No. 637,336. Patented Nov. 21, 1899.

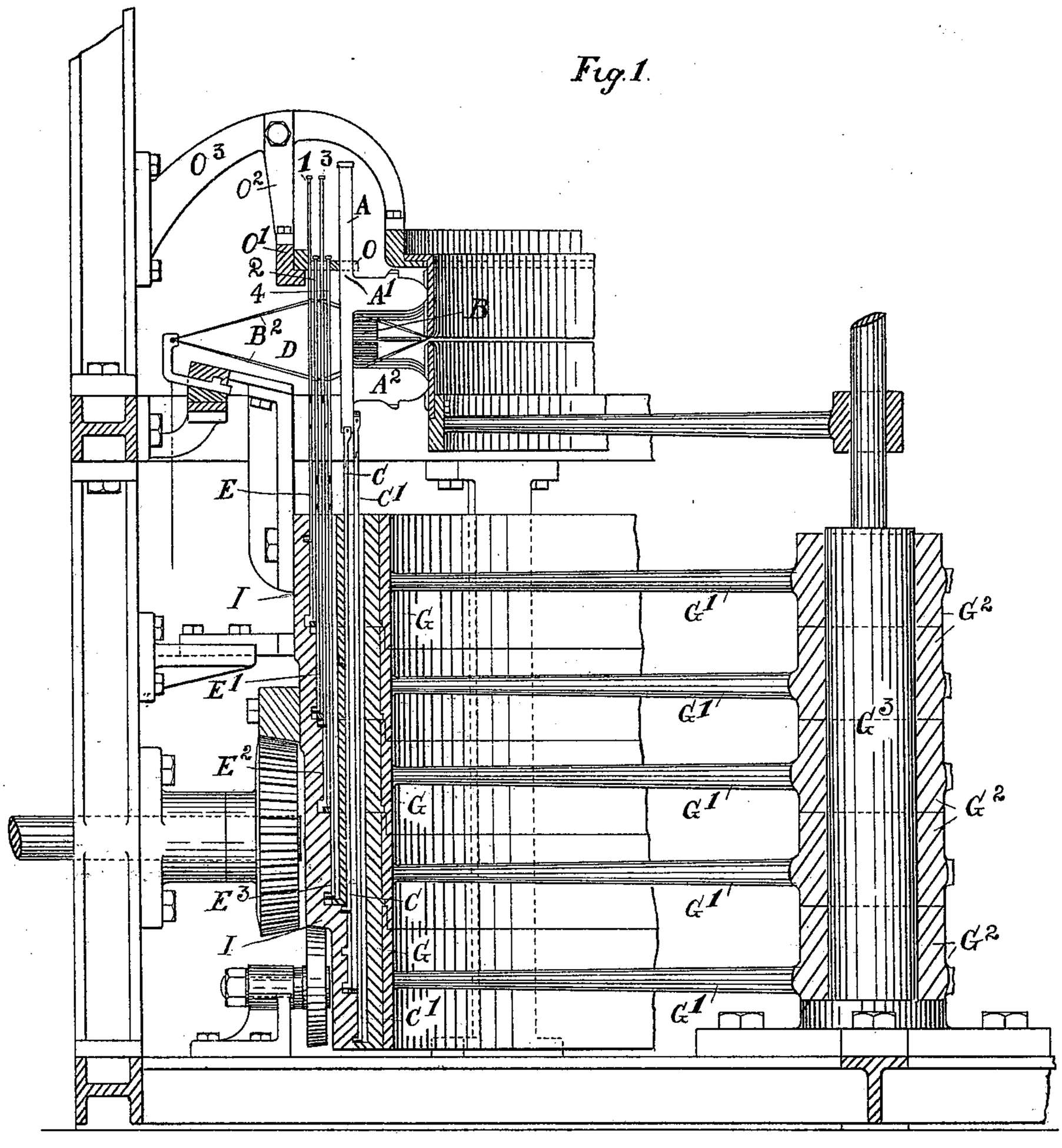
C. G. HILL & R. WEISS.

CIRCULAR WEAVING APPARATUS.

(Application filed Dec. 13, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses.
Thomas Durant
Virgil B. Newton.

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3 Sheets—Sheet 2.

Fig. 2.

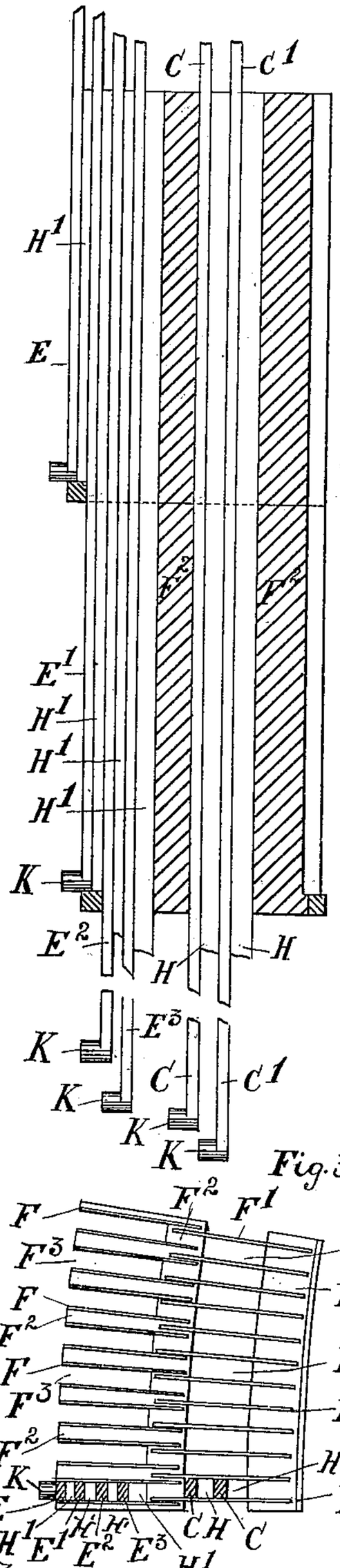

Fig. 3

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Fig. 4.

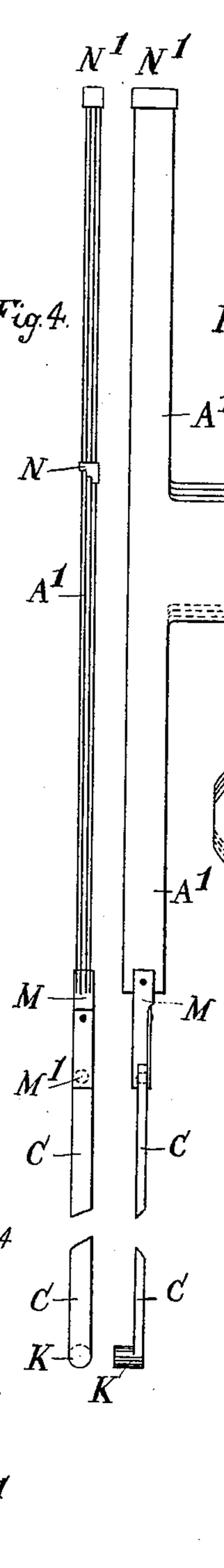

Fig 5

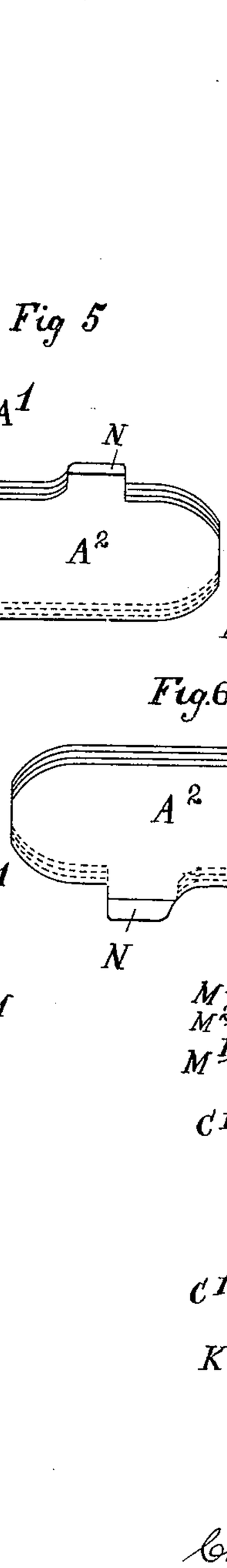

Fig.6

Fig.7

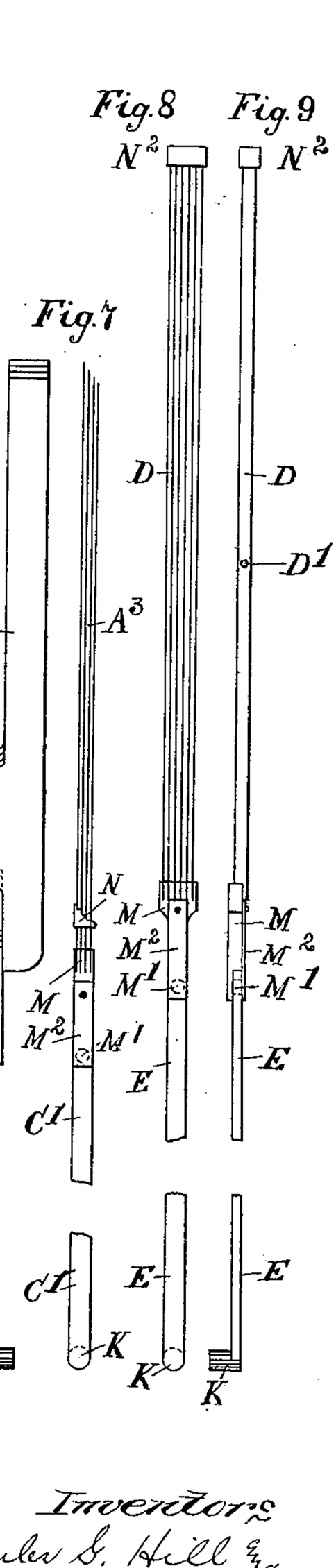

Fig.8

Fig.9

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Fig. 10.

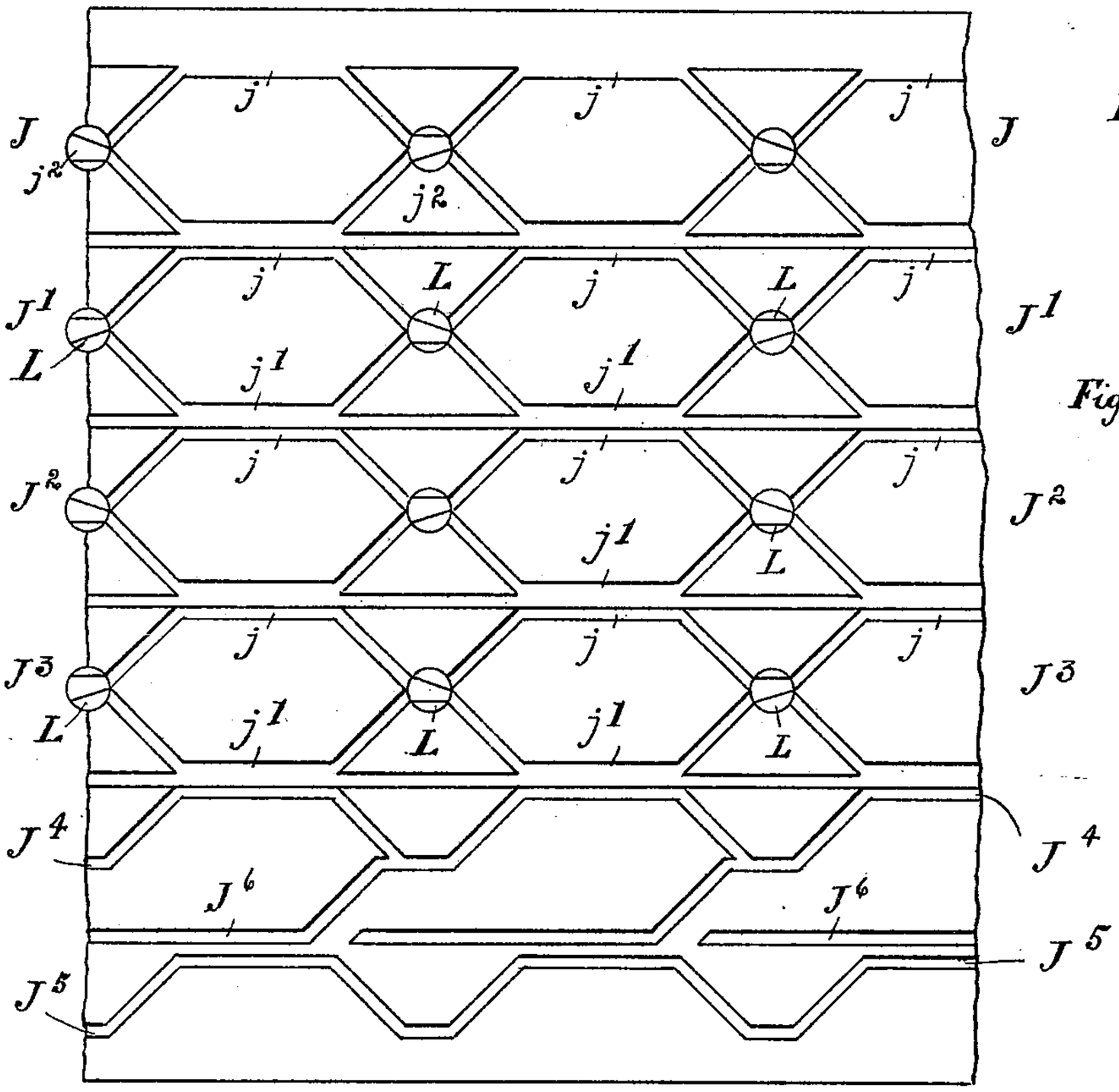
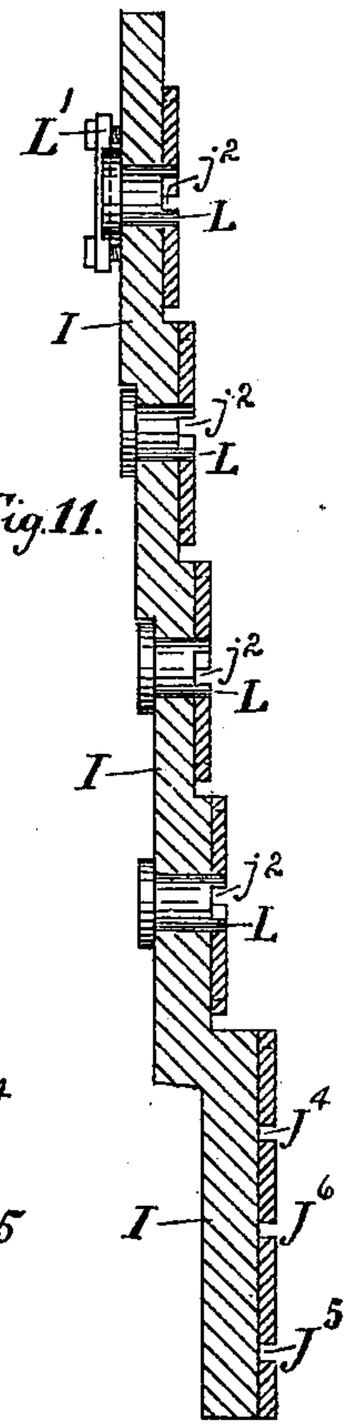


Fig. 11.



Witnesses:
Thomas Durant
V. B. Newton.

Inventors:
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Rudolph Weiss
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UNITED STATES PATENT OFFICE.

CHARLES GREY HILL, OF ARNOT HILL, AND RUDOLPH WEISS, OF NOTTINGHAM, ENGLAND.

CIRCULAR-WEAVING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 637,336, dated November 21, 1899.

Application filed December 13, 1897. Serial No. 661,767. (No model.)

To all whom it may concern:

Be it known that we, CHARLES GREY HILL, a subject of the Queen of England, residing at Arnot Hill, in the county of Nottingham, and RUDOLPH WEISS, a citizen of the Swiss Republic, residing at Nottingham, England, have invented certain new and useful Improvements in or Relating to Circular-Weaving Apparatus, of which the following is a specification.

This invention relates to improvements in circular looms such as described in the specification of Letters Patent No. 590,122, filed July 23, 1895.

The object of the present invention is to provide more substantial means for supporting and operating the shuttle-propelling jacks or blades and also the blades or heddles for operating the warp-threads, which are in looms adapted for weaving fine-gage fabrics excessively thin and fragile, and also render the said blades interchangeable in order that fabrics of different gages may be woven on the same loom. Heretofore the said blades have been arranged side by side, each in an independent compartment or recess formed in a supporting slay or ring and have each been operated singly by the direct action of the cam-races in the cam-ring. With this arrangement it has been found impossible to construct a loom to weave fabrics of the finer qualities, as owing to the excessive thinness of the blades required for this purpose and the reduced space between them this mode of arranging and operating them has failed, owing to the blades becoming bent, and thus set fast by the action of the cam-ring.

According to the present invention we attain the before-mentioned objects by the following arrangement: We divide the circumference of the loom into any convenient number of segments, each of which contains a group of shuttle-operating jacks and a group of warp-operating blades. These are again divided into subgroups, and each subgroup is connected to and is operated by a single vertical slider, which engages with and is moved up and down by the cam-ring. The whole of the vertical sliders comprised in each segment of the loom are placed radially one behind the other in the supporting slay or ring, instead of side by side, as in the case of independently-operated blades, and thus the strength of each slider is determined by the number of segments into which the loom is divided and is independent of the thickness of the blades. This arrangement also permits of the use of a supporting slay or ring having greater strength.

By grouping the warp-operating blades as hereinafter described we are also enabled to weave on looms of this description diagonal or twill fabrics, and also produce ornamental fabrics as well as plain fabrics.

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

Figure 1 is a vertical section showing a loom constructed according to our invention. Fig. 2 is a vertical elevation; and Fig. 3 is a plan view of one of the upper segments of the circular slay for holding the vertical sliders, showing the position of the latter. Fig. 4 is an end elevation, and Fig. 5 is a side elevation, of one subgroup of jacks in each group and the operating-slider. Fig. 6 is an end elevation, and Fig. 7 a side elevation, of the other subgroup of jacks in each group and the operating-slider. Fig. 8 is an end elevation, and Fig. 9 is a side elevation, of a group of warp-operating blades and the operating-slider. Fig. 10 is a development of part of the interior, and Fig. 11 a vertical section of the cam-ring. Figs. 2 to 11, inclusive, are drawn on a larger scale than Fig. 1.

Like letters indicate like parts throughout the drawings.

In carrying out this invention the circumference of the looms is divided into a convenient number of equal segments, each of which contains a group of, say, eight of the jacks A, which carry and propel the shuttle B and also perform the beating up of the weft-threads. Each group is also divided into two subgroups, the alternate jacks in each group forming one subgroup and the remainder the other subgroup.

The whole of the shuttle-propelling and beating-up jacks A′ in one subgroup (see Figs. 4 and 5) are formed with extensions A^2, which work above the center of the path of the shuttles B and are connected to one common operating-slider C. The whole of the jacks A in the other subgroup A^3 (see Figs.

6 and 7) are also formed with extensions A^2, which work below the center of the path of the shuttle and are connected to one common operating-slider C′. The jacks in one subgroup A′ are placed alternately with the other subgroup A^3, as previously stated.

The operating-sliders C C′ are carried and operated in the manner hereinafter described.

Each warp-thread B^2 is operated by an independent thin metal blade D, hereinafter called a "warp-blade," (see Figs. 8 and 9,) provided with warp-eyes D′ for the passage of a warp-thread, and these blades are arranged as follows:

Each segment of the loom in the present case contains a group of, say, twenty-four warp-blades D, and they are divided into four subgroups each containing six warp-blades, (see Figs. 8 and 9,) and each subgroup is arranged in a different circumferential line to the other subgroups in the same group—that is, one behind the other, as shown in Fig. 1. The whole of the warp-blades in each subgroup are connected to one common operating-slider. For example, as shown in Fig. 1, No. 1 subgroup is connected to and operated by a slider E, No. 2 subgroup to a slider E′, No. 3 subgroup to a slider E^2, and No. 4 subgroup to a slider E^3.

In distributing the warp-threads E^2 in the operating warp-blades each group of twenty-four threads may be disposed with every fourth thread in the same subgroup—that is, for example, as follows: threads Nos. 1, 5, 9, 13, 17, 21 in No. 1 subgroup, threads Nos. 2, 6, 10, 14, 18, 22 in No. 2 subgroup, threads Nos. 3, 7, 11, 15, 19, 23 in No. 3 subgroup, and threads Nos. 4, 8, 12, 16, 20, 24 in No. 4 subgroup.

The whole of the sliders for operating the shuttle-propelling and beating-up jacks A and the warp-blades D are carried, preferably, parallel to the axis of the loom in recesses or compartments in a ring secured to the framing of the loom or, as shown, between hard-metal blades cast into a soft-metal foundation in segments which are secured to the cylindrical casing G.

A segment constructed in the manner described is shown in Figs. 2 and 3, and it is formed with hard-metal plates F F′, cast into a soft-metal foundation F^2, as shown. Each segment is formed with recesses F^3 to receive the sliders E E′ E^2 E^3 for operating the warp-blades D and compartments F^4 for receiving the sliders C C′ for operating the shuttle-propelling and beating-up jacks A, the whole of which may be arranged as follows: The two sliders C C′ for operating each subgroup of shuttle-propelling and beating-up jacks A are preferably placed in the compartment F^4, as shown in Figs. 1, 2, and 3, with a stationary distance-piece or dummy H between them and a distance-piece or a dummy H at the back of the inner slider C′. The four sliders E E′ E^2 E^3 for operating each of the subgroups of warp-blades D of each group are placed one behind the other in the recesses F^3, with a stationary distance-piece or dummy Z behind each slider. The whole of the sliders in each segment of the loom are thus placed diametrically one behind the other.

It will be understood that the above is a description of a segment of a loom, and that the circumference of the said looms will be made up of segments correspondingly arranged, the shuttle-propelling and beating-up jacks in each of the said segments being operated by two sliders and the warp-blades by four sliders.

The sliders E E′ E^2 E^3 are held in position by an inclosing cylindrical cam-ring I, (see Fig. 1,) which is mounted and operated, as shown, in the same manner as described in the specification cited.

The cam-ring I (see Figs. 1, 10, and 11) is provided on its inner surface with six cam-races placed one above the other, as shown, and the sliders in each set are each provided at their lower ends with a stud K, which engages in one of the cam-races. The sliders in each segment are on this account varied in length, the outer one, E, being the shortest and the inner one, C′, the longest, and the walls of the recesses F^3 and compartments F^4 are reduced or stepped down and the internal diameter of the cam-ring I correspondingly reduced in diameter to fit the reduced parts, as shown. With this arrangement the studs K on the sliders may be all of the same length, and the inner face of the cam-ring where each race is formed works close up to the body of the slider which it is operating.

If preferred, the sliders may be placed in pairs side by side in the recesses instead of all being placed one behind the other, as shown.

By subdividing the warp-blades D into four subgroups arranged as shown, arranging the warp-threads as described, and operating each group by an independent cam-race we can make both a three-to-one diagonal fabric and also a plain fabric with either the full or half the full number of threads. We can also make a two-to-one diagonal fabric by employing three of the subgroups of warp-blades and a corresponding number of threads without altering the set-out of the loom. If, however, the warp-blades were divided into, say, three subgroups, we could make a two-to-one diagonal fabric, and also by using two of the subgroups of warp-blades with a corresponding number of threads could also make a plain fabric without altering the set-out of the loom.

The threads are distributed in the warp-blades in the manner described for the purpose of producing a diagonal or twill fabric; but numerous other effects may be produced by arranging the threads in the warp-blades in different orders in the several subgroups.

It is obvious that the movements imparted to the warp-operating slider of each subgroup must be different for the different classes of fabrics, and in order to obtain the different

movements required for each shuttle we form the cam-races J J′ J² J³ (see Figs. 10 and 11) for operating the respective sliders E E′ E² E³ each in the following manner: Each of the said races is formed with double parts—that is, an upper part *j* and a lower part *j′*, alternating with a single central part *j²*, from which latter the upper and lower parts alternately diverge from and converge into again, as shown. The single parts *j²* of the races are formed in removable and interchangeable studs or blocks L, which are inserted in corresponding openings in the wall of the cam-ring I from the exterior, where they may be secured by straps L′, secured to the cam-ring or by other convenient means. The single central parts *j²* of the races in the interchangeable studs or blocks L are disposed according to the movements required—that is, according to whether they are to return the warp-blades to the position which they previously occupied, and thus move the warp-thread which they operate back into the same wall of the shed again or move them into the reverse position—that is, into the opposite wall of the shed. For example, the studs K of the sliders C, which operate No. 1 subgroup of warp-blades D, may for one shuttle be in the lower part *j′* of the race J. It is then moved into the central part *j²* of the race as the cam rotates, (after the passage of the shuttle and during the beating up of the weft-thread.) The stud is then moved into the upper part *j* or the lower part *j′* of the race, according to the disposition of the single central part *j²* in the interchangeable stud L.

The warp-threads operated by the warp-blades D, which are connected to the slider C—that is, subgroup No. 1—will be moved in the corresponding manner.

In the cam-ring shown in Figs. 10 and 11 the single parts of the cam-recess *j²* are so disposed as to produce a plain fabric.

The shuttle-propelling and beating-up jacks A are moved from the upper and lower position, in which they are shown, into the center of the path of the shuttle and back again, the cam-races J⁴ J⁵ being arranged, as shown, to impart this movement through the operating-slider C C′.

The sliders C C′ are provided with studs K, which engage in the cam-races J⁴ J⁵. The upper race J⁴ is provided with turnouts J⁶, in order that by reversing the direction of rotation of the cam-ring I the projection A² on the upper subgroups A′ of the shuttle-propelling and beating-up jacks may be moved into the same position as the projections A² on the lower subgroups A³, so that the shuttles B′ may be released and removed.

The whole or any of the sliders E E′, E² E³, and C C′ may be removed without removing the cam-ring I by withdrawing the stationary distance-pieces H or H′ and then withdrawing the studs K on said sliders from their operating cam-races.

Each subgroup of shuttle-propelling and beating-up jacks and each subgroup of warp-blades is secured to a base M. (See Figs. 4, 5, 6, 7, 8, and 9.) This base is provided with a pin M′, which engages with a hole in the upper end of its operating-slider and is retained in this position by a spring M². By means of this arrangement we are enabled to change the set-out of the loom by removing the shuttle-propelling and beating-up jacks A and the warp-blades D from their respective sliders and replacing them with others of different gages and a different set-out.

The shuttle-propelling and beating-up jacks A in each subgroup are connected together at the points N in order that they may afford support to each other. The jacks in the subgroups A′ are also in addition connected at their upper ends N′. The upper ends of each subgroup of warp-blades D are also connected at their upper ends N².

The edges of the projections A² of the shuttle-operating and beating-up jacks A are disposed in a line which is parallel to the inclines on the rear of the shuttles, so that they all bear on the shuttles in the act of propelling them.

The upper ends of both the shuttle-propelling and beating-up jacks A and the warp-blades D (see Fig. 1) are supported in a slay O, secured to a ring O′, which is secured by brackets O² O³ to the framing.

The cylindrical casing G is built up of horizontal sections, which are each connected by radial arms G′ to bosses G², mounted on the central pillar G³ of the looms.

If preferred, the operating-sliders may be carried in sections secured to the inner face of a fixed ring occupying the position of the cam-ring I in the present arrangement and the cam-races be formed on the outer face of a rotating cylinder occupying the present position of the cylinder G, thus reversing the arrangement shown.

Having thus described our invention, what we claim as new is—

1. In a circular-weaving apparatus, the combination with the shuttle-operating jacks and the warp-operating blades each arranged in segmental groups, each group being divided into subgroups, a slider connected to and operating each subgroup of warp-blades and shuttle-jacks, a supporting ring or slay in which said sliders are supported and a cam-ring for operating the sliders; substantially as described.

2. In a circular-weaving apparatus, the combination with the shuttle-operating jacks and warp-operating blades each arranged in segmental groups, each group divided into subgroups, a vertical slider connected to and operating each subgroup, the whole of the vertical sliders in each segment placed radially in the supporting ring or slay, the supporting ring or slay and the cam-ring for operating the sliders; substantially as described.

3. In a circular-weaving apparatus, the combination with a group of shuttle-propelling

jacks or blades divided into two subgroups of alternate jacks connected together, of two sliders one for operating each subgroup, said sliders being placed in a compartment in the supporting-slay one radially behind the other, a supporting ring or slay having compartments, and a cam-ring for operating the said sliders; substantially as described.

4. In a circular-weaving apparatus the combination with a group of shuttle-blades and a group of warp-blades, a separate base to which each group is connected, an operating-slider for each group, means for detachably securing each base to its slider, a supporting ring or slay and a cam-ring for operating each slider; substantially as described.

5. In a circular-weaving apparatus, the combination with the sliders for operating the warp-blades, of a cam-ring, a double cam-race in the said cam-ring alternating with a single race, and a detachable stud in which the single part of the race is formed; substantially as described.

In witness whereof we have hereto set our hands in the presence of the two subscribing witnesses.

CHARLES GREY HILL.
RUDOLPH WEISS.

Witnesses:
H. C. SHELDON,
J. W. THORMAN.