

(No Model.)

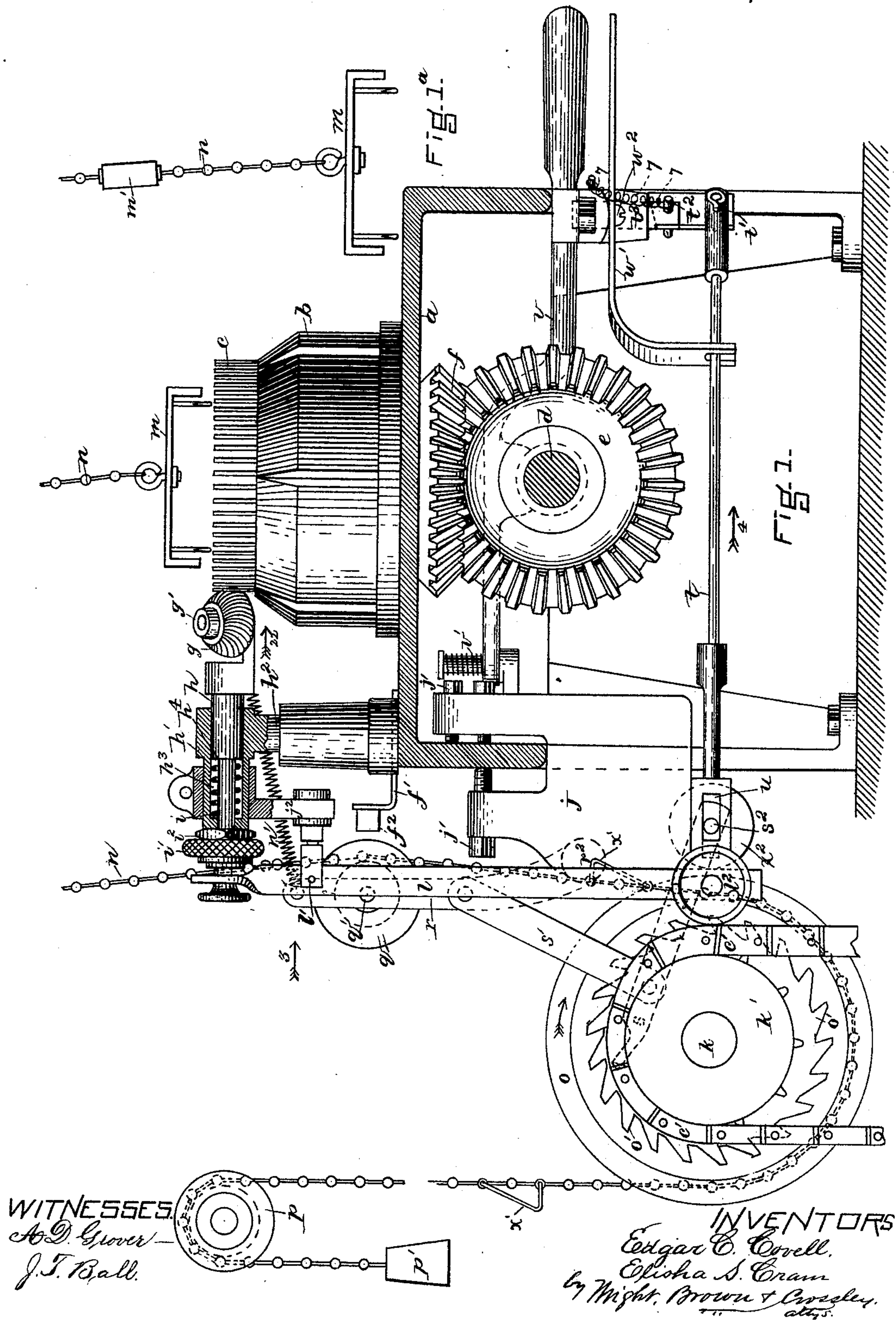
3 Sheets—Sheet 1.

E. C. COVELL & E. S. CRAM.

CIRCULAR KNITTING MACHINE.

No. 414,105.

Patented Oct. 29, 1889.



(No Model.)

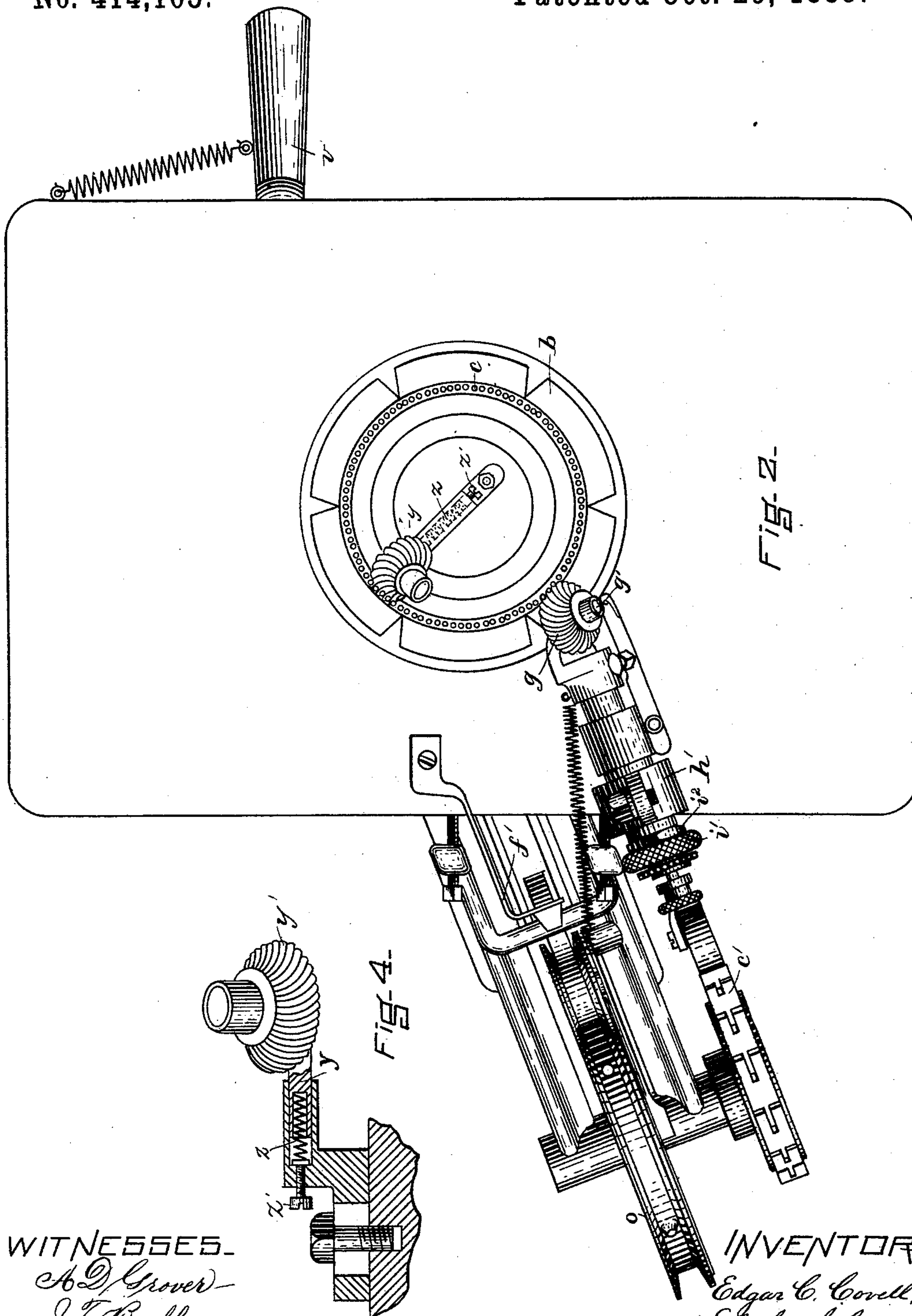
3 Sheets—Sheet 2.

E. C. COVELL & E. S. CRAM.

CIRCULAR KNITTING MACHINE.

No. 414,105.

Patented Oct. 29, 1889.



WITNESSES.  
A. D. Grover  
J. T. Ball.

INVENTORS  
Edgar C. Covell,  
Elisha S. Cram,  
by Wm. Brown & Crocker  
attys.



(No Model.)

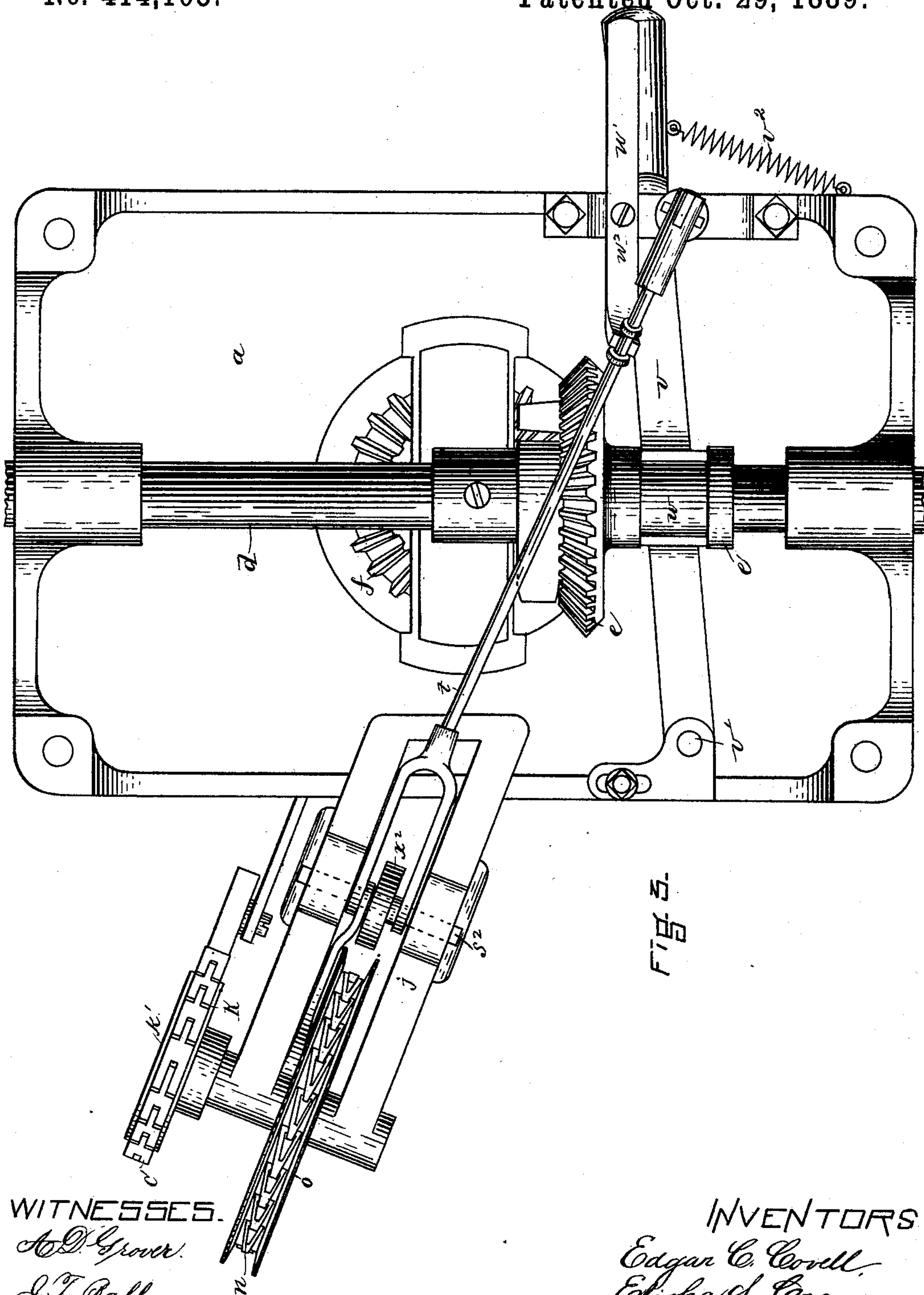
3 Sheets—Sheet 3.

E. C. COVELL & E. S. CRAM.

CIRCULAR KNITTING MACHINE.

No. 414,105.

Patented Oct. 29, 1889.



WITNESSES.

A. D. Grover.

J. T. Gall.

INVENTORS

Edgar C. Covell.

Elisha S. Cram.

By Wm. H. Brown & Co. Attys.



# UNITED STATES PATENT OFFICE.

EDGAR C. COVELL AND ELISHA S. CRAM, OF LACONIA, NEW HAMPSHIRE.

## CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 414,105, dated October 29, 1889.

Application filed May 16, 1887. Serial No. 238,334. (No model.) Patented in Canada June 23, 1887, No. 27,022.

*To all whom it may concern:*

Be it known that we, EDGAR C. COVELL and ELISHA S. CRAM, of Laconia, in the county of Belknap and State of New Hampshire, have  
5 invented certain new and useful Improvements in Circular-Knitting Machines, (patented in Canada by Canadian Letters Patent, No. 27,022, dated June 23, 1887,) of which the following is a specification.

10 Our invention relates to knitting-machines, and has for its object the improvement of the invention shown and described in a patent granted to us June 21, 1887, No. 365,244. In said patent we have disclosed a method of  
15 gradually varying the diameter of a tubular fabric in the process of knitting the same, which method involves a gradual change in the position of the stitch-wheel relatively to the needles, whereby the length or size of the  
20 loops is varied stitch by stitch and course by course, effecting the result mentioned. We have also discovered in said patent improved contrivances for effecting a stopping of the machine after a predetermined amount of  
25 knitting has been performed.

Our present invention comprises improvements which are the outgrowth of experience with the invention set forth in our said patent, which improvements secure greater simplicity of construction, entire certainty of  
30 operation, and perfect convenience in use.

As explained in said patent, our improvements have been wrought upon and applied to knitting-machines of the circular class employing barbed or spring-beard needles, fixed  
35 in a rotary cylinder and equipped to produce a knitted fabric by the aid of stitch or loop, presser, landing, and knocking-over wheels, though it is obvious that some parts of our  
40 improvements are equally well adapted to other kinds or types of machines.

In our present improvements the pattern-chain which governs the position of the stitch-wheel relatively to the needles is brought  
45 more nearly in contact with the support for said stitch-wheel—that is, it operates through the medium of fewer devices, which fact enables us to simplify the construction and make more compact the several parts, as also  
50 to render them entirely certain in the performance of their functions. We have also effected improvements whereby the machine

will be automatically stopped when the work runs off the needles through the breaking of the thread or from other cause, as well as  
55 when a predetermined amount or length of web has been knit. We have also contrived improvements whereby the excessive “ballooning” of the work-pulling-up cord and the consequent objectionable effects of such  
60 ballooning is avoided, and incidentally to these improvements rendering the control and manipulation of said cord more convenient. We have also simplified and improved  
65 the adjuncts of the stitch-wheel support, the pattern device for regulating and controlling the position of the stitch-wheel and the associated parts of said pattern device, as also other parts than those mentioned of the stop-motion mechanism, all of which will be here-  
70 inafter fully described and claimed.

Reference is to be had to the accompanying drawings, and to the letters of reference marked thereon, the same letters indicating the same parts wherever they occur. 75

Of the drawings, Figure 1 represents a side elevation, partly in section, of a knitting-machine head and its support with our improvements applied thereto, certain parts of the machine being omitted, as hereinafter explained, in order not unnecessarily to encumber and confuse the illustrations. Fig. 1<sup>a</sup> is a view of the swiveled work-hook bar, a portion of the pull-up cord or chain attached thereto, and the manner of applying a weight  
80 to said cord or chain for purposes to be explained. Fig. 2 is a top plan view of the same. Fig. 3 is bottom plan view of the same. Fig. 4 is an enlarged sectional detail of the knocking-over wheel and its support. 90

In the drawings, *a* represents the bed of the machine; *b*, the needle-cylinder; *c*, the barb or spring-beard needles; *d*, the driving-shaft; *e*, the bevel-gear on the driving-shaft, arranged to have its teeth mesh with those of  
95 a similar gear *f*, secured to or forming a part of the lower end of the needle-cylinder *b*.

This machine is adapted to be equipped with all of the appliances necessary to produce a tubular web in a manner well understood by all knitting artisans. A machine of this character is shown and described, for example, in a patent granted to John Bradley, No. 244,736, July 26, 1881, and reference may 100



be had thereto. The parts of such machine constituting no part of our present invention and performing common and well-known functions are, for the sake of clearness, 5 neither represented in the drawings nor described in the specification.

In carrying out our present improvements, we mount the stitch-wheel *g* on a stud *g'* formed on or secured to the inner end of an 10 adjustable rod *h*, supported in a star-box *h'*, which latter is in turn supported on a pillar or post *h<sup>2</sup>*, attached to the machine-bed. The star-box is provided toward its rear end with an enlarged chamber *h<sup>3</sup>*, and the part of rod 15 *h* passing through the enlarged chamber is turned down, so as to form a shoulder *h<sup>4</sup>* on said rod.

*i* represents a spiral spring surrounding rod *h* in chamber *h<sup>3</sup>* and bearing at its outer end 20 against the star-box and at its inner end against shoulder *h<sup>4</sup>* of the rod, and with this arrangement operating with a tendency to move the stitch-wheel and its supporting-rod toward the needles, as indicated by the flight 25 of the arrow 22 in Fig. 1.

*i<sup>2</sup>* is a set-nut screwed on the outer end of rod *h* and limiting or regulating the extent to which the wings or blades of the stitch-wheel may be sunk between the needles, *i'* being a 30 jam-nut for locking set-nut *i<sup>2</sup>* in position. As thus far described, the construction and arrangement of parts for supporting the stitch-wheel in operative position do not differ materially from those of common knowledge.

35 *j* represents a bracket adapted by means of screws *j'* to be secured to the frame *a'* at the rear thereof, said bracket being provided with suitable bearings for a rotary shaft *k*, having a sprocket-wheel *k'* secured to one end thereof, which sprocket-wheel carries a pattern- 40 chain *c'*, as most clearly shown in Fig. 1.

*j<sup>2</sup>* represents a bracket secured to any stationary part of the machine, (shown in the present instance as attached to star-box *h'*), 45 and to the said bracket *j<sup>2</sup>* is pivoted, as at *l'*, a lever *l*, forked or otherwise suitably constructed at its upper end to engage the stitch-wheel-supporting rod *h* to move the latter outward against the tension of spring *i'*.

50 Lever *l* is provided at its lower end with a roller or bowl *l<sup>2</sup>*, adapted to rest against pattern-chain *c'* on sprocket-wheel *k'*. The links of pattern-chain *c'* being of varying thickness, as shown in Fig. 2, it follows, when 55 sprocket-wheel *k'* is turned so as to bring the links of greatest thickness in contact with wheel or bowl *l<sup>2</sup>*, that lever *l* will be rocked on its fulcrum *l'*, so as to draw back stitch-wheel-supporting rod *h* in a direction opposite to the flight of the arrow 22 in Fig. 1, and 60 so shorten the stitches or loops formed by the stitch-wheel on the needles, and when said thicker or larger links pass bowl *l<sup>2</sup>* and the thinner or smaller links are brought around 65 opposite thereto spring *i* will move the stitch-wheel-supporting rod back in the direction of the flight of the arrow, and so permit knit-

ting to be performed with longer loops, all for a purpose fully explained in our afore- 70 said patent.

By our present invention the pattern-chain *c'* is arranged directly below the rear end of the stitch-wheel support, and but a single lever intervenes between said pattern-chain 75 and stitch-wheel support, so that the influence of the pattern-chain upon the stitch-wheel is quite direct and entirely certain, there being no intervening contrivance to get out of order.

*m* indicates the take-up head, of any known 80 or suitable construction, swiveled to the work, pull-up cord or chain *n*, extending upward and over pulleys or wheels (not shown) arranged in suitable brackets or bearings in the ceiling, from which pulleys the cord or 85 chain *n* extends down around a sprocket-wheel *o*, secured to shaft *k* at the end opposite that to which sprocket-wheel *k'* is secured, from whence said cord or chain passes up to and over a pulley *p*, arranged at any 90 suitable point of the ceiling or elsewhere in the rear of the machine, a weight *p'* being attached at the end of the cord or chain to operate the same, as is common in some classes of work-take-up devices. 95

In Fig. 1<sup>a</sup> we have shown a weight *m'*, as applied to the cord or chain *n*, for the purpose of counterbalancing the weight of that portion of the chain which extends down 100 from the ceiling around sprocket-wheel *o*, so that if take-up head *m* should be drawn up to or toward the ceiling out of reach of the operator said head may be lowered by simply lifting on said part of chain *n* passing 105 down from the ceiling to sprocket-wheel *o*, the lowering being effected by weight *m'*. The most important function, however, that is accomplished by the weight *m'* on the cord or chain *n* is the prevention of what is termed 110 the "ballooning" of the latter in the operation of knitting. The ballooning of the cord or chain above the knitting-head has the effect of varying the strain or draft on the stitches at different points in the circle of the 115 needles, resulting in imperfect work, so that by obviating this objection a desirable end is attained. Before the chain or cord *n* passing down from the ceiling reaches sprocket-wheel *o* it passes around, or, rather in front 120 of and in contact with, a wheel or pulley *q*, arranged to turn on a stud *q'*, secured to an arm or lever *r*, pivoted at its lower end, as at *r<sup>2</sup>*, to bracket *j* or other stationary part of the machine. A spring *n'* is attached by one end 125 to the upper free end of arm *r*, and at the other end to some stationary part of the machine-bed, said spring operating to draw the upper end of arm *r* in the direction of the arrow 3.

The inner edge or face of a rim of sprocket-wheel *o* is provided with notches *o'*, into 130 which notches a pawl *s* is adapted to be drawn. Said pawl is connected with arm *r* by means of a link *s'*, pivoted at one end to said pawl and at the other to said arm. Pawl *s* is



pivoted at its inner end on a short rod or stud  $s^2$ , fixed in the rear end of forked rod  $t$ , said rod or pin  $s^2$  being adapted to slide in slots or ways  $u$ , formed in the bracket  $j$ , as shown in Figs. 1 and 3.

Forked lever  $t$  is pivoted at its forward end, as at  $t'$ , to the lower end of a link  $t^2$ , which latter device is in turn pivoted at its upper end to the lower end or downward extension of a pin  $t^3$ , vertically arranged in a suitable bearing of the frame and adapted to extend up in front of the shipper-lever  $v$ , pivoted at its rear end, as at  $v'$ , to the machine-bed. Said lever  $v$  extends through a groove  $w$ , formed in the periphery of the elongated hub  $e'$  of gear-wheel  $e$ , which, with its hub, is splined on driving-shaft  $d$ , so as to move longitudinally thereon, but be turned therewith. A spring  $v^2$ , attached at one end to the shipper-handle and at the other end to the machine-bed, operates with a tendency to move said shipper-lever so as to move gear-wheel  $e$  on shaft  $d$  out of engagement with toothed ring or wheel  $f$  by which the cylinder  $b$  is revolved. When shipper-lever  $v$  is moved so as to bring wheel  $e$  into engagement with wheel  $f$ , pin  $t^3$  will be forced upward by a spring  $7$  in front of said lever, and hold it locked in this position against the stress or tension of spring  $v^2$ .

Chain or cord  $n$  is provided with swells or projecting loops or links  $x'$ , as shown in Fig. 1, which projecting links or loops are adapted, as they reach sprocket-wheel  $o$ , to press against a roller or bowl  $x^2$  and the latter away from sprocket-wheel  $o$ , said bowl  $x^2$  turning on pin  $s^2$  of forked sliding rod  $t$ , and so moving said rod in the direction of the arrow 4, Fig. 1, rocking link  $t^2$  on its pivotal connection with pin  $t^3$ , and by the upper inclined end  $t^4$  of said link bearing against any stationary part of the bed operating to draw pin  $t^3$  down and allow the shipper-lever to be moved to unship gear  $e$  and stop the rotation of the cylinder  $b$ , as aforesaid. In this way the machine may be stopped at any predetermined time—or, rather, after any predetermined length of fabric has been knit—by the arrangement of the swell or projecting loops or links  $x'$  on the chain.

Should the work run off the needles, the result would be to slacken the tension on chain  $n$ , permitting spring  $n'$  to move pivoted arm  $r$  in the direction of the arrow 3, which arm  $r$  would, through the medium of link  $s'$ , raise pawl  $s$  into engagement with the notches  $o'$  of sprocket-wheel  $o$ , which would move said pawl and forked lever  $t$ , to which it is pivoted, in the direction of the arrow 4, and so stop the machine. It is to be observed, also, that in the event of the work running off the needles, the consequent slackening of chain  $n$  and bringing of pawl  $s$  into engagement with the notches  $o'$  of sprocket-wheel  $o$  will stop the revolution of said wheel, so that the weight  $p'$  may not operate to pull the cord or chain around the pulleys and sprocket-wheel  $o$ , and

draw the head  $m$  up to the ceiling, and this operation would take place whether pawl  $s$  were pivoted to rod  $t$  or to a stationary part of the machine.

$f'$  indicates a finger secured at one end to the bed of the machine and having the other end extending outward or rearward toward wheel  $q$ , so as to engage chain or cord  $n$  between said finger and wheel  $q$  when it runs slack or loose by the work running off the needles or from other cause, and hold said chain or cord from becoming disengaged from the sprocket-wheel  $o$  or becoming entangled with any of the parts of the machine below wheel  $q$  and finger  $f'$ .

When wheel  $q$  is moved in the direction of arrow 3, the projection  $f^2$  on finger  $f'$  is brought against said wheel, clamping and holding the cord or chain between said parts.

$w'$  designates a lever fulcrumed or pivoted at  $w^2$  to the machine-frame, and at its inner downwardly-extending end resting upon or loosely engaging forked rod  $t$ , so that by rocking said lever on its fulcrum rod  $t$  may be slightly depressed, by which movement pin  $t^3$  will also be depressed, so as to permit the shipper-lever to move and stop the machine. The lever  $w'$  and its arrangement on the machine is not, however, a necessary adjunct of the invention.

When knitting very close or tight stitches—that is, when the larger or thicker links of chain  $c'$  bear against bowl  $l^2$  of lever  $l$ —knocking-over wheel  $y$ , if arranged as is commonly done for ordinary work, would break or cut the loops of the stitches by reason of the deep engagement of the blades of said wheels with the needles and the strain that would be put by them on the needles. To overcome this difficulty, we interpose a spring  $z$  between the rear end of the rod  $y$ , on which the knocking-over wheel is supported, and the bracket or support for said rod, and provide a screw  $z'$  for adjusting the tension or force by which said knocking-over wheel is pressed toward the needles. In this way, when the loops are quite short or tight, the knocking-over wheel will yield thereagainst without undue strain thereon, and at the same time fully perform its usual functions; and when the loops are long or quite slack the blades of the knocking-over wheel will sink deeply between the needles and better perform the work of knocking over the loops than though the said wheel were not so positioned when the stitches were loose and long. Sprocket-wheel  $k'$  being mounted on the same shaft as sprocket-wheel  $o$ , the first-mentioned wheel is turned by the rotation of the latter caused by the movement of chain or cord  $n$ , as described.

The construction and functions of the several devices have been so fully set forth as to make further description of the operation of the machine unnecessary.

Although we have been particular in our description of the construction and operation



of the various parts, it is obvious that some changes within the limits of mechanical skill may be made therein without departing from the nature or spirit of the invention.

5 Having thus described our improvements, what we claim is—

1. The combination, with the needles and their cylinder or head, of a stitch-wheel, a supporting-rod for the same, a spring for normally holding said stitch-wheel and its supporting-rod pressed toward the needles, a lever *l*, engaging at one end the stitch-wheel-supporting rod, a sprocket-wheel, a pattern-chain on said wheel adapted to engage the  
10 other end of said lever and draw the stitch-wheel backward from the needles, and means for rotating the needle cylinder or head and said sprocket-wheel, substantially as and for the purposes set forth.

2. The combination, with the needle-cylinder and needles, of the stitch-wheel, means, substantially as described, for gradually varying the position of the stitch-wheel with respect to the needles, and a knocking-over  
25 wheel and its support, and a spring for holding the knocking-over wheel pressed yieldingly toward the needles, as set forth.

3. The combination, with the needle-cylinder and needles, of a take-up head, a pull-up  
30 cord or chain attached to said take-up head, a pulley over which said chain or cord runs, and a weight *m'*, attached to said cord or chain above the take-up head and between the latter and said pulley, substantially as set forth.

4. The combination, with the bed or frame and the needle-cylinder and needles, of a pull-up cord or chain, a wheel *o*, around which said cord or chain is adapted to pass, said  
40 wheel having a rim provided with notches *o'*,

an arm *r*, pivoted to the frame and provided with a wheel or bowl *q*, a spring *n'*, a pawl *s*, and link *s'*, connecting said pawl with said arm, as set forth.

5. The combination, with the bed or frame, the needle-cylinder and needles, of a pull-up cord or chain, lever or arm *r*, pivoted to the bed or frame and provided with roller or wheel *q*, a spring *n'*, and a finger *f'*, as set forth. 45 50

6. The combination, with the bed or frame, the needle-cylinder and needles, gear *f* on the needle-cylinder, the driving-shaft, gearing connecting said gear *f* with the driving-shaft, and shipping mechanism for disconnecting  
55 said gear *f* from the driving-shaft, of a pull-up cord or chain, a wheel *o*, provided with ratchet-notches *o'*, arm *r*, bowl or roller *q*, pawl *s*, link *s'*, spring *n'*, forked rod *t*, and mechanism intermediate of said rod and said shipping mechanism, as set forth. 60

7. The combination, with the needle-cylinder and needles, the stitch-wheel and its supports, a spring for holding it yieldingly pressed toward the needles, pull-up cord or  
65 chain *n*, bracket *j*, wheel *o*, shaft *k*, wheel *k'*, chain *c'*, and lever *l*, provided on its lower end with roller or bowl *l'*, and connected at its upper end with the stitch-wheel support, as set forth. 70

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 5th day of May, A. D. 1887.

EDGAR C. COVELL.  
ELISHA S. CRAM.

Witnesses:

HERBERT E. MACE,  
F. GEO. H. OSGOOD.