

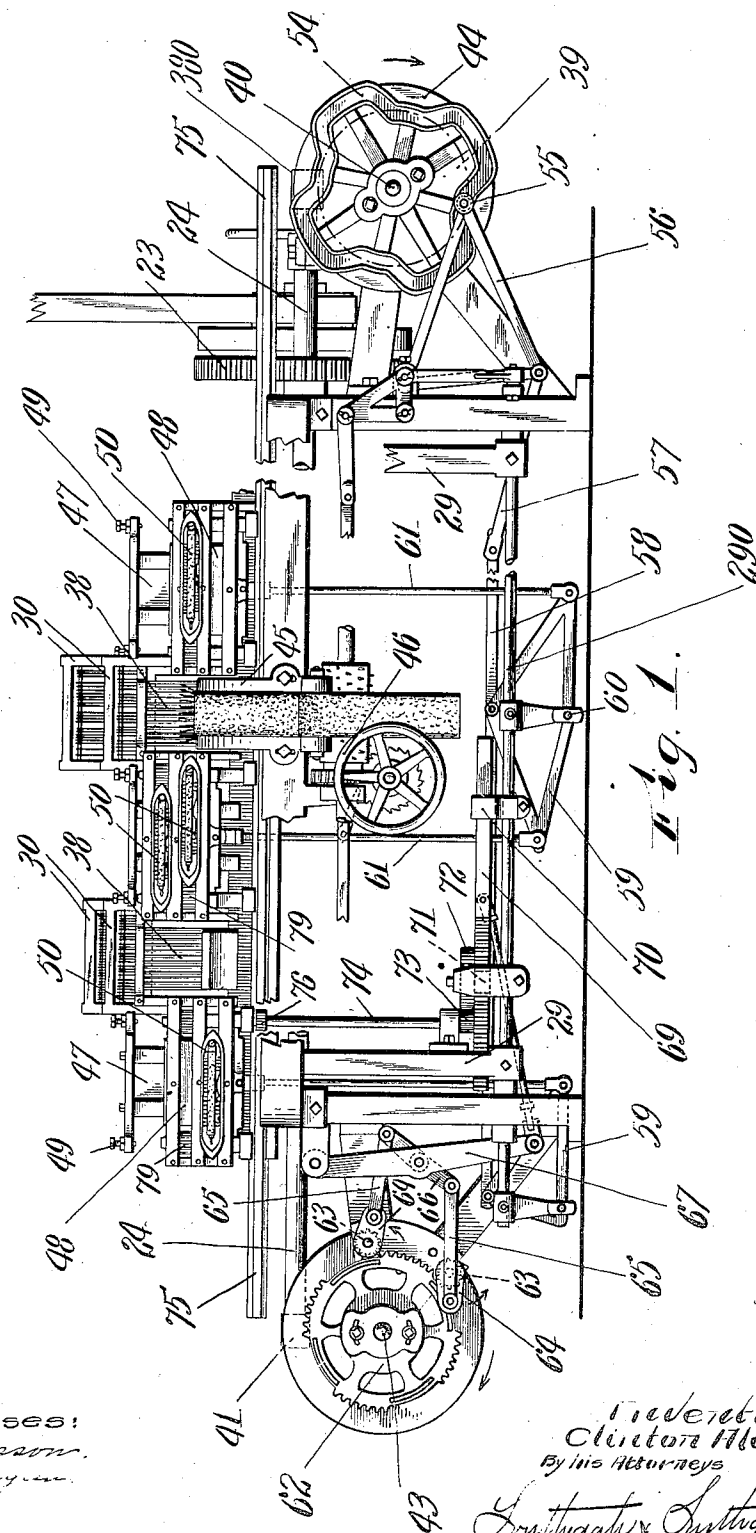
No. 824,226.

PATENTED JUNE 26, 1906.

C. ALVORD.
LOOM FOR WEAVING TUBULAR FABRICS.

APPLICATION FILED JAN. 8, 1904.

5 SHEETS—SHEET 1.



Witnesses:

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M. E. Ryerson.

Inventor:
Clinton Alvord.
By his Attorneys

Longfellow & Longfellow

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6 SHEETS—SHEET 2.

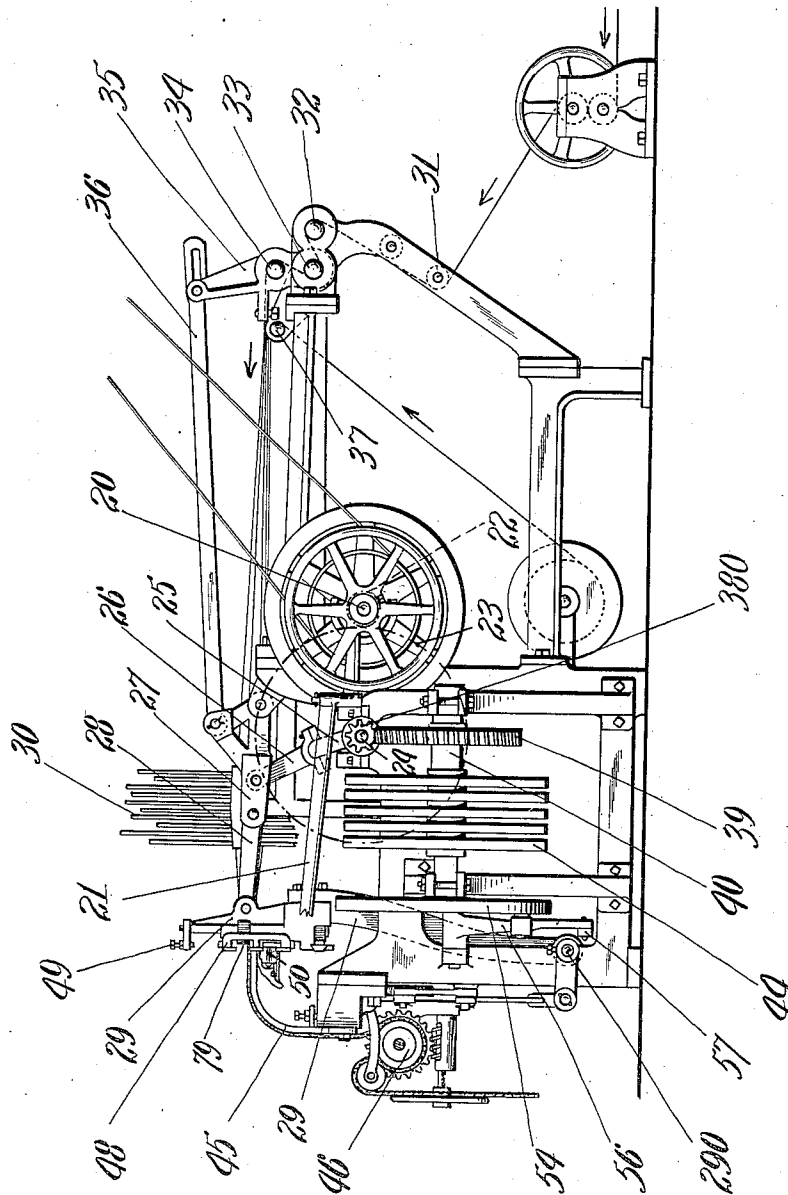


Fig. 2.

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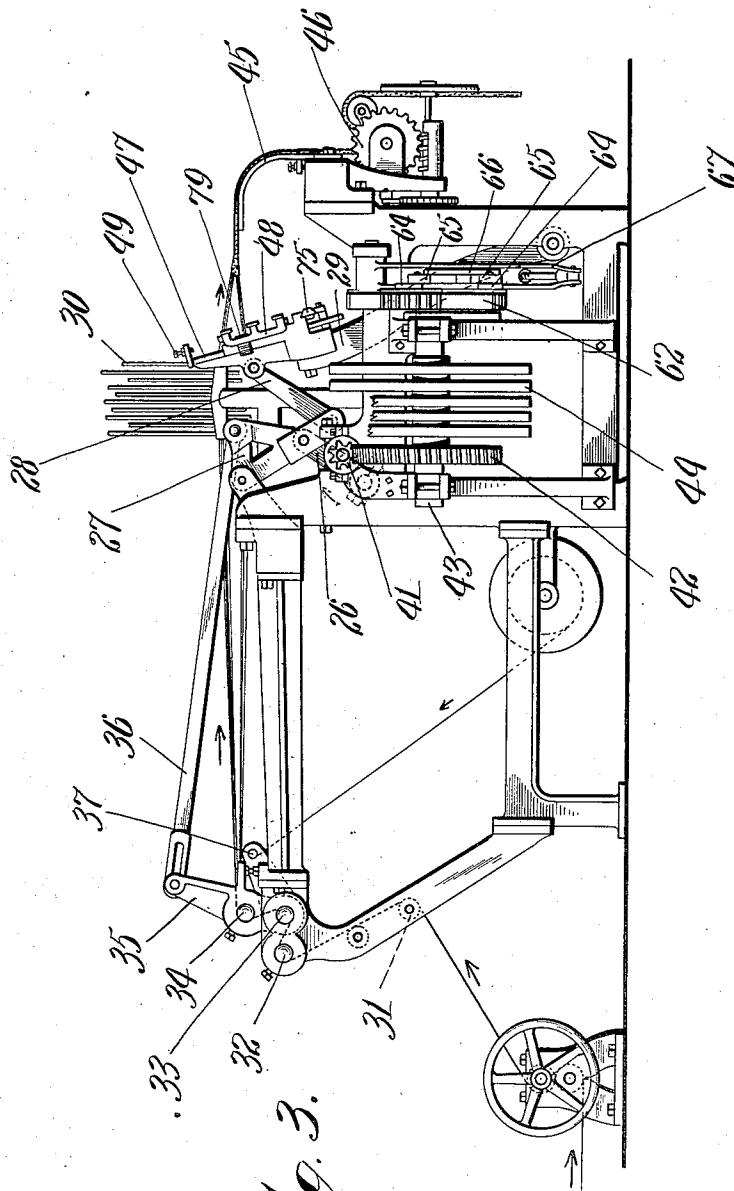


Fig. 3.

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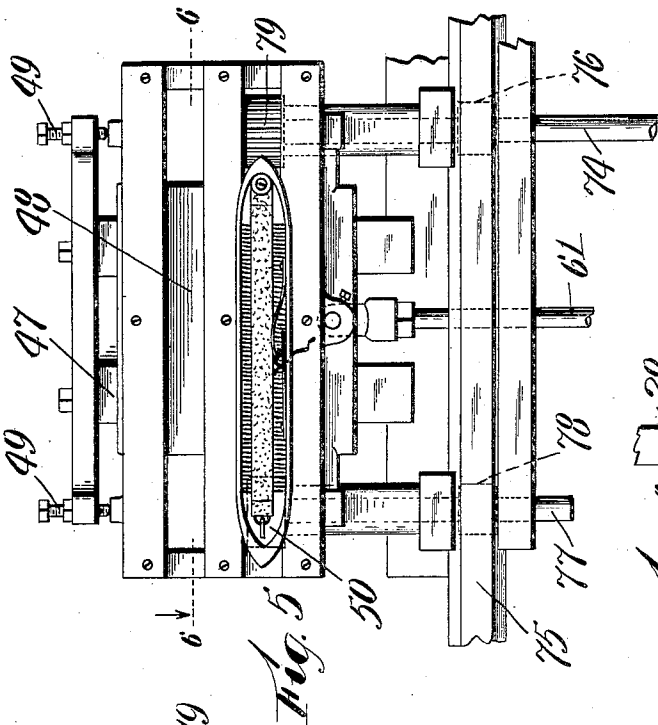


Fig. 5.

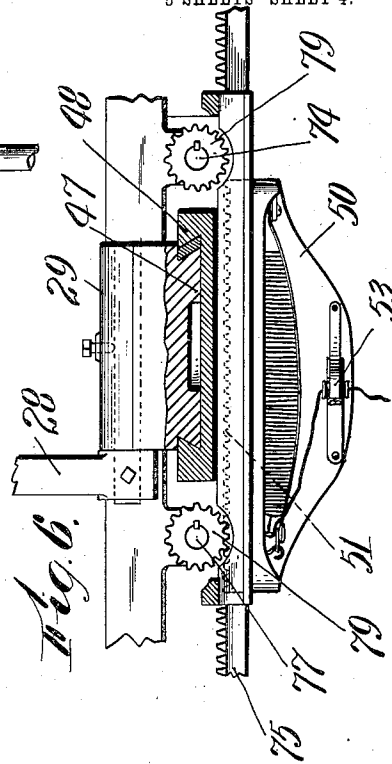


Fig. 6.

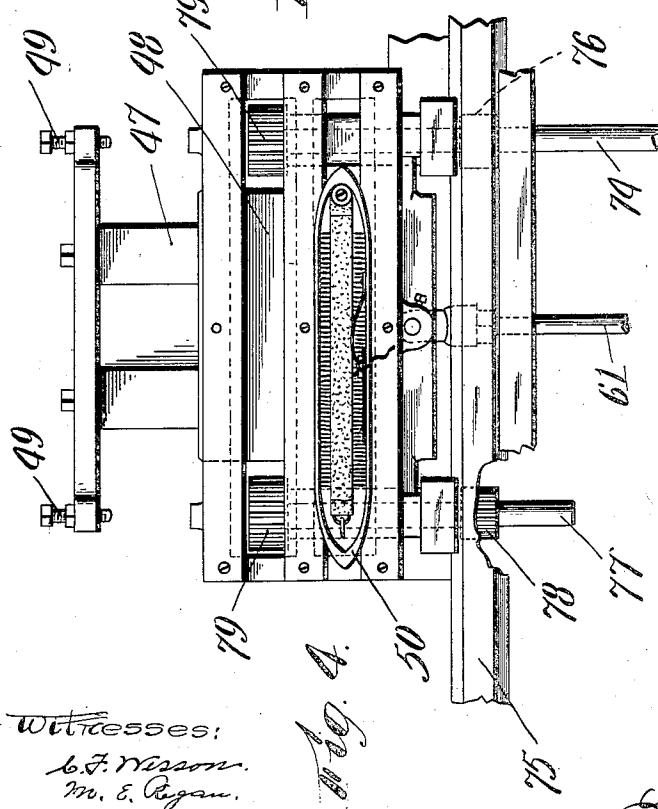
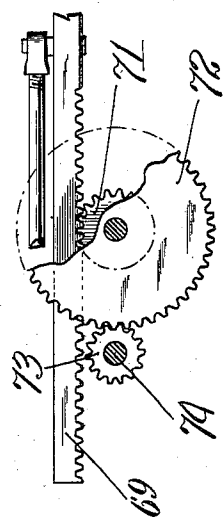


Fig. 4.

Fig. 7.



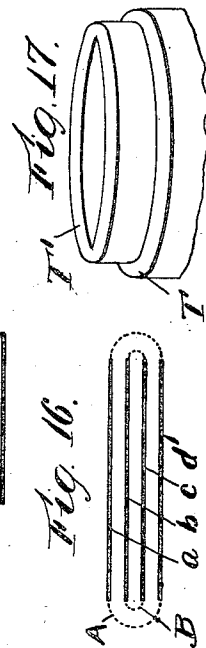
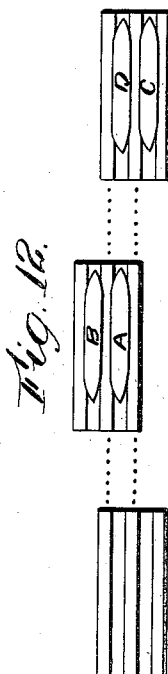
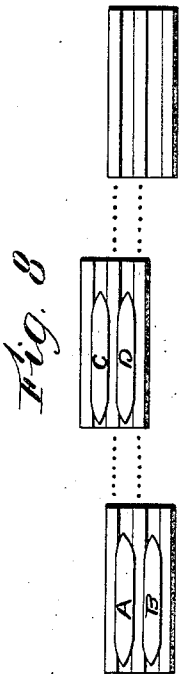
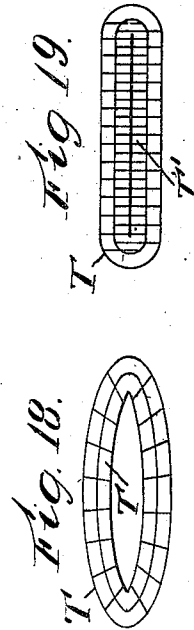
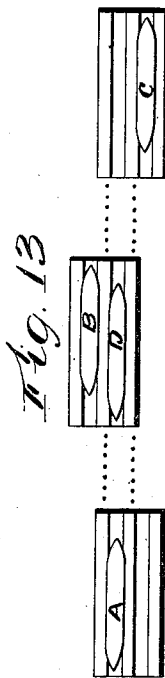
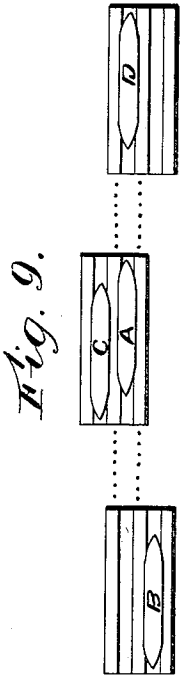
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LOOM FOR WEAVING TUBULAR FABRICS.

APPLICATION FILED JAN. 8, 1904.

5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

CLINTON ALVORD, OF WORCESTER, MASSACHUSETTS, ASSIGNOR, BY
MESNE ASSIGNMENTS, TO MULTIPLE WOVEN HOSE & RUBBER CO.,
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LOOM FOR WEAVING TUBULAR FABRICS.

No. 824,226.

Specification of Letters Patent.

Patented June 26, 1906.

Application filed January 8, 1904. Serial No. 188,258.

To all whom it may concern:

Be it known that I, CLINTON ALVORD, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Loom for Weaving Tubular Fabrics, of which the following is a specification.

The object of this invention is to provide a loom for weaving tubular fabrics which may be employed for hose, tubing, tires, belting, or other purposes, and particularly to provide a mechanism for weaving a fabric consisting of a plurality of tubes concentrically arranged or included one within the other. To this end a flat or plane warp is operated to form a number of plies twice the number of tubes to be woven. For example, if two tubes are to be woven, one inside the other, the warp is operated to form four plies. This is done by employing eight harnesses and operating the same as hereinafter described. A shuttle is provided for each tube to be woven. Thus in the example above taken two shuttles and mechanisms for operating the same are provided. A shuttle-box is provided at each side of each reed-space. These parts are so arranged in the example chosen for illustration that one shuttle will pass in one direction through the upper one of the intermediate plies and the other shuttle will pass through the upper or outside ply. The first shuttle will return through the lower one of the intermediate plies, and the second shuttle will return through the bottom or outside ply. By this arrangement two tubes will be woven one inside the other.

Suitable binder-warps are introduced and may be woven into the fabric in a number of ways. If some of the binder-warps are used to bind the two upper plies together and the remainder of the binder-warps to bind the two lower plies together, the resulting product of two tubes, one inside the other, will be bound together, but the inner tube will be left in open condition. This operation is employed when it is desired to weave a hollow fabric, such as hose, tubing, or tires. If the binder-warps are operated to bind all the plies together, two collapsed tubes, one inside the other, will be produced, and the tubes will be bound together to retain their flat or

collapsed position and relation to each other. This is a product well adapted for belting.

The loom has been arranged in multiple—that is to say, to form a loom which will weave a plurality of products—the shuttle-boxes and mechanisms being combined, so that the intermediate shuttle-boxes can be used in connection with the fabric woven at each side thereof, whereby there will have to be a number of shuttle-boxes exceeding the number of products by only one. With a loom thus designed to weave two products there need only be three shuttle-boxes. With a loom designed to weave three fabrics there need only be four shuttle-boxes. With a loom designed to weave four fabrics there need only be five shuttle-boxes, &c. The shuttles are preferably actuated by positive motion.

The invention further consists of improved details and mechanisms for operating the parts.

A loom embodying this invention is illustrated in the accompanying five sheets of drawings, in which—

Figure 1 is a front elevation of part of a loom constructed to embody the invention. Fig. 2 is a side elevation thereof. Fig. 3 is an elevation taken from the opposite side relatively to Fig. 2. Figs. 4 and 5 are front elevations, on an enlarged scale, illustrating the shuttle-box mechanism. Fig. 6 is a cross-sectional view through one of the shuttle-box mechanisms. Fig. 7 is a detail of the gearing and connections for actuating the shuttles. Figs. 8 to 15, inclusive, are diagrams illustrating the operation of the shuttles. Fig. 16 is a diagrammatic representation of the operation of weaving. Figs. 17 and 18 are diagrammatic views of a tubular product, Fig. 17 representing the outer tube partly cut away to show the inner tube and Fig. 18 representing the fabric partly open to show the binders; and Fig. 19 is an end view of the fabric as bound together for belting.

The drawings have been taken from a loom constructed to weave four products and having five shuttle-boxes, Fig. 1 being broken away so that only two of the reed-spaces and three of the shuttle-boxes are shown.

Referring to the drawings and in detail, in Fig. 2, 20 designates the driving-shaft, to

which power is applied and which has a fly-wheel and the usual hand-wheels and a clutch operated by a handle 21, so that the loom can be thrown into and out of operation in the usual way. A pinion 22 on the driving-shaft 20 meshes with a large gear 23 on the crank-shaft 24, which crank-shaft has a plurality of crank-arms 25, which connect by pitmen 26 to links 27, pivoted at one end to the framework and at the other end to links 28, which are connected to the lay-frame 29, pivoted on the usual shaft 290, whereby the lay will be vibrated back and forth on its pivot-shaft.

Suitable harness-frames 30 are arranged to slide in guides, there being a set of two frames for each ply of the fabric and two frames for the binder-warps. These harness-frames are arranged to carry the usual heddles. In the particular illustration shown there are ten harnesses, two harnesses for each of the four plies of the fabric and two harnesses for the binder-warps, the binder-warps being operated by the harness-frames nearest the front of the loom.

The warps are drawn from any suitable source and are led into the loom around rolls 31, 32, and 33 and around a whip-roll 34. This whip-roll 34 is mounted in brackets 35, pivoted concentrically with the roll 33. The brackets 35 are connected by links 36 to the links 27, which form part of the mechanism for operating the lay. The ends of the links 36 are slotted, as shown, and engage pins secured to the brackets 35. The arrangement is such that as the lay beats up from the position shown in Fig. 3 to the position shown in Fig. 2 to beat the filling into place the whip-roll 34 will be moved back to tighten the warp, so that the fabric will be tight while being beaten up, and the tension will be relaxed during shedding. The binder-warps are drawn from any suitable source and are carried around the roll 37 to their frames. From the heddles the warps pass through the usual reeds 38, carried by the lay.

On the right-hand end of the crank-shaft 24 (looking at Fig. 1) is a spiral pinion 380, which meshes with a spiral gear 39 on the shaft 40. At the left-hand end of the loom is a similar spiral pinion 41, which meshes with a spiral gear 42 on a shaft 43. The shafts 40 and 43 carry cams 44, which operate the harness-frames through any of the usual connections, not necessary to show or describe in this case. The cams on the shafts 40 and 43 nearest the front of the machine are of split or removable form and are connected to operate the harness-frames which control the binder-warps, so that by substituting different cams the binder-warps may be laid in the fabric in different ways.

Each fabric after it is woven passes out over any suitable guiding device 45 to a take-up device 46, which may be of the usual con-

struction and which it is not necessary to describe in detail in this case.

Arranged at each side of each reed-space are shuttle-boxes, which will now be described.

Vertical guides 47 are formed or secured to the lay-frame 29, and fitted to slide on the same are the shuttle-boxes 48, each of which in the construction shown has two shuttle-compartments. The upper position of the shuttle-boxes on the guides may be determined by stop-screws 49. The shuttles are designated by 50. Each shuttle 50, as shown in Fig. 6, has a rack 51 at the back thereof, and each shuttle is provided with the usual appurtenances whereby a cop can be carried by the same and the filling led out through any of the usual outlet devices 53. On the front end of the shaft 40, as shown in Fig. 1, is a cam 54 for operating the shuttle-boxes. Engaging this cam is a roller 55, mounted on the end of a pivoted lever 56, which is connected by a link 57 to a sliding bar 58. Rocking levers 59 are pivoted at 60 and are connected to be operated from the slide-bar 58. The ends of these rocking levers are connected by links 61 to the shuttle-boxes. The rocking lever 59 at the left-hand end of the machine is practically only a half-lever and is connected to but one shuttle-box. These connections are arranged so that the shuttle-boxes are operated relatively oppositely on each side of each reed-space—that is to say, the shuttle-box at one side thereof moves down as the shuttle-box at the other side thereof moves up, and vice versa.

In the particular loom illustrated the relation between the spiral gears and spiral pinions is eight to one, so that the shaft 40 turns once for each eight beats of the loom, and the cam 54 is designed so that the shuttle-boxes change positions relatively to each other at each beat of the loom.

The mechanism for operating the shuttles will now be described.

On the shaft 43 is a mutilated gear 62, which has four toothed sections. Two pinions 63, having teeth properly designed, are journaled in the framing, and each carries a crank 64. The cranks 64 are connected by links 65 to a lever 66, pivoted on a lever 67, which extends down from a pivot on the framing. The operation of this mechanism is such as to swing the lever 67 by a two-step movement to the right or to the left, with a dwell between each of these movements and a dwell at each of its extreme positions—that is to say, for example, the upper pinion will first turn one hundred and eighty degrees to swing the lever 67 to the right. There will then be a short dwell. The lower pinion will turn one hundred and eighty degrees and swing the lever 67 still farther to the right. There will then be a short dwell. The upper pinion will turn one hundred and

eighty degrees and swing the lever 67 to the left to its intermediate position. There will then be a short dwell. Then the lower pinion will turn one hundred and eighty degrees and will swing the lever 67 to its extreme left-hand position. There will then be a short dwell, completing the cycle.

The lower end of the lever 67 is connected by a universally-jointed link to a rack 69, which is fitted to slide in bearings 70, carried by the pivoted shaft 290 of the lay-frame. This rack engages a pinion 71, mounted on a short shaft which carries a gear 72, which meshes with a pinion 73, secured on a vertical shaft 74, journaled in bearings carried by the lay.

A long rack 75 is fitted to slide in the lay under the shuttle-boxes. The vertical shaft 74 carries a pinion 76, engaging the long rack 75. Journaled in the lay so as to come at each side of each shuttle-box are shafts 77. Each of these shafts 77 has a pinion 78, which meshes with the long rack 75, and each of these shafts has a pinion 79 at its upper end. These pinions 79 constitute the shuttle-driving means.

The construction is the same for each of the shuttle-boxes, except that at the right-hand side of the left-hand shuttle-box the vertical shaft 74 extends up and carries the right-hand shuttle-driving pinion 79. These shuttle-driving pinions 79 are arranged in position so that when the shuttle-box is in its lowest position, as shown in Fig. 4, the upper shuttle in that box will be operated and so that when the shuttle-box is in its raised position, as shown in Fig. 5, the lower shuttle in that box will be operated. The pinions are operated by the gearing before described so that one shuttle and then the other shuttle will be moved from one box over to the other and then one shuttle and then the other shuttle will be moved back.

The intermediate shuttle-box—that is, each shuttle-box between an adjacent set of harnesses—is designed so that it is used for the shuttles of the fabric at each side thereof.

When the shuttle-box is lowered, the upper shuttle will be brought into mesh with the shuttle-driving pinion and the lower shuttle will be moved out of mesh, and when a shuttle-box is raised the lower shuttle will be brought into mesh with the shuttle-driving pinion and the upper shuttle moved out of mesh.

The operation is shown in the fifth sheet of drawings in connection with a four-ply or double tubular fabric and in connection with the weaving of two pieces of fabric. Calling the shuttles for the left-hand fabric A and B and the shuttles for the right-hand fabric C and D, the operation is as follows, starting with the parts in the position shown in Fig. 8: At the first movement shuttles A and D pass to the right to the position shown in Fig. 9.

The shuttle-boxes then change as shown in Fig. 10. The shuttles B and C then pass to the right, as shown in Fig. 11. The shuttle-boxes then change as shown in Fig. 12. The shuttles A and D then pass to the left, as shown in Fig. 13. The shuttle-boxes then change as shown in Fig. 14. The shuttles B and C then pass to the left, as shown in Fig. 15. The shuttle-boxes then change, bringing the parts back to the position shown in Fig. 8 and completing the cycle. It will be seen that the shuttle B follows the shuttle A both to the right and to the left and that the shuttle D similarly follows the shuttle C. By this operation the shuttles will properly pass through the warp, the lay beating up just after each movement of the shuttles. Now considering the fabric woven by the shuttles A and B, the warp is operated to form four plies *a*, *b*, *c*, and *d*. Shuttle A will pass over through the top one of the intermediate plies *a*. Shuttle B will pass over through the upper or outside *b*. Shuttle A will pass back through the lower one of the intermediate plies *c* and the shuttle B will pass back through the lowest or outside ply *d*. This, in connection with the harness-motion and the beating up of the fabric by the lay, will weave two tubes T and T', one inside the other, as shown in Fig. 17. By using cams 44 to operate the harness-frames of the binder-warps so that the binder-warps will tie the plies *a* and *b* together and so that another part of the binder-warps will tie the plies *c* and *d* together the two tubes will be bound to each other and a double hollow fabric will be woven, suitable for hose, tubing, or tires, as shown in Figs. 17 and 18. If cams are used to cause the binder-warps to tie the four plies together, the product will be a four-ply fabric consisting of two tubes, one inside the other, the two tubes being collapsed and bound together to form a product suitable for belting. In Fig. 19 I have shown an arrangement of binder-warps in which part of the binder-warps will tie the plies *a*, *b*, and *c* together, while the other part of the binder-warps will tie the plies *b*, *c*, and *d* together—that is to say, in the fabric illustrated in Fig. 19 the binder-warps do not extend completely through the fabric, one set of binder-warps extending part way through from one face of the fabric and the other set of binder-warps extending part way through from the other face of the fabric. This form of fabric has been found in practice to be particularly well adapted for use as belting; but although I have herein illustrated and described this form of fabric for the purpose of clearly explaining the character of products which can be made on a loom constructed according to this invention it is to be understood that this particular form of fabric forms no part of my present invention and was not devised by me.

It is of course within my invention to di-

vide the warp into a greater number of plies for weaving more than two tubes inside of each other, and of course the loom may be designed to weave as many fabrics abreast as is thought desirable, depending upon the width of product produced.

The arrangement of shuttle-boxes and various combinations referred to in the claims may be used in many other forms of looms, and I have not intended to limit the scope of the claims covering the same to the application of such shuttle-boxes to any particular class of loom.

The details and arrangements herein described may be greatly varied by a skilled mechanic without departing from the scope of my invention as expressed in the claims.

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

1. In a loom for weaving a multiple concentric tubular fabric, means for separating a flat warp into a number of plies twice the number of concentric tubes to be woven, and means for weaving a filling in the outside plies to form the outside tube and a filling in the inclosed plies to form a tube included in the outside tube.

2. In a loom for weaving a double tubular fabric, means for separating a flat warp into four plies, and means for weaving a filling in the two outside plies to form the outside tube and a filling in the two inclosed plies to form a tube included in the outside tube.

3. In a loom for weaving a multiple concentric tubular fabric, means for separating a warp into a number of plies twice the number of concentric tubes to be woven, means for operating a shuttle back and forth in the

outside plies to form the outside tube, and means for operating another shuttle back and forth in the inclosed plies to form a tube included in the outside tube.

4. In a loom for weaving a double concentric tubular fabric, means for separating a warp into four plies, means for moving a shuttle in one direction through the top ply and back through the lower ply to form the outside tube, and means for moving a shuttle in one direction through the second ply and back through the third ply to form a tube included in the outside tube.

5. In a loom for weaving a multiple concentric tubular fabric, means for separating a flat warp into a number of plies twice the number of concentric tubes to be woven, a positive motion for moving a shuttle back and forth in the outside plies to form the outside tube, and a positive motion for moving another shuttle back and forth in the inclosed plies to form a tube included in the outside tube.

6. In a loom for weaving a multiple concentric tubular fabric, means for separating a flat warp into a number of plies twice the number of concentric tubes to be woven, means for weaving a filling in the outside plies to form the outside tube and a filling in the inclosed plies to form a tube included in the outside tube, and means for binding the plies together.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CLINTON ALVORD.

Witnesses:

J. ELMER HALL,
PHILIP W. SOUTHGATE.