No. 684,301. Patented Oct. 8, 1901.

H. G. OSBURN.

LOOM FOR FORMING FLEXIBLE CONDUITS.

(Application filed June 19, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

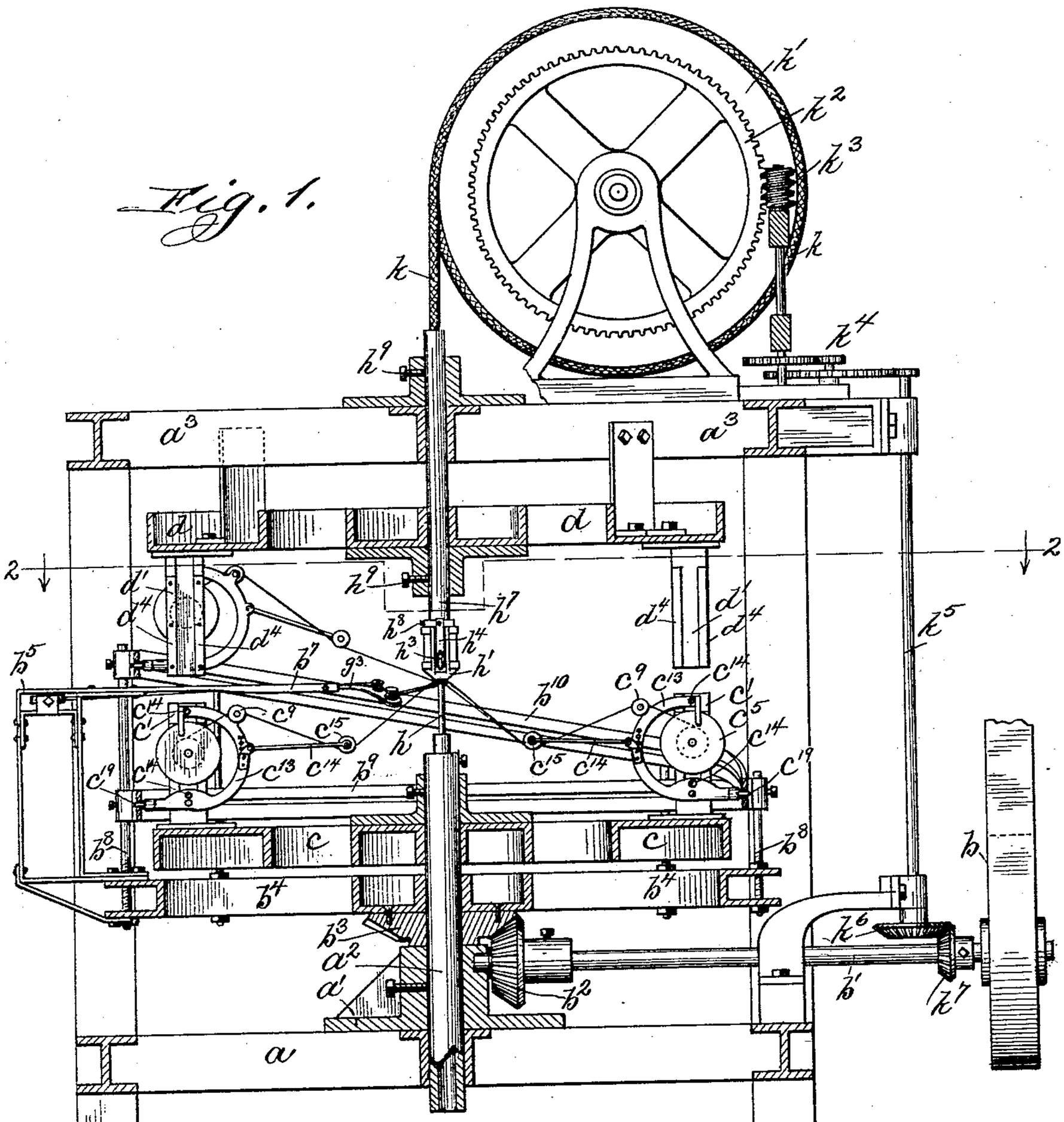
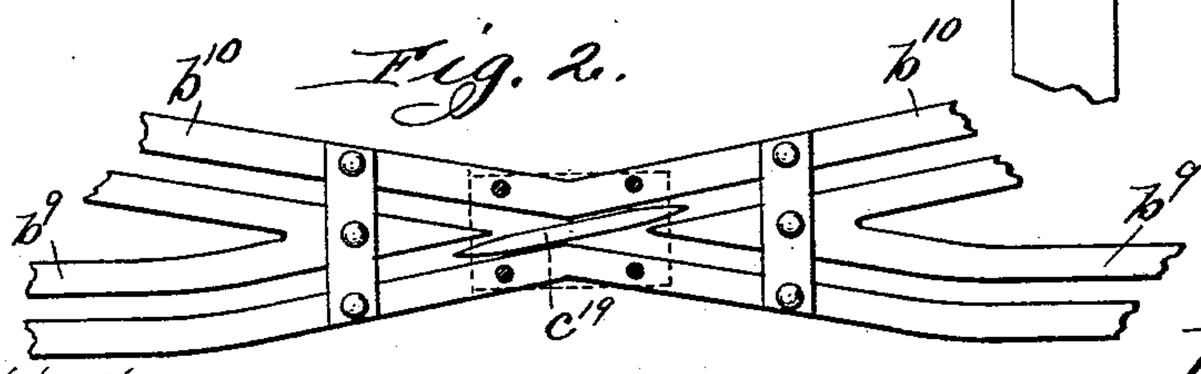


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

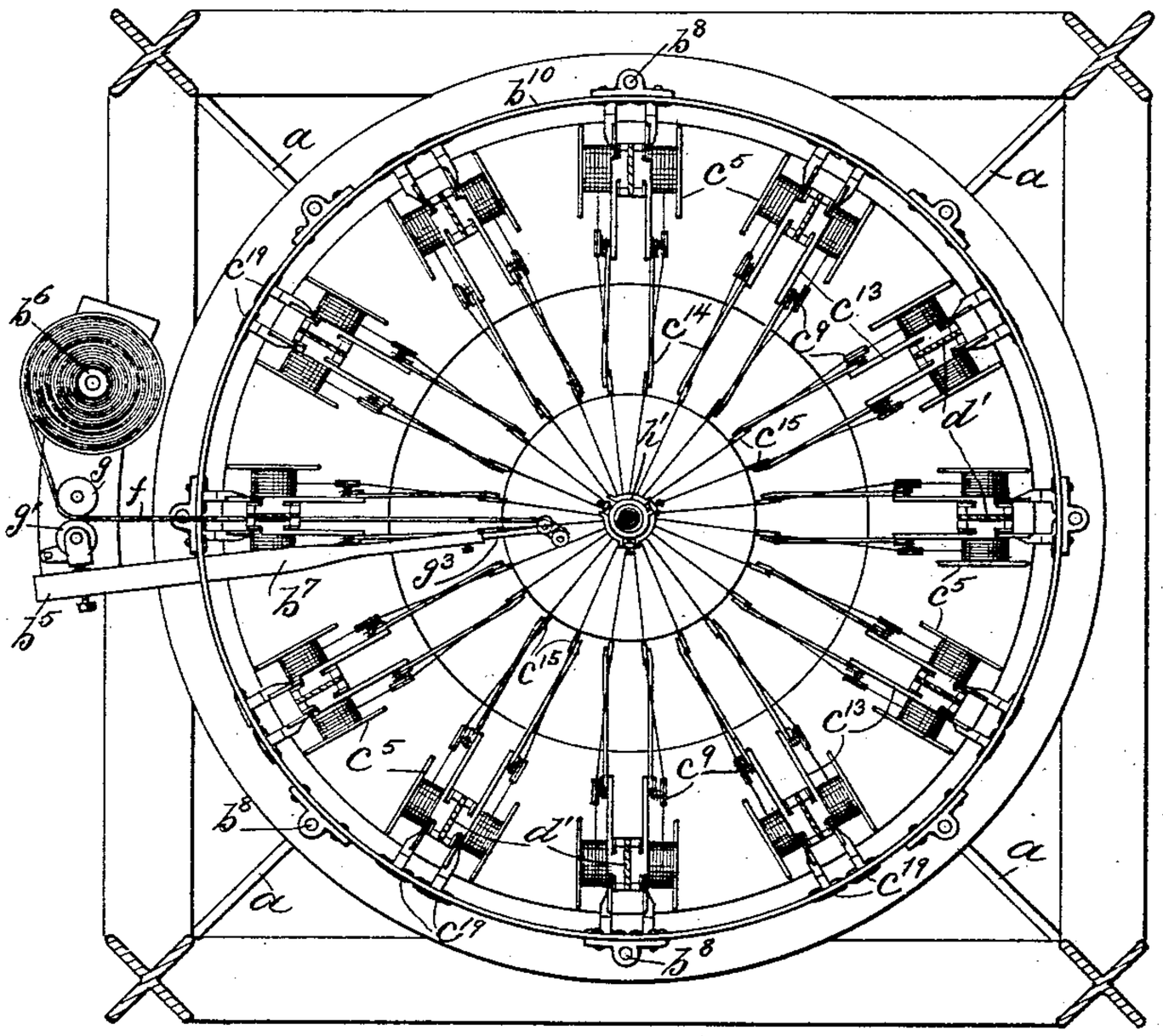

Fig. 3.

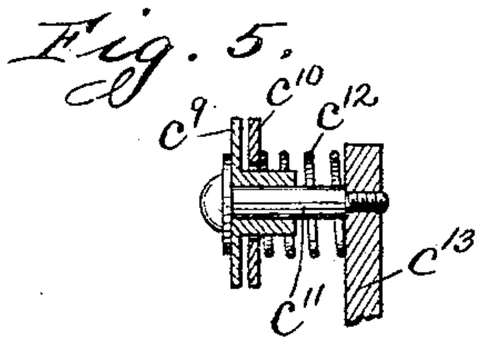

Fig. 5.

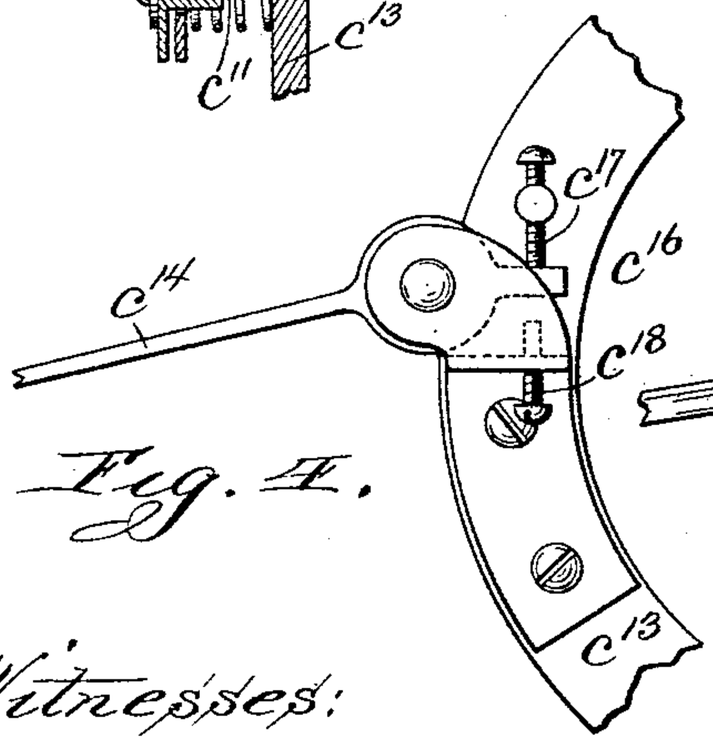

Fig. 4.

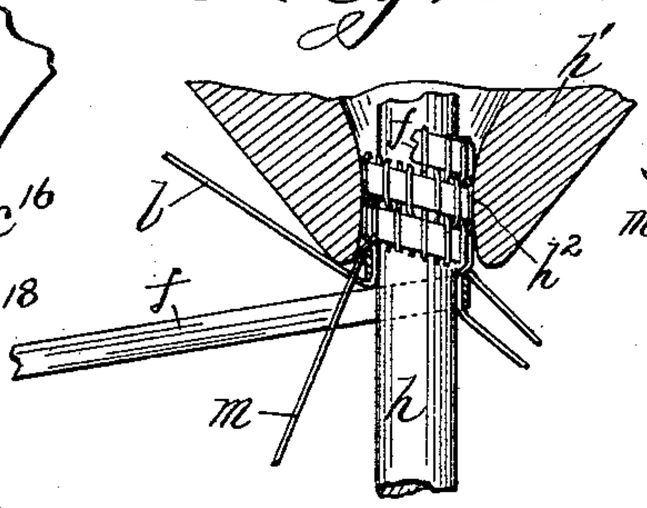

Fig. 6.

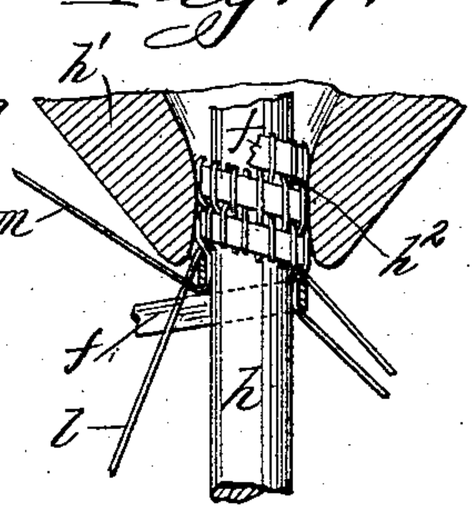

Fig. 7.

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Fig. 8.

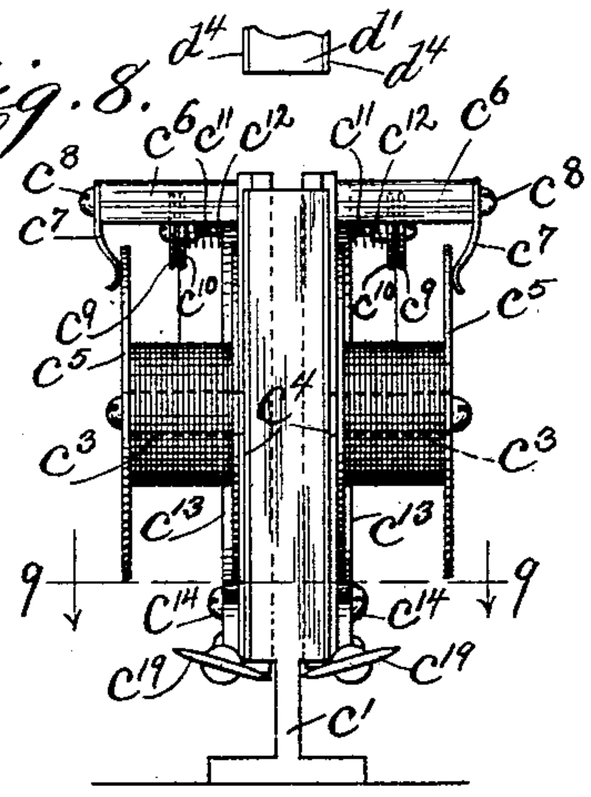


Fig. 9.

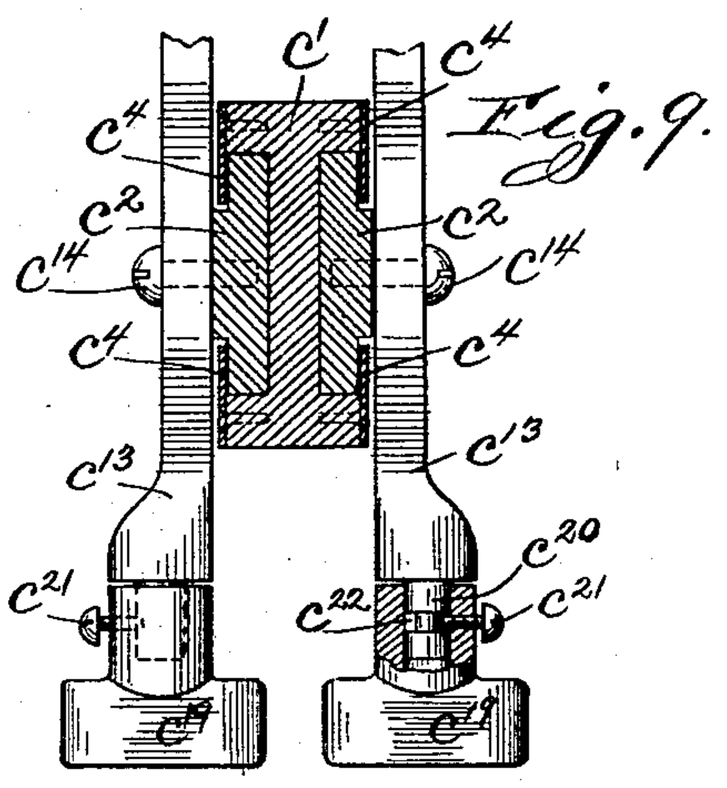


Fig. 11.

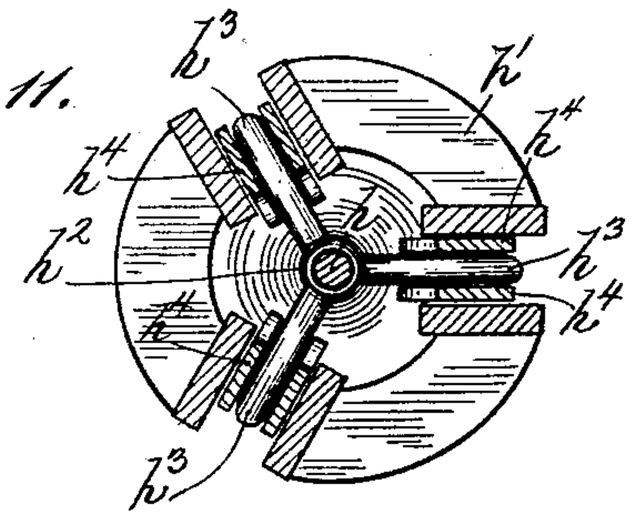


Fig. 10.

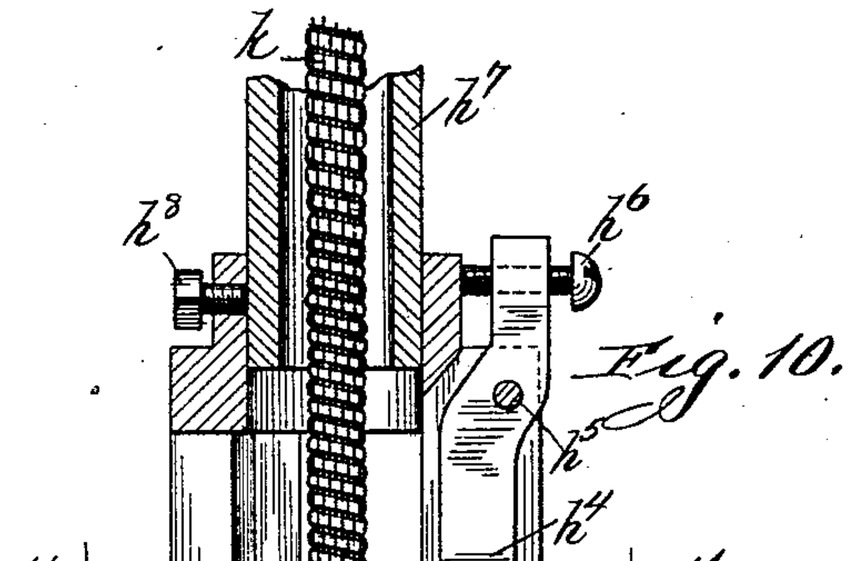
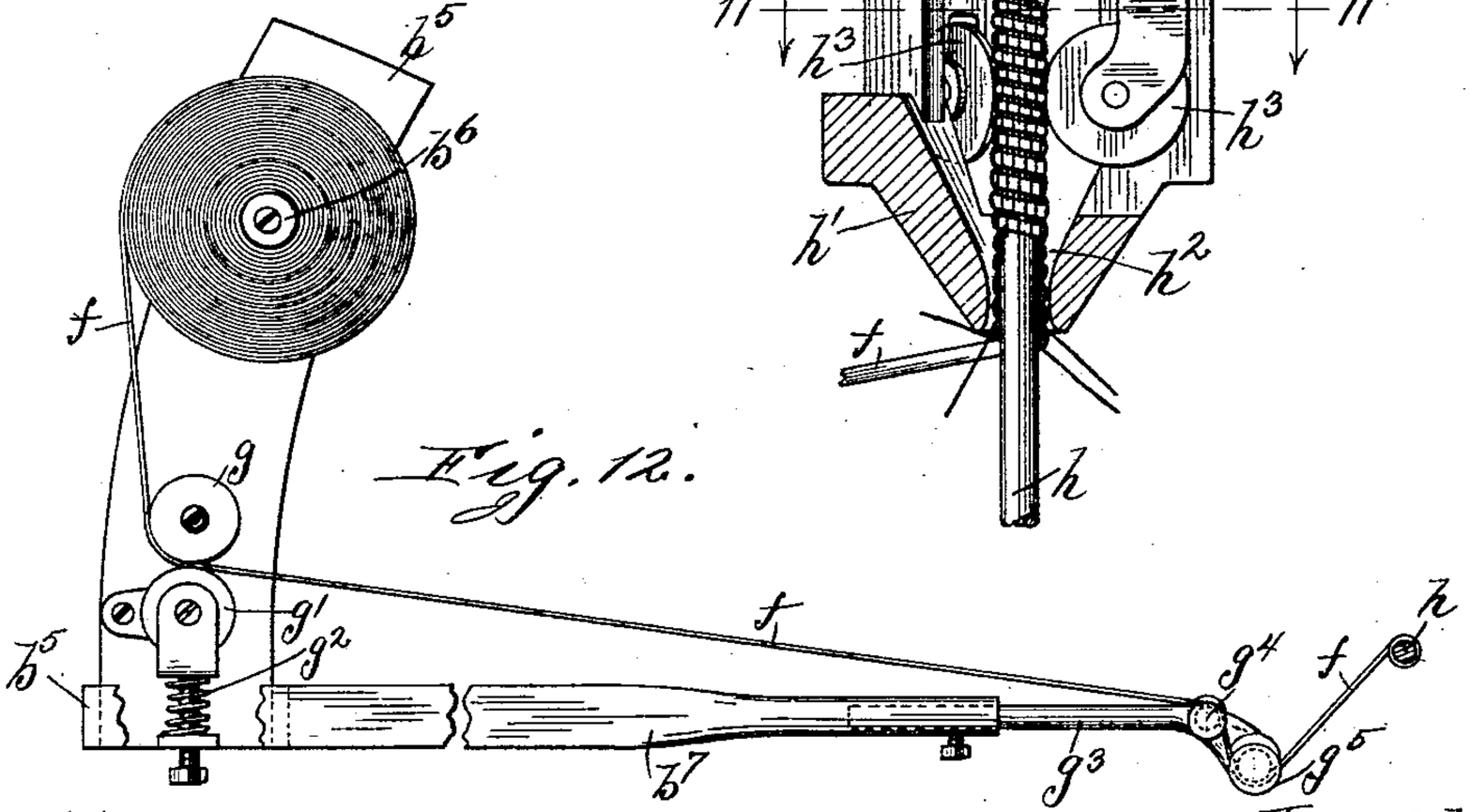


Fig. 12.



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UNITED STATES PATENT OFFICE.

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LOOM FOR FORMING FLEXIBLE CONDUITS.

SPECIFICATION forming part of Letters Patent No. 684,301, dated October 8, 1901.

Application filed June 19, 1899. Serial No. 721,036. (No model.)

To all whom it may concern:

Be it known that I, HARRY G. OSBURN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Looms for Forming Flexible Conduits, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a loom for forming flexible conduits. In Letters Patent No. 652,806, granted July 3, 1900, I have disclosed and claimed a flexible conduit adapted for electrical conductors comprising a woof wound into helical form and having interwoven therewith a series of warp-threads.

The present invention relates to a loom for forming the conduits above referred to.

The woof, which is wound into a helix to constitute the body of the conduit, may be formed of any suitable material possessing the necessary flexibility and rigidity of structure—such as fiber, heavy paper, cane, and the like—while the warps may be made of any suitable material—such, for instance, as cotton or other thread. In accordance with the present invention I provide mechanism for winding the woof into the form of a helix and provide a plurality of supports for the warps arranged to move the warps alternately into and out of the path of the woof, whereby the warps alternately engage the interior and exterior surfaces of the convolutions of the woof. In practice I have mounted the woof-support upon a revolving frame, the support having an arm carrying suitable guides which serve during the revolution of the support to wind the woof about a suitable spindle. The warp-supports are arranged to be moved alternately to opposite sides of the path of the woof-support, whereby the warp-threads are moved alternately into and out of the path of the woof, so that in the completed structure the warp-threads rest alternately against the inner and the outer faces of the convolutions of the woof. I preferably arrange the warp-supports so that during one revolution of the woof-support the warp-supports are upon one side of the path of the woof-support and are upon the other side of said path during the succeeding revolution. By this arrangement each warp-thread is placed in contact with the inner face of one convolution of the woof and in contact with the outer face of the adjacent convolution. Where desired, the warp-supports may be moved at greater intervals, so as to cause the warp-threads to overlap a plurality of convolutions of the woof. The changes necessary to accomplish this will be obvious from the description hereinafter contained.

While I have shown a machine employing a single woof, it will be understood that the invention is not limited to the use of a single woof.

My invention is shown in the accompanying drawings, in which—

Figure 1 is a view in elevation, partially in section, of the machine of my invention. Fig. 2 is a detail view illustrating the crossing of the guiding-tracks. Fig. 3 is a plan view of the machine. Fig. 4 is a detail view of the arm for supporting one of the guiding-rollers. Fig. 5 is a detail view of one of the guides for the warp-threads. Figs. 6 and 7 are detail views illustrating the conduit in the process of formation. Fig. 8 is a detail view of the spools containing the warp-threads. Fig. 9 is a sectional view on line 11 11, Fig. 8. Fig. 10 is a detail view of the guiding mechanism for the completed conduit. Fig. 11 is a sectional view on line 9 9, Fig. 10. Fig. 12 is a detail view of the mechanism for supporting and guiding the woof.

Like letters refer to like parts in the several figures.

Upon the base or support a is mounted the bracket a', in which is supported a vertical sleeve a^2. The driving-pulley b is mounted upon a shaft b', carrying at the end a bevel-gear b^2, meshing with a bevel-gear b^3, journaled to rotate about the sleeve a^2 and connected to the frame b^4, which is rotated thereby. The frame b^4 carries the standard b^5, upon which the spool b^6, carrying the woof, is supported. Upon the standard b^5 is also carried the arm b^7, which supports the guiding-rollers for the woof. The frame b^4 also supports, by means of vertical rods b^8 b^8, guiding-tracks b^9 b^{10}. As the frame b^4 rotates, the guiding-tracks b^9 and b^{10} and the spool b^6,

carrying the woof and the arm b^7, are all carried around together. Upon the upper end of the sleeve a^2 the frame c is mounted, and this frame carries a series of standards c' c'. A pair of plates c^2 c^2 is supported upon each standard and guided therein, the plates being held in position by the overhanging plates c^4 c^4. (Shown more clearly in Fig. 9.) As shown in Fig. 8, an axle or shaft c^3 is supported upon each of the sliding plates c^2, upon which the spool c^5, carrying the warp-thread, is mounted. Upon the plate c^2 is a projecting arm c^6, upon the end of which is a spring c^7, pivoted at c^8, which normally rests against the side of the spool to retard the motion thereof and place the warp-thread under tension. When it is desired to remove the spools, the spring c^7 may be rotated about its pivot c^8 to permit the removal of the spool from the axle c^3. The warp-thread as it passes from the spool passes between a pair of disks c^9 c^{10}, the disk c^9 being mounted upon the end of a shank c^{11}, while the disk c^{10} is loosely mounted thereon and pressed toward the disk c^9 by means of a coiled spring c^{12}. The disk c^{10} may thus yield under pressure from the warp-thread while serving to maintain the same under tension. To the sliding plate c^2 a semicircular frame c^{13} is secured by means of screws c^{14} c^{14}, and upon this frame the shank c^{11} of the warp-guiding device is supported. Upon said frame c^{13} an arm c^{14} is pivoted, which arm carries upon the end the guiding-roller c^{15}. A lug c^{16} upon the rear of the arm c^{14} vibrates between screws c^{17} and c^{18}, whereby the arm c^{14} may rise and fall to accommodate the varying length of the slack portion of the warp-thread during the operation of the machine. By adjusting the screws c^{17} and c^{18} any desired movement of the arm c^{14} may be permitted. Upon the lower end of the frame c^{13} a tongue c^{19} is provided, which is rotatably mounted upon a shank c^{20}, carried upon the end of said frame c^{13}, a screw c^{21} being adapted to lie in a peripheral slot c^{22}, provided upon the shank c^{20} to prevent the removal of the tongue while permitting the rocking thereof. The tongue c^{19} fits in the groove or slot provided in the guiding-tracks b^9 b^{10}. As shown in Fig. 2, the guiding-tracks b^9 and b^{10} intersect upon one side, so that the tongue c^{19} after traveling around the track b^9 will pass by the incline shown in Fig. 2 into the slot of track b^{10} and after passing around track b^{10} will pass by the descending incline into the slot of track b^9 again. Consequently during one rotation of the frame carrying the guiding-tracks the tongue c^{19}, belonging to any particular warp-thread, will be held in a lowered position due to its engagement with the slot of track b^9, and upon the succeeding rotation due to its engagement with the slot of track b^{10} it will be raised into the extreme upper position and lowered again. Above the standards c' c' and in line therewith are the series of standards d' d', one for each of the standards c', the same being supported upon the frame d, which is supported upon the main frame a^3. The standard d' is similar in construction to standard c' and is provided upon each side with plates d^4 d^4, which form the outer walls of a guideway within which the sliding plate c^2 is adapted to move. When the tongue c^{19} travels in the slot of track b^{10}, the plate c^2 is moved upward to the standard d'. A space is left between the opposed ends of the strands c' and d' to accommodate the passage of the arm b^7, which supports the woof. The woof f passes between the guiding-rollers g and g', the roller g' being yieldingly pressed toward the roller g by a spring g^2. Upon the end of the arm b^7 is mounted an adjustable extension g^3, whereby the position of the guiding-rollers g^4 g^5 may be varied. A spindle or rod h is supported in the upper end of the sleeve a^2, about which spindle the woof is adapted to be wound as the arm b^7, guiding the woof, travels around the spindle. Surrounding the spindle in a frame h', having an aperture h^2 slightly larger in diameter than the completed conduit, and the conduit thus formed passes upward through the annular space left between the spindle and the opening h^2. A plurality of rubber-tired rollers h^3 h^5 are adapted to press against the conduit as the same is fed upward to prevent the twisting of the conduit during formation. The roller h^3 is carried upon an arm h^4, pivoted at h^5 and provided with an adjusting-screw h^6, whereby the position of the roller may be adjusted. The frame h' is secured to the sleeve h^7 by means of the set-screw h^8, and the sleeve h^7 is secured to the frames d and a^3 by means of set-screws h^9 h^9. The completed conduit k after passing through the sleeve h^7 is wound around the drum k', the drum carrying a gear-wheel k^2, meshing with the worm k^3, which is connected, through the intermediate gear k^4, with the shaft k^5, geared to the main driving-shaft b' by the bevel-gears k^6 k^7. The gearing between the driving-shaft and the drum is such as to wind the conduit upon the drum as fast as the same is formed.

The operation of the loom is as follows: The spools containing the warp-threads are placed in position and the spool upon one side of each standard is arranged with the tongue thereof in the slot of the lower track, while the spool upon the opposite side of the standard is arranged with the tongue in the slot of track b^{10}, so that the spool upon one side of each standard is in the lower position, while the spool upon the other side is in the upper position. The warp-threads are passed over the guiding-rollers, as shown. The woof is supported upon the standard b^3 and passes between the guiding-rollers, as shown. As the machine is operated the frame b^4 rotates, thus carrying the woof around the spindle and winding the same thereon. The upward movement of the conduit as formed causes the woof to assume the form of a helix. As shown more clearly in Fig. 6, the woof f

is passed during one revolution between the warp-threads l and m, the woof passing over the top of the thread m, while the thread l is raised out of the path of the woof. Upon the next revolution, as shown in Fig. 7, the warp-thread l has been moved into the lower position, and as the woof is wound around the spindle it is passed over the top of thread l, while the thread m is raised upward out of the path of the woof. Upon the succeeding revolution the thread m will again be in position beneath the woof, and each warp-thread is thus placed alternately beneath and above the woof-thread, whereby the warp is interwoven with the helical woof. The raising and the lowering of the warp-threads are accomplished, as above described, by the engagement of the tongues c^{19} with the slots in the tracks b^9 and b^{10}. During one revolution the tongue travels in the slot of track b^9, which is horizontal, and is thus maintained in the lowered position. During the next revolution the tongue travels in the slot of track b^{10}, and is thus raised during the first half of the revolution and lowered to the initial position during the second half of the revolution.

By the above construction, wherein the woof is fed to the spindle at an angle to the axis thereof, the flat or ribbon-like woof is prevented from buckling or twisting and lies flat against the spindle, whereby the same may readily pass through the annular space between the spindle and the bore in which the spindle is adapted to rest. It will be found that it will be necessary to vary the angle for different widths of material, and accordingly the part g^3, carrying the guiding-rollers, is rotatably mounted upon the end of the woof-support b^7, whereby the angle at which the woof is conveyed to the spindle may be varied and adjusted at will.

It will be noted that the revolving endless track serves to positively move the warp-supports from one position to another, and, moreover, it will be noted that the warp-supports serve to carry the warps not only to opposite sides of the path of the woof, but also to opposite sides of a plane passing through the intersections of the warps and perpendicular to the axis of the spindle. Accordingly when the warp-supports reach the ends of their travel the warps are drawn taut and are pulled in opposite directions, whereby the warps are caused to firmly grasp the convolutions of the woof to bind the same in position. When a pliable woof, such as thread, is employed, it is possible to weave the same with the warps extending to one side of a plane passing through the intersections of the warps perpendicular to the axis of the helix, since the pliable woof seems to gradually creep into position. When, however, a flat or ribbon-like woof is employed, I have found that this creeping effect does not take place, and therefore it is necessary to pass the warps alternately to opposite sides of the perpendicular plane above mentioned. Moreover, it is necessary to positively move the warp-supports from one position to another in order to make the warps taut, and thereby securely bind the same about the convolutions of the woof.

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

1. In a loom, the combination with means for forming the woof into a helix, of supports for the warps, and means for positively moving said warp-supports to opposite sides of the path of said woof and to opposite sides of a plane passing through the intersections of the warps, and perpendicular to the axis of said helix, whereby the warps are drawn taut by the warp-supports as the same pass to the opposite ends of their travel to thereby cause the warps to securely grasp and bind in position the successive convolutions of the woof, substantially as described.

2. The combination with a revolving woof-support and coöperating means for forming the woof into a helix, of a plurality of pairs of standards between the opposite ends of which said woof-support is adapted to travel, supports for the warps mounted upon said standards, a revolving endless track adapted to engage and positively move said warp-supports alternately from one side of the path of said woof-support to the other to carry the warps to opposite sides of a plane passing through the intersections of the warps and extending perpendicular to the axis of said helix, whereby the warps are caused to securely and tightly grasp the successive convolutions of the woof and bind the same in position, substantially as described.

3. The combination with a woof-support and coöperating means for forming a flat or ribbon-like woof into a helix, of supports for the warps, and means for positively moving the same to opposite sides of the path of said woof, said woof-support being adapted to pass the woof to the said helix at an angle to the axis thereof, whereby the woof is formed into a helix without causing the same to twist or buckle, substantially as described.

4. The combination with a woof-support and coöperating means for forming the woof into a helix, of a plurality of pairs of standards between the opposed ends of which said woof-support is adapted to travel, supports for the warps mounted upon said standards, a revolving endless track adapted to engage and positively move said warp-supports from one side of the path of said woof to the other, and guiding means carried upon said woof-support for passing the woof to said helix at an angle to the axis thereof, substantially as described.

5. The combination with a woof-support and coöperating means for forming a flat or ribbon-like woof into a helix, of warp-supports and means for positively moving the same alternately to opposite sides of the path

of said woof, and means associated with said warp-support for varying at will the angle at which said woof is passed to said helix, substantially as described.

6. The combination with a revolving woof-support and coöperating means for forming a flat or ribbon-like woof into a helix, of supports for the warps and means for positively moving the same alternately from one side of the path of said woof to the other, and a part carrying suitable guiding-surfaces for the woof and rotatably mounted upon the end of said woof-support, whereby the angle at which the woof is passed to said helix may be varied at will, substantially as described.

7. The combination with a revolving support for the woof, of a plurality of pairs of standards extending perpendicular to the plane of rotation of said support between the opposite ends of which said woof-support is adapted to pass, supports for the warps mounted to move from one standard of a pair to the other, two of said supports being mounted upon opposite sides of each pair of standards, and an endless track rotating with the woof-supports and engaging said warp-supports to move the same, substantially as described.

8. The combination with a spindle about which a fabric is adapted to be formed, of means for drawing the finished product from the machine and a roller having a cushioned periphery adapted to engage said fabric to prevent the twisting of the same about said spindle, substantially as described.

9. The combination with a spindle h about which a fabric is adapted to be formed, of the pivoted levers h^4 provided at one end with the rollers h^3 having cushioned peripheries adapted to engage the fabric, and the adjusting-screws h^6 at the opposite ends of said lever, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

HARRY G. OSBURN.

Witnesses:
W. CLYDE JONES,
M. R. ROCHFORD.