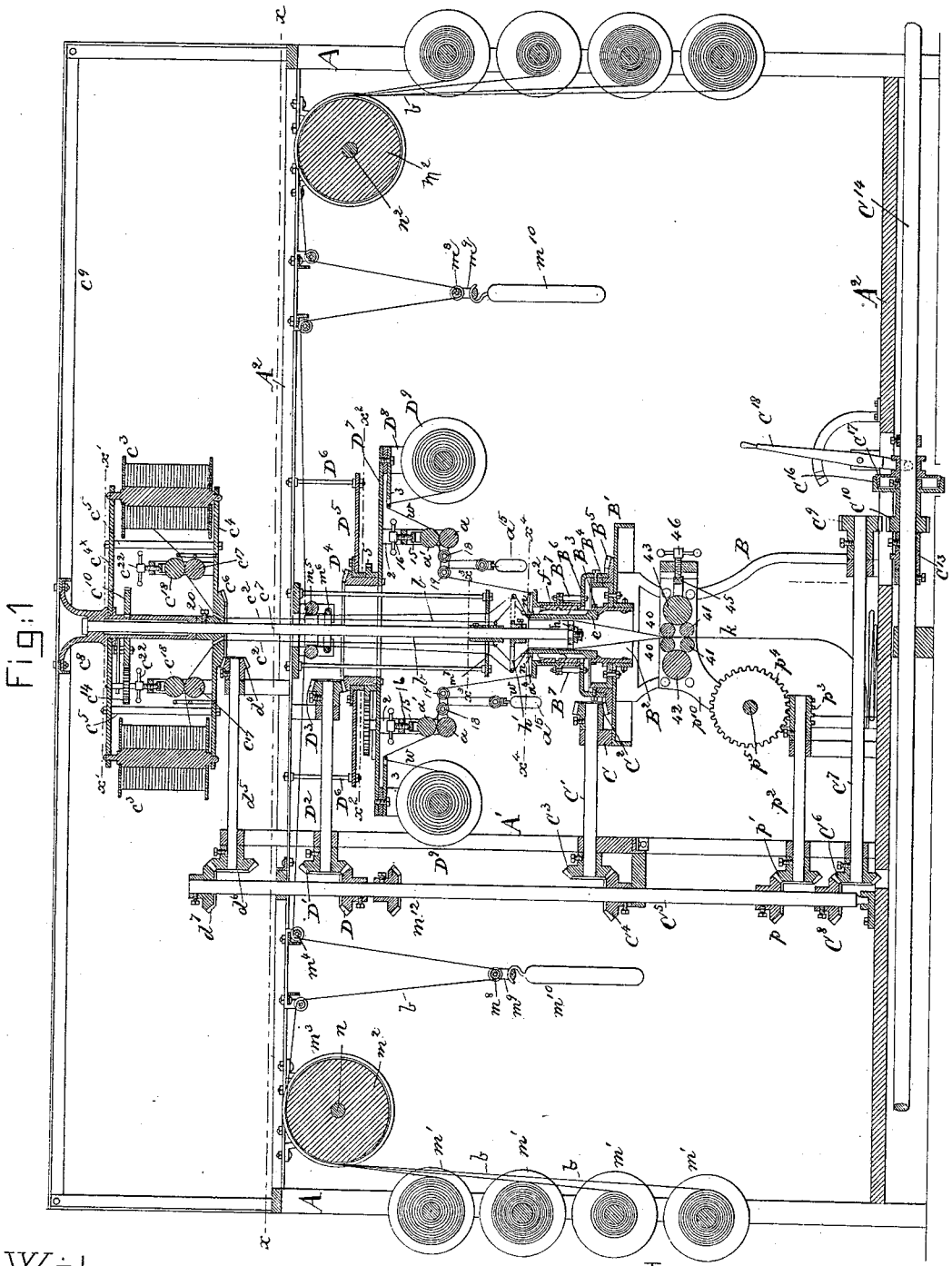
(No Model.) 3 Sheets—Sheet 1.

E. E. SIBLEY.

KNITTING MACHINE.

No. 386,272. Patented July 17, 1888.

Fig: 1



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Attys.

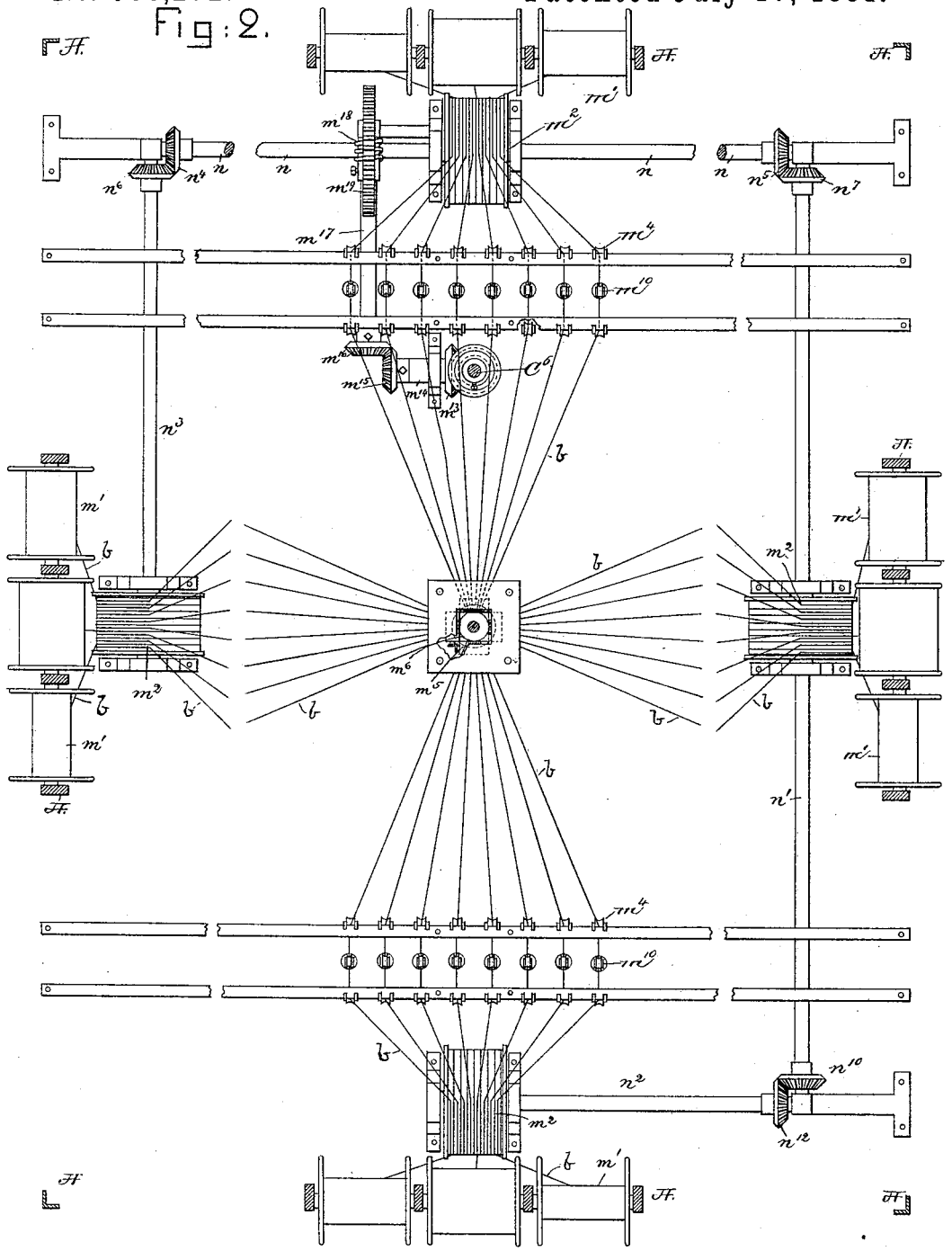
(No Model.) 3 Sheets—Sheet 2.

E. E. SIBLEY.

KNITTING MACHINE.

No. 386,272. Patented July 17, 1888.

Fig: 2.



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(No Model.) 3 Sheets—Sheet 3.

E. E. SIBLEY.

KNITTING MACHINE.

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Fig: 3.

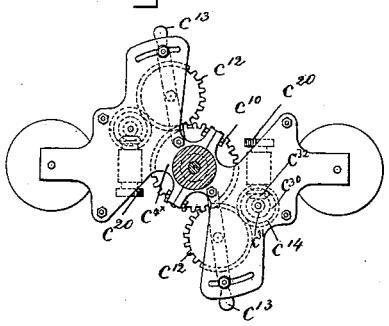


Fig: 4.

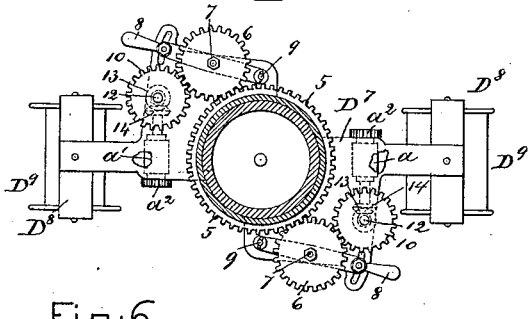


Fig: 5.

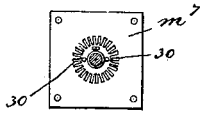


Fig: 6.

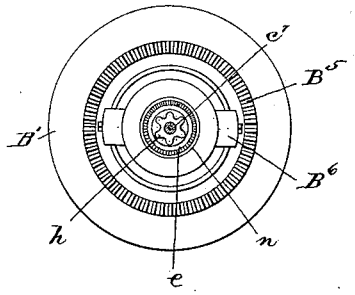


Fig: 7.

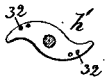


Fig: 8.

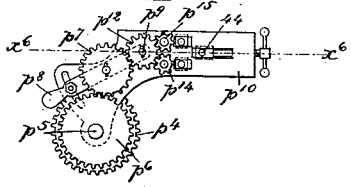


Fig: 10.

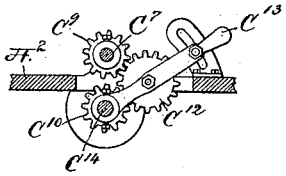
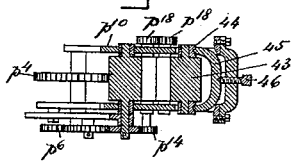


Fig: 9.



Witnesses.
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Attys.

UNITED STATES PATENT OFFICE.

EDWIN E. SIBLEY, OF CHELSEA, MASSACHUSETTS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 386,272, dated July 17, 1888.

Application filed June 18, 1887. Serial No. 241,736. (No model.)

To all whom it may concern:

Be it known that I, EDWIN E. SIBLEY, of Chelsea, county of Suffolk, and State of Massachusetts, have invented an Improvement in Knitting-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention is an improvement upon that class of knitting-machines represented in United States Letters Patent No. 246,288. In the manufacture of tubular fabric—such as hose—by the machine described in that patent much difficulty has been experienced to maintain the tension on the warp and filling threads uniform. Lack of uniformity of tension in the said warp results in a loss of strength in the fabric in the direction of its length, for if some of the warp-threads are held more taut than others the warps which are most taut really have to bear substantially the entire strain put upon the fabric longitudinally, and so, also, if one of the filling-threads is more taut than another it in turn has to bear substantially the entire expanding strain to which the hose is subjected.

From the foregoing it will be obvious that for the production of tubular fabrics having a maximum strength equal to the combined strength of all the warp and weft used it is essential that each warp be held under like tension, and also be so held that the tension shall be the same at each knitting course.

To accomplish the object of my invention in the best practical manner I have by experiment ascertained that each warp may be presented to the knitting-point under exactly the same conditions, provided a dead-weight is suspended upon each warp-thread between the spool or beam from which it is taken and the knitting-point, the warp being fed or taken from the said spools or beams by a feeding device independent of the weight, so that the latter always exerts just the same tension under all conditions of knitting.

Prior to my invention the warp-holding spools of looms have been provided with brakes, which have been released to permit the spools to turn and deliver warp whenever a weight hung upon the warp was lifted against a lever or other device operating the brake, but in such cases the spool has been turned only by the stress of the weight; but such plan would not answer in accordance with my invention, for uniformity of tension could not be secured. So, also, by feeding the warp off from the spools or bobbins containing them, and thereafter applying to the said warps independent weights, which do not act to draw the warp from the said spools or bobbins, I have been enabled to keep each individual warp under a greater strain than heretofore, the strain being such as to maintain the warps under such tension that the warp is not crimped, as heretofore, by the weft and knitting threads as the latter are being introduced into the fabric, and this is of especial advantage, for the straighter the warp and the greater the tension upon it as the weft and knitting threads are being united the less the longitudinal stretching of the fabric in use. I have also provided the machine with a take-up by which the fabric is drawn upon sufficiently to always keep it at the same and at a uniform tension below the knitting-point.

Figure 1 is a vertical central section of a sufficient portion of a knitting-machine embodying my invention to enable the same, in connection with the United States Patent No. 246,288, to be understood, part of the gearing shown in Figs. 3 and 4 being omitted. Fig. 2 is a diagram looking down upon the top of the machine from below the line x x, Fig. 1, part of the frame-work being wholly omitted and other parts being broken out to show the circle-contracting devices where the warps turn to descend to the needle, some of the parts omitted from Fig. 2 being shown in other figures to be described. Fig. 3 is a detail looking downward below the line x', Fig. 1. Fig. 4 is a detail just below the line x^2, Fig. 1. Fig. 5 is a section just below the line x^3, Fig. 1. Fig. 6 is a top or plan view of the cam-cylinder and the needle-bed below the dotted line x^4, Fig. 1. Fig. 7 is a plan view of the warp-spreading cam. Fig. 8 is a side elevation of the gearing connected with and to operate the take-up rolls. Fig. 9 is a section of Fig. 8 on the line x^6; and Fig. 10 is a detail, to be referred to.

The cylindrical needle-bed e, the needles n therein, and the cam-cylinder f^2 are the same as in the patent referred to, with the exception that therein the cam-cylinder was sta-

tionary and the needle-bed was rotated, whereas herein the cam-cylinder is rotated and the needle-bed is stationary. The cam-grooves in the said cam-cylinder and the needles *n* being shaped as in the said patent, and their operation in connection with the warp-threads *m*, knitting-threads c^2, and the weft-thread *w*, in order to unite the said threads into a fabric, being the same as in the said patent, further description thereof in detail is considered unnecessary. Herein the frame-work is composed of suitable uprights A A′ and cross-girts A^2.

The base or stand B of the knitting parts has connected to its upper end a table, B′, to which is preferably bolted a holder, B^2, (see Fig. 1,) the upper end of which supports the cylindrical needle-bed *e*, the latter being grooved longitudinally, as shown and described in the said patent, to receive the shanks of the hooked needles *n*, the lower end of the said needle-cylinder being held in place by means of suitable set-screws, B^3. This table B′ also has erected upon it a cylindrical bearing, as B^4, for the gear B^5, to the flange of which is secured, by suitable set-screws, the plate B^6, to which is attached, by posts B^7, the two shells, substantially such as shown in the said patent, within which shells are placed the two cam-rings, such as shown in the said patent, the edges of the said cam-rings receiving between them the usual projections of the shanks of the slides carrying the needles *n*.

The table B′ has erected upon it a bearing, C, which receives in it the shaft C′, also having a bearing in the upright A′. The shaft C′ at its inner end has a bevel-gear, C^2, which meshes with the bevel-gear B^5, referred to as connected to the parts of the machine carrying the cam-cylinder, the rotation of the shaft C′ effecting the rotation of the cam-cylinder for knitting. The shaft C′ at its outer end has attached to it a bevel-gear, C^3, which is engaged by a bevel-gear, C^4, fast on the shaft C^5, the said shaft deriving its motion of rotation from the bevel-gear C^6 on the shaft C^7, the said bevel-gear engaging a bevel-gear, C^8, fast on the shaft C^5. The shaft C^7 at one end has a pinion, C^9, which is engaged by an intermediate, C^{12}, (see Fig. 10,) carried by a lever, C^{13}, the hub of which (see Fig. 1) embraces and partially rotates upon the shaft C^{14}. The intermediate C^{12} is driven by the gear C^{10}, forming part of a sleeve, C^{15}, loose on the shaft C^{14}. This sleeve C^{15} has a conical hub or disk, C^{16}, and forms part of a friction-clutch, the other part being the conical plate or disk C^{17}. The hub of the disk C^{17} is splined to the shaft C^{14}, and is provided with an annular groove, as in Fig. 1, which is engaged by lever C^{18} when it is desired to move the disk C^{16} to start the machine or to move the said disks one from the other to stop the machine.

The shaft C^5 has attached to it a bevel-gear, D, which engages a bevel-gear, D′, fast on the shaft D^2, provided with a bevel-gear D^3, which engages a bevel-gear, D^4, the hub of which is extended loosely down through a bearing attached to a plate, D^5, suspended by arms or rods D^6 from a stationary part of the frame-work of the machine. (Shown only in Fig. 1.)

The hub of the gear D^4 has connected to its lower end a plate, D^7, to the under side of which are secured suitable brackets, D^8, to receive the journals of the spools D^9, containing the weft-threads *w* and also brackets 2, which contain suitable bearings to support the journals of a set of rolls, *a a′*, employed to feed the weft-thread positively from the spools D^9. Each weft-thread between its spool and the said feeding-rolls *a a′* is passed through an eye in a suitable guide, 3. The bearing for the hub of the gear D^4 has fast to it a gear, 5, which, as the hub carrying the plate D^7 and its attached parts rotates, meshes with an intermediate, 6, (see Fig. 4,) mounted upon a stud, 7, of a hand-lever, 8, pivoted at 9, the intermediate 6 meshing with a pinion, 10, secured to the shaft 12, which, extended down through the plate D^7, has fast upon it a bevel-gear, 13, (shown by dotted lines, Fig. 4,) the said bevel-gear engaging a bevel-gear, 14, on the journal of the lower roll, *a*.

The journals of the upper roll, *a′*, are carried in a frame, 15, (see Fig. 1,) made adjustable vertically by a screw, 16, rotation of the screw causing the roll *a′* to bear with more or less force upon the roll *a*, thus making a sufficient friction upon the weft-thread to cause the latter to be fed or drawn from the spool D^9 positively. The rolls *a a′* have each at one end a like gear, as a^2, (see Fig. 4,) and the said gears mesh together to rotate the said rolls at the same speed as the plate D^7 is rotated, the weft-threads being thus fed off from the spools D^9 positively and at a predetermined speed.

Each weft-thread between the feed-rolls *a a′* and the usual guide-eye, a^4, which receives the weft-thread preparatory to its introduction into the fabric, is passed over a rest consisting, preferably, of two rods, 18 19, and is acted upon by a weight, as a^{15}, which is hung upon the said thread at a point between the said rest-rods, the said weight acting to hold the said weft-thread under a uniform tension, so that it is introduced into the fabric under uniform tension, and is thus made capable of resisting strain uniformly at all parts of the fabric. The knitting-threads c^2 are taken from spools c^3, the journals of which are properly supported in plates c^4 c^{4*}, connected together by posts c^5. The plate c^4 has at the middle of its length a suitable gear, c^6, which is attached by a set-screw, 20, (see Fig. 1,) to a shaft, c^7, which is suspended loosely in a bearing, c^8, secured to a top frame, c^9, the said bearing having, as herein shown, an annular groove, which receives within it and forms the support for the central portion of the plate c^{4*}, referred to. The bearing c^8 has a long sleeve, which, as herein shown, meets the hub of the gear c^6. This sleeve has fast upon it a gear, c^{10}, which in the rotation of the plates c^4 and c^{4*}, as will be described, is engaged by intermediates c^{12},

mounted upon levers c^{13}, pivoted upon the frame c^{4*}, the said intermediates c^{12} engaging and rotating gears c^{14}, (see full lines, Fig. 1, and dotted lines, Fig. 3,) attached to short vertical shafts c^{30}, having at their lower ends beveled gears c^{31}, (shown in dotted lines, Fig. 3,) which engage like beveled gears, c^{32}, at the ends of the shafts of the feed-rolls c^{17}, which constitute the lowermost rolls of the pair of rolls c^{17} c^{18}, which positively feed off from the spools c^3 the knitting-threads c^2. The ends of the rolls c^{17} c^{18} opposite that end of the roll c^{17}, which has a beveled gear and is driven as described are provided with suitable like gears, as c^{20}, which insure the rotation of the upper and under rolls of the feed-rolls at the same speed, these rolls drawing from the spools at uniform speed the knitting-threads, so that they are given up to or presented to the needles always at the proper speed and practically free from tension.

The journals of the rolls c^{18} are mounted in usual loose boxes made adjustable by a screw, as c^{22}. The gear c^6 is engaged and driven by a bevel-gear, d^4, on a shaft, d^5, it having a bevel-gear, d^6, which is engaged and driven by a bevel-gear, d^7, on shaft C^5. The lower end of the shaft c^7 is provided with a foot, h, the configuration of which is best shown in Fig. 6, the said foot being mounted loosely upon the lower end of the said shaft and serving chiefly to prevent the lateral motion or vibration of the shaft with relation to the needle-cylinder, but permitting the passage of the knitted fabric between the foot and the needle-cylinder.

The shaft c^7, above the top of the needle-cylinder, has fast to it a spreading-cam, h', the shape of which is best shown in Fig. 7, the said spreading-cam acting substantially as the cam designated by the letter c in United States Patent No. 246,288, it acting upon the warp-threads in advance of the knitting-thread to press the warp-threads outwardly from the hooks of the needles, in order that the knitting-thread may be led into the hooks of the needles, the cam acting to hold the said warp-threads out until the needle shall have descended with the knitting-thread to a point where the needle cannot catch the warp or weft threads, the spreader also holding the warp-thread taut until the needle has taken off the proper amount of knitting-thread to form the stitch.

The knitting-threads c^2 referred to are extended down parallel to the shaft c^7 and through eyes 30 (see Fig. 5) of a hub properly secured to the shaft c^7, and thence through guide-eyes 32 in the spreader, the said spreader having, as herein shown, two eyes at each side, to enable the knitting-thread to be placed in either one of them, as may be desired. The warp-threads m, as herein shown, are wound singly upon suitable spools, as m', the said spools being located around the cam cylinder and, as herein shown, at four different points. The warp-threads m are extended in groups over or are preferably wound once around a feed-roller, as m^2, and thereafter the said threads are passed over small friction-rolls m^3 m^4, and thence over other rolls, m^5, through a circle-contracting device, m^6, (shown as a ring,) thence down through notches of the warp-comb m^7, (shown best in Fig. 5,) and thence to the work, the spreader, however, rotating within the series of warp-threads and pushing them out at proper times, as is well understood, the comb referred to being located well down toward the needle-cylinder, acting to prevent the movement of the warp-threads in the direction of the rotation of the spreader, it having been found that the less the warp-threads are diverted from a straight vertical line the better the fabric.

The eyes 30, before referred to, are so located with relation to the central opening of the comb-plate m^7 that the knitting-threads cannot catch upon the points of the combs or upon the teeth between the adjacent warp-threads. It being essential to the production of uniformly strong hose and to the production of hose of maximum strength from threads of a given size to keep the said warp-threads uniformly taut when being incorporated into the fabric, I have hung upon the said warps, as herein shown, between the rolls m^3 and m^4, a dead-weight consisting, essentially, of a roller, as m^8, in a small frame, m^9, and a piece of metal, as m^{10}, this weight hanging upon the said warp-threads at a point between the feeding-roll m^2 and the fabric. These weights do not act to pull the warp-threads from the spools m', nor do they act to rotate the feed-rolls m^2, but they simply act as dead-weights to effect a substantially uniform hold upon each and every warp thread going into the hose, so that the warp-threads so introduced under like conditions at every round of the knitting make the hose or other tubular fabric of like strength at all points with relation to the length of the fabric. The different feed-rolls m^2, as herein shown, (see Fig. 1,) are mounted upon like shafts, n n' n^2 n^3.

The shaft C^5 has a gear, m^{12}, (see Fig. 1, where the said gear is shown in section,) which engages a beveled gear, m^{13}, on a short shaft supported in a bearing, m^{14}, the said shaft having a second beveled gear, m^{15}, which engages (see Fig. 2) a beveled gear, m^{16}, on a shaft, m^{17}, provided with a worm, m^{18}, which engages a worm-toothed gear, m^{19}, fast on and rotates the shaft n. Viewing Fig. 2 the shaft n has two beveled gears, n^4 n^5. The gear n^4 engages a beveled gear, n^6, on and rotates the shaft n^3, it having attached to it one of the like feeding-wheels m^2. The gear n^5 engages a beveled gear, n^7, on the shaft n', it having fast to it another of the feeding-wheels m^2. The opposite end of the shaft n' has a gear, n^{10}, which engages a gear, n^{12}, on and rotates the shaft n^2, it having fast to it another of the warp-feeding rolls. The knitted material (marked k) is drawn down through the center of the needle-cylinder by means of drawing-rolls 40 41, arranged in pairs.

The shaft C^5 has a gear, p, which engages a

bevel-gear, p', on and rotates the shaft p^2, having a worm, p^3, the latter engaging a worm-gear, p^4, fast on a shaft, p^5, the said shaft having attached to it a gear, p^6, which engages an intermediate, p^7, mounted upon a stud carried by a lever, p^8, having its fulcrum at p^9 on a yoke or frame, p^{10}, the said yoke or frame containing the boxes or bearings for the said drawing-rolls 40 41. The intermediate p^7 engages a gear, p^{12}, having its center of motion coincident with the fulcrum of the lever p^8, the said gear engaging small toothed pinions p^{14} and p^{15} on, respectively, one of the rolls 41 40 and rotating the said rolls positively. The rolls 41 40 at their opposite ends have suitable like toothed gears, p^{18}, which mesh together, so that one roll 40 drives in unison with its companion roller 40, while one roll 41 drives its companion roll 41.

Heretofore in practice it has been customary to adjust the boxes to constitute bearings for the journals of the rolls 40 41 separately at each end by separate screws; but this has been found objectionable, because it is almost impossible to adjust both boxes or bearings just alike, and if not so adjusted the drawing-rolls do not act uniformly across the fabric, and consequently do not pull and take up the fabric at a uniform speed entirely across its width. To obviate this, I have provided, as herein shown, two rolls, 42 43, and have mounted the journal of the roll 43 in boxes 44, which are acted upon by a yoke, 45, the said yoke between its ends being acted upon by a suitable adjusting-screw, 46, rotation of the said screw forcing the yoke forward, it acting upon the boxes at both ends of the roller 43, pushing it into the bite between one of the rolls 40 and one of the rolls 41, thus causing the said rolls to act uniformly against their opposed rolls and also preventing any springing of the rolls between their ends.

By the devices herein described the fabric may be drawn away from the needles and needle-cylinder with the greatest uniformity, and when passed beyond the drawing-rolls it may be accumulated in a pile or wound upon a reel in any usual manner.

I do not herein claim the herein described method of making hose pipe or fabric, as that forms the subject of an application, Serial No. 265,366, divided from this case under the rulings of the Patent Office and filed February 27, 1888.

I claim—

1. The combination, with a needle-cylinder, a cam-cylinder, suitable means to move the cam-cylinder, a series of reciprocating needles, and means, as feed-rolls, to positively feed the warp-threads from their source of supply on their way to the needles, of means, as weights, substantially as described, to produce uniform tension upon the individual warp-threads between the feeding-rolls and the needles, whereby the warp-threads introduced into the fabric being knitted by the needles are subjected to uniform tension, substantially as and for the purpose set forth.

2. The needle-cylinder, a series of needles therein, means to reciprocate the said needles, feeding-rolls to act upon and feed the knitting-threads to be supplied to the needles, guides for the weft-threads, feeding-rolls to feed the weft-threads from their spools or bobbins preparatory to entering the said guides, and a tension device to act upon each weft-thread between the feeding-rolls and its guide to hold the said weft-thread under uniform tension, substantially as described.

3. The needle-cylinder, a series of needles therein, means to reciprocate the said needles, feeding-rolls to feed the knitting-threads, guides for the weft-threads, means to feed the weft-threads forward to the fabric, and a tension mechanism, substantially as described, to act upon each weft-thread between its feeding-rolls and the said guides to subject the weft-threads to uniform tension, combined with a feeding mechanism, substantially as described, for the warp-threads, a contracting device to bring the warp-threads into a circle, a warp-spreading device, means to operate it, and a series of weights, one acting upon each individual warp-thread, to hold the same under like and uniform tension on their way to the fabric, substantially as described.

4. The needle-cylinder, a series of needles therein, means to reciprocate the said needles, a circle-contracting device to support a series of warp-threads on their way to the fabric, and a warp spreader and means to operate it, combined with a comb, m^7, substantially as described, to receive the said warp-threads and guide them while being acted upon by the warp-spreader, as and for the purpose set forth.

5. The needle-cylinder, a series of needles therein, means to reciprocate the said needles, and a circle-contracting device to support a series of warp-threads on their way to the fabric, a warp-spreader, means to operate it, and a comb, m^7, to support the warp-threads on their way to the spreader, the said comb being provided with a thread guide or eye, 30, to control the knitting-thread and move it within the comb m^7, substantially as described.

6. The needle-cylinder, a series of needles therein, and means to actuate them, combined with two pairs of drawing-rolls to take the knitted fabric from the needle-cylinder, and with a presser-roll, as 43, to act simultaneously upon one roll of each pair of drawing-rolls and force them uniformly against the fabric passing between them and their opposed rolls, substantially as described.

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

EDWIN E. SIBLEY.

Witnesses:
G. W. GREGORY,
C. M. CONE.