No. 890,761. PATENTED JUNE 16, 1908.

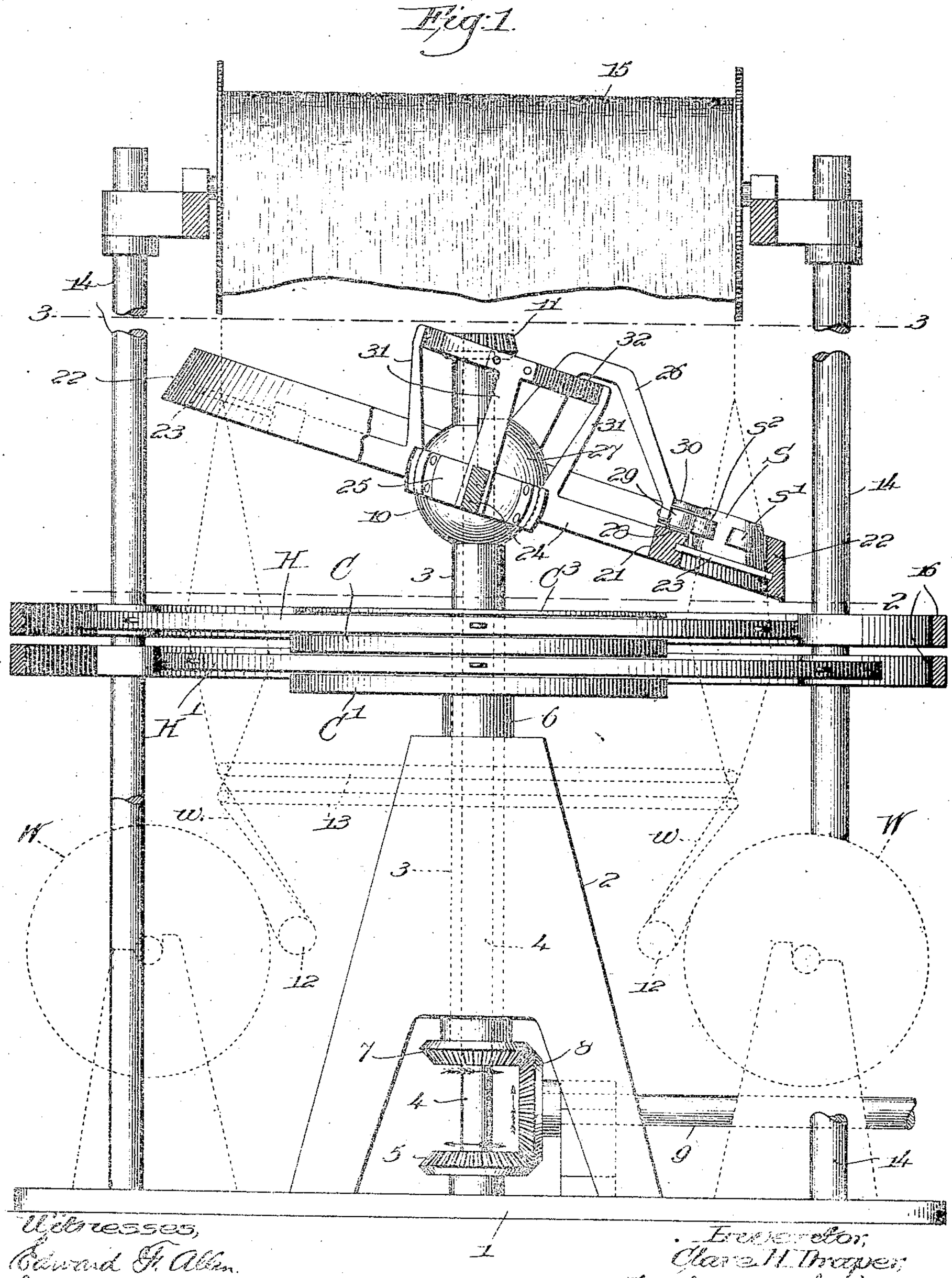
C. H. DRAPER.

LOOM FOR WEAVING TUBULAR FABRICS.

APPLICATION FILED JUNE 3, 1907.

3 SHEETS—SHEET 1.

Fig. 1.



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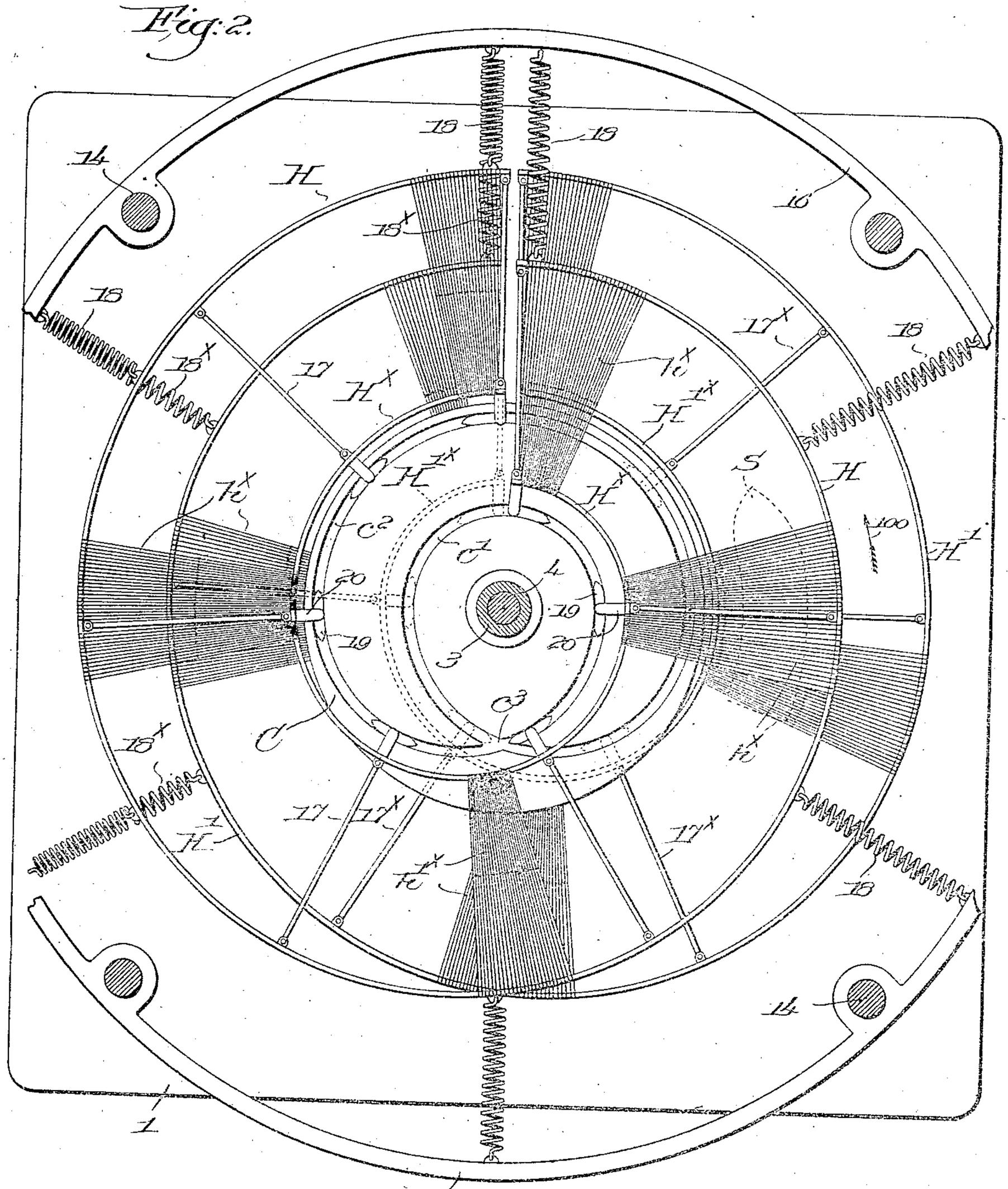
3 SHEETS—SHEET 2.

Fig. 2.



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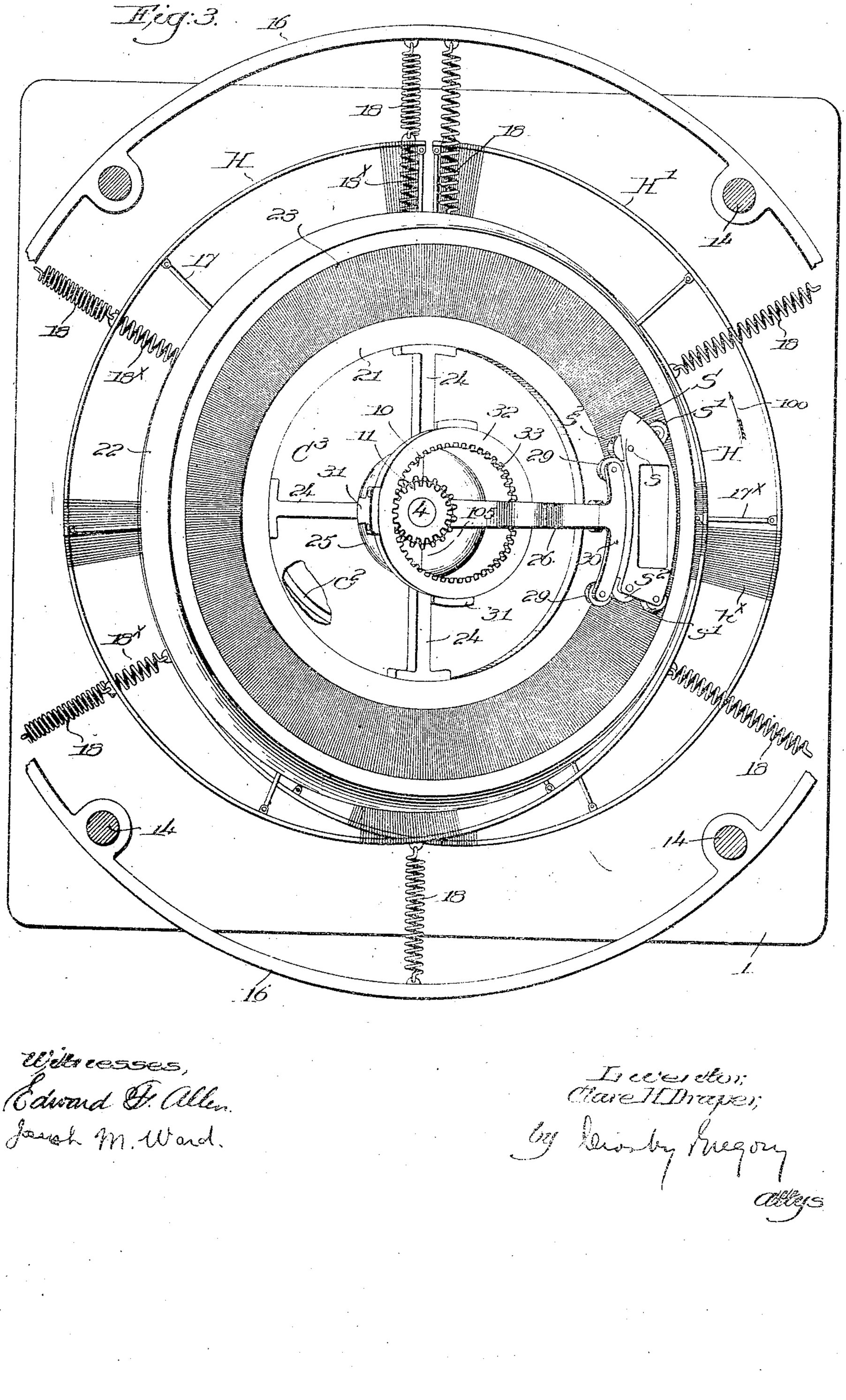
3 SHEETS—SHEET 3.

Fig: 3.



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UNITED STATES PATENT OFFICE.

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LOOM FOR WEAVING TUBULAR FABRICS.

No. 890,761. Specification of Letters Patent. Patented June 16, 1908.

Application filed June 8, 1907. Serial No. 376,953.

To all whom it may concern:

Be it known that I, CLARE H. DRAPER, a citizen of the United States, and a resident of Hopedale, in the county of Worcester and State of Massachusetts, have invented an Improvement in Looms for Weaving Tubular Fabrics, of which the following description, in connection with the accompanying drawing, is a specification, like letters on the drawing representing like parts.

This invention relates to looms for weaving fabrics wherein the shuttle is carried in a circular path through the tubular shed by means located inside of the tube of warp, and it has for one of its objects the production of means to prevent rotative movement of the reed independently of the warp. By restraining the reed from rotative movement in a positive manner the warp threads are relieved from the lateral pull or strain due to the effort of the reed to rotate.

Other objects of my invention and novel features of construction will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a front elevation and partial section of a sufficient portion of a loom for weaving tubular fabrics, illustrating one embodiment of my present invention; Fig. 2 is a top plan view of the parts below the horizontal line 2—2, Fig. 1, the cover plate for the upper harness-cam being omitted; Fig. 3 is a transverse sectional view on the line 3—3 Fig. 1, looking down.

Referring to Fig. 1 the base or bed 1 is provided with a standard 2 in which is rotatably mounted a tubular shaft or sleeve 3 and an inclosed shaft 4, the latter having an end bearing on the base 1 and being provided with a gear 5. A collar 6 on the sleeve vertically sustains the same, and at its lower end the sleeve has an attached gear 7, the gears 5 and 7 meshing with a gear 8 fast on a horizontal driving shaft 9 mounted in suitable bearings on the base and driven from any suitable source of power. The sleeve 3 and shaft 4 are rotated in opposite directions, as indicated by the arrows, Fig. 1, the sleeve being herein shown as provided near its upper end with a ball-like enlargement 10, for a purpose to be described, and the upper end of the shaft 4 has an attached bevel pinion 11. The warp beams W are mounted on the base and in practice four beams may be used, arranged in a rectangle, only two opposite beams being shown by dotted lines Fig. 1, the warp w passing from the beams under a suitable guide or guides 12 and thence upward through leasing means 13 to the heddles of the harnesses. Posts 14 erected on the base 1 support at their upper ends take-up mechanism, the take-up roll 15 thereof being the only member of such mechanism herein shown, and forming no part of my present invention, said posts also having fixedly secured to them two or more like rings 16, one slightly above the other and located above the leasing devices in horizontal planes. These rings sustain the harnesses, which are of peculiar construction, each consisting of an inner and an outer flexible member, preferably a metallic band, the two members being connected in substantial parallelism in the form of a short spiral or evolute with the heddles radially disposed and carried by the two members.

For convenience I have indicated the outer and inner members of the upper harness at H and $H^{\times}$, and said members in practice may be flexible steel bands, connected at suitable intervals by rods 17, the bands being in substantial parallelism and in the form of an evolute or short spiral, best shown in Fig. 2. Springs 18 attached to the rings 16 and to the outer member H support the harness at the outer part thereof, while the inner part is supported by followers 19 carried by ears 20 projecting inwardly from the member $H^{\times}$, the followers traveling in the grooves of and being upheld by an actuating cam, shown as a disk C. The lower harness is similar to the upper one, and comprises an outer member H′ and an inner member $H'^{\times}$, connected by rods $17^{\times}$ and suspended by springs $18^{\times}$, see Fig. 2, the lower harness being provided with followers such as described to travel in the grooves of the lower cam C′.

As shown in Fig. 2 the cam has a groove consisting of inner and outer lobes c', c^2 intersecting or crossing at c^3, to give the proper movement to the harnesses in forming the tubular shed, opening the same in front of the circularly moving shuttle and closing the shed behind the shuttle, the cams having like grooves. Said cams C and C′ are fixedly mounted on the sleeve 3 and are rotated thereby. Heddles $h^{\times}$ are strung between the inner and outer members of each harness, the heddles lying in a substantially hori-

zontal plane and being practically radially disposed, though at the point where the planes of the shed cross there is some slight distortion as at $h'^{\times}$, Fig. 2.

In Figs. 2 and 3 I have shown only sections of the heddles, in order to avoid confusing the drawing. As the cams rotate the crossing point of the shed advances in the direction of arrow 100, Fig. 2, which arrow also indicates the movement of the shuttle, the shed opening in advance of the shuttle and closing and crossing behind it, the harnesses being flexed or bent during such operation by or through the action of the cams on the followers. The upper cam C acts as a downhold to overcome any tendency of the followers of the cam C' to lift out of the grooves therein, and a plate C^3 is secured to the sleeve 3 above the cam C for a similar purpose relative to its followers, said plate C^3 being omitted altogether in Fig. 2. Herein I have shown the circular reed as consisting of inner and outer rings 21, 22, the latter being made somewhat conical to resist the thrust of the shuttle due to centrifugal force, said rings being connected by reed-dents 23, through which the warps pass in a tubular body, between the rings 21 and 22, the latter and the dents constituting a race for the shuttle.

Arms 24, Figs. 1 and 3, connect the ring 21 with a central socket member 25 arranged to loosely embrace the ball 10 on the sleeve 3, so that a ball and socket connection is established between the sleeve and reed, the latter being vertically supported by the former. The reed is mounted to tip or gyrate about the ball 10, and herein I effect the gyratory movement of the reed by an actuator shown as an arm 26 having a foot 27 fastened to a part of the ball, the arm extending radially and being bent down at its outer end and provided with a roll 28 to travel upon the top of the ring 21 of the reed. Manifestly as the sleeve 3 revolves the roll 28 will move in a circular, horizontal path, and will impart to the reed a gyratory motion about the ball 10 as a center, the reed being held from rotation by means to be described. The actuator 26 is also arranged to act as a shuttle-driver, the shuttle S, Fig. 3, being adapted to receive a bobbin and having a delivery eye *s* for the thread, and herein I have shown the shuttle as provided with rolls *s'* to travel upon the inner face of the ring 22, the warp threads of one division passing up between the said ring and the shuttle. Other rolls s^2 on the inner side of the shuttle are arranged to cooperate with rolls 29 on the segmental extension 30 of the arm or actuator 26, in order to drive the shuttle forward in the direction of arrow 100, Fig. 2, while the warp threads are permitted to pass easily between the rolls s^2 and 29. The shuttle and the driving device may be varied or changed according to convenience, and I have shown herein substantially a form of shuttle and driving device which has been used in looms of this character. In looms wherein a gyrating reed has been used the rotative movement of the reed has been restrained or prevented by the warp, but this is objectionable, as it subjects the warp to undue strain and it also causes a deterioration in the product. To overcome this objectionable feature I have herein provided means to positively coöperate with the reed and prevent its rotative movement independently of the warp, so that the latter is absolutely relieved of all strain due to this cause.

Referring to Figs. 1 and 3, the socket member 25 of the reed is shown as having upturned arms 31 which support at their upper ends a ring 32 having upon its inner circumference gear teeth 33, the actuator 26 passing up within the ring 32 and then down outside of and below it, as clearly shown in Fig. 1, the ring 32 being parallel to the plane of the circular reed and above it. The bevel pinion 11 fast on the shaft 4 is, it will be remembered, rotating in a direction opposite to that of the shuttle, or in the direction of arrow 105, Fig. 3, and the internal gear 33 is at such an angle that its teeth will mesh with the beveled teeth of the pinion 11. As the reed is gyrated one after another of its teeth will be brought into engagement with said pinion, the tendency of the gear 33 being to rotate with the shuttle, but as the pinion 11 is rotating oppositely the one tendency overcomes or neutralizes the other, and the reed is held from any rotative movement whatever. Such restraining action, however, does not in the least interfere with or retard the free gyratory movement of the reed, it being understood that such movement serves to beat or press in the filling as it is laid by the shuttle.

I have illustrated herein only so much of the loom as may be requisite for a clear understanding of my invention, omitting various parts which form no part of the invention herein and which may be of any usual or suitable construction, arrangement and operation.

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

1. In a loom for weaving tubular fabrics, means to effect the formation of a tubular shed, an upright rotatable member concentric with the warp, a circular reed, a ball and socket connection between it and said upright member, separate means on and fixedly connected with the latter to coöperate with the reed near its periphery and impart a gyratory movement to the reed, and a positively operating device to restrain the reed from rotative movement.

2. In a loom for weaving tubular fabrics, means to effect the formation of a tubular

shed, a vertical shaft and a surrounding sleeve concentric with the warp, means to rotate the shaft and sleeve in opposite directions, a circular reed, a ball and socket supporting connection between it and the sleeve permitting gyratory movement of the reed, an actuator rotating with the sleeve and cooperating with the reed to gyrate the latter, and a positive connection between the rotating shaft and the reed to prevent rotative movement of the latter.

3. In a loom for weaving tubular fabrics, means to effect the formation of a tubular shed, a vertical shaft and a surrounding sleeve concentric with the warp, means to rotate the shaft and sleeve in opposite directions, a circular reed, a supporting connection between it and the sleeve, permitting gyratory movement of the reed, an actuator rotating with the sleeve and coöperating with the reed to gyrate the latter, a pinion on the rotating shaft, and an internal gear carried by the reed and meshing with the pinion, the engagement of the gear and pinion restraining the reed from rotative movement.

4. In a loom for weaving tubular fabrics, means to effect the formation of a tubular shed, a vertical shaft and a surrounding sleeve concentric with the warp, means to rotate the shaft and sleeve in opposite directions, a circular reed, a ball and socket connection between it and the sleeve, permitting gyratory movement of the reed while the sleeve rotates, separate means positively connected with the sleeve to gyrate the reed and drive the shuttle through the shed, a shuttle, and means acting through the shaft upon the reed to prevent rotative movement of the latter.

5. In a loom for weaving tubular fabrics, means to form a tubular shed, a circular reed, a rotating support on which the reed is mounted to gyrate, an actuator fixedly connected with said support and having a traveling engagement with the reed near its periphery to impart gyratory movement thereto, and means, including a member rotating oppositely to said support, to coöperate with and restrain the reed from rotative movement.

6. In a loom for weaving tubular fabrics, harnesses each comprising inner and outer flexible members substantially in parallelism, spacing connections between and to retain said members in substantial parallelism when flexed, radially disposed heddles attached to said inner and outer members, and an actuating cam for and operatively connected with each harness.

7. In a loom for weaving tubular fabrics, harnesses each comprising inner and outer flexible members, spacing connections between and to retain said members in substantial parallelism, radially disposed heddles attached to said inner and outer members, and lying in a substantially horizontal plane, the two harnesses lying one above the other and coöperating with the warp to form a tubular shed, yielding supporting devices for the harnesses, and an actuating cam for and operatively connected with each harness, each cam having a continuous groove comprising inner and outer intersecting lobes.

8. In a loom for weaving tubular fabrics, harnesses each comprising two connected flexible metallic bands in parallelism and arranged in a substantially spiral form, and radially disposed heddles sustained by and between the two bands, cams to actuate the harnesses to open and close a tubular shed, a circular reed above the harnesses, means to impart a gyratory motion to the reed, a device to restrain the reed from rotation, a shuttle and a shuttle-driving device to propel the shuttle in a circular path, the harnesses opening the shed in advance of and closing the shed behind the shuttle.

9. In a loom for weaving tubular fabrics, a circular reed, harnesses below it and having radially disposed heddles, a rotating sleeve concentric with the reed, a ball and socket connection between the reed and the sleeve, a shuttle-driving and reed-actuating arm extended radially from the sleeve, to drive the shuttle in a circular path and having a traveling engagement with the periphery of and to impart a gyratory movement to the reed, harness cams fast on the sleeve, to operate the harnesses, and a device to engage and prevent rotative movement of the reed while permitting gyratory movement thereof.

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

CLARE H. DRAPER.

Witnesses:

FRANK J. DUTCHER,

EUGENE BEAUDRY.