawl-plate *n* is made with an upward extension and with a spring-finger 20 engaging the notches of the flange 18, the tooth of the pawl-plate *n* engaging the teeth of the disk 16 and being held thereto by the said spring 19. Within the head *m* is a coiled spring *o*, the inner end of which is fastened to the hub of said head, and the outer end is fastened to a bracket 23, having perforated bearings surrounding the shaft 17 and an extension car-

rying the grooved roller 24, and the normal tendency of the spring *o* in connection with the roller 24 is to hold the roller at a distance from the pawl-plate *n*. The upper end of the shaft 17 is surmounted by a thread-guide 25, (see Fig. 2,) the same being formed of an upright portion, a perforated top, through which the thread passes, and a base-hub fitting upon the upper end of the shaft 17 and held thereto by a pin 26. I provide upon the spindle *e* a fixed ring or collar *r* and above the same a friction-yoke 27, having a circular portion surrounding the spindle and two free ends extending approximately parallel with one another and radially from the spindle. The pin 28 is fastened to one of these radial arms and extends up into the thread-bobbin *f*, and a screw 29 passes freely through one of said arms and screws into the other, and around the screw is a spring 30, the action of which is to force the two arms toward one another and so maintain the frictional grip of the circular part of the yoke 27 upon the spindle, and thus prevent the thread-bobbin *f* turning freely or accidentally. Upon the spindle and below the fixed ring *r* I provide a collar *s*, loose upon the spindle, and a hook-ended wire 31 is secured to the collar *s* and rises therefrom, and the thread from the thread-bobbin passes first through the thread-notch 22, then under the hook end of the wire 31, upward through the thread-guide 21, behind the upward extension of the pawl-plate *n*, around the grooved roller 24, through the eye of the thread-guide 25, and so to the portion of the machine where the braiding is being effected. In the operation of these parts and starting with the position shown in Fig. 9 a normal tension only is upon the thread, and as the thread is consumed in the braiding operation the roller 24 moves progressively toward the upward extension of the pawl-plate *n* and then strikes the same, forcing the said pawl-plate outward against the spring 19 and drawing the tooth of the pawl-plate out of the teeth of the disk 16, so releasing the thread-bobbin, and because of the tension of the thread upon the thread-bobbin the same will rotate an appreciable distance and allow the thread to pay out. The roller 24 because of the action of the spring *o* will follow this paying out of the thread, so that there will be no uncontrolled slack. The tooth of the pawl-plate will almost immediately reëngage a tooth of the disk 16, so as to return the parts to their normal position, and these movements are repeated every time the thread is so consumed that the grooved roller 24 comes in contact with the upward extension of the pawl-plate. In case there is not enough tension or too much tension upon the coiled spring *o* the same may be regulated at pleasure by withdrawing the free end of the spring-finger 20 from one of the notches of the notched flange 18 and rotating the flange 18 in one direction or the other to tighten or loosen the spring and then reëntering the end of the spring-finger 20 in one of the notches. It will be observed that if a thread breaks the collar *s* and the hook-ended wire 31, held up solely by the thread, will fall. This movement brings into operation the devices for stopping the mechanism hereinafter described.

Devices for stopping the motion of the machine upon the breaking of a thread.—I provide an arm *t*, pivoted to one of the frames *p* at 32 and extending across the machine below the circular platform *a* and projecting beyond the other frame *p* of the machine and terminating in a handle 6. This arm is provided with an enlarged portion and a rising cam projection 33, (see especially Figs. 1, 12, and 13,) and I provide a spring 34, with one end fastened to the arm and the other to one frame *p* for holding the said arm in the desired position. A link 35 is pivotally connected at one end to the arm *t* and at its other end to a lever 36, which lever is pivoted to a support 37, connected to one of the supports of the shaft *u*. (Shown in Fig. 12.) A clutch 38 is upon the main operative shaft *u*, and this lever 36 passes through the annular groove in the said clutch, and it will be noticed that this clutch can be moved longitudinally of the shaft by the arm *t* through the intervention of the link 35. This clutch 38 is slotted and a guide-pin 39 in the said slot passes through the shaft *u* so as to connect the shaft and the clutch to compel them to turn together and at the same time provide for the longitudinal movement of the clutch, said pin 39 also acting as a stop for the clutch. The other end of the clutch is provided with a pin 40, adapted to enter an opening in the hub of the belt-wheel *v*, which belt-wheel is loose upon the shaft, and consequently when the parts are in the position shown in Figs. 1 and 12 the clutch is engaged with the belt-wheel and the main shaft *u* is rotated, and when the clutch is moved longitudinally of the shaft and the pin 40 disengaged from the belt-wheel the said wheel is free to revolve without rotating the main shaft. When the belt-wheel *v* through the clutch 38 and pin 40 rotates the shaft *u*, the bevel-wheels 41 and 42 are also set in motion and the gear 43 is rotated, and it in turn sets in operation all of the revolving heads *c* and the devices connected therewith, moving the spool-spindles and the bobbins of thread in the progressive order hereinbefore described for effecting the operations of the braiding-machine.

The platform *a* is made with a spider-frame *w* and central bearing 3, and within the central bearing is a spindle 44, having a projecting pin 45 from the lower end and radial curved arms 46 connected to and extending out from the disk-head of the spindle. The spindle 44 has connected to it a stop-arm 47, extending radially and long enough to pass beneath and beyond the frame *p*, and I provide a fixed stop 48 in the outer surface of the platform, located above the normal po-

sition of the stop-arm 47. I employ arms 50, each composed of two parts alike, one of said parts being secured to the under side of the frame and the other of said parts being free to move on the pivotal connection, and springs 49, each composed of a center loop, and two free arms are connected at one end to the fixed portion of said arms and at the other end to the movable portions, and the outer ends of said arms 50 are upturned and the upturned portions are long enough to embrace the stop-arm 47 and the fixed stop 48 and bearing against the fixed stop serve to hold in alinement therein the stop-arm 47. This position insures the alinement of the pin 45 and the position of the point of said pin against the point of the cam projection 33, and so long as these two parts are in the position shown in Figs. 1 and 13 the clutch-pin is in engagement with the belt-wheel and the machine is in full operation. The arms 46 are long enough to come closely adjacent to the spindles *e* when the same pass around the revolving heads upon the inside of the platform, so that when a thread breaks and the collar *s* falls, the same being of considerably greater diameter than the spindle *e* comes immediately in the path of one of the arms 46, going in either direction, and striking one of said arms 46 moves the same and the spindle 44, instantly swinging the pin 45 out of its relation with the cam projection 33 and allowing the spring 34 to pull on the arm *t* and through the link 35 move the clutch 38 and its pin 40 out of engagement with the belt-wheel *v*, and thus stop the machine. In this movement the stop-arm 47 has moved a corresponding distance with the arm 46 against the force of the spring-actuated arms 50, and so the parts remain, the spring 34 being of greater power than the springs 49. When the thread has been reconnected and the parts are to be returned to an operative normal position, it is only necessary to move the arm *t* by the handle 6 toward the left hand, and with it the clutch, so that the pin 40 of the clutch again engages the belt-wheel to set the parts again in motion. With this movement of the arm *t* and the cam projection 33 the spring-actuated arms 50 move the stop-arm 47, the arms 46, the spindle 44, and the pin 45, returning the same to the normal position in line with the stop 48, in which the pin 45 again comes against the point of the cam 33, and the parts are held in place until another thread breaks.

The operations of this machine are entirely automatic, and the same does not require constant attention on the part of an operator, because where a thread breaks the machine is stopped and remains stopped until the thread has been reconnected and the arm *t* moved by hand to reëstablish the normal operative position of the parts and set the machine again in motion. The operations of the revolving heads, the exchange-plates *g*, the switches *h*, the locking-pins *i*, and the stop-pins *k* are all positive and do not in any respect depend upon springs for their operation, so are not liable to get out of order or to make any false movements in the operation of the machine.

I claim as my invention—

1. In a braiding-machine, the combination with the power mechanism, of a platform, revolving heads supported upon said platform, gears for actuating the same in opposite directions, spool-spindles and exchange-plates connected therewith, switches pivoted in opposite directions upon the said platform, locking-pins moving vertically in the revolving heads and raised by the switches or permitted to drop for disengaging or engaging the exchange-plates and stop-pins independent of the locking-pins and swinging in the said revolving heads and adapted to engage a portion of the exchange-plate, so that between the locking-pins and the stop-pins the exchange-plates are positively held in position to the revolving heads, substantially as set forth.

2. In a braiding-machine, the combination with the platform and pivot-posts mounted thereon at spaced-apart intervals, of revolving heads mounted upon said pivot-posts, each head being constructed with an integral gear at the base, with an annular groove between the gear and the head, with a second annular groove about midway of the head, with a cavity in the top of the head and with semicircular recesses extending vertically in the surface of the head and at spaced-apart intervals, spindles adapted to be received in the semicircular vertical recesses of the head, exchange-plates connected to the spindles and adapted to pass into the midway annular groove in the head, locking-pins moving vertically in said head, and means for actuating the same to cause the locking-pins to engage the exchange-plate, and stop-pins in said head capable of a swinging movement and adapted to engage the said exchange-plate and a cam device mounted upon the upper end of the said pivot-post and acting upon the locking-pins and stop-pins, substantially as set forth.

3. In a braiding-machine, the combination with the platform and pivot-posts mounted thereon at spaced-apart intervals, of revolving heads mounted upon said pivot-posts, each head being constructed with an integral gear at the base, with an annular groove between the gear and the head, with a second annular groove about midway of the head, with a cavity in the top of the head and with semicircular recesses extending vertically in the surface of the head and at spaced-apart intervals, locking-pins each composed of a bent portion and a long and short member, the long member extending through the head into the cavity above the gear and the short member through the head into the midway cavity, stop-pins in the upper portion of the head, each having a bent part and a long and short member, the long member passing through the upper part of the head and acting

as a pivot for the pin, and the short member passing through the cavity and through an opening below the same in the top of the head and having a notched end projecting into the midway cavity, a cam stationary in the cavity in the top of the head and fixed to the upper end of the pivot-post and having peripheral inclines adapted to act upon the stop-pins, and under cam-surfaces adapted to act upon the locking-pins, and means acting against the point of the longer end of the locking-pins for raising the same, substantially as set forth.

4. In a braiding-machine, the combination with the platform and pivot-posts mounted thereon at spaced-apart intervals, of revolving heads mounted upon said pivot-posts each head being constructed with an integral gear at the base, with an annular groove between the gear and the head, with a second annular groove about midway of the head, with a cavity in the top of the head, and with semicircular recesses extending vertically in the surface of the head and at spaced-apart intervals, locking-pins each composed of a bent portion and a long and short member, the long member extending through the head into the cavity above the gear, and the short member through the head into the midway cavity, stop-pins in the upper portion of the head each having a bent part and a long and short member, the long member passing through the upper part of the head and acting as a pivot for the pin, and a short member passing through the cavity and through an opening below the same in the top of the head, and having a notched end projecting into the midway cavity, the cam stationary in the cavity in the top of the head and fixed to the upper end of the pivot-post and having peripheral inclines adapted to act upon the stop-pins, and under cam-surfaces adapted to act upon the locking-pins, spindles *e* and exchange-plates *g* formed with the spindles, each exchange-plate being composed of a thick and thin portion, the thick portion having edge notches 10 at opposite sides of the spindle and an undercut edge 12 adjacent to the thin portion—the notches 10 being engaged by the short parts of the locking-pins, and the undercut edge by the notched end of the short part of the stop-pins so as to positively lock the exchange-plate to the head from opposite points, and switches pivoted to the platform and operating in the annular groove above the gear against the lower end of the long member of the locking-pin, substantially as set forth.

5. In a braiding-machine, the combination with the platform and pivot-posts mounted thereon at spaced-apart intervals, of revolving heads mounted upon said pivot-posts, each head being constructed with an integral gear at the base, with an annular groove between the gear and the head, with a second annular groove about midway of the head, with a cavity in the top of the head and with semicircular recesses extending vertically in the surface of the head and at spaced-apart intervals, locking-pins each composed of a bent portion and a long and short member, the long member extending through the head into the cavity above the gear, and the short member through the head into the midway cavity, stop-pins in the upper portion of the head each having a bent part and a long and short member, the long member passing through the upper part of the head and forming a pivot for the pin, and a short member passing through the cavity and through an opening below the same in the top of the head, and having a notched end projecting into the midway cavity, a cam stationary in the cavity in the top of the head and fixed to the upper end of the pivot-post and having peripheral inclines adapted to act upon the stop-pins, and under cam-surfaces adapted to act upon the locking-pins, spindles *e* and exchange-plates *g* formed with the spindles, each exchange-plate being composed of a thick and thin portion, the thick portion having edge notches 10 at opposite sides of the spindle and an undercut edge 12 adjacent to the thin portion, the notches 10 being engaged by the short parts of the locking-pins, and the undercut edge by the notched end of the short part of the stop-pins so as to positively lock the exchange-plate to the head from opposite points, and switches pivoted to the platform and moving in the annular groove above the gear and each comprising converging cams 14, a central elliptical cam projection 15 and a two-part curved advancing edge or cam faces 13 with which the base of the spindle is adapted to contact for moving the cam, substantially as set forth.

6. In a braiding-machine, the combination with a platform, of a series of heads and gears connected therewith mounted upon said platform, and means for revolving the adjacent heads in opposite directions, each head having a midway annular groove and semicircular vertical grooves at spaced-apart intervals, a series of spool-spindles and exchange-plates connected therewith, the exchange-plates being adapted to pass into the annular midway grooves of the heads and each exchange-plate having a thick portion to fit said grooves, and a thinner rear portion, an undercut edge at the junction of the thick and thin portions and edge notches at opposite sides of the spool-spindle, devices connected to the head and adapted to successively engage one of the edge notches of the exchange-plate and the undercut edge thereof at the same time to hold the exchange-plates in a fixed relation to the heads, means for controlling the movements of the engaging devices, and means operated by the spindle in its circular motion with the heads for transferring the spindles from one head to the other progressively in opposite directions, substantially as set forth.

7. In a braiding-machine, the combination with a platform, pivot-posts mounted thereon, revolving heads and gears upon said pivot-

posts, of switches set in alternate opposite directions on radial lines from the center of the platform and between the heads and having thereon cam forms, stationary cams mounted upon the upper end of the pivot-posts above the heads and having peripheral inclines, notches, under cam-faces and flat faces, spool-spindles and exchange-plates connected therewith and two sets of devices connected to, rotating with and vertically movable in said heads and one set actuated and controlled by the switches and the other set by stationary cams for progressively engaging and positively holding the exchange-plates to the heads and alternately transferring the same from one head to the next in opposite directions, substantially as set forth.

8. In a braiding-machine, the combination with revolving heads, spool-spindles, exchange-plates connected therewith and means for operating the same, of thread-bobbins mounted upon said spindles, means for frictionally holding the thread-bobbins to the spindles, means for periodically and progressively supplying thread and applying tension thereto, and means for adjusting the tension, and means carrying the thread and acting in connection with the tension for releasing the holding devices, substantially as set forth.

9. In a braiding-machine, the combination with revolving heads, spool-spindles, exchange-plates connected therewith and means for operating the same, of thread-bobbins mounted upon said spindles, a toothed disk secured upon the top of each thread-bobbin, a shaft fitting the upper end of the spindle and projecting therefrom, a bracket-plate having two parts at right angles to one another with one part in a vertical position and the other part in a horizontal position and passing over the same shaft, thread-guides connected to the vertical part of the bracket-plate, means pivotally connected to the bracket-plate and adapted to engage the toothed disk, a grooved roller around which the thread passes and devices for applying tension thereto, and means for adjusting said tension and a guide for the thread from the grooved roller, substantially as set forth.

10. In a braiding-machine the combination with revolving heads, spool-spindles, exchange-plates connected therewith and means for operating the same, of thread-bobbins mounted upon said spindles, a toothed disk secured upon the top of each thread-bobbin, a shaft fitting the upper end of the spindle and projecting therefrom, a bracket-plate having two parts at right angles to one another with one part in a vertical position and the other part in a horizontal position and passing over the said shaft, thread-guides connected to the vertical part of the bracket-plate, a pawl-plate having a beveled extension pivoted to the upright part of the bracket-plate and having a point engaging the toothed disk, and a spring for holding the same normally in place, a hollow head having a central hub surrounding the said shaft with a notched flange to the said head, and a spring-finger connected to the bracket-plate and engaging the said notched flange for holding the head in a fixed relation to the bracket, a coiled spring within the head with one end connected to the hub, a bracket above the head loose upon the said shaft, and a grooved roller carried thereby with the free end of the coiled spring fastened to the said bracket and the bracket adapted to swing with the roller, a thread-guide connected to and extending above the said shaft for the thread as the same passes away to the braiding mechanism, whereby the grooved roller, as the thread is used, is adapted to come against the upward extension of the pawl-plate to release the parts and allow the thread to pay out and the grooved roller is moved by the spring to take up the slack and return the parts into a normal position of engagement, substantially as set forth.

11. The combination in a braiding-machine, with the spindles, the exchange-plates connected therewith, and means for supporting and operating the same, of the thread-bobbins mounted upon said spindles and devices connected therewith for periodically and progressively supplying thread and applying tension thereto, collars upon the spindles, hook-ended wires connected to the collars and rising therefrom and beneath which the threads from the thread-bobbins pass so that the said collars and wires are held in an elevated position by the threads and fall when the threads break, a spindle having a head mounted central in the frame of the machine, arms extending radially and upwardly and connected to the said head, a radial pin connected to the lower end of the spindle, the said radial arms being so placed as to come in the path of and contact with a fallen collar upon a spindle and to be then moved thereby to swing the pin at the base of the spindle out of its normal position, devices acting in connection with the said pin and controlling the movements of the power mechanism of the machine for holding the same in a normally operative position which are released and disengaged and the machine stopped when the said pin is swung out of its normal position, substantially as set forth.

12. The combination in a braiding-machine with the spindles, the exchange-plates connected therewith, and means for supporting and operating the same, of the thread-bobbins mounted upon said spindles and devices connected therewith for periodically and progressively supplying thread and applying tension thereto, collars upon the spindles, hook-ended wires connected to the collars and rising therefrom and beneath which the threads from the thread-bobbins pass so that the said collars and wires are held in an elevated position by the thread and fall when the threads break, a spindle having a head mounted central in the frame of the machine,

arms extending radially and upwardly and connected to the said head, a radial pin connected to the lower end of the spindle, the said radial arms being so placed as to come in the path of and contact with a fallen collar upon a spindle and to be then moved thereby to swing the pin at the base of the spindle out of its normal position, devices acting in connection with the said pin and controlling the movements of the power mechanism of the machine for holding the same in a normally operative position which are released and disengaged and the machine stopped when the said pin is swung out of its normal position, and devices adapted to return the radial arms, spindle and pin to a normal position when the devices acting in connection with the pin are shifted into a position of engagement by hand, substantially as set forth.

13. The combination in a braiding-machine, with the spindles, the exchange-plates connected therewith and means for supporting and operating the same, of the thread-bobbins mounted upon said spindles and devices connected therewith for periodically and progressively supplying thread and applying tension thereto, collars upon the spindles, hook-ended wires connected to the collars and rising therefrom and beneath which the threads from the thread-bobbins pass so that the said collars and wires are held in an elevated position by the threads and fall when the threads break, an arm *t* pivoted to the frame of the machine at one end and extending across the machine and projecting and terminating with a handle, a main shaft to the machine, an engaging clutch and gears connected therewith and devices extending from the arm *t* for operating the clutch and a spring for operating the arm, and a cam projection 33 upon said arm centrally of the machine and devices contacting with said cam projection 33 and set in operation by the fall of the collars upon the spindles whereby the said arm *t* is released and moved by its spring and the clutch disengaged and the mechanism stopped, substantially as set forth.

14. The combination in a braiding-machine, with the spindles, the exchange-plates connected therewith and means for supporting and operating the same, of the thread-bobbins mounted upon said spindles and devices connected therewith for periodically and progressively supplying thread and applying tension thereto, collars upon the spindles, hook-ended wires connected to the collars and rising therefrom and beneath which the threads from the thread-bobbins pass so that the said collars and wires are held in an elevated position by the thread and fall when the thread breaks, an arm *t* pivoted to the frame of the machine at one end and extending across the machine and projecting and terminating with a handle, a main shaft to the machine, an engaging clutch and gears connected therewith and devices extending from the arm *t* for operating the clutch and a spring for operating the arm, and a cam projection 33 upon said arm centrally of the machine, a revoluble spindle centrally mounted in the frame of the machine, radial and rising arms 46 connected therewith at the upper end and agreeing in number with the number of the revolving heads, a radial pin 45 projecting from the lower end of the spindle and adapted to engage the point of the cam projection 33 upon the arm *t*, a stop-pin 48 on the frame of the machine, a radial arm 47 projecting from the spindle 44 and normally occupying a position beneath the stop 48, and spring-actuated arms 50 with upturned ends simultaneously engaging the end of the arm 47 and stop-pin 48 to hold the same in alinement and in a normal position in which the point of the pin 45 contacts with the point of the cam projection 33, and the parts are held in their normal position of operation and by which the parts are returned to a normal position with the operation of the arm *t* by hand, substantially as set forth.

Signed by me this 12th day of November, 1900.

ALBERT B. DISS.

Witnesses:
GEO. T. PINCKNEY,
S. T. HAVILAND.