No. 689,490.

Patented Dec. 24, 1901.

C. G. HILL.

CIRCULAR LOOM.

Application filed June 3, 1901.)

(No Model.)

5 Sheets—Sheet 1.

Fig. 1.

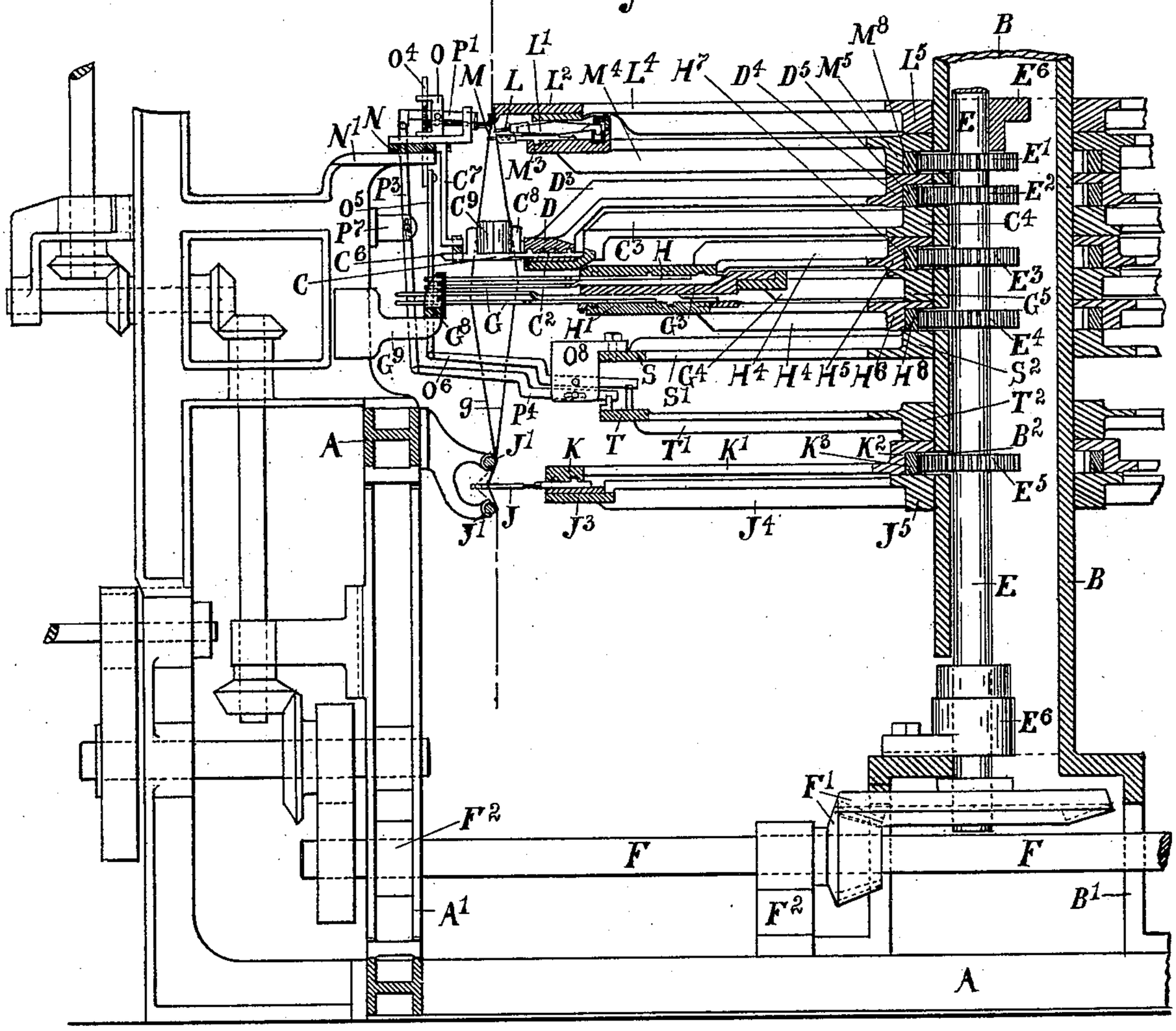
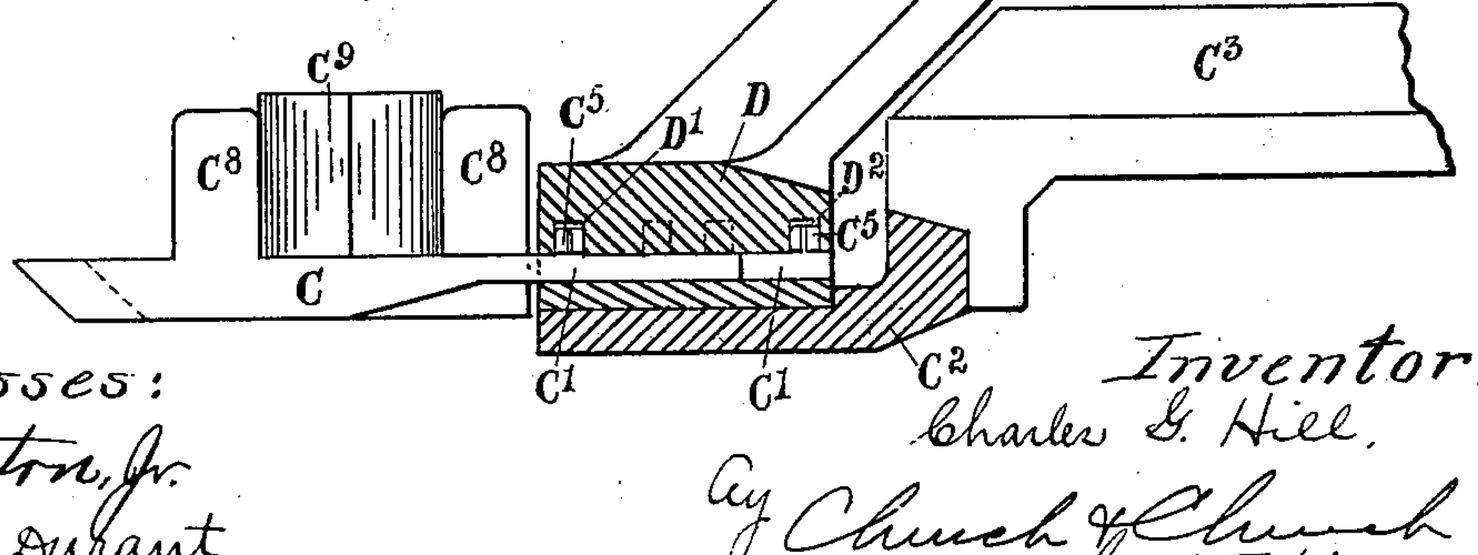


Fig. 2.



Witnesses:
J. B. Peyton, Jr.
Thomas Durant

Inventor:
Charles G. Hill.
by Church & Church
his Attys.

No. 689,490. Patented Dec. 24, 1901.

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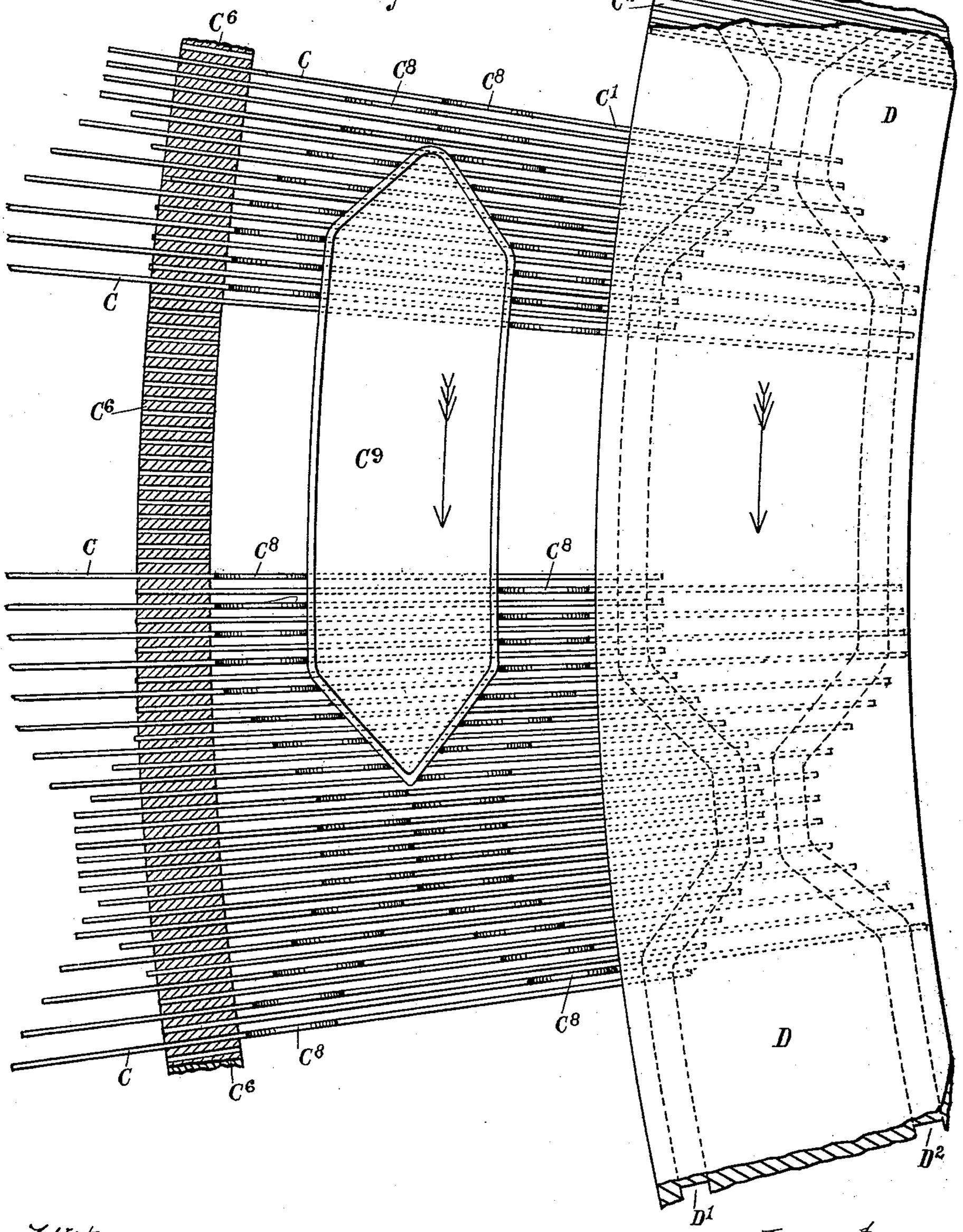
(No Model.) 5 Sheets—Sheet 2.

Fig. 2a.



Witnesses:
John B. Peyton, Jr.
Thomas Durant

Inventor:
Charles G. Hill,
by Church & Church
his Attorneys.

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(No Model.) 5 Sheets—Sheet 3.

Fig. 3.

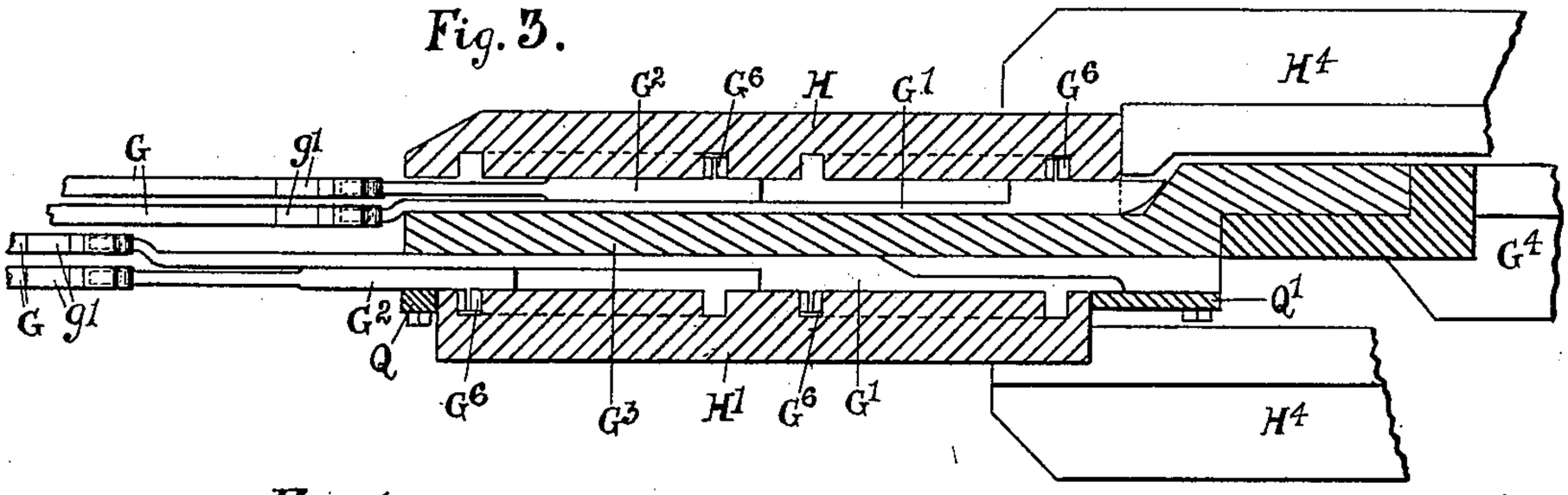

Fig. 4.

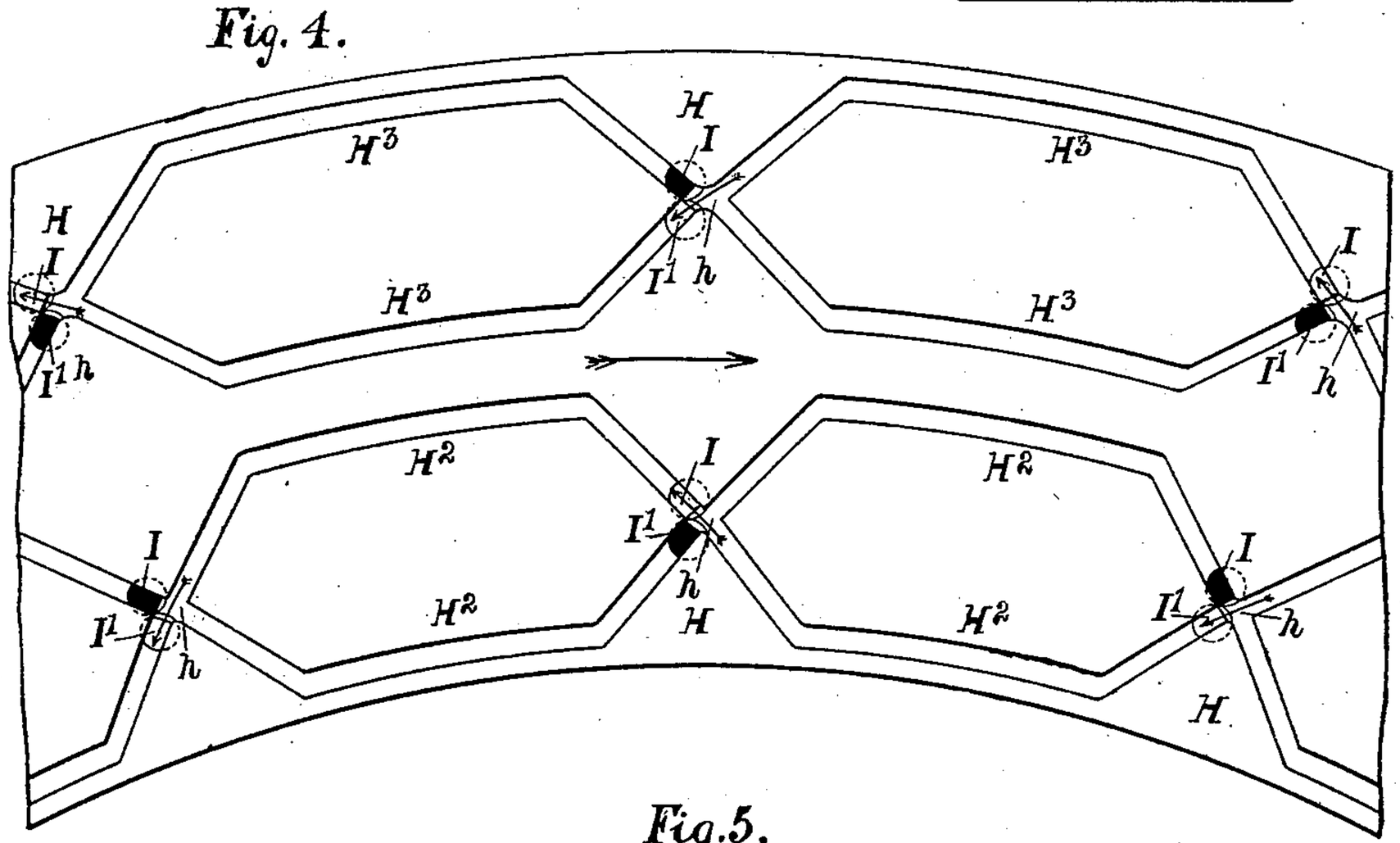

Fig. 5.

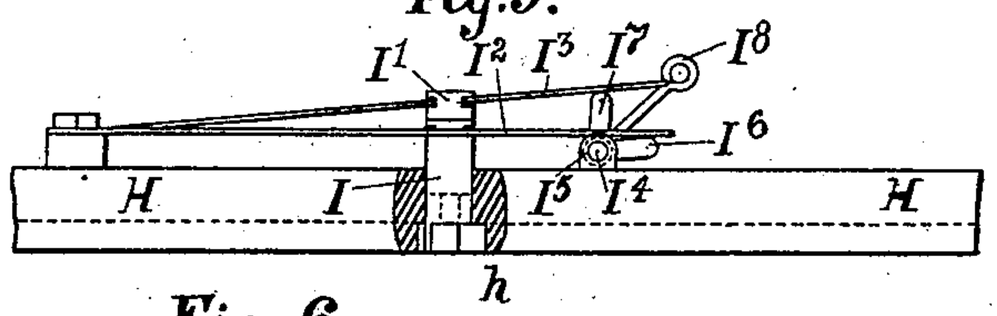

Fig. 6.

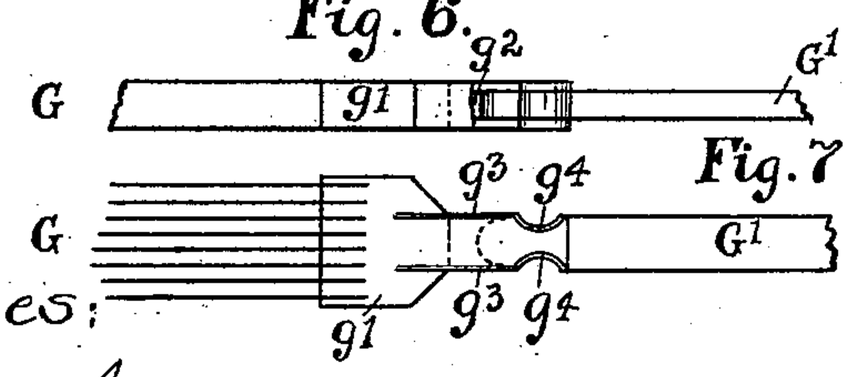

Fig. 7

Witnesses:
J. B. Peyton, Jr.
Thomas Durant

Inventor:
Charles G. Hill,
by Church & Church
his Attys.

No. 689,490. Patented Dec. 24, 1901.

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(No Model.) 5 Sheets—Sheet 4.

Fig. 8.

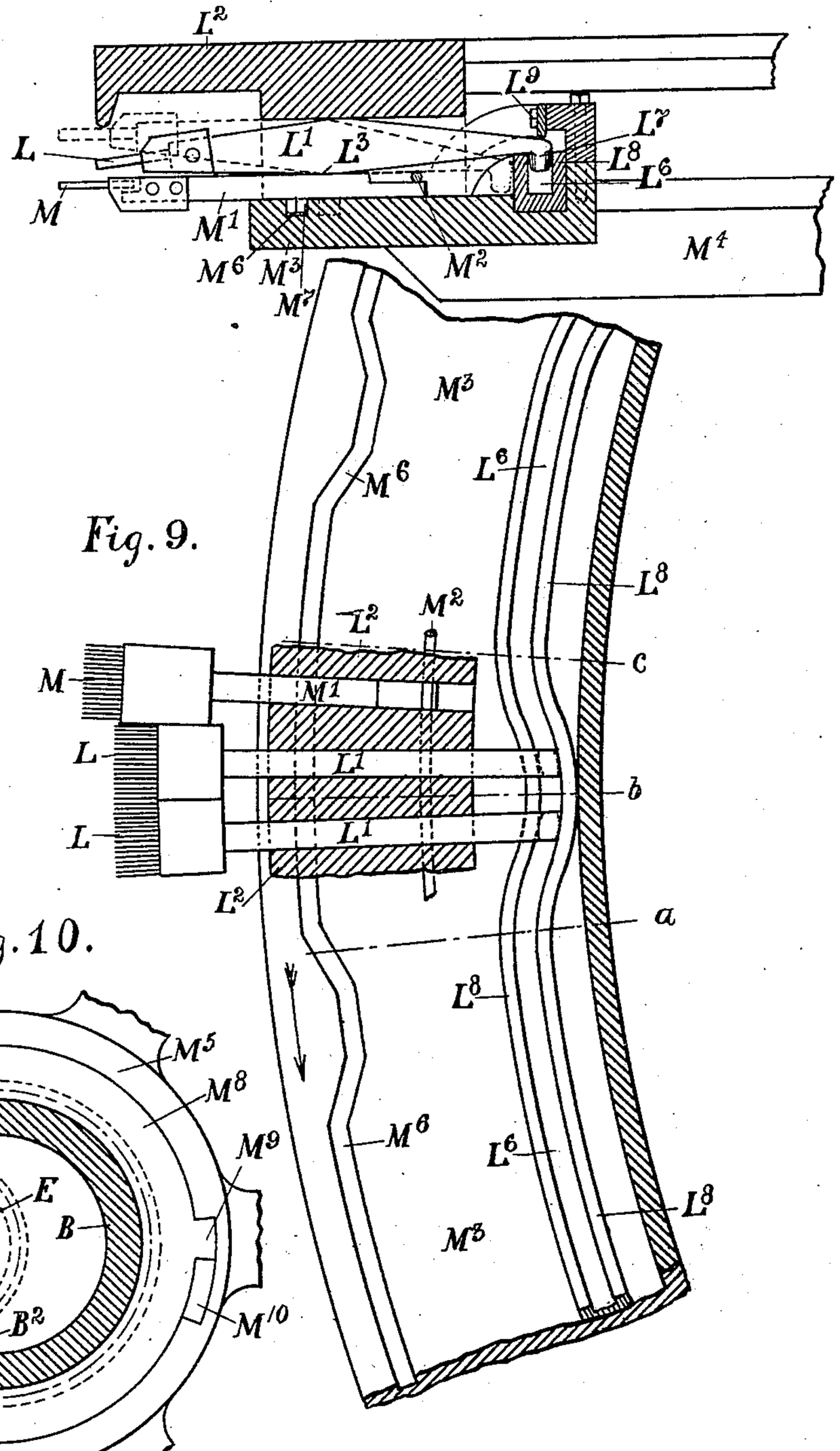
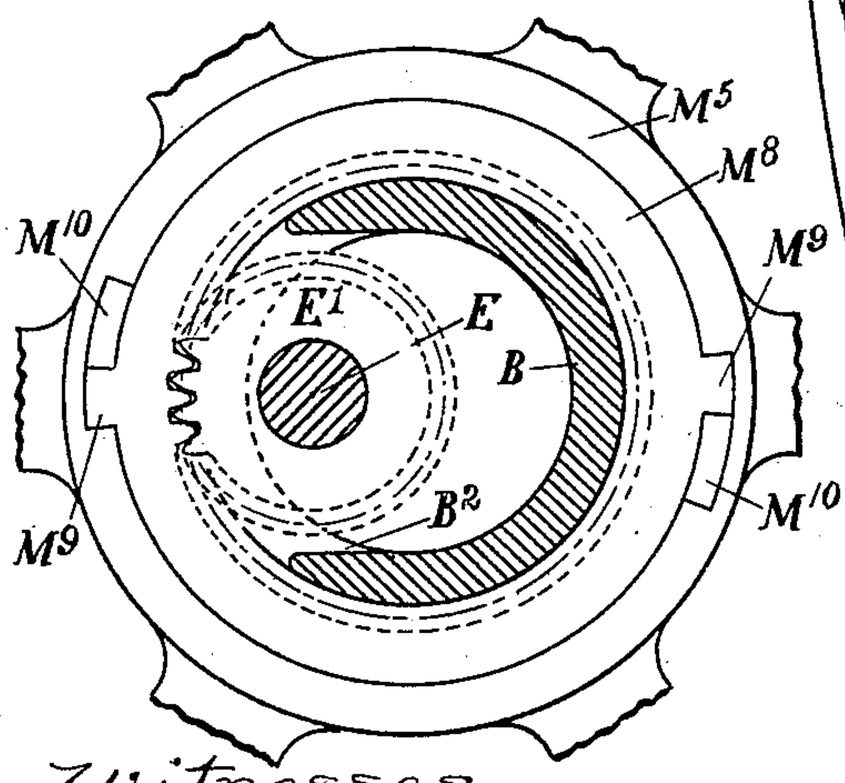


Fig. 9.

Fig. 10.



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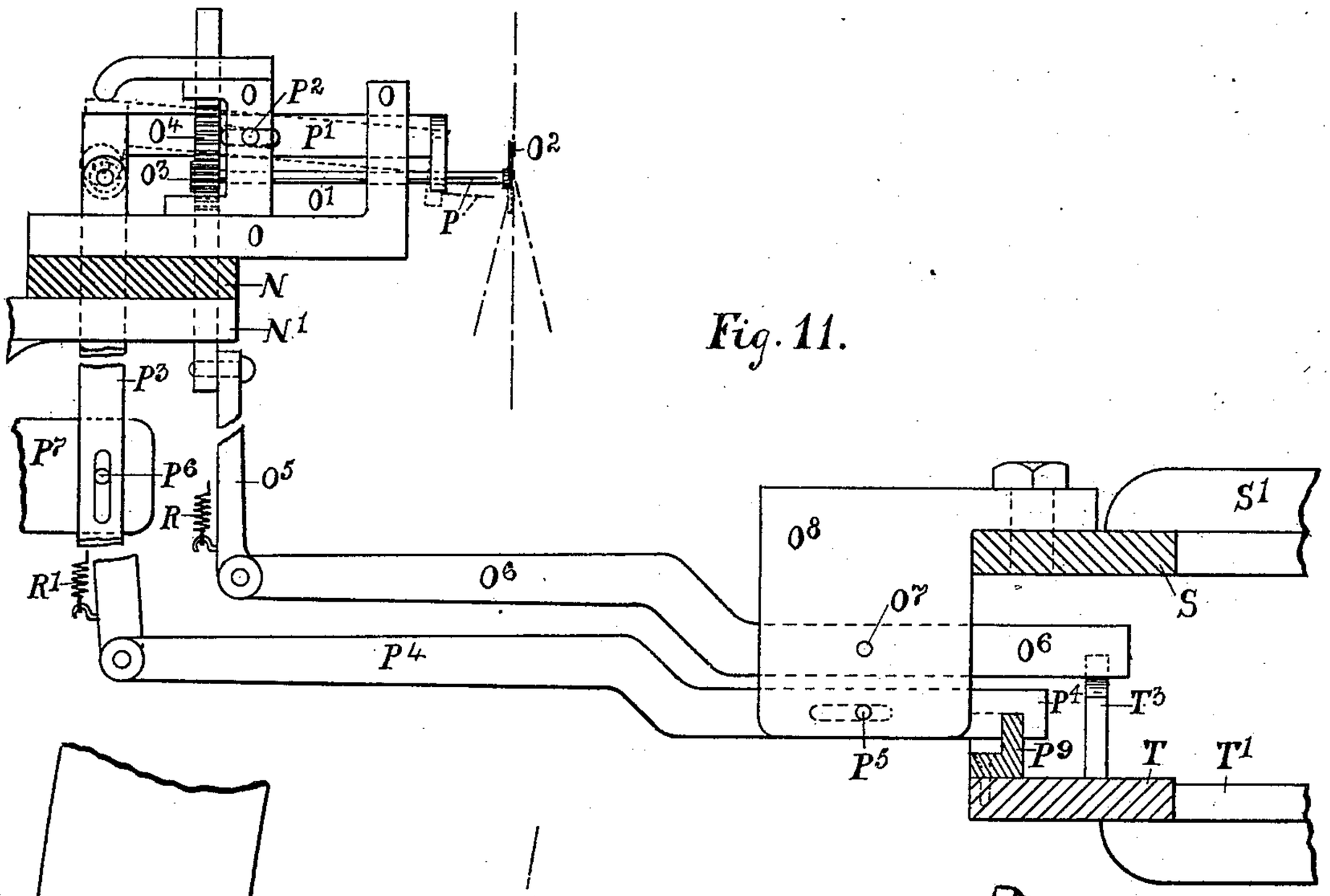

Fig. 11.

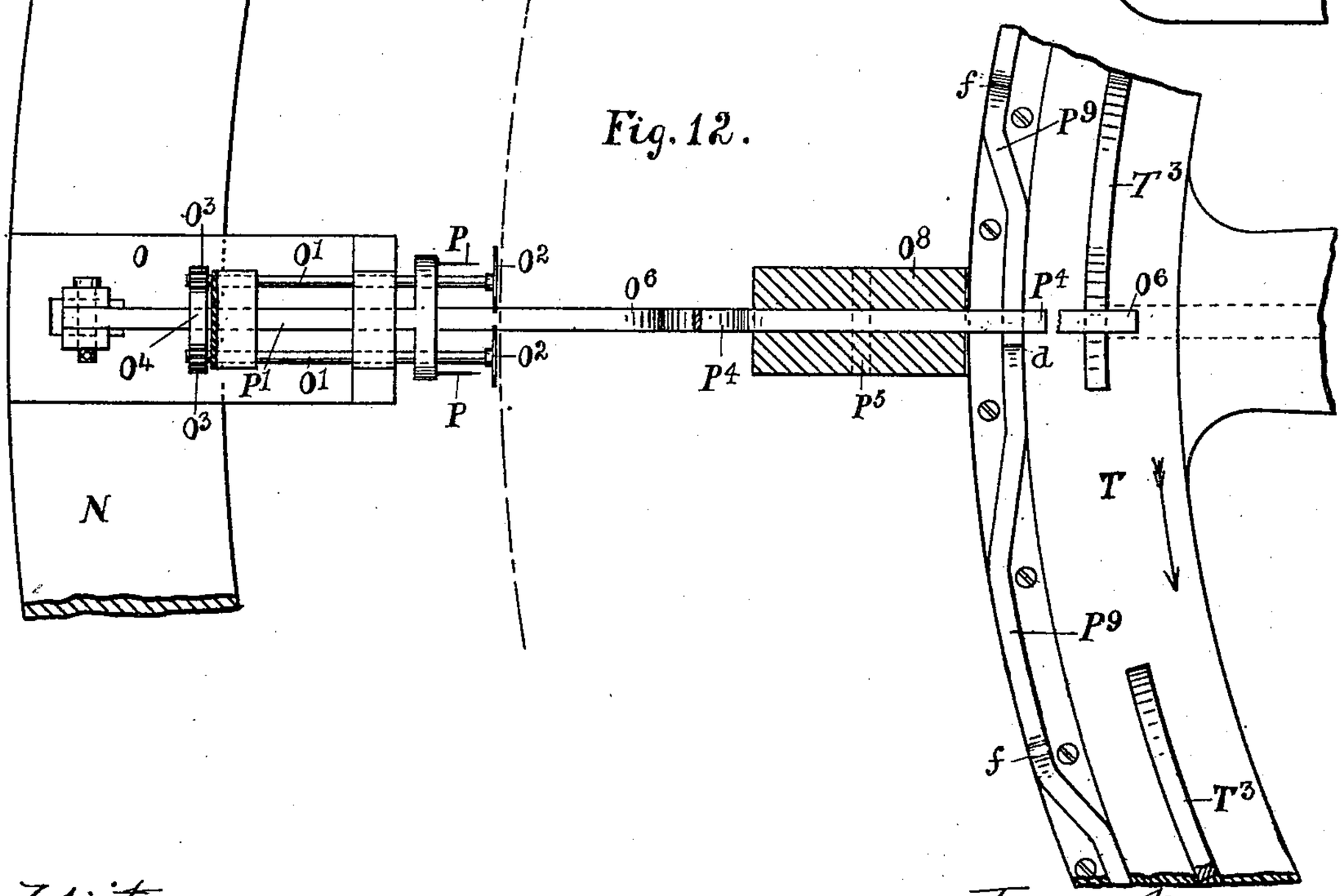

Fig. 12.

Witnesses:
J. B. Peyton, Jr.
Thomas Durant

Inventor:
Charles G. Hill,
by Church & Church
his Attys.

UNITED STATES PATENT OFFICE.

CHARLES GREY HILL, OF NOTTINGHAM, ENGLAND.

CIRCULAR LOOM.

SPECIFICATION forming part of Letters Patent No. 689,490, dated December 24, 1901.

Application filed June 3, 1901. Serial No. 62,984. (No model.)

To all whom it may concern:

Be it known that I, CHARLES GREY HILL, a subject of the King of England, residing at Daybrook, Nottingham, England, have invented certain new and useful Improvements in or Relating to Circular Looms, (for which application has been made in Great Britain, under No. 19,743, dated November 3, 1900,) of which the following is a specification.

This invention relates to improvements in circular-weaving looms, such as described in the specification of Letters Patent of the United States, No. 637,336, filed December 13, 1899.

According to the present invention the shuttle-propelling jacks or devices, the warp-operating blades comprising the shedding mechanism, and the beating-up mechanism are arranged radially in a plane approximately at right angles to the axis of the loom instead of parallel to the said axis, as in the specification cited. The several parts of the loom are also so disposed that the slay-rings for supporting the principal operating parts and the cam-rings for operating said parts are carried by a central column and the cam-rings driven from this central point.

The invention will be best understood by reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation showing one-half of a loom constructed according to my invention. Fig. 2 is a sectional elevation showing the supporting and operating mechanism of the shuttle-propelling jacks. Fig. 2ª is a plan view of the shuttle-propelling mechanism. Fig. 3 is a sectional elevation of the warp-blade-operating mechanism. Fig. 4 is a face view of part of one of the warp-blade-operating cams. Fig. 5 is an elevation, partly in section, showing details of the warp-blade cam-switch mechanism. Fig. 6 is an elevation, and Fig. 7 a plan, showing details of the detachable joints for connecting the bunches of warp-blades to their supporting and operating stocks. Fig. 8 is a sectional elevation, and Fig. 9 a plan, partly in section, showing details of the beating-up mechanism. Fig. 10 is a plan showing details of the beating-up cam-driving mechanism. Fig. 11 is an elevation, and Fig. 12 a plan, of the arrangement for operating the selvage mechanism. Figs. 2 to 12, inclusive, are drawn to a larger scale than Fig. 1.

Like letters of reference indicate similar parts throughout the drawings.

The framing of the loom is comprised mainly of a base A, a central hollow column or pillar B, mounted on a hollow casing B′, which is secured to the base A, and a concentric external framing A′, which is mounted on or secured to the base A.

The shuttle-propelling jacks C (see Figs. 1, 2, and 2ª) are formed with or secured to stocks or sliders C′, mounted in radial recesses in the upper face of an annular slay-ring C^2, which latter is situated in a plane at right angles to the axis of the loom. The slay-ring C^2 is carried by radial arms C^3, extending from a boss C^4, (see Fig. 1,) secured on the central column B.

The stock C′ or slider of each shuttle-propelling jack C is placed in an independent recess in the slay-ring C^2, and each stock is provided with a projection or stud C^5, (see Fig. 2,) which engages in one of two independent cam-races D′ D^2, formed in the lower face of a cam-ring D, which latter is placed above the slay-ring C^2. Every alternate stock C′ is longer than the remainder, and the long ones engage in the inner race D^2 and the short ones in the other or outer race D′.

The cam-ring D (see Fig. 1) is carried by radial arms D^3, extending from a boss D^4, which is mounted loosely on the central pillar B. In addition to the boss D^4 taking a bearing on the pillar B it is provided with an annular toothed wheel D^5, which is preferably let into the boss, as shown. This wheel D^5 engages with a pinion E^2, mounted on a vertical shaft E, which is situated within the pillar.

The shaft E is carried in bearings E^6 (see Fig. 1) at the top and bottom of the pillar B and is in an eccentric position relatively to the outer face of the said pillar. The shaft is provided with pinions E′ E^2 E^3 E^4 E^5 for operating the several parts of the loom, which pinions project through lateral openings B^2, (see Fig. 10,) formed in the wall of the pillar at the points where the pinions are situated.

The vertical shaft E is connected by bevel-toothed gearing F′ within this pillar to a hori-

zontal main shaft F, which latter is carried across the lower part of the loom and through the hollow casing B', on which the central pillar B is mounted. This main shaft F is mounted in suitable bearings F^2, secured to or formed in the framing. The outer ends of the shuttle-propelling jacks are further supported by a slay-ring C^6, (see Fig. 1,) carried by brackets C^7, secured to the outer framing A'.

Vertical extensions C^8 (see Figs. 2 and 2^a) on the propelling-jacks C form an annular shuttle-race, and the said extensions are moved radially to and from the center line of the said race in the manner described in the specification cited and propel the shuttles C^9 by their action on the double-inclined rear ends thereof.

The warp-blades G (see Figs. 1, 3, 6, and 7) for operating the warp-threads *g* are in each segment of the loom subdivided into, say, four groups or bunches, placed one under the other, and each group is connected to and operated by a stock or slider G' or G^2 in the same manner as described in the specification of Letters Patent hereinbefore referred to. These stocks G' G^2 are carried in radial recesses formed in the upper and lower faces of a slay-ring G^3, which is placed below that of the shuttle-propelling jacks C. The slay-ring G^3 (see Fig. 1) is also carried by radial arms G^4, extending from a boss G^5, secured on the central pillar B.

The stocks G' G^2 in the recesses in the under side of the slay-ring G^3 are held in the said recesses by an outer ring Q and an inner ring or plate Q', (see Fig. 3,) secured on the under side of the slay-ring. The stocks G' G^2 are arranged in pairs in these recesses, each pair comprising a long stock G' and a short stock G^2. The long stocks G' are first placed in the recesses and the short ones G^2 on the outer side thereof, while both are provided with studs G^6, which engage in one of two independent cam-races formed in two cam-rings H H', one cam-ring H being situated above and the other below the slay-ring G^3.

Each cam-ring H H' (see Fig. 1) is carried by radial arms H^4, extending from two bosses H^5 H^6, mounted loosely on the central column B, and these bosses are provided with annular toothed wheels H^7 and H^8, engaging with the pinions E^3 E^4, respectively, on the vertical shaft E within the column B. Both cam-rings H H' are provided with two independent double cam-races H^2 H^3, (see Fig. 4)—that is, one double race, H^2, for the long stocks G' and the other, H^3, for the short stocks G^2. Each double cam-race H^2 or H^3 alternates with single parts *h*, as described in the specification hereinbefore cited, the number and position of the double parts H^2 and H^3 of each race corresponding with the number of and position of the shuttles. At the point where the single parts *h* of each race open out into double parts H^2 or H^3 switches of special form are introduced in order to turn the studs G^6 on the stocks G' G^2 from the single parts *h* into either of the said double parts, so that the threads operated by each group of warp-blades G may be moved to the inner or outer side of each shuttle, as desired. The openings from the single parts *h* to the double parts H^2 or H^3 may be closed by bolts or studs I I', mounted in the position shown in openings in the body of the cam-ring H. When one of these bolts is pushed in, its inner end fits in and closes the entrance to the corresponding part of the cam-race and deflects the stud G^6 on the stocks into the other part of the race. The bolts I I' are each pushed in and held in this position by the action of flat springs I^2 I^3, (see Fig. 5,) which are secured to the outer face of the cam-ring H and engage with the outer end of the respective bolts or studs; but in order that one of the said switch-bolts may always be held out of action the following arrangement is employed.

Under the free ends of the two springs I^2 I^3 is a rod or shaft I^4, placed transversely to the springs, and is carried in bearings I^5 on the cam-ring H. This shaft I^4 is provided with two arms, cranks, or projections I^6 I^7, which engage with the respective springs I^2 I^3. These arms or projections I^6 I^7 are disposed approximately at right angles to each other, so that one spring I^3 and the corresponding bolt I' is held out of action, as shown, while the other spring I^2 and bolt I is in action. The position of the two bolts is reversed by turning the shaft I through an angle of, say, ninety degrees by means of the arm I^8, when the projection I^6 will raise the spring I^3 and withdraw the corresponding stud I, while the projections I^7 will release the spring I^3, and the latter will now push the corresponding stud I' into action.

It will be understood that each pair of switch-bolts is controlled by a separate arrangement, such as described, although only one is shown in the drawings, and that the position of the said bolts may thus be conveniently altered and the character of the fabric produced changed with great facility. As shown in Fig. 4 of the drawings, the ends of the bolts which are filled in are in action and are disposed so as to produce plain weaving.

Each group of warp-blades G is connected to a single block *g'*, as shown in Figs. 3, 6, and 7, and the latter to its stock or slider G' or G^2 by a detachable joint of special form, the outer ends of the blades being supported in a circular slay-ring G^8, (see Fig. 1,) carried by brackets G^9 on the outer framing A.

The detachable joint referred to is preferably formed as follows: The end of the block *g'* (see Figs. 6 and 7) to which the warp-blades G are attached is formed with a horizontal recess g^2, adapted to receive the end of the stock G'. The sides of this recess are closed by side springs g^3, provided at their free ends with depressions g^4, which enter

notches formed both in the end of the stock G′ and the top and bottom of the recess g^2, and thus securely hold the former in the latter.

Below the warp-blades G are the take-up jacks J, (see Fig. 1,) through openings in which the warp-threads *g* are carried. These jacks are so operated as to take up the slack in the warp-threads *g* during the shedding of the said threads. In order to assist the jacks in performing this operation, the warp-threads are carried through slays or over bars J′, placed above and below the take-up jacks J. The threads are thus confined at these two latter points J′, while the jacks J move further out of line with those points, as indicated in dotted lines, and thus take up the slack. The take-up jacks are carried in recesses in a slay-ring J^3, which is carried by radial arms J^4, extending from a boss J^5, secured to the central pillar B. These jacks J are provided with heels or projections, which engage in a cam-race formed in a cam-ring K, placed above the slay-ring J^3. This cam-ring K is carried by radial arms K′, extending from a boss K^2, mounted loosely on the central pillar B and driven by means of an annular toothed wheel K^3 in the boss K^2, which engages with the pinion E^5 on the shaft E.

The beating-up mechanism is comprised of a number of instruments L, arranged, preferably, on the inner side of the cloth-line as follows: The circumference of the loom is for this purpose divided into segments of convenient size, and the whole of the beating-up instruments L (see Figs. 1, 8, and 9) in each of these segments are mounted on the outer end of a single radial lever L′. These levers L′ are mounted in radial recesses formed in the under side of the cloth-ring L^2 and are adapted to slide radially in the said recesses and also to oscillate about a fulcrum L^3, which is preferably formed by increasing the width of the lever at or near the middle of its length, or, if preferred, the levers L′ may be mounted on cylindrical pivots passing through slots formed in the levers at or about the middle of their length.

Below the beating-up instruments L is disposed a set of instruments M, which are similar to the beating-up instruments and are mounted on the outer ends of suitable stocks M′. These stocks M′ are mounted in the same radial recesses in the cloth-ring L^2 as the levers L′ of the beating-up instrument L, but below the latter. The levers L′ thus rest on the stocks M′ of the instruments M. The inner ends of the stocks M′ are prevented from rising with the levers L′ by a wire M^2, which may be continuous and lies in openings formed in the walls of the recesses.

The cloth-ring L^2 is carried by radial arms L^4, (see Fig. 1,) extending from a boss L^6, secured on the central pillar B. Below the cloth-ring L^2 is a cam-ring M^3, (see Figs. 8 and 9,) which is carried by radial arms M^4, extending from a boss M^5, mounted loosely on the central pillar B. This cam-ring M^3 is provided on the outer part of its upper face with a cam-race M^6, which engages with studs M^7 on the stocks M′, and thus operates the latter. This cam-ring is also provided with a cam race or groove L^6 on the inner part of its face, and each lever L′ is provided at its inner end with a stud L^7, which engages in the cam-race L^6. The walls L^8 of this cam-race rise from the point *a* to *b* (see Fig. 9) and then fall again from *b* to *c*, and these raised parts engage with and raise the inner ends of the beating-up levers L′, which are again depressed by a cam-plate L^9, extending above the ends of the levers, said plate being secured to the cam-ring M^3. The cam-race L^6 imparts a radial in-and-out motion to each lever L′, while the raised parts *a b c* of the walls L^8 of the said race raise the inner ends of the levers, which are again depressed by the cam-plate L^6. In beating up the instruments L are so operated by the mechanism described that they are inserted beneath the weft-thread after the latter is inserted in the shed, then beat up into the position shown in dotted lines in Fig. 8, and remain in this position until the next thread is inserted, when they are withdrawn and lowered ready for the next beat.

The instruments M below the beating-up instruments normally mesh with the warp-threads and are only withdrawn to admit of the insertion of the weft-threads above the point where they are situated and are then immediately reinserted, the beating-up instruments L being in the position shown in dotted lines when the instruments M are withdrawn.

It must be understood that the whole of the instruments L do not beat up simultaneously, but that each set beats up in succession as a shuttle passes it and inserts a weft-thread, the instruments M below the beating-up instruments being operated in like manner.

The cam-ring M^3 is driven by means of an annular toothed wheel M^8 in the boss M^5 engaging with the pinion E′ on the shaft E within the pillar B. The wheel M^8 is not fixed in the boss M^5, but is loosely mounted therein. It is provided with radial lugs or extensions M^9, (see Fig. 10,) which work in recesses M^{10} in the said boss, the said recesses being of greater length than the width of the lugs M^9, so that the wheel M^8 may be turned a certain distance in a reverse direction while the boss M^5 remains stationary.

The above arrangement is provided in order that the cam-ring M^3 may remain stationary when the loom is turned in the reverse direction for a short distance in order to release and permit of the removal of the shuttles, as described in the specification above cited.

The warp-beams are placed at the lower part of the loom, and the fabric as it is produced is carried up above the cloth-ring L^2 over a spreader, and up to the take-up rollers, which are situated above. They may be

arranged and actuated in any well-known manner.

When it is desired to produce selvages, I mount at the requisite point or points a bearing-bracket O, in which are mounted two spindles O′, carrying the looping devices O^2 for inserting loops of the selvage-thread into the open shed. These brackets O are supported on a bracket N′, (see Figs. 1, 11, and 12,) secured to the outer framing A, or on a ring N, carried by brackets N′. These spindles O′ are provided with pinions O^3, which engage with a vertical rack O^4, mounted in guideways in the bearing-bracket O. The lower end of this rack O^4 is connected by a link O^5 to a lever O^6, pivoted at O^7 to a bracket O^8, that is secured to a ring S, carried by arms S′, extending from a boss S^2, secured to the central pillar B.

Below the ring S is a cam-ring T, carried by arms T′, extending from a boss T^2, mounted on the central pillar B, and the boss T^2 is connected to the boss K^2 of the take-up cam-ring K. The cam-ring T is provided at intervals corresponding with spaces between the shuttles with raised striking parts T^2, (see Figs. 11 and 12,) which engage with and raise the inner end of the lever O^6 at the proper time. This movement of the lever O^6 draws down the rack O^4 against the action of a spring R, connected to the link O^5, and rotates the loopers O^2, so that the latter carry the selvage-threads into the open shed. The two points or instruments P for temporarily holding the loops of the selvage-threads in the shed are mounted on the inner forked end of an approximately horizontal lever P′, which is fulcrumed at P^2 in the bracket O. This lever is connected by means of a lever P^3 to a second lever P^4, which is fulcrumed at P^5 in the bracket O^8. The lever P^3 is fulcrumed at P^6 to a bracket P^7, secured to the framing, and the levers P^3, P′, and P^4 are all slotted at the points where they are fulcrumed, so that they may be moved longitudinally as well as angularly about their fulcrums. The inner end of the lever P^4 engages with a raised cam-rib P^9 on the cam-ring T, and said race is so disposed that it not only moves the lever P^4 longitudinally, but also oscillates the said lever. For this purpose the cam-rib shown in plan in Fig. 12 rises at the point *f* and falls at *d*. The inner end of the lever P^4 is held in contact with the cam-rib P^9 by a spring R′, connected to the lever P^3. The double movement imparted to the lever P^4 by the cam-rib P^9 is communicated by the lever P^3 to the lever P′. The instruments P are by the movement of the lever P′ first lowered into the position shown in dotted lines in Fig. 11, after which they are inserted into the loops of the selvage-thread that have been previously inserted by the loopers O^2. The loopers then retire and the points P rise and hold the said loops until they are fixed in the fabric by the shedding of the warp-threads and the beating up of the weft-thread, after which they are withdrawn.

Selvage mechanism such as described may be placed at any point or points in the circumference of the loom, the whole of which may be operated by cam-races on the cam-ring T.

It will be understood that the whole of the cam-races shown are repeated at equal intervals in the circumference of the cam-rings and that the number of the repeats is determined by the number of shuttles employed.

At the points where the selvage mechanism is situated the warp-thread, the blades for operating the same, and the beating-up instruments are omitted in order to make room for the selvage mechanism.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a circular loom the combination with a fixed central column, of a shuttle of shuttle-propelling mechanism, of warp-thread-shedding mechanism, of weft-thread-beating-up mechanism, of a series of slay-rings fixed on the central column for supporting the said operative parts, of a series of cam-rings for operating the said parts said cam-rings being mounted loosely on the central column each adjacent to a fixed slay-ring and of a rotary shaft within the column for operating the cam-rings.

2. In a circular loom the combination with a fixed central column, of a shuttle, of a shuttle-propelling mechanism, of warp-thread-shedding mechanism, of weft-thread-beating-up mechanism, of means for taking up the slack in the warp-threads, of a series of slay-rings fixed on the central column for supporting the said operative parts, of a series of cam-rings for operating the said parts said cam-rings being mounted loosely on the central column each adjacent to a fixed slay-ring, and of a rotary shaft within the column for operating the cam-rings.

3. In a circular loom the combination with a fixed central column, of a shuttle, of shuttle-propelling jacks, of extensions on the jacks forming a shuttle-race, of warp-thread-shedding mechanism, of weft-thread-beating-up mechanism, of a series of slay-rings fixed on the central column for supporting the said operative parts, of a series of cam-rings for operating the said parts said cam-rings being mounted loosely on the central column each adjacent to a fixed slay-ring, and of a shaft within the column for operating the cam-rings substantially as described.

4. In a circular loom the combination with a fixed central column, of shuttle-propelling jacks, of stocks on said jacks, of vertical extensions on said jacks forming a shuttle-race, of a slay-ring fixed on the central column and having recesses for the reception of the stocks of the shuttle-propelling jacks, of warp-thread-shedding mechanism, of weft-thread-beating-up mechanism of slay-rings for sup-

porting the shedding and beating-up mechanisms fixed on the central column, of cam-rings for operating the propelling, the shedding and the beating-up mechanisms, said cam-rings being mounted loosely on the central column each adjacent to a fixed slay-ring, and a rotary shaft within the column for operating the cam-rings substantially as described.

5. In a circular loom the combination with a fixed central column, of shuttle-propelling jacks, of stocks on said jacks, of vertical extensions on the said jacks forming a shuttle-race, of a slay-ring fixed on the central column and having recesses for the reception of the shuttle-jacks, stocks, of a cam-ring mounted loosely on the central column and having independent cam-races, of projections on the stocks of the shuttle-jacks for engaging with one or other of the said cam-races, of warp-thread-shedding mechanism, of weft-thread-beating-up mechanism, of slay-rings for supporting the shedding and beating-up mechanisms fixed on the central column, of cam-rings on the central column for operating the shedding and beating-up mechanisms said cam-rings being mounted loosely on the central column, of a rotary shaft within the column, of wheels on the cam-rings engaging with pinions on the central shaft, substantially as described.

6. In a circular loom the combination with a fixed central column, of shuttle-propelling jacks, of stocks on said jacks, of vertical extensions on the said jacks forming a shuttle-race, of a slay-ring fixed on the central column and having recesses for the reception of the shuttle-jacks, stocks, of a slay-ring for supporting the outer ends of the shuttle-jacks, of a cam-ring mounted loosely on the central column and having independent cam-races, of projections on the stocks of the shuttle-jacks for engaging with one or other of the said races, of warp-thread-shedding mechanism, of weft-thread-beating-up mechanism, of slay-rings for supporting the shedding and beating-up mechanisms, fixed on the central column, of cam-rings on the central column for operating the shedding and beating-up mechanisms, said cam-rings being loosely mounted on the central column, of a rotary shaft within the column, of wheels on the cam-rings engaging with pinions on the central shaft; substantially as described.

7. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race on said jacks, of a slay-ring supporting said jacks fixed on the central column, of a cam-ring for operating said jacks mounted loosely on the central column, of warp-blades, of means for taking up the slack in the warp-thread, of weft-thread-beating-up mechanism, of slay-rings for supporting the warp-blades and the beating-up mechanism fixed on the central column, of cam-rings for operating the propelling and beating-up mechanisms said cam-rings being mounted loosely on the central column, of wheels on the cam-rings, of a rotary shaft within the column, and of pinions on the rotary shaft engaging with the wheels on the cam-rings; substantially as and for the purpose specified.

8. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race on said jacks, of a slay-ring supporting said jacks, of a cam-ring for operating said jacks, of warp-blades, of stocks on said blades, of a slay-ring having recesses on its upper and lower faces for the reception of the stocks on the blades, of inner and outer rings for holding the stocks in the lower face of the ring in place, of means for taking up the slack in the warp-threads, of weft-thread-beating-up mechanism, of slay-rings supporting the warp-blades and the beating-up mechanism, of cam-rings for operating the propelling mechanism and the beating-up mechanism, of wheels on the cam-rings, of a rotary shaft within the column and of pinions on the rotary shaft engaging with the wheels on the cam-rings, substantially as and for the purpose specified.

9. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race on said jacks, of a slay-ring supporting said jacks, of a cam-ring for operating said jacks, of warp-blades, of stocks on said blades, of a slay-ring having recesses on its upper and lower faces for the reception of the stocks on the blades, of inner and outer rings for holding the stocks in the lower face of the ring in place, of studs on the stocks, of cam-rings mounted loosely on the column and having recesses for the studs, of means for taking up the slack in the warp-threads, of weft-thread-beating-up mechanism, of slay-rings supporting the warp-blades and the beating-up mechanism, of cam-rings for operating the propelling mechanism and the beating-up mechanism, of wheels on the cam-rings, of a rotary shaft within the column and of pinions on the rotary shaft engaging with the wheels on the cam-rings, substantially as and for the purpose specified.

10. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race on said jacks, of a slay-ring supporting said jacks, of a cam-ring for operating said jacks, of warp-blades, of blocks carrying a group of blades, of a recess in the end of each block and of springs for retaining the end of the stocks in the saw-gate, of slay-rings for the outer ends of the blades, of a slay-ring having recesses on its upper and lower faces for the reception of the stocks on the blades, of inner and outer rings for holding the stocks in the lower face of the ring in place, of studs on the stocks, of cam-rings mounted loosely on the column and having recesses for the studs, of means for taking up the slack in the warp-threads, of weft-thread-beating-up mechanism, of slay-rings supporting the warp-blades and the beating-up mechanism, of cam-rings for operating the

propelling mechanism and the beating-up mechanism, of wheels on the cam-rings, of a rotary shaft within the column and of pinions on the rotary shaft engaging with the wheels on the cam-rings, substantially as and for the purpose specified.

11. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race formed on the said jacks, of warp-blades, of weft-thread-beating-up mechanism, of slay-rings supporting the propelling-jacks, the warp-blades and the beating-up mechanism, of a rotary shaft within the column, toothed wheels on the bosses of the cam-rings, and of pinions on the shaft for operating the cam-rings, of jacks for taking up the slack in the warp-threads, of slay-rings and bars operating in connection with the jacks, of projections on the ends of the jacks, of a cam-ring on the central column having a race with which the projections on the jacks engage, of a toothed wheel on the boss of the cam-ring and of a pinion on the central shaft for operating the cam-ring, substantially as described.

12. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race formed on the said jacks, of warp-blades, of instruments for beating up the weft-threads, of radial levers to which the beating-up instruments are attached, of slay-rings supporting the propelling-jacks, the warp-blades and the beating-up mechanism, of a rotary shaft within the column, of toothed wheels on the bosses of the cam-rings, and of pinions on the shaft for operating the cam-rings, of jacks for taking up the slack in the warp-threads, of slay-rings and bars operating in connection with the jacks, of projections on the ends of the jacks, of a cam-ring on the central column having a race with which the projections on the jacks engage, of a toothed wheel on the boss of the cam-ring and of a pinion on the central shaft for operating the cam-ring, substantially as described.

13. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race formed on the said jacks, of warp-blades, of instruments for beating up the weft-threads, of radial levers to which the beating-up instruments are attached in groups, of slay-rings supporting the propelling-jacks, the warp-blades and the beating-up mechanism, of a rotary shaft within the column, toothed wheels on the bosses of the cam-rings, and of pinions on the shaft for operating the cam-rings, of jacks for taking up the slack in the warp-threads, of slay-rings and bars operating in connection with the jacks, of projections on the ends of the jacks, of a cam-ring on the central column having a race with which the projections on the jacks engage, of a toothed wheel on the boss of the cam-ring and of a pinion on the central shaft for operating the cam-ring, substantially as described.

14. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race formed on the said jacks, of warp-blades, of weft-thread-beating-up instruments, of radial levers to which the instruments are attached in groups, of a cam-ring having a cam-race for moving the levers radially and provided with walls raised at intervals to raise the inner ends of said levers, a cam-plate on the cam-ring to depress the said ends of the levers, of a slay-ring on the central column supporting the cam-ring, of a toothed wheel on the boss of the cam-ring, of a rotary shaft within the column and of a pinion on the said shaft gearing with the wheel on the cam-ring, substantially as described.

15. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race formed on the said jacks, of warp-blades, of weft-thread-beating-up instruments, of radial levers to which the instruments are attached in groups, instruments below the beating-up instruments adapted to mesh with and hold the warp-threads in position, stocks to which said instruments are attached, means for supporting the levers and stocks, a cam-ring having a cam-race for moving the levers radially and provided with walls raised at intervals to raise the inner ends of said levers, a cam-plate on the cam-ring to depress the said ends of the levers, of a slay-ring on the central column supporting the cam-ring, of a toothed wheel on the boss of the cam-ring, of a rotary shaft within the column and of a pinion on the said shaft gearing with the wheel on the cam-ring, substantially as described.

16. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race on the said jacks, of warp-blades for operating the warp-threads, of stocks for operating the warp-blades, of a slay-ring supporting the said stocks, of a cam-ring provided with a double race alternately with single parts for operating the stocks, bolts in the cam-ring for closing the openings from the single to the double parts of the cam-race, of springs for pushing in said bolts, of a shaft provided with arms for operating the said bolts in pairs, of instruments for beating up the weft-threads, of radial levers to which said instruments are attached, of instruments coöperating with and situated below the beating-up instruments, of stocks to which said instruments are attached, of slay-rings for supporting the beating-up instruments, a cam-ring for operating the beating-up instruments, of gear-wheels on the bosses of said cam-rings, of a central rotary shaft within the column and of pinions on the rotary shaft engaging with the pinions on the cam-rings for the purpose specified.

17. In a circular loom the combination with a central column, of shuttle-propelling jacks, of a shuttle-race on the said jacks, of warp-blades for shedding the warp-threads, of in-

struments for beating up the weft-threads, of instruments for forming selvages, of loopers for inserting selvage-threads, of a rack operating the loopers, of a cam-lever connected to the rack, of a second cam-lever, of a lever connecting this second lever to the lever of the selvage mechanism, of points on the latter lever, of a cam-ring on the central column, of striking parts on the cam-ring for operating the loopers, of a cam-rib on the cam-ring for moving the lever of the selvage mechanism longitudinally, raised parts on the cam-rib for oscillating the said lever about its fulcrum, of a wheel on the boss of the cam-ring, of a rotary shaft within the column, of a pinion on the rotary shaft engaging with the wheel on the cam-ring, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES GREY HILL.

Witnesses:
HARRY C. SHELDON,
ALFRED CLARKE.