

(No Model.)

5 Sheets—Sheet 1.

H. A. HOUSEMAN.
AUTOMATIC CIRCULAR KNITTING MACHINE.

No. 484,737.

Patented Oct. 18, 1892.

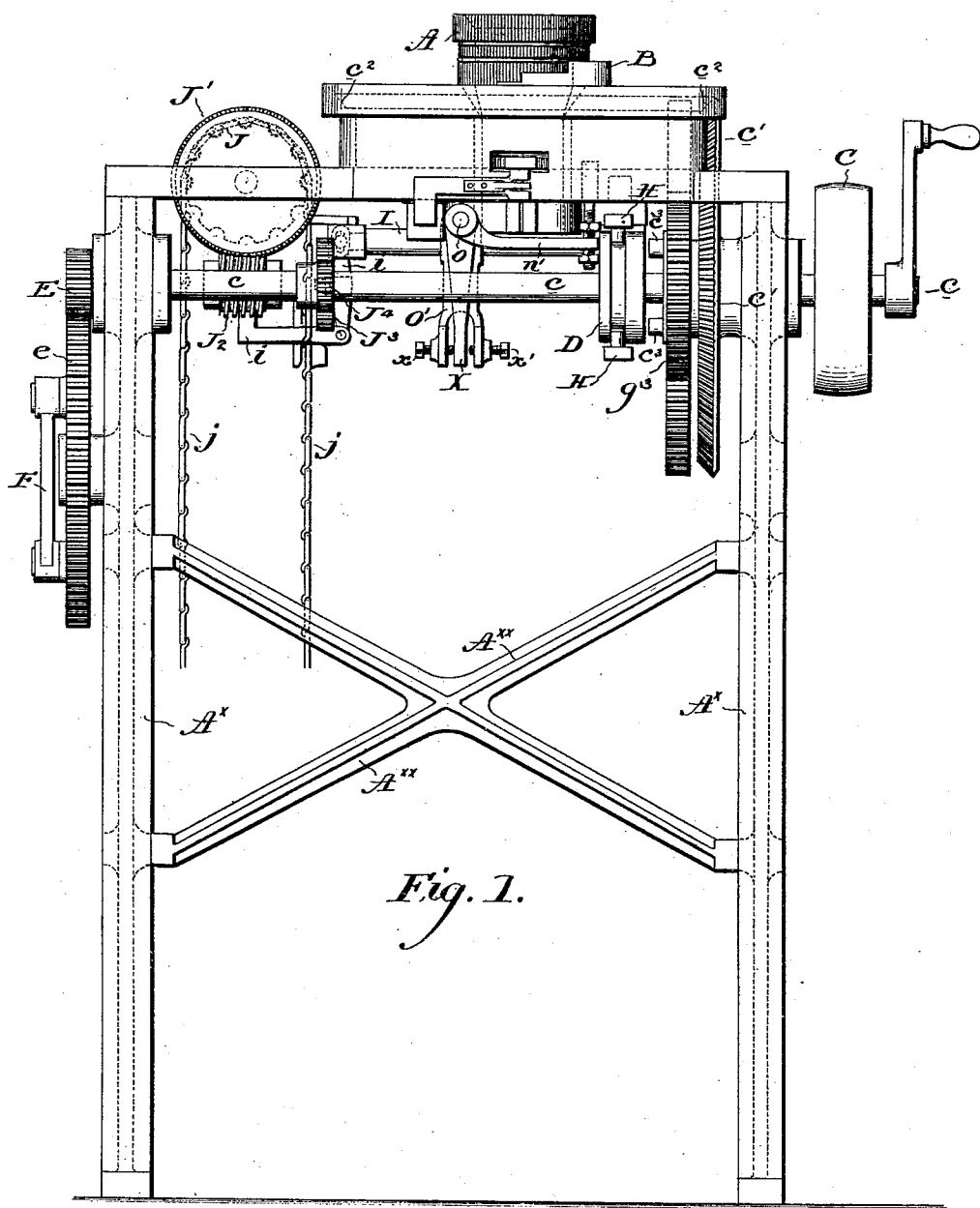


Fig. 1.

WITNESSES:

Frank J. Bussell
J. C. Moore

INVENTOR:

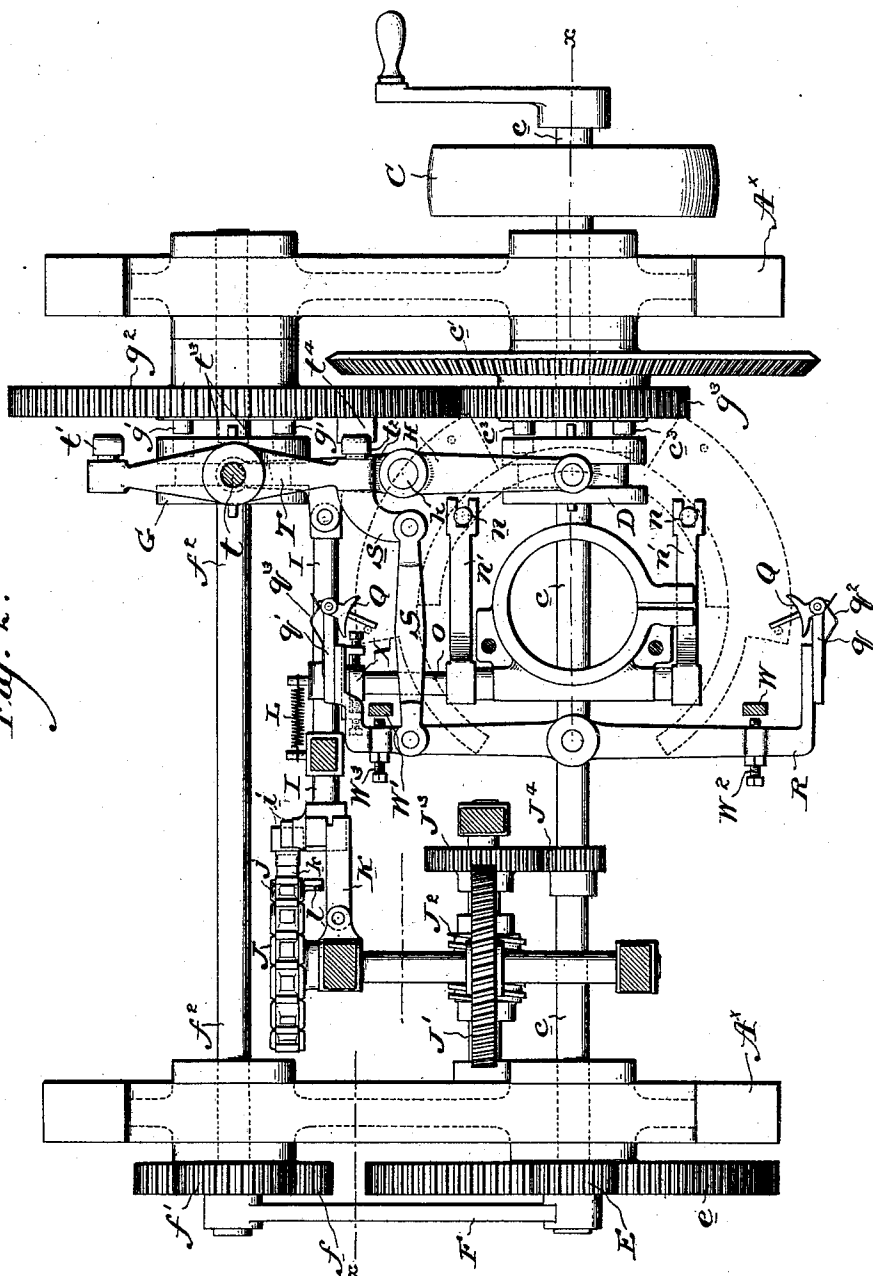
Harry A. Houseman
By his attorney
J. P. Kilduff

H. A. HOUSEMAN.
AUTOMATIC CIRCULAR KNITTING MACHINE.

No. 484,737.

Patented Oct. 18, 1892.

Fig. 2.



WITNESSES:

Frank A. Busser
J. C. Lomae.

INVENTOR:

Harry A. Houseman
Solicitor
R. Harding

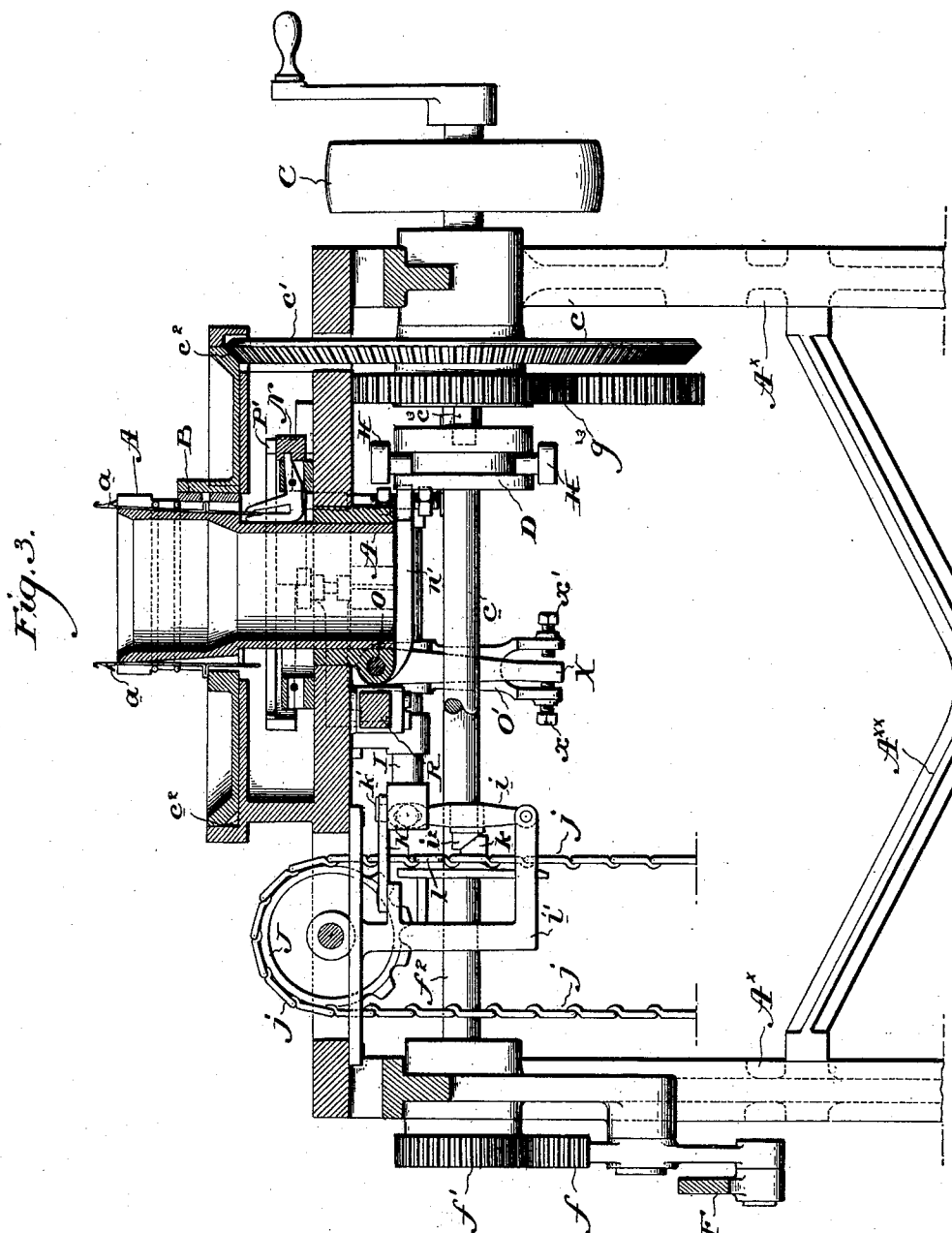
(No Model.)

5 Sheets—Sheet 3.

H. A. HOUSEMAN.
AUTOMATIC CIRCULAR KNITTING MACHINE.

No. 484,737.

Patented Oct. 18, 1892.



WITNESSES:

Frank A. Bussan
A. C. Sumner

INVENTOR:

Harry A. Houseman
by his atty
J. V. Harding

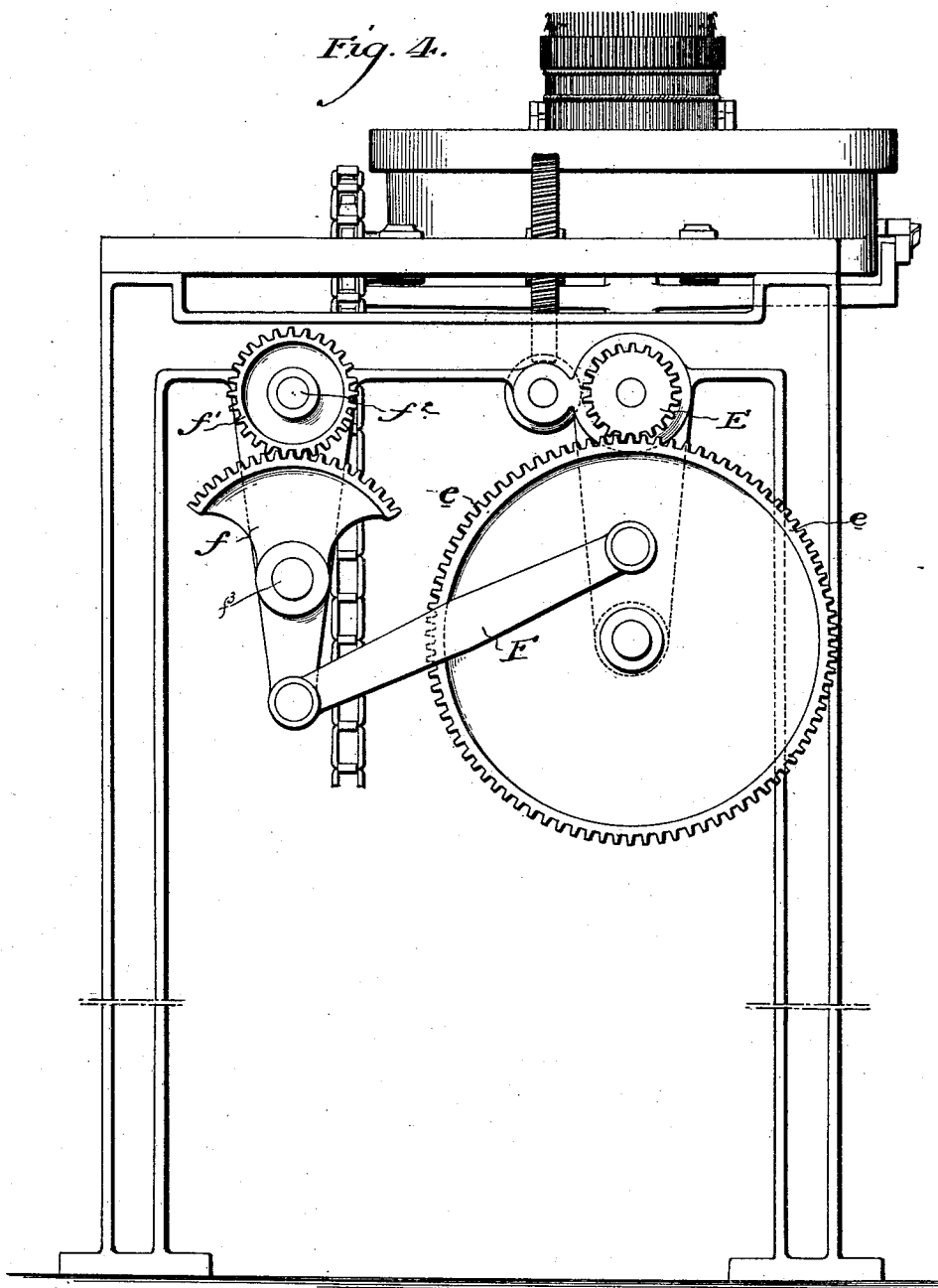
H. A. HOUSEMAN.

AUTOMATIC CIRCULAR KNITTING MACHINE.

No. 484,737.

Patented Oct. 18, 1892.

Fig. 4.



WITNESSES:

Frank S. Bussell
J. H. Moore

INVENTOR:

Harry A. Houseman
by his atty.
J. P. Harding

H. A. HOUSEMAN.
AUTOMATIC CIRCULAR KNITTING MACHINE.

No. 484,737.

Patented Oct. 18, 1892.

Fig. 5.

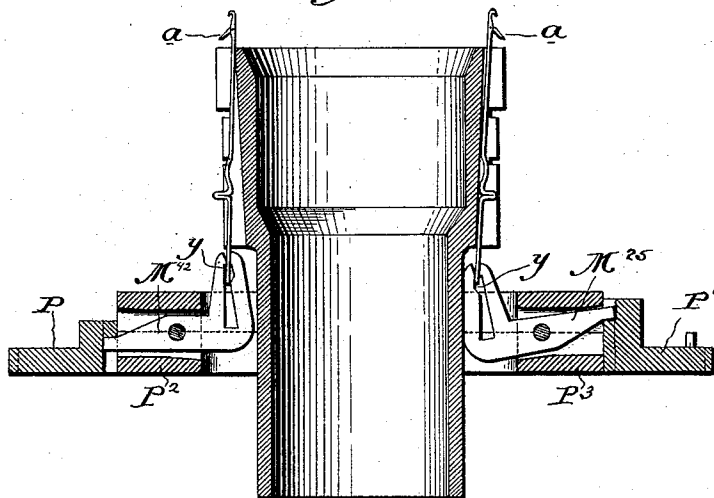


Fig. 7.

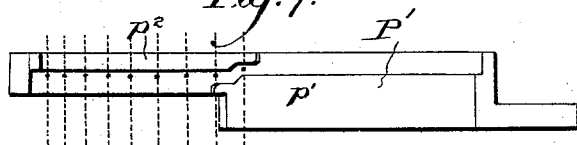
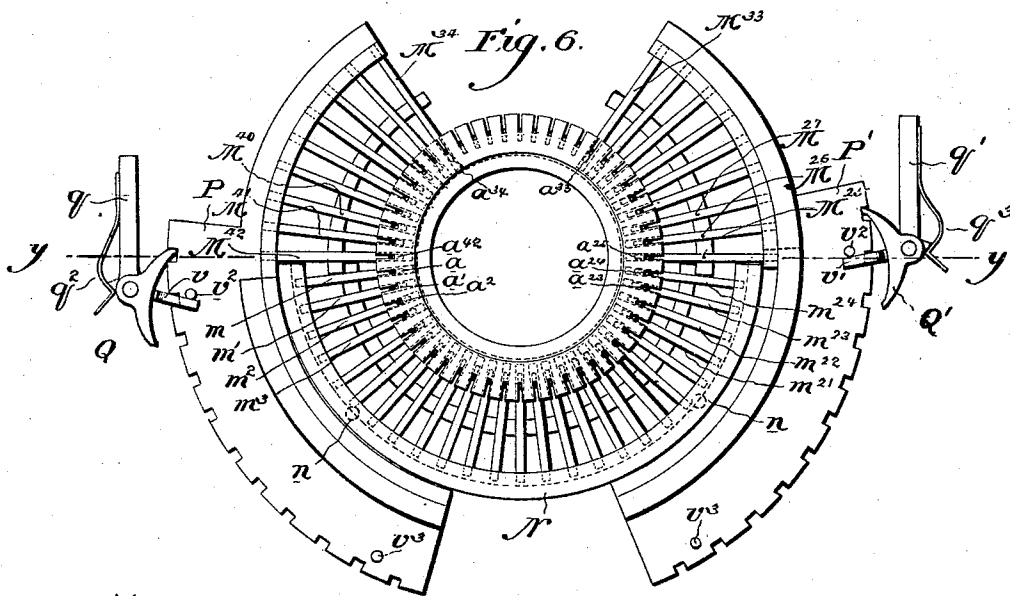


Fig. 6.



WITNESSES:

Frank J. Bassett
H. C. Sumner

INVENTOR:

Harry A. Houseman
by his atty.
G. H. Harding

UNITED STATES PATENT OFFICE.

HARRY A. HOUSEMAN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO
THE STANDARD MACHINE COMPANY, OF SAME PLACE.

AUTOMATIC CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 484,737, dated October 18, 1892.

Application filed September 1, 1891. Serial No. 404,459. (No model.)

To all whom it may concern:

Be it known that I, HARRY A. HOUSEMAN, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Automatic Circular-Knitting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

I will now describe a machine in which my improvements are embodied in the preferred form.

In the drawings, Figure 1 is a front elevation of the machine. Fig. 2 is a plan view of upper portion of the machine with the bed removed. Fig. 3 is a section on line *xx*, Fig. 2. Fig. 4 is an end view of the machine. Fig. 5 is a sectional view of the needle-cylinder on line *yy*, Fig. 6. Fig. 6 is a plan view of Fig. 5. Fig. 7 is a diagrammatical view showing operation of needle-operating cam.

A is the needle-cylinder, in which are the needles *a a'*, &c.

B is the knitting-cylinder carrying the needle-operating cams, as in the ordinary machine.

C is the driving-pulley.

c is the main driving-shaft.

c' is a bevel-gear loose on the main driving-shaft and engaging the rack *c²* on the knitting-cylinder.

D is a clutch feathered on the main driving-shaft.

c³ c³ are lugs on the hub of the bevel-gear *c'*, and the clutch D is adapted to engage said lugs *c³ c³*, so that when said clutch is in engagement with the bevel-gear *c'* the cam-cylinder is rotated.

In making the heel and toe of a stocking the cam-cylinder, in place of being rotated, is reciprocated, and this is accomplished in the following manner:

Upon the main driving-shaft *c* is the gear-wheel E, which works in the gear *e*.

F is a link which connects the gear-wheel *e* with segmental gear *f*, pivoted at *f³*, which meshes in gear *f'* upon shaft *f²*. Upon the other end of this shaft *f²* is the clutch G, adapted to engage with the lugs *g' g'* upon gear-wheel *g²*, the gear-wheel *g²* working in

gear-wheel *g³*, which is keyed to the hub of bevel gear-wheel *c'*, so that they revolve together.

H is a clutch-lever, pivoted at *h* and having forked ends which encircle the clutches G and D, and, as may be readily seen, the construction and arrangement is such that when it is operated it throws one clutch into connection and the other clutch out of connection. This lever H is operated in the following manner:

I is a connecting-rod, one end being connected to clutch-lever H, the other end to link *i*, to which it is pivoted. The other end of the link is pivoted to standard *i'*. Supported from the frame of the machine upon this link *i* is the inclined projecting-lug *i²*.

J is a sprocket-wheel, upon which travels the sprocket-chain *j*. This sprocket-wheel is driven in the following manner: Upon the shaft of the sprocket-wheel J is the worm-wheel J', driven by the worm J², the worm J² being on the same shaft as the gear-wheel J³, which is driven by the gear-wheel J⁴ upon the main driving-shaft. The sprocket-wheel is thus continuously driven, carrying around it the sprocket-chain. The position of the clutch H at the commencement of knitting is such that the clutch D is in engagement with the bevel-gear *c'* and the knitting-cylinder is rotated. Upon the sprocket-chain *j* is lug *k*, which in its line of travel strikes the lug *i²*, moving the connecting-rod I on its pivot-point so as to force the clutch G into connection with gear-wheel *g²* and the clutch out of engagement with the bevel-gear *c'*, which causes the bevel-gear to reciprocate, thus reciprocating the knitting-cylinder. The clutch G is held in this position by the notched bar K, supporting the projecting end *k'* of connecting-rod I. The clutch G is held in connection with gear-wheel *g²* until the lug *l* upon the sprocket-chain trips the bar K, when the spring L, which was put in tension by the movement of rod I, throwing clutch G into connection with wheel *g²*, returns the rod I, releasing clutch G and throwing clutch D into action, when the cylinder is again rotated. When the machine is first operated, forming the leg of the stocking, the cam-cylinder is rotated continuously and the sprock-

et-chain is carried around the sprocket-wheel, but slowly, by the mechanism used, and the lug k is placed in such a position upon the chain that it strikes the lug i^2 at the point where the heel and toe are to be formed, and the lug l is in such position as to trip off the bar K when the heel and toe have been formed.

In forming the heel and toe, as is well known, half of the needles are thrown out of action. I accomplish this in the following manner: The needles a a' a^2 , &c., rest in slots in the knitting-cylinder, and the shanks of each needle are inclosed in the jaws of the needle-levers M M' M^2 , &c., each lever being pivoted and having a tail-piece. The tail-pieces of the levers M M' M^2 to M^{24} of the needles a a' a^2 to a^{24} , which are to be thrown out of action simultaneously when the heel and toe are to be knitted, rest in a groove in the plate N. This plate N has the pins n n , which are connected to forked rods n' n' , which forked rods are secured on the shaft O. On the shaft O is the lever X.

O' is a stand, which is connected to the connecting-rod I. x x' are set-screws, which pass through said stand in line with the lever X, so that when rod I is moved from left to right the set-screw x strikes the lever X, rocking the shaft O and moving the plate N, elevating the end of the levers m m' to m^{25} , forcing in the corresponding needles out of action of the knitting-cylinder. As before described, at the end of knitting the heel or toe the other set-screw x' rocks the shaft in the other direction, depressing the lever and again bringing the needles into action. The mouth or jaw of each of the levers has the inset y , which supports the needle when forced in out of action. In knitting the heel and toe the remainder of the needles are used in forming the heel and toe, and one from each side is thrown out of action at each reciprocation of the knitting-cylinder until the goods are narrowed down sufficiently. Then one from each side is thrown into action until the heel or toe is complete. These needles thrown out of action in narrowing and into action in widening are called "fashioning-needles." I accomplish this in the following manner:

a^{25} to a^{42} are the needles used in forming the heel and toe, although, of course, their number may be varied, as desired. Each of these needles is inclosed in the jaws of a pivoted lever M^{25} to M^{42} . (See Figs. 5 and 6.)

P P' are the fashioning-needle-operating cams, which cams are carried by the rock-plates P^2 P^3 . The form of the cam is shown in detail in Fig. 7.

Q Q' are two double pawls, one for each rock-plate, pivoted to supports q q' and acted upon by the springs q^2 q^3 . The supports q q' are connected one at each end of the pivoted rod R.

S is a link, one end pivoted to rod R, the other end to arm s . The arm s is connected to lever T, pivoted at t to clutch-lever H. Upon this lever T are lugs t' t^2 , one at the

outer and one at the inner end of lever T, and corresponding lugs t^3 t^4 are upon the gear-wheel g^2 . When the clutch G is thrown into engagement with the gear-wheel g^2 , the lugs t' t^2 are brought into the line of travel of the lugs t^3 t^4 , and, as the gear-wheel reciprocates, the lugs t' t^2 are alternately struck and the lever T vibrated first in one direction and then in the other and the pivoted rod R vibrated on its pivot-point, operating upon first one pawl and then the other, the return movement drawing one pawl and then the other back to engage the next tooth. As before described, the ends of levers M^{25} to M^{42} are in the line of travel of the cams, and as the cams strike them it lifts up the end, forcing the needles in out of action.

The left hand of Fig. 5 shows the needle before action by the cam and the right hand after action by the cam. The cams act upon first one needle, then the next, until the last tooth is reached, when the projections v v' on each cam strike the pins v^2 v^3 , which turns the pawl, so that its other end becomes active and farther movement reverses the rack, depressing one by one on each side the ends of the levers M^{42} to M^{25} , bringing the needles forward and into action one by one until the last tooth in the racks is reached, when the pins v^3 v^3 again turn the pawls. When the rod I is released and the clutch G thrown out of action, the lugs t' t^2 are drawn out of line of the lugs t^3 t^4 . Upon the plate of the machine are secured the guards w w' , and set-screws w^2 w^3 pass through the rod R, so that the throw of the rod R may be limited. The jaws of the levers M^{25} to M^{42} have each an inset or shoulder y , which supports the needles when drawn in out of action.

The operation of the machine is as follows: The clutch D being in connection with the bevel-gear c' and power being applied to pulley C, the knitting-cylinder is rotated to form the tubular fabric—say for the leg—the sprocket-chain moving on the sprocket-wheel. When the lug on the sprocket-chain strikes the projection, which is adjusted to occur when the amount of tubular goods desired has been formed, the rod I is forced forward, moving the clutch G into engagement with gear g^2 and clutch D out of engagement with bevel-gear c^2 , and the knitting-cylinder is reciprocated. The shifting of the rod I having, by mechanism fully described, thrown half of the needles out of action, while the cylinder is reciprocated by the mechanism described, one needle alternately on each side of the active needles is thrown out of action until the desired number are so acted on, when one on each side alternately is thrown into action until the same number are again in action. This is done in fashioning or forming the heel and toe. When the latch is tripped so as to release the rod I, the clutch D is again thrown into action and the knitting-cylinder again revolved, forming tubular fabric.

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

1. In a knitting-machine, in combination, 5
a main driving-shaft, a segmental gear, intermediate connection, substantially as described, between said shaft and segmental gear, a shaft adapted to oscillate, a clutch upon said shaft, a gear-wheel, a clutch-lever 10
adapted to operate said clutch, a connecting-rod, as I, a sprocket-wheel, intermediate connection between said wheel and the driving-shaft, a sprocket-chain upon said wheel, and lugs upon said sprocket-chain adapted to act 15
upon said rod and force said clutch into engagement with said gear-wheel.

2. In a knitting-machine, in combination, a main driving-shaft, a segmental gear, intermediate connection, substantially as described, between said shaft and segmental 20
gear, a shaft adapted to oscillate, a clutch upon said shaft, a gear-wheel, a clutch-lever adapted to operate said clutch, a connecting-rod, as I, a sprocket-wheel, intermediate connection between said wheel and the driving-shaft, a sprocket-chain upon said wheel, a lug 25
upon said sprocket-chain adapted to act upon said rod and force said clutch into engagement with said gear-wheel, and means to retain said rod in position after being acted 30
upon by the lug.

3. In a knitting-machine, in combination, a main driving-shaft, a segmental gear, intermediate connection, substantially as described, between said shaft and segmental 35
gear, a shaft adapted to oscillate, a clutch upon said shaft, a gear-wheel, a clutch-lever adapted to operate said clutch, a connecting-rod, as I, a sprocket-wheel, intermediate connection between said wheel and the driving-shaft, a sprocket-chain upon said wheel, lugs 40
upon said sprocket-chain adapted to act upon said rod and force said clutch into engagement with said gear-wheel, means to retain said rod in position after being acted upon by 45
the lug, and means, substantially as described, to release said rod.

4. In a knitting-machine, in combination, a main driving-shaft, a clutch, as D, upon said 50
shaft, a bevel-gear adapted to be connected with said clutch, a knitting-cylinder, a rack upon said cylinder operated by said bevel-gear, a segmental gear, intermediate connection between the shaft and the segmental 55
gear, a shaft adapted to oscillate, intermediate connection between said shaft and the segmental gear, a clutch, as G, upon said shaft, a gear-wheel, as g^2 , adapted to be connected with said clutch, and intermediate 60
connection between said gear and the bevel-gear, a clutch-lever pivoted in the center and adapted to operate upon both of said clutches, and mechanism, substantially as described, to operate said lever, whereby when one 65
clutch is thrown into action the other is released.

5. In a knitting-machine, in combination,

a main driving-shaft, a clutch, as D, upon said shaft, a bevel-gear adapted to be connected with said clutch, a knitting-cylinder, a rack 70
upon said cylinder operated by said bevel-gear, a segmental gear, intermediate connection between the shaft and segmental gear, a shaft adapted to oscillate, intermediate connection between said shaft and the segmental 75
gear, a clutch, as G, upon said shaft, a gear-wheel, as g^2 , adapted to be connected with said clutch, and intermediate connection between said gear and the bevel-gear, a clutch-lever pivoted in the center and adapted to 80
operate upon both of said clutches, a sprocket-wheel, means to rotate said wheel, a sprocket-chain carried by said wheel, a connecting-rod connected to said clutch-lever, a lug connected to said connecting-rod, and a lug on 85
the sprocket-chain in line with said lug connected to the connecting-rod, whereby when the lug is struck the connecting-rod is moved and clutch G engaged and clutch D disengaged, and means to retain and to release 90
said connecting-rod I.

6. In a knitting-machine, in combination, a main driving-shaft, a clutch, as D, upon said shaft, a bevel-gear adapted to be connected with said clutch, a knitting-cylinder, a rack 95
upon said cylinder operated by said bevel-gear, a segmental gear, intermediate connection between the shaft and segmental gear, a shaft adapted to oscillate, intermediate connection between said shaft and the 100
segmental gear, a clutch, as G, upon said shaft, a gear-wheel, as g^2 , adapted to be connected with said clutch, and intermediate connection between said gear and the bevel-gear, a clutch-lever pivoted in the center and 105
adapted to operate upon both said clutches, a sprocket-wheel, means to rotate said wheel, a sprocket-chain carried by said wheel, a connecting-rod connected to said clutch-lever, a lug connected to said connecting-rod, and a 110
lug on the sprocket-chain in line with said lug connected to the connecting-rod, whereby when the lug is struck the connecting-rod is moved and clutch G engaged and clutch D disengaged, a notch-rest adapted to secure 115
one end of connecting-rod, and a lug on the sprocket-chain in line with the said notch-rest.

7. In a knitting-machine, the combination of a cylinder, needles sliding in grooves therein, a circular cam outside of the cylinder, and 120
angular needle-shifting levers pivoted between the cam and cylinder, the horizontal outer portions of the levers engaging and being oscillated in a direction lengthwise of the needles by the cam and the inner vertical 125
portions having jaws to receive the butt-ends of the needles, substantially as described.

8. In a knitting-machine, the combination of a cylinder, needles sliding in grooves therein, a circular cam outside of the cylinder, 130
angular needle-shifting levers pivoted between the cam and cylinder, and connections between the levers and the needles, the outer horizontal portions of the levers being en-

gaged and oscillated by the cam in a direction lengthwise of the needles and the inner vertical portions oscillating in a direction transverse to the movement of the needles, substantially as described.

9. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, and means, substantially as described, to simultaneously rock the tails of the levers corresponding to the needles in the front half of the needle-cylinder.

10. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, a plate upon which the tails of said levers corresponding to the needles in the front half of said needle-cylinder rest, and means, substantially as described, to elevate said plate.

11. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, a plate upon which the tails of said levers corresponding to the needles in the front half of said needle-cylinder rest, pins connected to said plate, a rock-shaft and intermediate connection between said shaft and said pins, and means, substantially as described, to operate said shaft when the means for imparting reciprocating motion to the knitting-cylinder is thrown into action.

12. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, a plate upon which the tails of said levers corresponding to the needles in the front half of said needle-cylinder rest, pins connected to said plate, a rock-shaft and intermediate connection between said rock-shaft and said pins, the clutch connecting-rod I, mechanism, substantially as described, to operate said rod, and intermediate connection between said rod and the rock-shaft, whereby when the rod is moved the rock-shaft is rocked.

13. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, a plate upon which the tails of said levers corresponding to the needles in the front half of said needle-cylinder rest, pins connected to said plate, a rock-shaft and intermediate connection between said rock-shaft and said pins, the clutch connecting-rod I, mechanism, substantially as described, to operate said rod, a lever on said rock-shaft, a stand connected to said connecting-rod, and set-screws passing through said stand, one on each side of said lever in line with said lever, whereby when said rod is operated one of said screws strikes said shaft to rock it.

14. In a circular-knitting machine, in combination,

a knitting-cylinder, a rack on said cylinder, a gear-wheel adapted to operate said rack, a main driving-shaft, a clutch upon said shaft adapted to be connected with said gear-wheel, an oscillating shaft, a clutch upon said shaft, a gear-wheel adapted to be engaged by said clutch, connection between said gear and the knitting-cylinder-rack gear-wheel, a clutch-lever common to both clutches, and means, substantially as described, to operate said clutch-lever, whereby one clutch is released and the other brought into action.

15. In a circular-knitting machine, in combination, a knitting-cylinder, a rack on said cylinder, a gear-wheel adapted to operate said rack, a main driving-shaft, a clutch upon said shaft adapted to be connected with said gear-wheel, an oscillating shaft, a clutch upon said shaft, a gear-wheel adapted to be engaged by said clutch, connection between said gear-wheel and the knitting-cylinder-rack gear-wheel, a clutch-lever common to both clutches, a connecting-rod connected to said clutch-lever, a lug connected to said connecting-rod, a sprocket-wheel, a sprocket-chain driven by said sprocket-wheel, and a lug upon said sprocket-chain in line of travel of said lug connected to the connecting-rod.

16. In a circular-knitting machine, in combination, a knitting-cylinder, a rack on said cylinder, a gear-wheel adapted to operate said rack, a main driving-shaft, a clutch upon said shaft adapted to be connected with said gear-wheel, an oscillating shaft, a clutch upon said shaft, a gear-wheel adapted to be engaged by said clutch, connection between said gear-wheel and the knitting-cylinder-rack gear-wheel, a clutch-lever common to both clutches, a connecting-rod connected to said clutch-lever, a lug connected to said connecting-rod, a sprocket-wheel, a sprocket-chain driven by said sprocket-wheel, a lug upon said sprocket-chain in line of travel of said lug connected to the rod, and means to lock said rod when moved by the lugs striking.

17. In a circular-knitting machine, in combination, a knitting-cylinder, a rack on said cylinder, a gear-wheel adapted to operate said rack, a main driving-shaft, a clutch upon said shaft adapted to be connected with said gear-wheel, an oscillating shaft, a clutch upon said shaft, a gear-wheel adapted to be engaged by said clutch, connection between said gear-wheel and the knitting-cylinder-rack gear-wheel, a clutch-lever common to both clutches, a connecting-rod connected to said clutch-lever, a lug connected to said connecting-rod, a sprocket-wheel, a sprocket-chain driven by said sprocket-wheel, a lug upon said sprocket-chain in line of travel of said lug connected to the rod, means to lock said rod when moved by the lugs striking, and means, substantially as described, to release said rod.

18. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said nee-

dles, needle-shifting cams in line of travel of the tails of said levers, a needle-cylinder mechanism, substantially as described, to reciprocate said knitting-cylinder, and intermediate connection between said cams and needle-cylinder-reciprocating motor.

19. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, needle-shifting cams in line of travel of the tails of said levers, racks by which said cams are carried, pivoted pawls adapted to work in said racks, a pivoted lever to which said pawls are connected, a main driving-shaft, a clutch upon said shaft, a reciprocating shaft, a clutch upon said shaft, a clutch-lever common to both clutches, a lever pivoted to said clutch-lever, connection between said pivoted lever and lever pivoted to clutch-lever, lugs upon the lever pivoted to clutch-lever, a gear-wheel adapted to be connected with the clutch on the reciprocating shaft, and lugs upon said gear-wheel in line with said lugs on the lever pivoted to clutch-lever when said clutch is in connection with the gear-wheel but out of line when said clutch is out of connection with said gear-wheel.

20. In a knitting-machine, in combination, a needle-cylinder provided with slots, needles in said slots, pivoted levers provided with jaws adapted to hold the shanks of said needles, needle-shifting cams in line of travel of the tails of said levers, racks by which said cams are carried, pivoted pawls adapted to

work in said racks, a pivoted lever to which said pawls are connected, a main driving-shaft, a clutch upon said shaft, a reciprocating shaft, a clutch upon said shaft, a clutch-lever common to both clutches, a lever pivoted to said clutch-lever, connection between said pivoted lever and lever pivoted to clutch-lever, lugs upon the lever pivoted to the clutch-lever, a gear-wheel adapted to be connected with the clutch on the reciprocating shaft, lugs upon said gear-wheel in line with said lugs on the lever pivoted to the clutch-lever when the clutch is in connection with the gear-wheel but out of line when said clutch is out of connection with said gear-wheel, and guards to limit the movement of said pivoted lever.

21. In combination, a knitting-cylinder, a rotary shaft, a clutch on said shaft, an oscillating shaft, a clutch on said shaft, a gear-wheel adapted to be engaged by the clutch on the rotary shaft, and a gear-wheel adapted to be engaged by the oscillating shaft-clutch, connection between said gear-wheels and knitting-cylinder, a clutch-lever common to both clutches, and means, substantially as described, to operate said clutch-lever, whereby one clutch is released and the other brought into action.

In testimony of which invention I have hereunto set my hand.

HARRY A. HOUSEMAN.

Witnesses:

JOHN SHALLCROSS,
FRED. W. CASSIDY.