J. P. GAIL.

COUCH FABRIC MACHINE

APPLICATION FILED AUG. 2, 1

1,051,724.

Patented Jan. 28, 1913.

20 SHEETS-SHEET 1

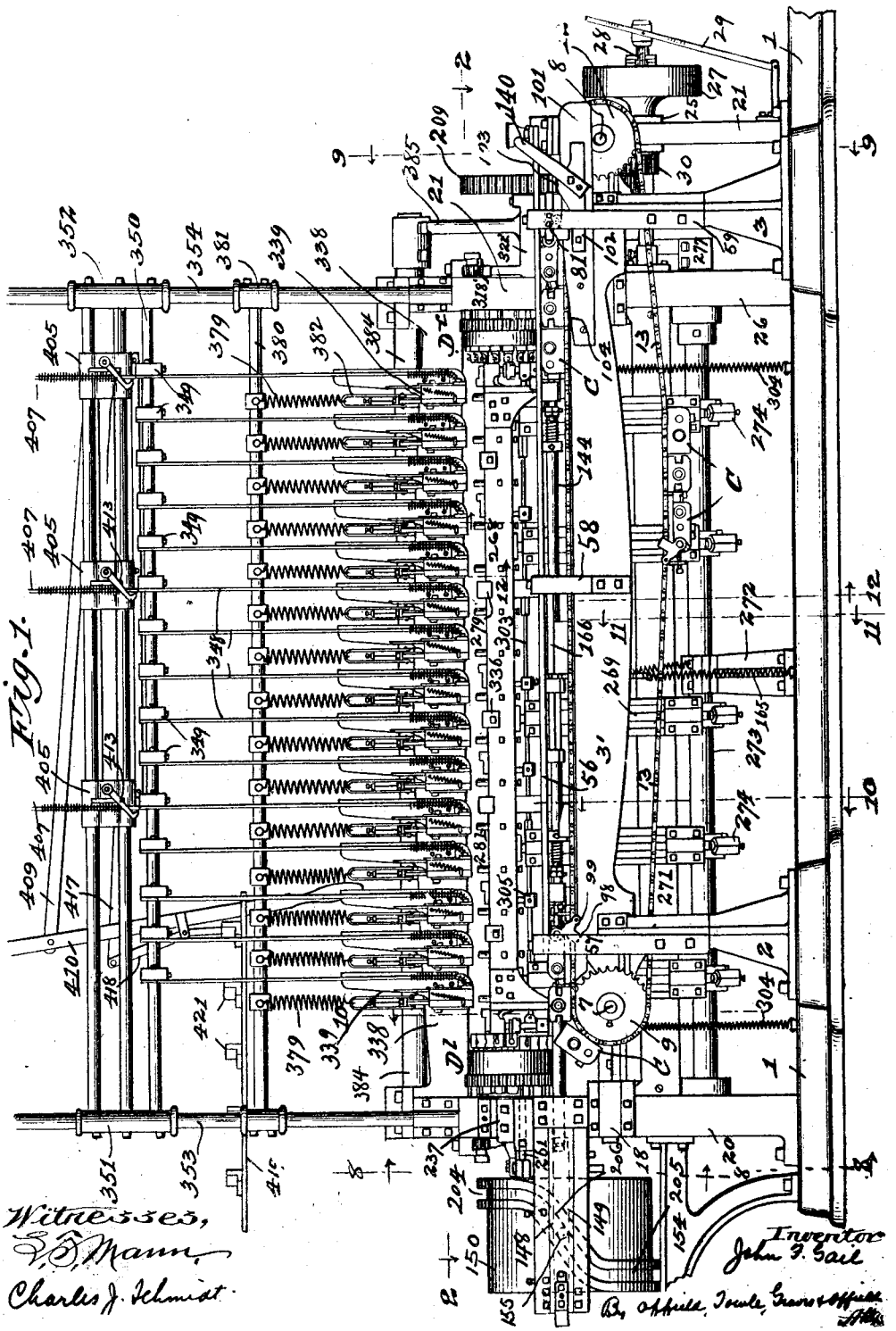

Fig. 1.

Witnesses,
P. S. Mann,
Charles J. Schmidt.

Inventor
John P. Gail
By Offield, Towle, Graves & Offield
Attys

J. F. GAIL.

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20 SHEETS—SHEET 7

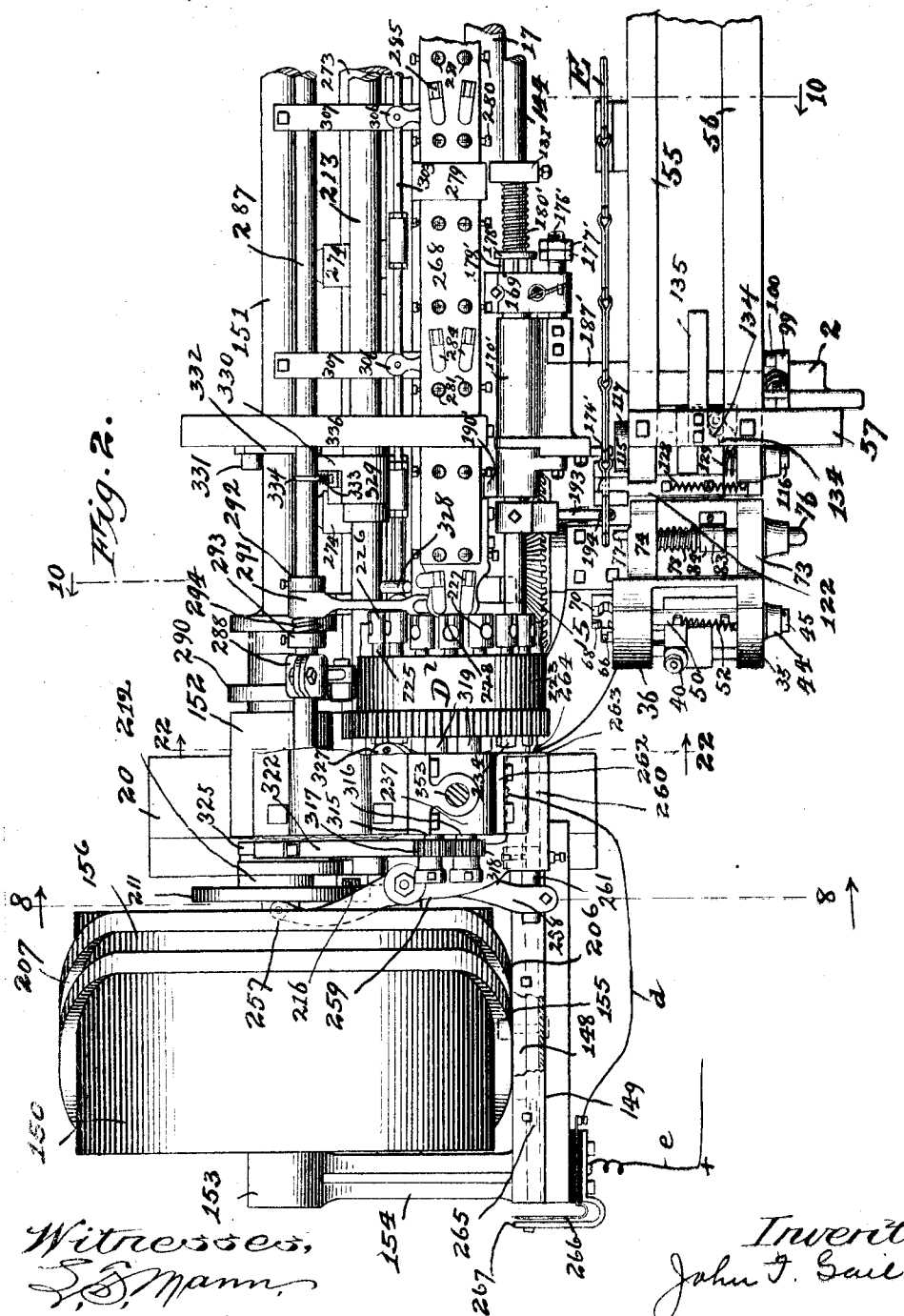

Fig. 2.

Witnesses,
F. S. Mann.
Charles J. Schmidt.

Inventor,
John F. Gail
By Offield, Towle, Graves & Offield
Attys

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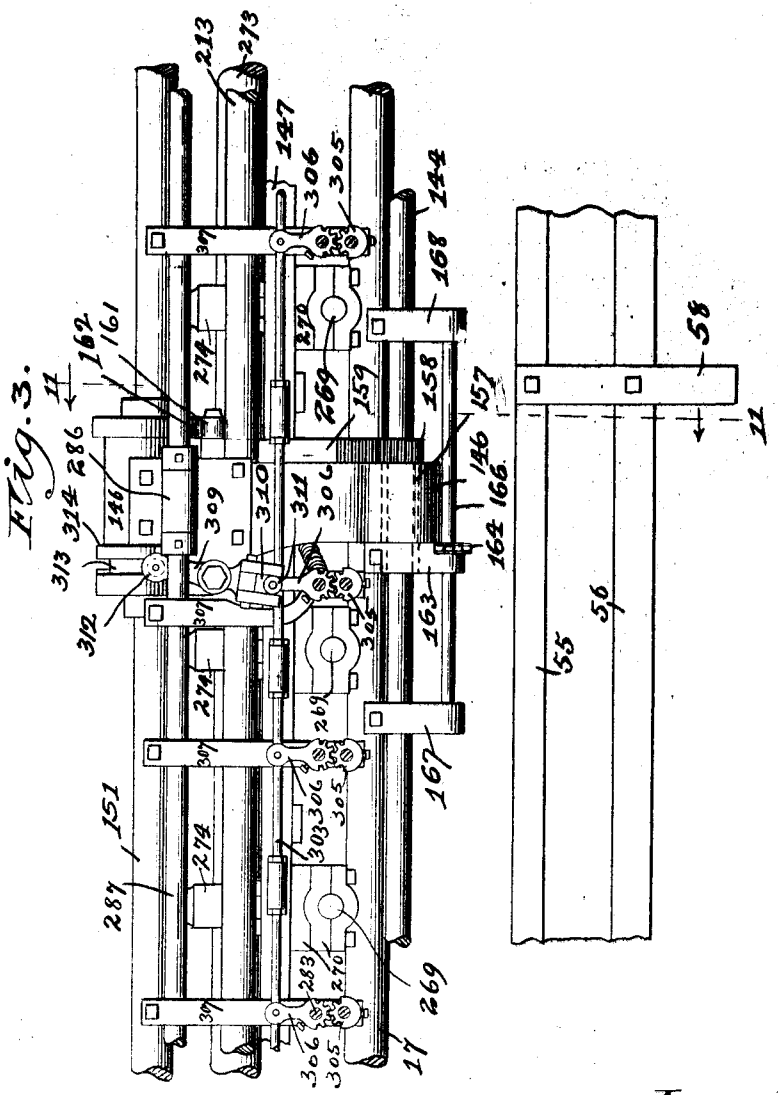
20 SHEETS—SHEET 3.

Fig. 3.



Witnesses,

L. D. Mann

Charles J. Schmidt.

Inventor,

John F. Gail

By Offield, Towle, Graves & Offield

Att'ys.

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20 SHEETS—SHEET 4.

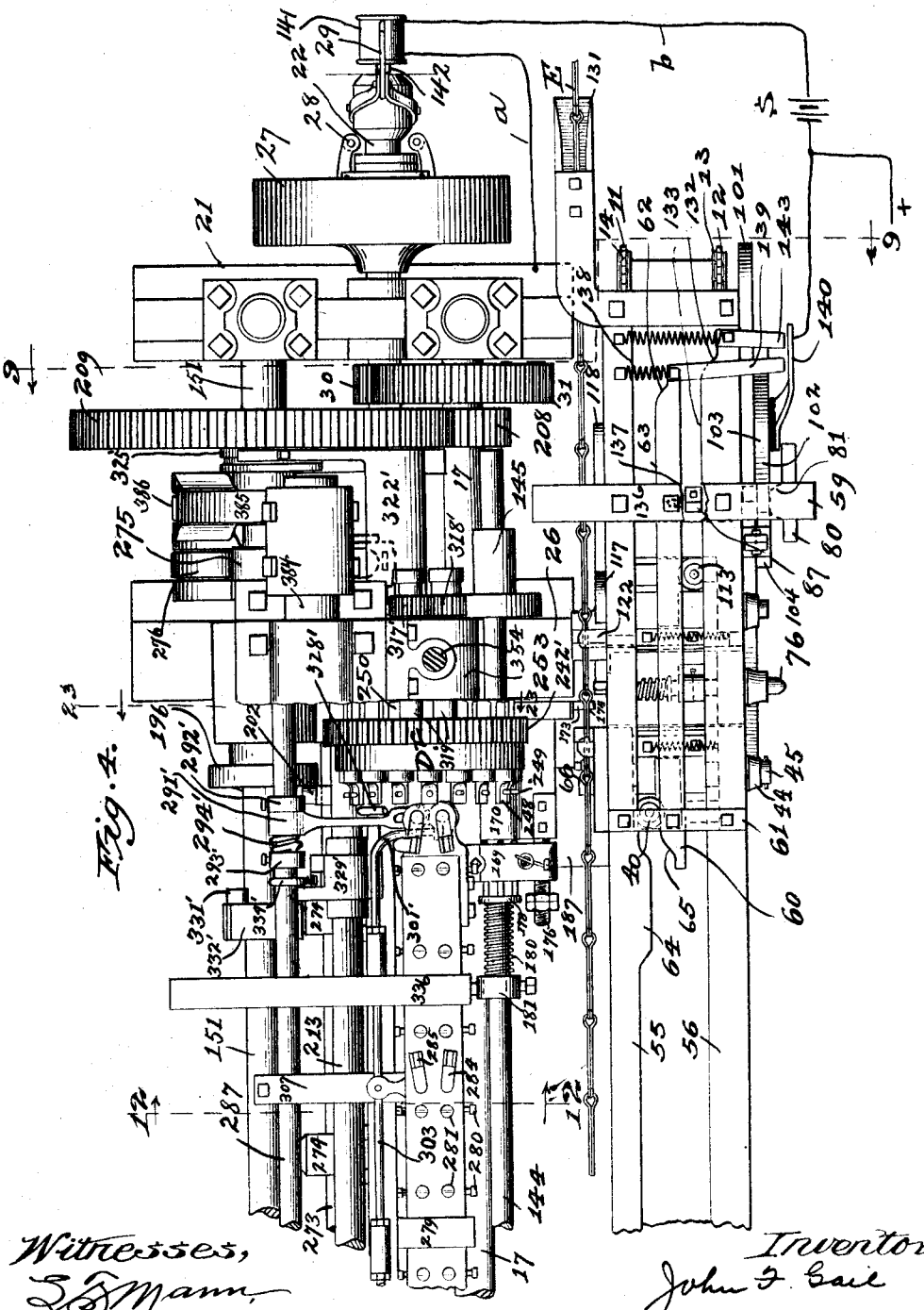

Fig. 4.

Witnesses,
L. S. Mann,
Charles J. Schmidt

Inventor,
John F. Gail
By Offield, Towle, Graves & Offield
Atty's

J. F. GAIL.

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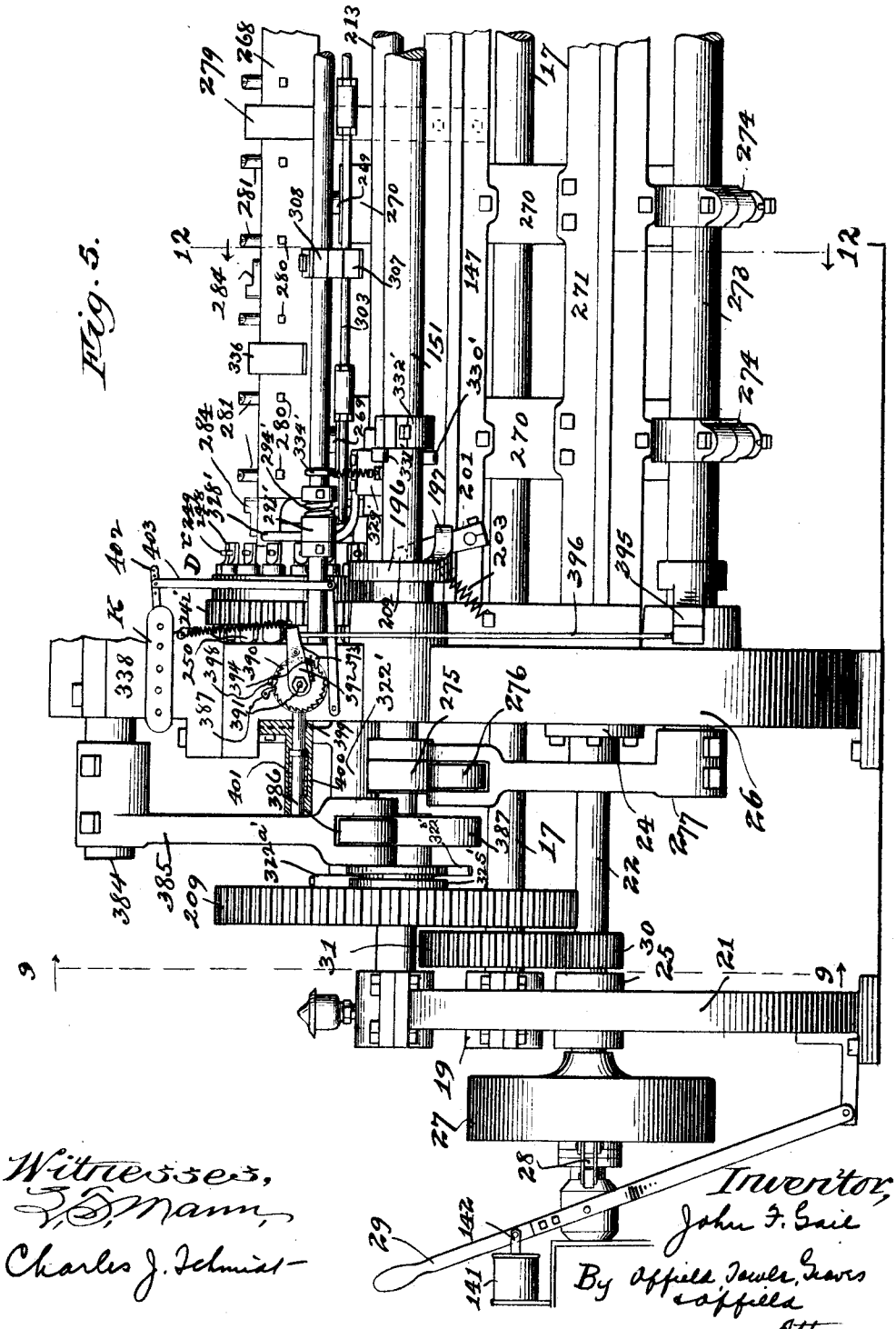
20 SHEETS—SHEET 5.

Fig. 5.



Witnesses,
F. D. Mann,
Charles J. Schmidt

Inventor,
John F. Gail
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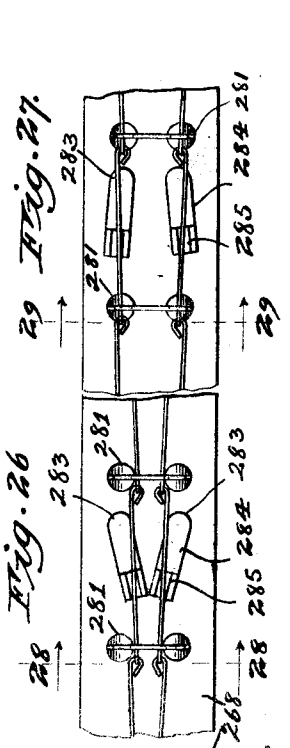
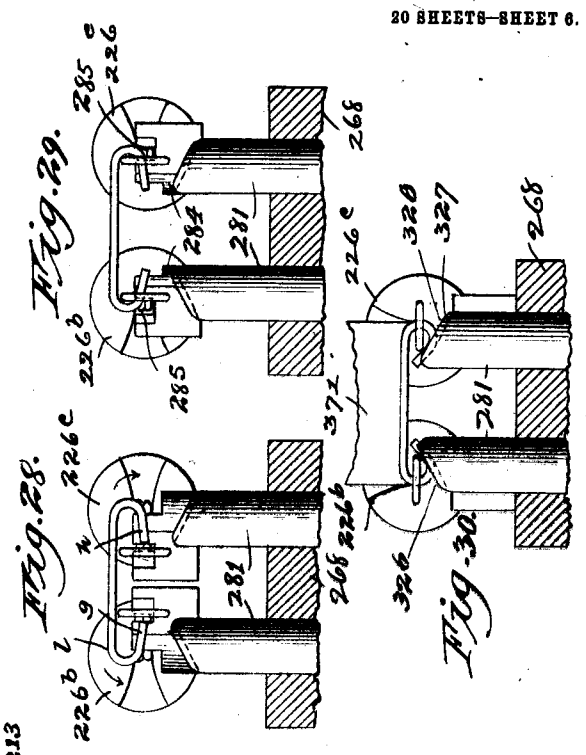
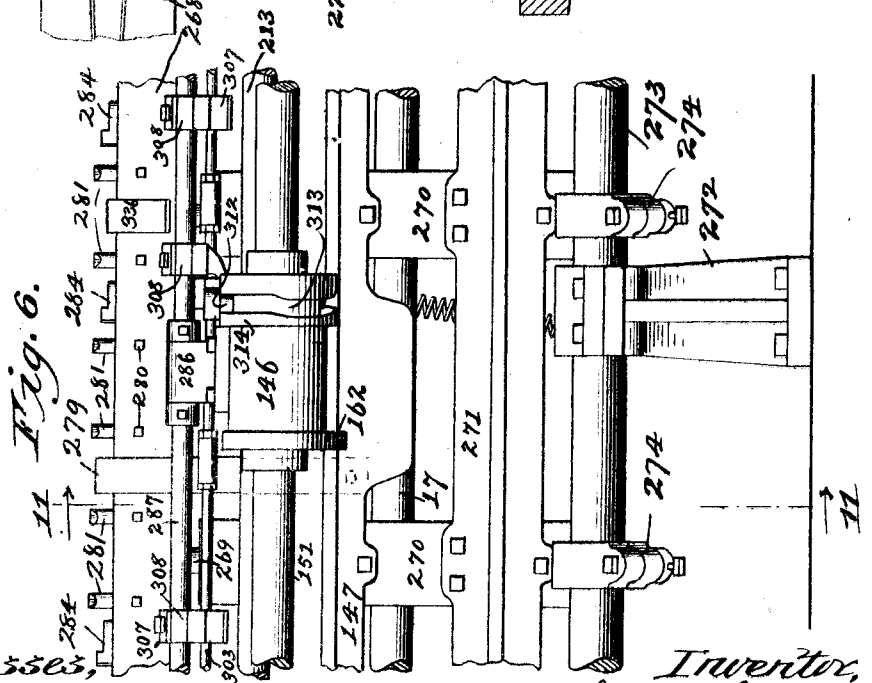
20 SHEETS—SHEET 6.







Witnesses,
F. S. Mann
Charles J. Schmitt.

Inventor,
John F. Gail
By Offield, Towle, Graves & Offield
Att'ys.

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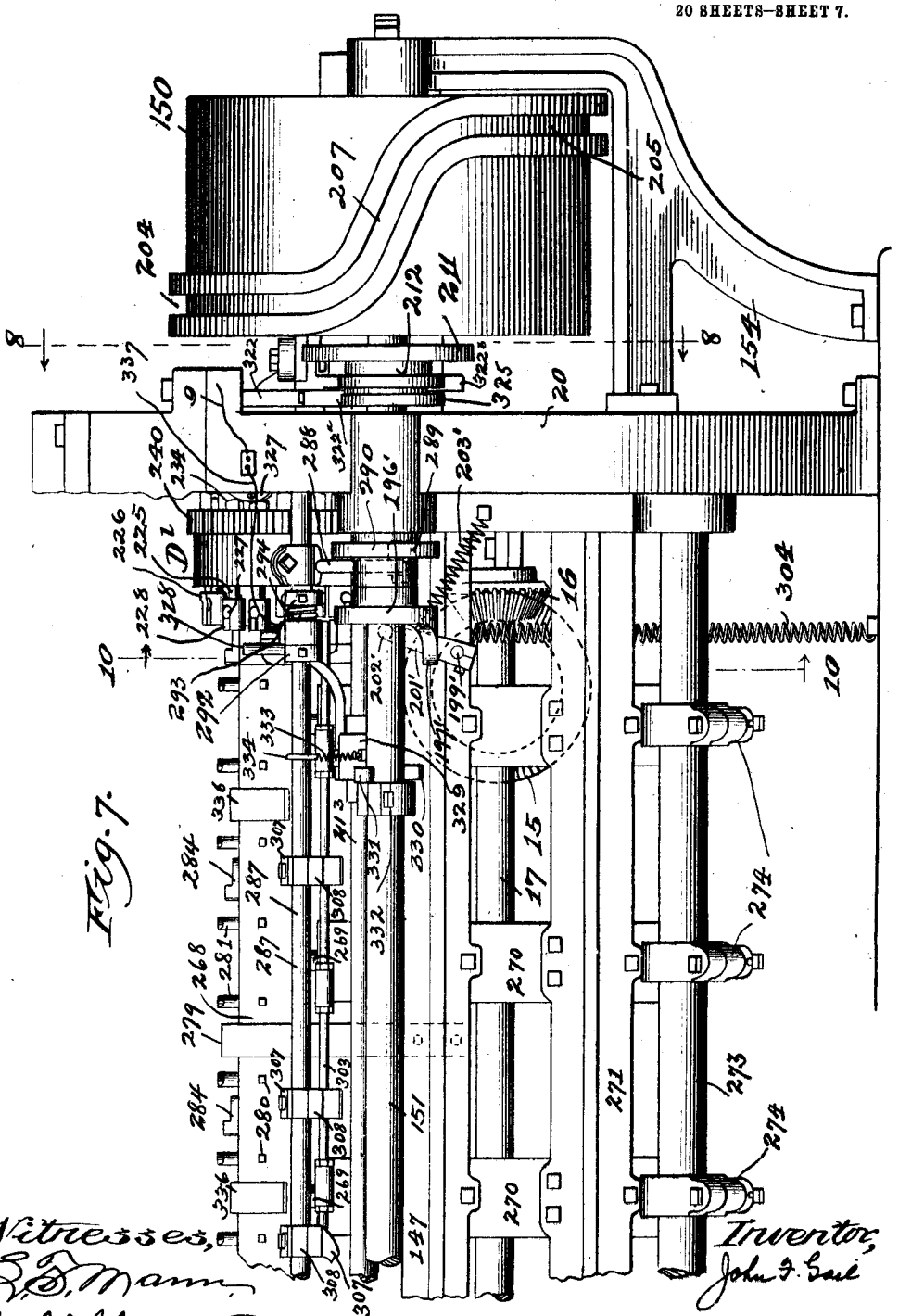

Witnesses,
L. D. Mann
Charles J. Schmidt.

Inventor,
John F. Gail

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Attys.

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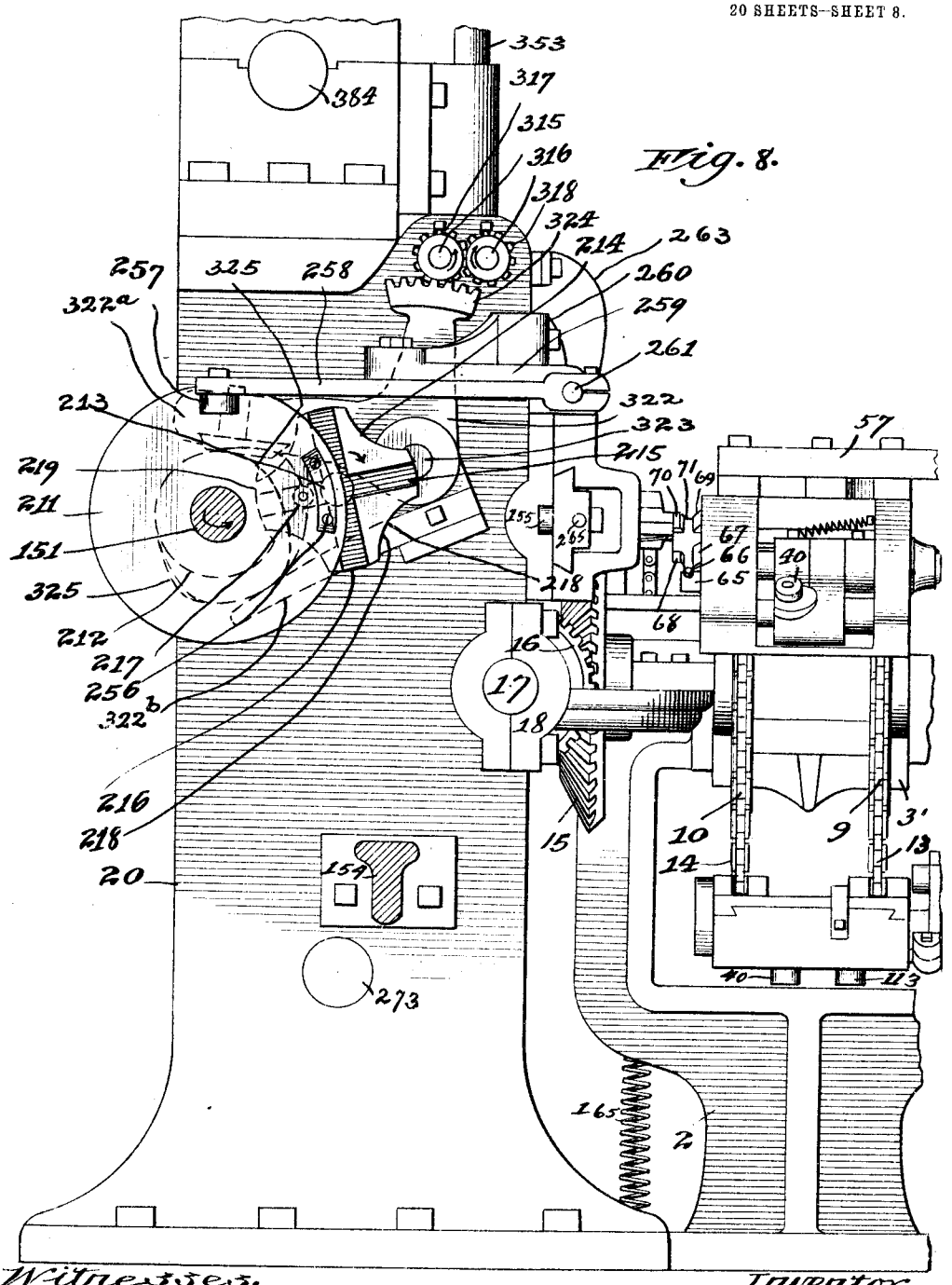
20 SHEETS—SHEET 8.

Fig. 8.



Witnesses,
E. F. Mann,
Charles J. Schmidt.

Inventor.
John F. Gail
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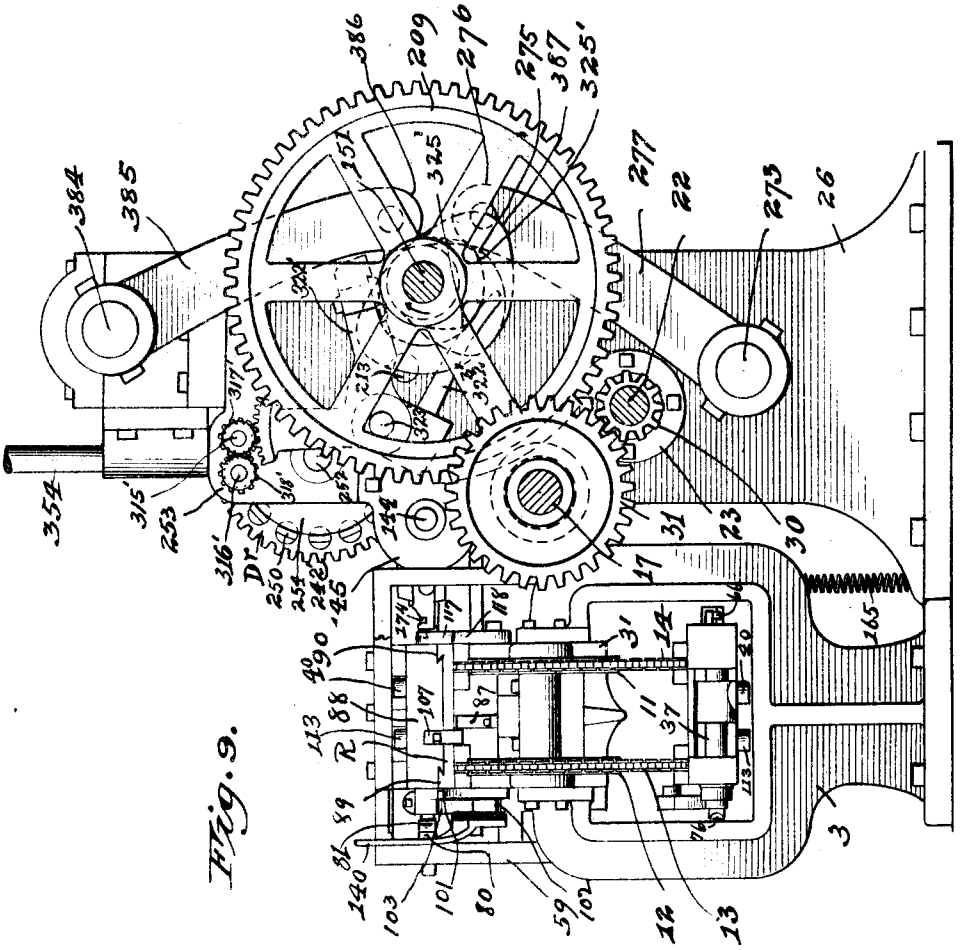

Fig. 9.

Witnesses,
F. S. Mann,
Charles J. Schmidt.

Inventor,
John F. Gail
By Offield, Towle, Graves & Offield
Att'ys

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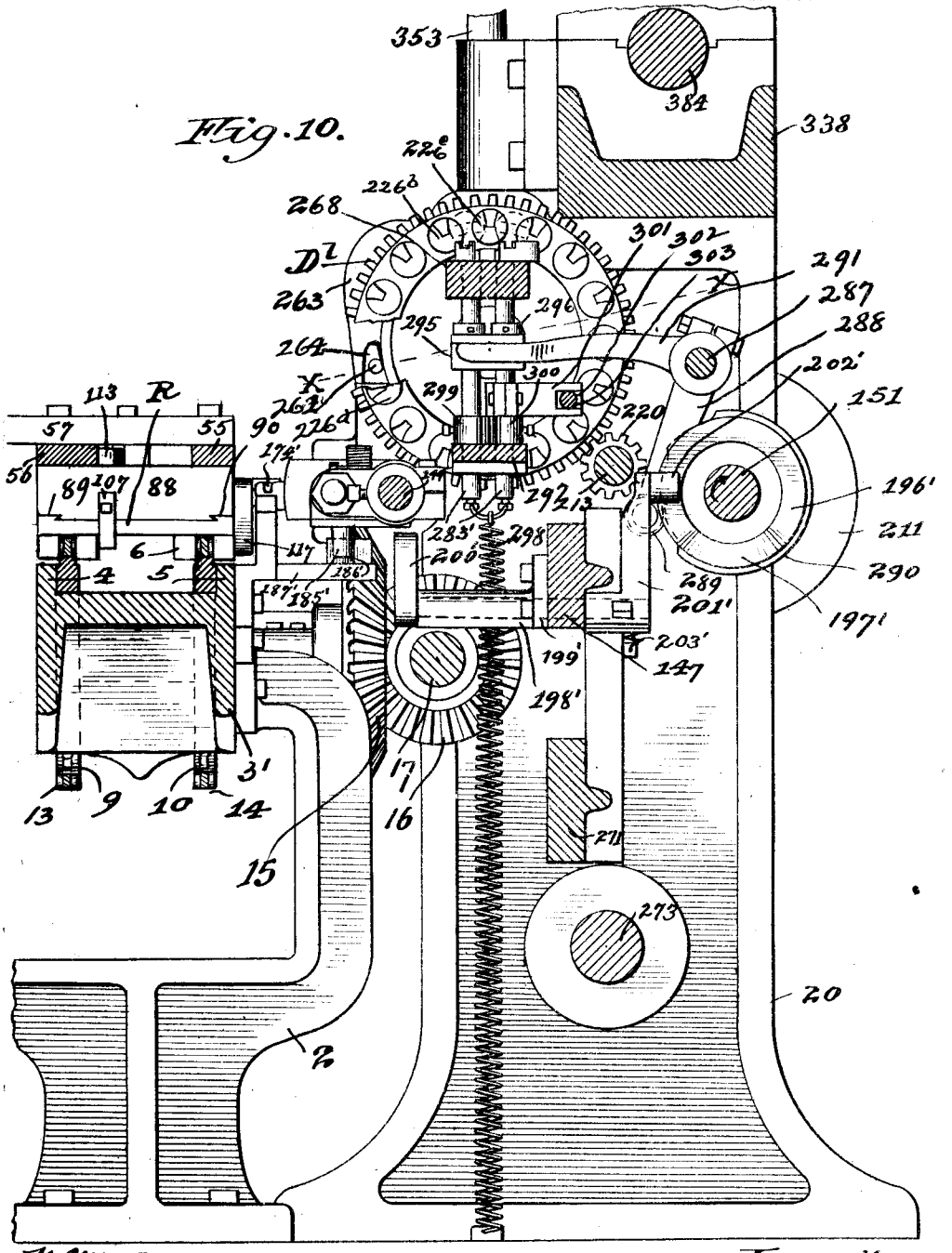
20 SHEETS—SHEET 10.

Fig. 10.



Witnesses:

L. S. Mann

Charles J. Schmidt

Inventor:

John F. Gail

By Offield, Towle, Graves & Offield

Attys

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COUCH FABRIC MACHINE.

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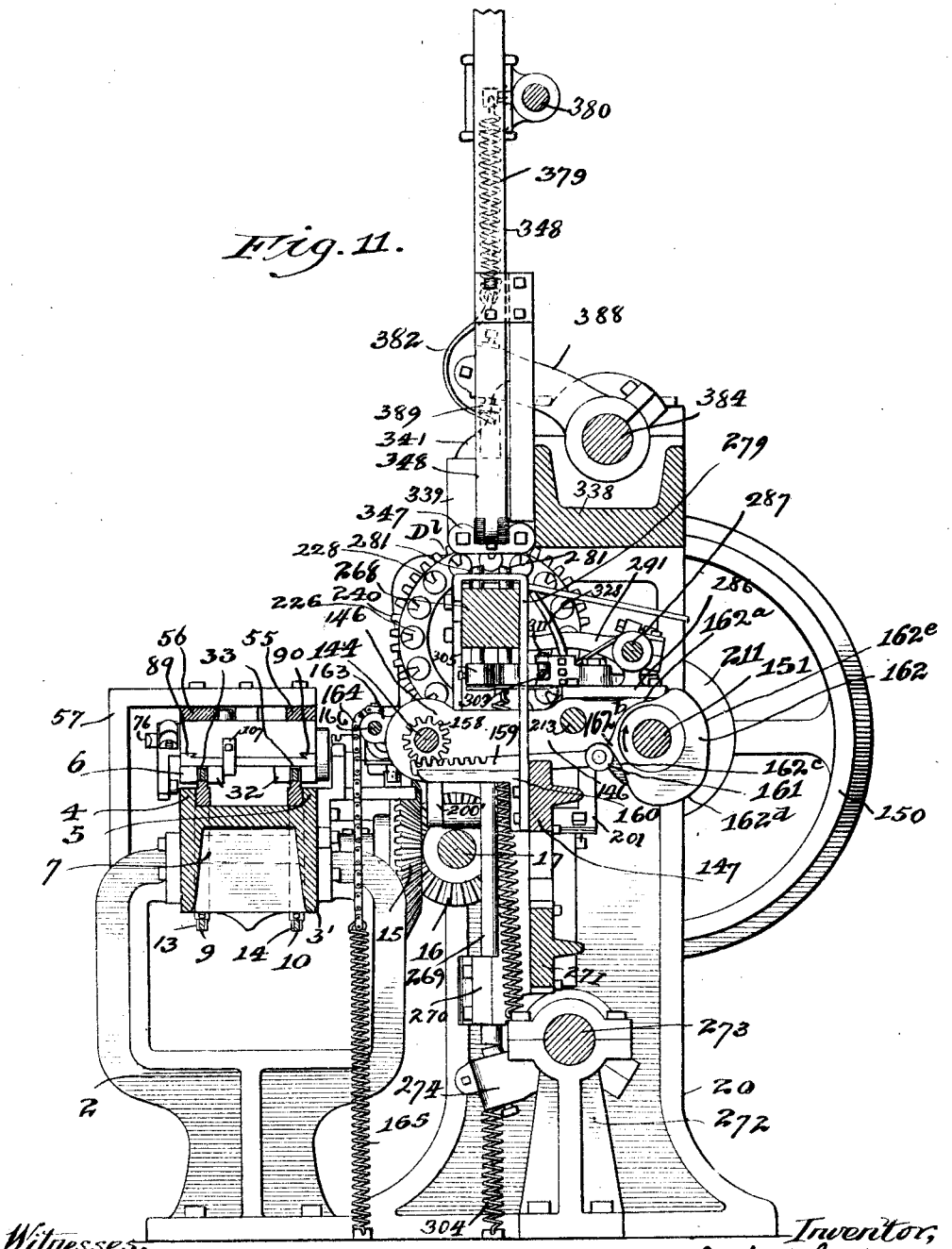
20 SHEETS—SHEET 11.

Fig. 11.



Witnesses,
E. D. Mann.
Charles J. Schmidt.

Inventor,
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J. F. GAIL.

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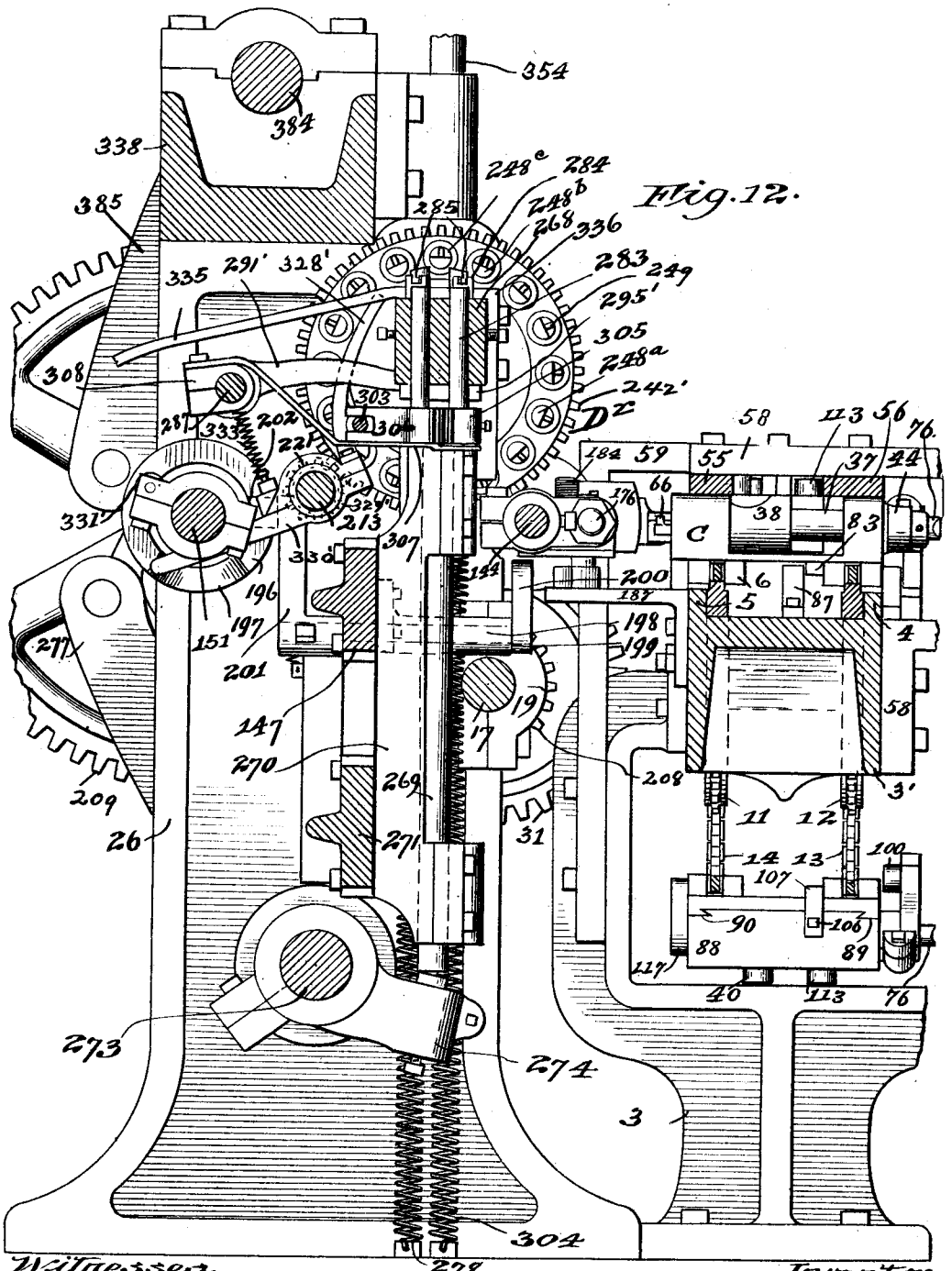
20 SHEETS—SHEET 12.

Fig. 12.



Witnesses,
E. B. Mann,
Charles J. Schmidt

Inventor,
John F. Gail
By Offield, Towle, Graves & Offield
Att'ys.

J. F. GAIL.

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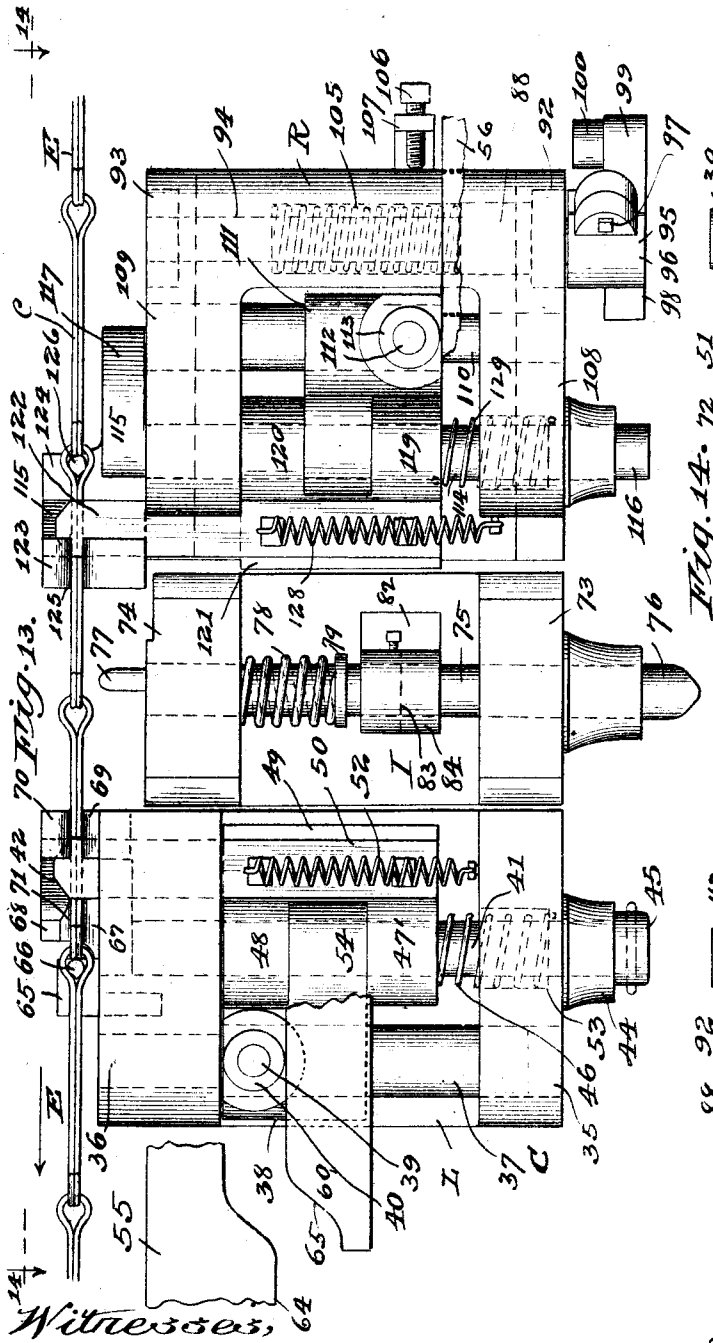

Fig. 13.

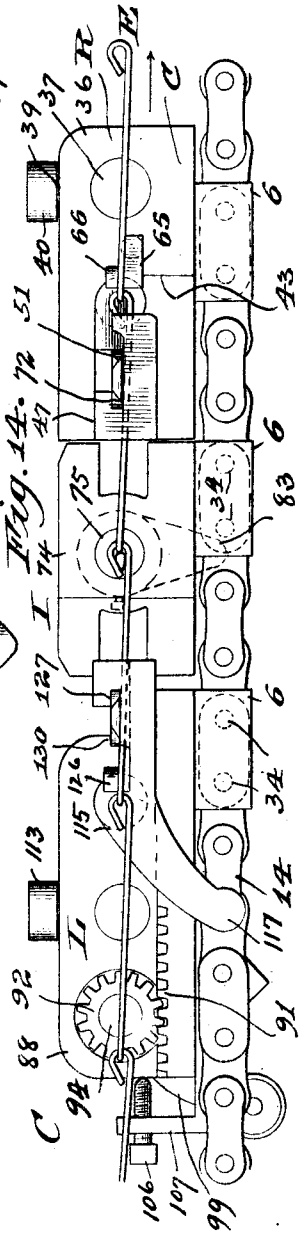

Fig. 14.

Witnesses,

L. S. Mann

Charles J. Schmidt.

Inventor.

John F. Gail

By Offield, Towle, Graves & Offield

Atty's.

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COUCH FABRIC MACHINE.

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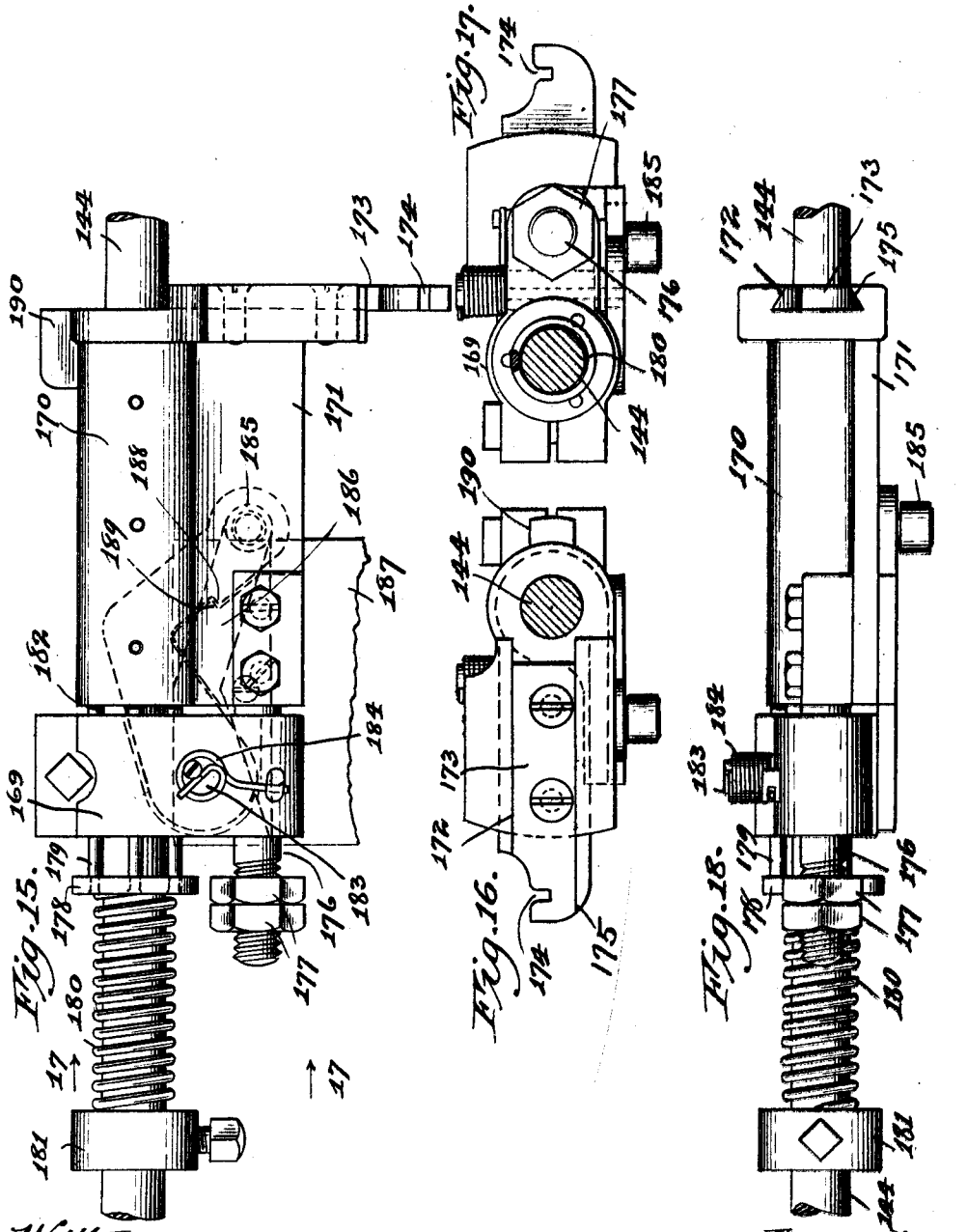
20 SHEETS—SHEET 14.



Witnesses,
F. E. Mann
Charles J. Schmidt.

Inventor,
John F. Gail
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J. F. GAIL.

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20 SHEETS—SHEET 15.

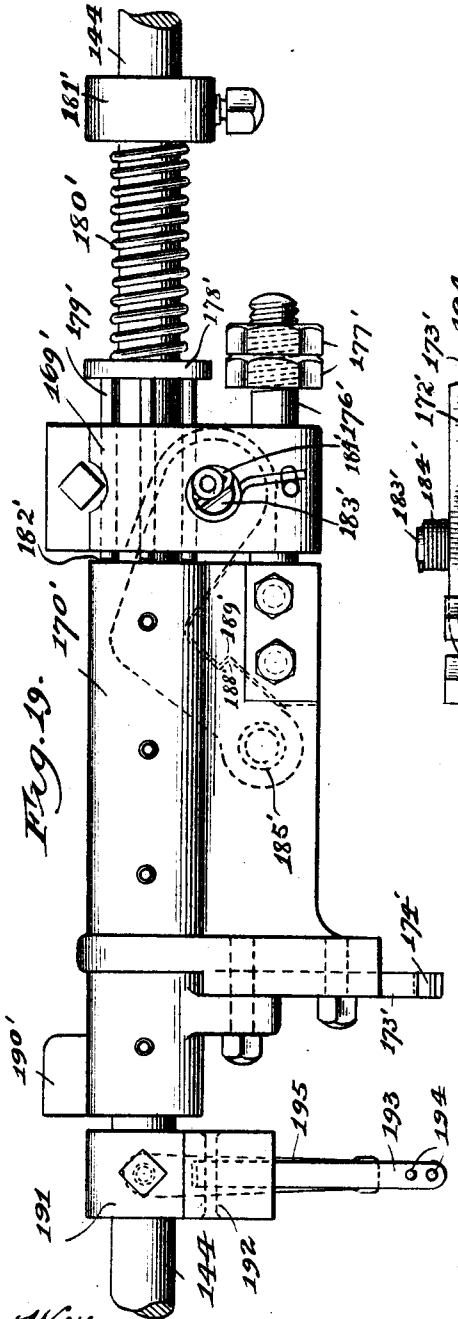


Fig. 19.

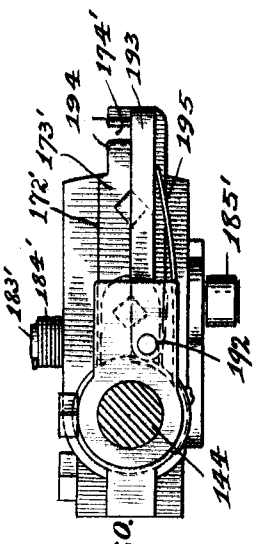


Fig. 20.

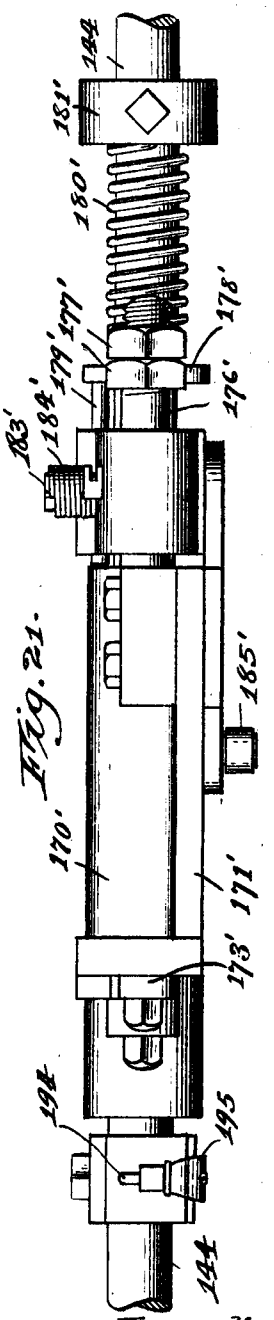


Fig. 21.

Witnesses,
F. S. Mann,
Charles J. Schmidt.

Inventor,
John F. Gail
By Offield, Towle, Graves & Offield
Atty's.

J. F. GAIL.

COUCH FABRIC MACHINE.

APPLICATION FILED AUG. 2, 1909.

1,051,724. Patented Jan. 28, 1913.

20 SHEETS—SHEET 16.

Fig. 22.

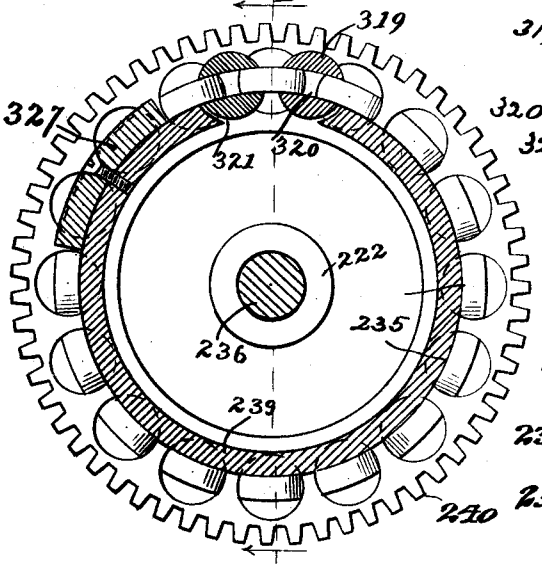
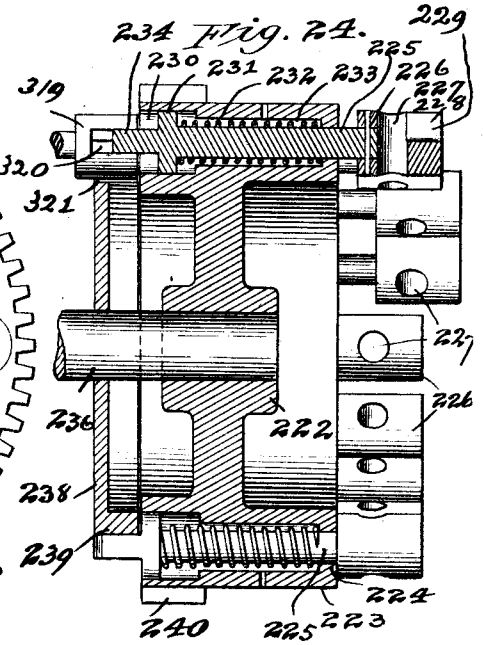


Fig. 24.



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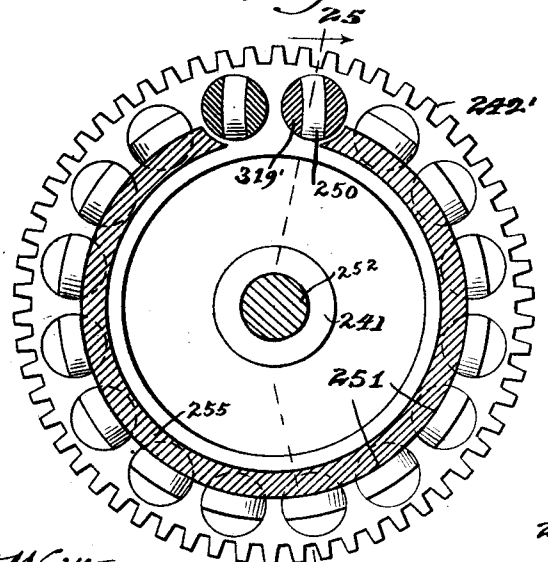
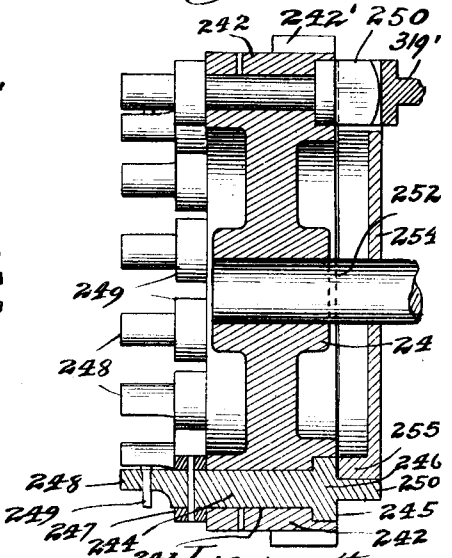


Fig. 25.



Witnesses,

E. S. Mann,

Charles J. Schmitt.

Inventor;

John F. Gail

By Offield, Towle, Graves & Offield

Atty's

J. F. GAIL.

COUCH FABRIC MACHINE.

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1,051,724.

Patented Jan. 28, 1913.

20 SHEETS—SHEET 17.

Fig. 31.

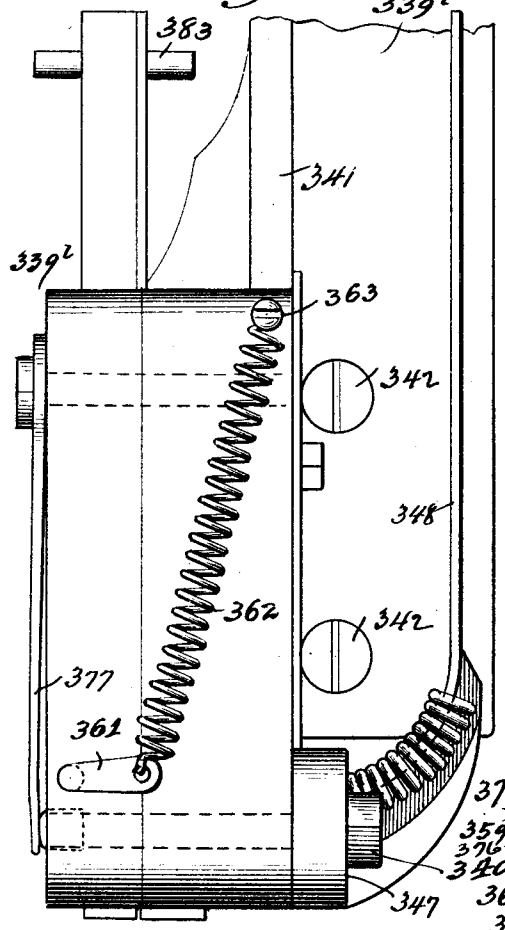


Fig. 32.

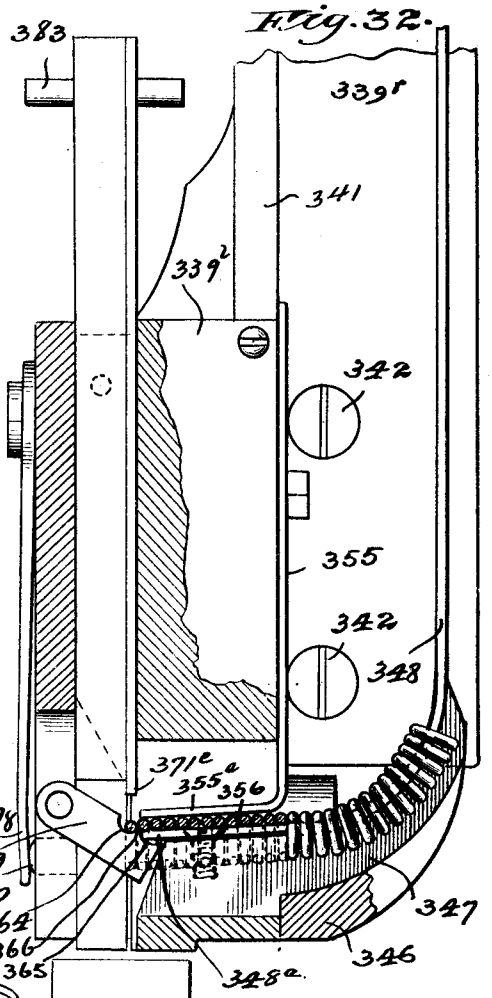
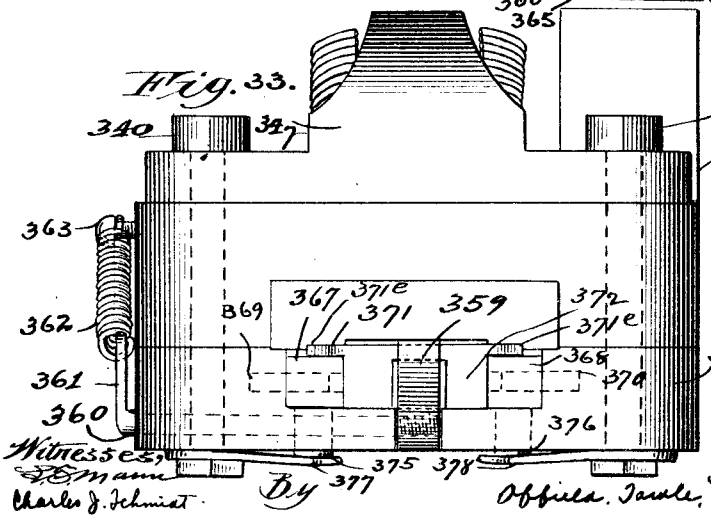


Fig. 33.



Witnesses,
Charles J. Schmidt.

By

Inventor,
John F. Gail

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Patented Jan. 28, 1913.

20 SHEETS—SHEET 18.

Fig. 35.

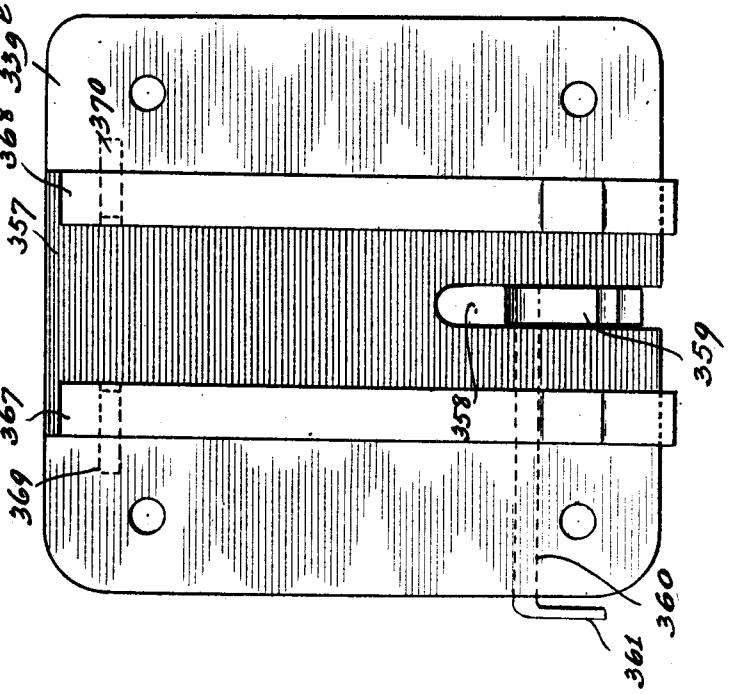
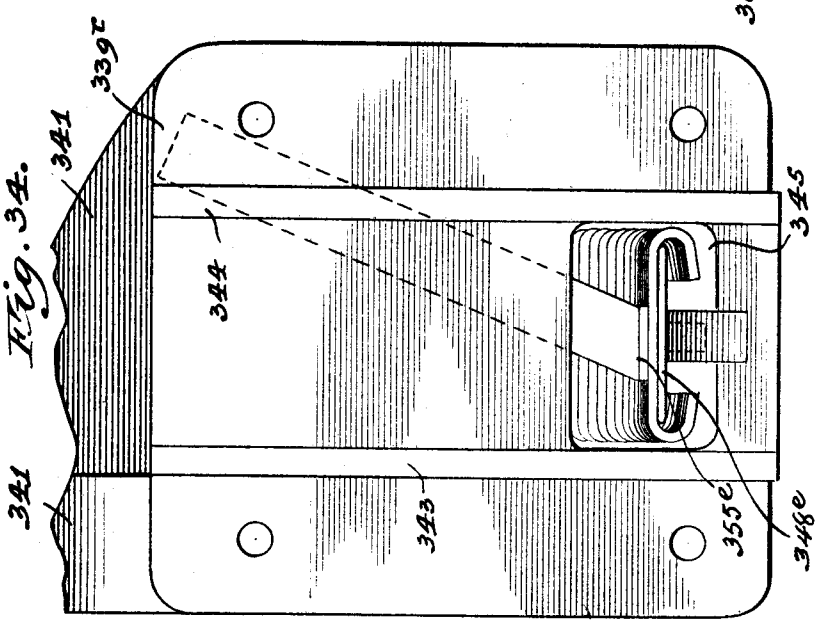


Fig. 34.



Witnesses,
F. C. Mann,
Charles J. Schmidt.

Inventor,
John F. Gail

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Atty's.

J. F. GAIL.

COUCH FABRIC MACHINE.

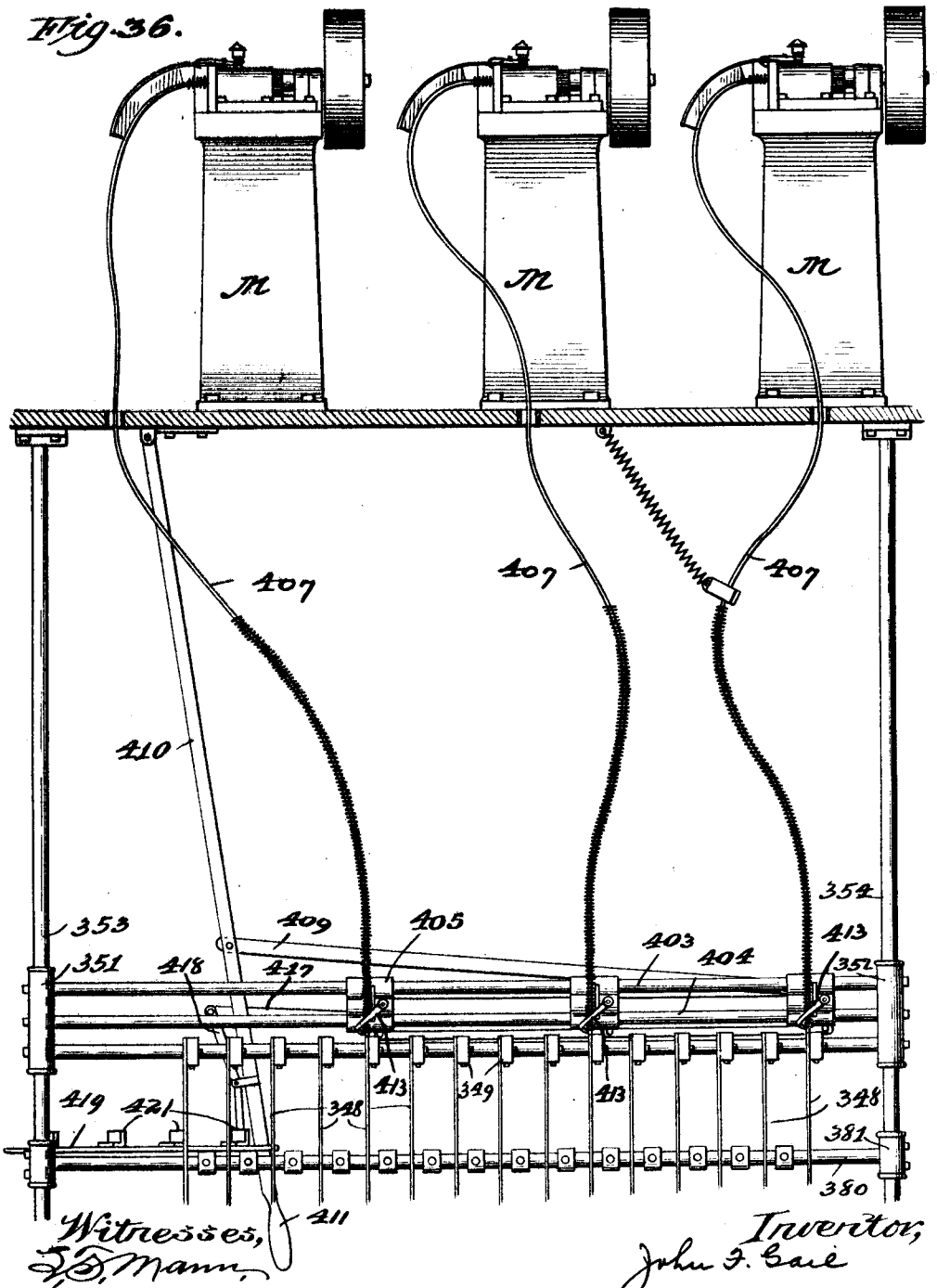
APPLICATION FILED AUG. 2, 1909.

1,051,724.

Patented Jan. 28, 1913.

20 SHEETS—SHEET 19.

Fig. 36.



Witnesses,
F. D. Mann,
Charles J. Schmidt.

Inventor,
John F. Gail
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COUCH FABRIC MACHINE.

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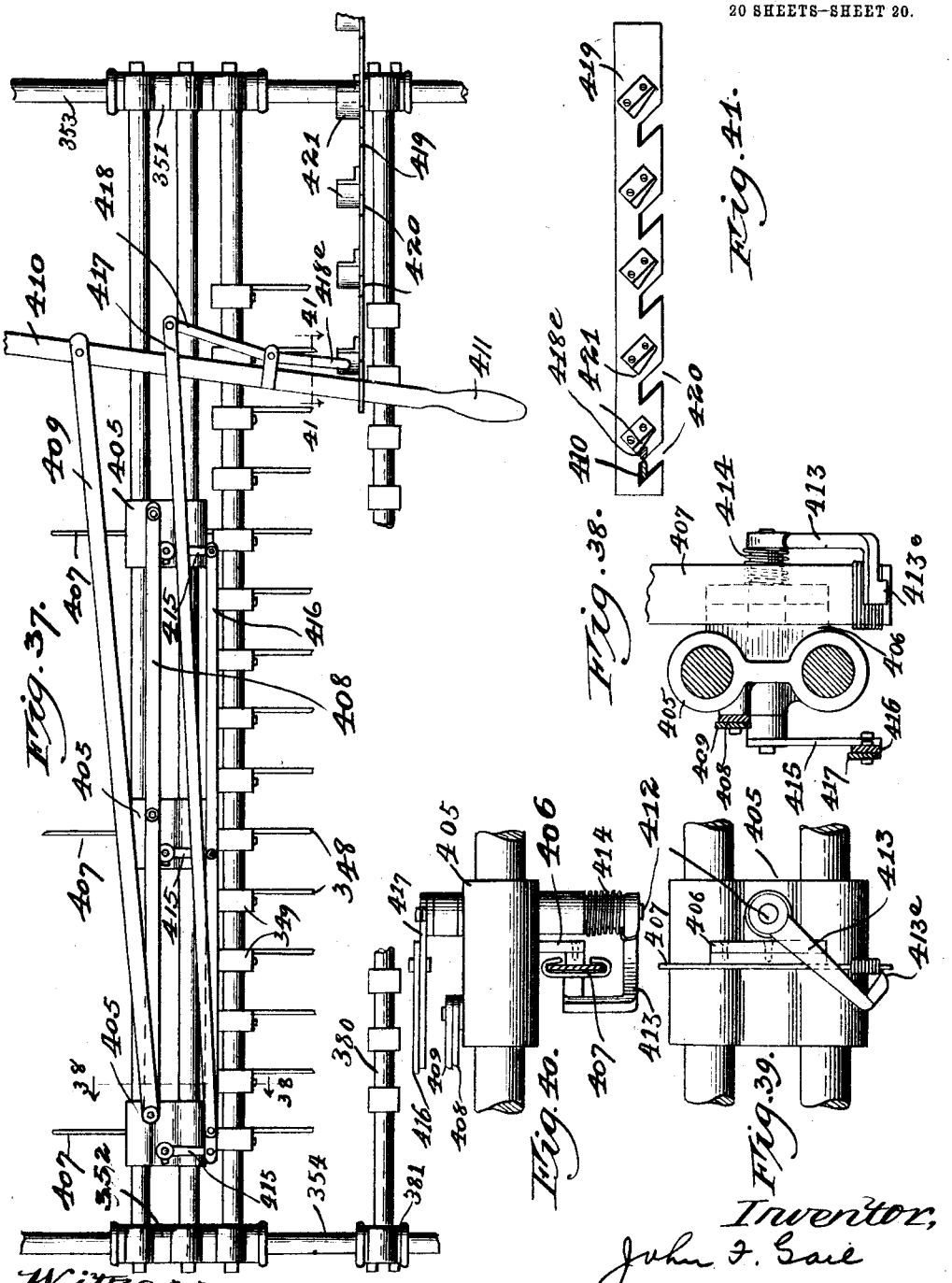
20 SHEETS—SHEET 20.



Witnesses,
F. E. Mann,
Charles J. Helmuth.

Inventor,
John F. Gail

By Offield, Towle, Graves & Offield
Atty's.

UNITED STATES PATENT OFFICE.

JOHN F. GAIL, OF KENOSHA, WISCONSIN, ASSIGNOR TO THE SIMMONS MANUFACTURING COMPANY, OF KENOSHA, WISCONSIN, A CORPORATION OF WISCONSIN.

COUCH-FABRIC MACHINE.

1,051,724. Specification of Letters Patent. Patented Jan. 28, 1913.

Application filed August 2, 1909. Serial No. 510,764.

To all whom it may concern:

Be it known that I, JOHN F. GAIL, residing at Kenosha, in the county of Kenosha and State of Wisconsin, have invented certain new and useful Improvements in Couch-Fabric Machines, of which the following is a complete, clear, full, and precise specification.

My invention relates to couch fabric machines for manufacturing wire fabric to use for couches, beds or the like.

The main object of my invention is to provide a machine which will operate entirely automatically to receive endless chain and cross links, to separate the chain into longitudinal sections, to apply the cross links to these sections and to deliver finished fabric sections which are ready for immediate use. In my Patent No. 975,850, granted November 15, 1910, I have described a machine for manufacturing links and endless chain therefrom, and in my Patent No. 957,203, granted May 10, 1910, I have described a machine for manufacturing cross links, and the fabric machine which I will describe in the present application is designed particularly to receive such endless chain and cross links and to work them into finished fabric.

Another object of my invention is to so construct the machine that it will take up very little floor space and be well balanced to turn out the product with minimum power and time and with maximum efficiency.

Other salient objects reside in improved safety attachments for giving indication and for stopping the machine if the various operations are not performed perfectly.

Other valuable and novel features both in construction and arrangement are also present in my machine whose construction and operation are clearly shown in the following specification and the accompanying drawings.

In these drawings:—Figure 1 is a front elevation of the machine showing the general arrangement of the parts; Fig. 2 is a plan view of the left end of the machine below plane 2—2, Fig. 1, Fig. 3 is a plan view of the middle part of the machine below plane 2—2, Fig. 1, Fig. 4 is a plan view of the right end of the machine below plane 2—2, Fig. 1. Fig. 5 is a rear elevation of the right end of the machine below plane 2—2, Fig. 1, Fig. 6 is a rear elevation of the middle part of the machine below plane 2—2, Fig. 1, Fig. 7 is a rear elevation of the left end of the machine below plane 2—2, Fig. 1, Fig. 8 is an end elevation view taken from plane 8—8, Figs. 1, 2 and 7, Fig. 9 is an end elevation view taken on plane 9—9, Figs. 1, 4 and 5. Fig. 10 is a sectional view taken on plane 10—10, Figs. 1, 2 and 7, Fig. 11 is a sectional view taken on plane 11—11, Figs. 1, 3 and 6, Fig. 12 is a sectional view taken on plane 12—12, Figs. 1, 4 and 5, Fig. 13 is an enlarged plan view of one of the chain feed mechanism carriers showing a chain locked thereto and also parts of cam rails, Fig. 14 is an end view taken from plane 14—14, Fig. 13, Fig. 15 is an enlarged plan view of the right end transfer mechanism, Fig. 16 is an end view from the right of Fig. 15, Fig. 17 is a view taken from plane 17—17, Fig. 15, Fig. 18 is a view from the front of Fig. 15, Fig. 19 is an enlarged plan view of the left end transfer mechanism, Fig. 20 is an end view from the left of Fig. 19, Fig. 21 is a view taken from the front of Fig. 19, Fig. 22 is an enlarged view of the outer end of the left chain drum looking from plane 22—22, Fig. 2 and showing the locking disk in section, Fig. 23 is an enlarged view of the outer end of the right chain drum looking from plane 23—23, Fig. 4, and showing the locking disk in section, Fig. 24 is a sectional view taken on plane 24—24, Fig. 22, Fig. 25 is a sectional view taken on plane 25—25, Fig. 23, Fig. 26 is an enlarged plan view of a section of the anvil bar showing adjacent chains brought together by the grippers to receive cross links, Fig. 27 is a similar view showing the chains spread apart after receiving the cross links, Fig. 28 is an enlarged sectional view taken on plane 28—28, Fig. 26, Fig. 29, is an enlarged sectional view taken on plane 29—29, Fig. 27, Fig. 30 is a view like Fig. 29, but showing the positions of the parts during closing of the cross link nooks, Fig. 31 is an enlarged front elevation view of one of the cross link feeding members shown on Fig. 1 just above plane 2—2, Fig. 32 is a view similar to Fig. 31, but showing some of the frame work broken away to reveal internal mechanism, Fig. 33 is a view looking toward the bottom of Fig. 31, Fig. 34 is an elevation view of the right half of

tne feed member in Fig. 31, swung to the right, Fig. 35 is an elevation view of the left half of the feed member Fig. 31, swung to the left, Fig. 36 is a front elevation showing the mechanism of Fig. 1 about the cross link feed members and showing also the cross link machines and the replenishing bars for delivering the cross links, Fig. 37 is a rear elevation, somewhat enlarged, of the replenishing bar controlling mechanism, Fig. 38 is an enlarged sectional view taken on plane 38—38, Fig. 37, Fig. 39 is a view taken from the right of Fig. 38, Fig. 40 is a view taken from the top of Fig. 39, Fig. 41 is a plan view taken from plane 41—41, Fig. 37.

In general the machine comprises feed mechanism, transfer mechanism, receiving and arranging mechanism, cross link application mechanism, separating and releasing mechanism and safety mechanism. The feed mechanism receives the endless chain and separates this chain into sections. The transfer mechanism picks up the sections and transfers them to the receiving mechanism, the sections being arranged on the receiving mechanism in parallel order. The receiving mechanism successively carries the sections into the cross link field where the cross link mechanism applies cross links to connect together adjacent sections to form the finished fabric. The separating and releasing mechanism separates the fabric into sections which are delivered from the machine ready for use. The safety mechanisms operate electrically to give indication of imperfect operation and to stop the machine to prevent injury thereto and to prevent continued imperfect operation. The part of the machine which supports the transfer mechanism is in the form of a vertical structure. The feed mechanism is disposed longitudinally in front of the machine and the fabric releasing and delivering mechanism is at the rear end of the machine.

The feed mechanism is best shown in Figs. 1, 2, 4, 8 to 12 and particularly in Figs. 13 and 14. Extending upwardly from the front and near the ends of the bed plate 1 are U shaped standards 2 and 3 between the upper ends of whose limbs is secured a longitudinal rail frame 3′ of H cross section. The upper extensions of this frame form rails 4 and 5 for receiving the shoes 6 of the chain carriers C. Shafts 7 and 8 are journaled at the left and right ends of the rail frame, the shaft 7 carrying sprocket wheels 9 and 10 and the shaft 8 carrying sprocket wheels 11 and 12. The sprocket wheels 9 and 12 are adjacent the outer rail 4 and carry a sprocket chain 13, while the sprocket wheels 10 and 11 are adjacent the inner rail 5 and carry the sprocket chain 14. The shaft 7 at its inner end carries a bevel gear 15 which meshes with a bevel gear 16 mounted on shaft 17 extending longitudinally across the machine and journaled in suitable bearings 18 and 19 carried on the standards 20 and 21 extending upwardly from the bed plate 1. Below this shaft at a distance to the rear thereof is the main drive shaft 22 journaled in bearings 24 and 25 on supporting standards 21 and 26, this shaft carrying at its right end the drive pulley 27 which is normally loose on the shaft, but which is adapted for driving connection therewith by means of clutch mechanism, 28 controlled by the clutch lever 29 whose lower end is pivoted to the standard 21. This main driving shaft at its right end carries also a pinion 30 which meshes with pinion 31 on shaft 17 so that rotation of the main drive shaft will be transmitted through the bevel gears 15 and 16 to shaft 7 and sprocket wheels 9 and 10 to cause rotation of all the sprocket wheels and longitudinal travel of the sprocket chains about the rail frame.

In Figs. 13 and 14 the construction of the carriers C is shown in detail. Each carrier has a left frame L, an intermediate frame I and a right frame R. These frames are substantially rectangular in shape and from their lower faces and at their side edges extend the shoes 6 already referred to. Inside of each shoe is a lug 32 forming with the shoe a slot 33 for receiving the corresponding sprocket chain, the chain link pins 34 extending laterally sufficient to pass through the adjacent shoes and lugs so that the various carrier sections are secured to the chain to travel therewith. The sections of each carrier are close together as shown in Figs. 13 and 14 and support the various operative parts for receiving endless chain E and for separating this chain into sections. Each block L at its front and rear edges has upwardly extending walls 35 and 36 in whose left ends is journaled a slide shaft 37 which carries a block 38 mounting a vertical pin 39 which carries a cam roller 40. To the right of the slide shaft 37 and parallel therewith is a shaft 41 which is journaled in the walls 35 and 36. The inner end of this shaft carries a block 42 whose front end extends into pocket 43 cut in the rear face of wall 36 as best shown in Fig. 14. A collar or lug 44 is interposed between the wall 35 and the head 45 at the outer end of the shaft and the shaft 41 is thereby prevented from longitudinal movement, but may rotate so that the block 42 may swing downwardly. A spring 46 encircles the shaft, is secured thereto and to the wall 35 and tends to rotate the shaft to hold the block 42 against the top wall 47 of pocket 43. The collars 47′ and 48 free on shaft 41 are integral with a shelf 49 to which is secured a locking bar 50 extending parallel with the shaft and whose rear end

extends through a guide passageway 51 cut through the wall 36. A tension spring 52 connecting between the shelf and the wall 35 tends to hold the shelf in a front position against the wall 35. During this position of the shelf frame the spring 46 will coil up in pocket 53 formed in wall 35. The block 38 on the slide shaft 37 has the bearing arm 54 which receives shaft 41 between the collars 47′ and 48 so that sliding of the shaft 37 will result in corresponding movement of the shelf frame 49 and the lock bar. As shown in Figs. 2 and 4 cam bars 55 and 56 are secured to cross arms 57, 58 and 59 and extend longitudinally over the rails 4 and 5, respectively, the cross arms 57 and 59 being supported by the standards 2 and 3, respectively, and the cross arm 58 being supported from the rail frame 3′. Between the right ends of the cam bars 55 and 56 is supported a third cam bar 60 from the cross frame 59 and from a cross strip 61 secured to the cam rails, as best shown in Fig. 4. As the sprocket chains travel around in counter-clockwise direction the cam rollers 40 of the carriers successively engage the rounded approach end 62 of the cam bar 60 and the rollers are carried to the rear edge 63 and along this edge until they strike the cam projection 64 extending forwardly from the rear cam bar 55 whereupon the rollers are moved forwardly to their normal position, the departure end 65 of the cam bar 60 being also rounded as shown. When the rollers are moved to their rear position, as shown in Figs. 4 and 13, the shelf frame 49 will be carried to its rear position and the end of the locking bar 42 will project beyond the wall 36, and when the rollers strike the cam projection 64, the parts connected with the slide shaft 37 will be forcibly returned to their front position and the locking bar again moved to its front position, the springs 52 then holding the parts in this front position. Extending rearwardly from the wall 36 to the left of the locking block 42 is a rigid shelf 65 from which extends upwardly a lug or pin 66 for receiving an eye of the fed in chain, as will be shown later. As best shown in Figs. 8 and 13, the block 42 at its left end has inner and outer upward guard projections 67 and 68, respectively, and the right end of the block has inner and outer upward guard extensions 69 and 70, the inner and outer extensions forming between them a groove 71 for receiving the body of the link to the right of the link whose eye is engaged by the pin 66, as will also be shown more fully later. The left sides of the extensions 69 and 70 are undercut a distance above their bases to form a locking slot 72 which registers with the locking bar passage-way 51 and which receives the end of the locking bar when the locking bar is projected, the locking bar end passing over the link engaging the block to securely clamp the link to the block, lateral movement of the link being prevented by the guard extensions.

The inner frame I of each carrier has outer and inner walls 73 and 74 extending upwardly therefrom, these walls journaling a shaft 75 which may both reciprocate and rotate. The outer end of this shaft is rounded to form a cam 76, while projecting inwardly from the inner end of the shaft is a spreader blade 77 which is in line with the hook of the link next to the right of the link locked to the block 42 of the left frame L. A compression spring 78 encircles the shaft between the walls 74 and the collar 79 secured to the shaft and tends to hold the shaft in its out position with the spreader 77 withdrawn from the chain. As best shown in Figs. 4 and 9, a cam piece 80 is secured to the vertical part of cross-frame 59 and has a cam projection 81 extending into the path of the cam end 76 of shaft 75, so that when the carriers travel, their cam ends 76 will engage with this projection at the proper time and the shafts 75 pushed inwardly to carry the spreader 77 into the hook of the adjacent link. The frame I has the opening 82 through which extends downwardly a cam arm 83 from the hub 84 held on shaft 75 by set screws 85. As best shown in Figs. 4, 9 and 12, a cam abutment 87 is secured to and extends upwardly from the rail frame 3′ and will be in the path of the cam arm 83 when shaft 75 is slid rearwardly, (Fig. 12). The position of this cam abutment with relation to the cam projection 81 is such that the cam end 76 of each carrier is first engaged by the projection 81 to cause the spreader to enter the hook of the adjacent link and the abutment 87 then engages cam arm 83 to cause a rotation of the spreader shaft to twist the spreader to cause the engaged hook to be opened, the twist of the spreader being in counter-clockwise direction, looking from the front of the machine. Besides returning the shaft 75 to its outer position spring 78 may serve also to rotate the shaft back to normal position after the cam arm 83 leaves abutment 87.

The right frame R of the carriers is best shown in Figs. 9, 10, 11, 13 and 14. The frame is secured to the sprocket chains, but carries a top U shaped block 88 which has a slight longitudinal reciprocation on the frame. The block has dove-tailed engagement with the side flanges 89 and 90 of the frame R and is thus held in place thereon. Rack teeth 91 are cut in the top faces of these flanges for receiving pinions 92 and 93 secured to the ends of a shaft 94, passing through the body part of the block, this shaft at its outer end carrying a cam frame 95. This cam frame comprises a split sleeve

96 which may be adjustably secured to the shaft by means of a set screw 97. This sleeve has a V shaped cam projection 98 and an arm 99, the arm pivoting a cam roller 100, see Figs. 1 and 13. As best shown in Figs. 1, 4 and 9, a cam plate 101 is secured against the front side of the track frame 3' and at the right end thereof. Also secured to the rail frame and against the outside of the cam plate 101 is the cam plate 102 having the vertical cam projection 103. The upper edge of cam plate 101 is in the path of the cam rollers 100 as the carriers travel, and the cam projection 103 is in the path of the V cam extensions 98. The relative position of the cam plate is such that the cam projection 103 will be engaged by the V cam extension and the cam roller carried in line with the upper edge of the cam plate 101. The engagement of the V extension with the projection 103 is momentary, and as a result of such engagement the shaft 94 is given a quick rotation and the block 88 given a quick reciprocation toward the left by virtue of the pinions and rack teeth. After the V extension leaves the projection 103 the cam roller 100 still remains in engagement with the cam plate 101 which has a gradual departure surface 104 so that the block must return gradually to reassure its correct position at the right of the main frame R, the return movement being accomplished by a spring 105 encircling the shaft 94 and secured thereto and to the block 88. The oscillation of the block 88 can be adjusted by means of a set screw 106 passing through a bracket 107 secured to the main frame R.

In the legs 108 and 109 of the U block 88 and at the bases thereof is slidably journaled a shaft 110 which carries a block 111 mounting a vertical pin 112 pivoting the cam roller 113. In the legs at the front thereof is journaled a shaft 114 carrying at its rear end a locking block 115, which extends to the left, this locking block together with the head 116 at the front end of the shaft locking the shaft against longitudinal movement and allowing only rotatable movement thereof. Extending downwardly toward the right the block 115 has a cam arm 117 adapted to engage with the cam rail 118 secured to the inner side of the rail frame 3', and at the right end thereof, as best shown in Figs. 4 and 9. The position of this rail is such that the engagement therewith of the cam arm 117, as the carriers travel, will cause the cam arm to be swung upwardly to rotate shaft 114 in a counter-clockwise direction thereby to swing block 115 downwardly. Collars 119 and 120 receiving shaft 114 are integral with the shelf 121 to which is secured the locking bar 122 whose rear end coöperates with the locking block 115. The locking block has the left and right upward guard extensions 123 and 124 in which is cut a slot 125 for receiving the link with whose hook the spreader 77 engages, and a pin 126 extending upwardly from the right end of the block receives the eye of the link. The extension 123 is also undercut a distance above the base of the slot to form a locking groove 127 into which the front end of the locking bar passes, the link being clamped between the block and the bar. The locking bar end always engages in the groove 127, but when the cam roller 113 is disengaged from cam bar 56, the spring 128 secured to the leg 108 and the shelf 121 will move the shelf and the parts connected therewith to the front position against the leg 108, and in this position the locking bar is withdrawn forwardly away from the link. A torsion spring 129 connects to the leg 108 and with the collar 119 and tends to rotate shaft 114 in clockwise direction to hold the block 115 in its up position with the locking bar abutting against the shoulder 130 formed at the end of the leg 109.

In the machine shown three carriers are provided, and the distance between each is equal to the length of the sections into which the continuous chain is divided. The continuous chain is fed from a reel through a guide trough 131 supported from the right end of the rail frame, as best shown in Fig. 4. The cycle of operation of a carrier is as follows. When a carrier is carried about the right sprocket wheels and on to the rails the pin 66 enters an eye of the chain E and the groove 71 of block 42 receives the next link to the right. Immediately thereafter the cam roller 40 engages surface 62 and is carried to surface 63 of the cam bar 60, the result being that the locking bar 50 is moved rearwardly over the link engaging the block 42 to securely clamp the link in place in a manner already described. As the right section R of the carrier rounds the right sprocket wheels the block 115 engages the link of the chain adjacent the link engaged by the left carrier section L, the link body entering slot 125 and its eye receiving the pin 126. Immediately thereafter cam roller 113 engages the entrance surface 132 at the right end of cam bar 56 and is carried to the inner surface 133 of said cam bar, the result being that the locking bar 122 is forced rearwardly to clamp the engaged link to the block 115 in a manner already explained. The next step is the engagement of cam end 76 with the cam projection 81 to force in shaft 75 of the middle carrier section I thereby engaging the spreader 77 in the hook of the link engaged by the right section R. The engagement of the cam end 76 with the projection 81 is immediately followed by engagement of cam arm 83 with the cam abutment 87, so that the spreader is twisted when within the link hook, this causing opening of the hook. After this

step there is practically simultaneous engagement of the V cam extension 98 with the cam projection 103 and of the cam arm 117 with the cam rail 118, this resulting in simultaneous leftward movement of block 88 and rotational movement of the shaft 114 to swing downwardly the locking block 115. The link carried by the section R is, therefore, simultaneously moved to the left and deflected downwardly, so that the hook of the link will be disconnected from the eye of the link carried by the section L. Upon downward swing of the link of section R the link of section L will be carried downwardly a distance, but as soon as the hook is disconnected from the eye the block 42 will be swung upwardly to its horizontal position by force of the spring 46. The leftward movement of the block 88 is sudden, owing to the engagement of the V extension 98 with the short projection 81, but the return movement of the block to the right will be delayed on account of the engagement of the cam roller 100 with the cam plate 101 so that the chain end which was pulled leftwardly a distance by the block 88 upon separation of the hook from the eye will be returned gradually to the right so that an eye of this chain end will be in proper position to be engaged by the pin 66 of the following carrier as it rounds the right end sprocket wheel. The chain going from the reel is under more or less tension, and if the block 88 were returned suddenly to the right disturbances might occur which would prevent proper entry of the pin into an eye.

In the position shown in Fig. 4 the carrier roller 40 is just about to engage the cam projection 64, both locking bars being effective and two links having just before uncoupled. In the position shown in Fig. 2 the preceding carrier is just beginning to round the left end sprocket wheels to pass below the rail frame, the locking bar of the right section R being still held in locking position by the engagement of cam roller 113 with the cam surface 133 of bar 56. Upon further movement to the left of the carriers from the positions shown in Figs. 2 and 4, roller 40 of the right end carrier will strike the projection 64 on cam bar 55 and the cam roller 113 of the left end carrier will engage the surface 134 of a cam bar 135 secured to the cross frame 57, as shown. Both the rollers will, therefore, be deflected forwardly to cause the respective locking bars to be withdrawn and the links released, the ends of the chain section between the carriers having been previously received by transfer mechanism whose construction and operation will be referred to later. The locking bar of the section R of the carrier in Fig. 4 will, however, remain effective so that as the carrier moves to the position shown in Fig. 2 the chain will be drawn across the front of the machine and the third carrier brought into position around the right end sprocket wheels to engage the chain and to separate a section therefrom. The carriers in succession pass first through the operation field at the right of the machine to receive the chain and to sever it, and then to the operation field at the left of the machine.

It is very important that the links of chain sections connect and engage properly with the carrier sections. If a link is not engaged snugly in a locking block, the locking bar will strike the link and will be prevented from moving to its locking position. It is very desirable, therefore, to provide means for giving a signal or for automatically stopping the machine when such conditions occur.

Referring to Fig. 4 the cam bar 60 is pivoted at its left end, but its right end is free to swing forwardly a distance by virtue of engagement of screw 136 in slot 137 formed in the cross frame 59. A spring 138 connecting between the bar 60 and the bar 65 tends to hold the bar 60 parallel with the cam bars 55 and 56. If the operation of the carrier is perfect the spring 138 will be sufficient to overcome the spring 52 on the carriers so that the bar 60 will not be swung upon engagement therewith of the rollers 40. Should the locking bar, however, strike the link, or be prevented in some other way from moving into locking position, the roller will remain in an out position and will swing the bar 60 forwardly to carry a contacting arm 139 on said bar against a contact plate 140. As shown in Figs. 4 and 5 a solenoid 141 is stationarily mounted, its core 142 being pivoted to the clutch controlling lever 29. One terminal of the solenoid connects through wire *a* with the machine frame, its other terminal being connected through a conductor *b* with the contact plate 140, a battery or other source of current S being included in the circuit. The contact arm 139 forms part of the frame, and, therefore, when this arm is carried into engagement with the contact plate 140, the circuit through the solenoid will be closed and the solenoid energized to move the clutch lever into unclutching position, so that the machine stops. This stopping of the machine is a signal that some of the parts of the machine are not operating properly, and upon inspection the operator will find the trouble and repair it. The cam bar 56 is also adapted to swing at its right end, being stationarily pivoted at its left end to the cross frame 57 and movably supported at the other cross frames so that its end may swing forwardly. Should for any reason the cam roller 123 fail to move inwardly its full distance, such forward swinging will

cause the contact arm 143 on said cam bar to engage the contact plate 140 to close the solenoid circuit and to stop the machine.

The chain section transfer mechanism which receives the chain sections from the carriers and transfers them to the receiving mechanism is best shown in Figs. 1, 2, 3, 9 to 12, and particularly in Figs. 15 to 18. Extending across the machine to the rear of the path of the carriers is a transfer shaft 144 which at its right end journals in a bearing 145 carried on standard 26 and which at an intermediate point bears in a frame part 146 supported by cross bar 147 connecting between the main standards 20 and 26. The left end of this shaft is rotatably secured in a slide bar 148 mounted in slide frame 149 supported from the standard 20 in front of a cylindrical cam 150 which is pivoted on shaft 151 which is journaled in bearings 152 and 153 on standard 20 and bracket 154, respectively. The slide bar 148 pivots a cam roller 155 which travels in cam slot 156 and is carried back and forth therein across the full width of the cam wheel 150. The frame 146 through which the shaft 144 passes has a bushing 157 through which the shaft may slide, but in which it is free to rotate. This bushing at its right end carries the pinion 158 engaged by the teeth of a horizontal rack bar 159 slidably mounted below said pinion on a bracket 160 extending forwardly from the cross bar 147, the rear end of this rack bar pivoting a cam roller 161 for coöperating with a cam disk 162 mounted on the cam wheel shaft 151 which extends between the standards 20 and 26, and which at its right end has also bearing on standard 26. Secured to the left end of the bushing 157 is a forwardly projecting arm 163 to whose rounded end is pinned the upper end of a chain 164 whose lower end connects with a spring 165 secured to and extending upwardly from the bed plate, as best shown in Fig. 11. Freely passing through the end of the frame 163 is a rod 166 secured at its ends to the front ends of arms 167 and 168, respectively, whose rear ends are rigidly clamped to the transfer shaft 144. With this arrangement, upon forward actuation of the rack bar 159 by cam arm 162, the pinion 158 will be rotated and with it the bushing 157 and arm 163, the arm swinging upwardly against the tension of the spring 165. This upward swing is communicated through the rod 166 to arms 167 and 168 secured to the transfer shaft and the transfer shaft will be rotated. At the same time, however, the transfer shaft with the arms 167 and 168 and rod 166 can be reciprocated longitudinally by the engagement of cam roller 155 with the cam wheel 150.

At each end of the transfer shaft is carried a transfer mechanism for coöperating with the carriers of the feeding mechanism. In Figs. 15 to 18 the right end transfer mechanism is shown in detail, and in Figs. 19, 20 and 21, the left end transfer mechanism is shown in detail. Referring first to Figs. 15 to 18, a forwardly extending arm 169 is securely clamped to the transfer shaft 144 to partake of all of the movements of said shaft, and freely pivoted on said shaft to the right of the arm 169 is a hub 170 having a forwardly extending shelf 171 having a horizontal channel 172 in its right end in which is clamped a pick up bar 173 having at its front end and in the top a notch 174, the entrance edges of this notch being rounded and the lower front edge 175 being also rounded. Slidable horizontally through the front end of the arm 169 is a rod 176 clamped at its right end to the shelf 171 and at its left end having adjustable stop nuts 177. Slidable on shaft 174, immediately to the left of the arm 169 is a disk 178 from which a plurality of pins 179 extend slidably through the arm 169 and whose right ends abut against the left end of hub 170. A compression spring 180 encircles shaft 144 between the disk 178 and a collar 181 secured to the shaft, the spring tending to force the disk and pins inwardly to force the hub 170 to the right. This movement of the hub 170 is normally prevented by the latch member 182 which is V shaped, its left end being secured to a pin 183 journaled in the arm 169, a spring 184 secured to and coiled about this pin and also secured to the arm 169, tending to rotate said latch member to hold it in a front position, as shown in Fig. 15. The right end of the latch member pivots on its lower side a cam roller 185 which coöperates with a V shaped cam slot 186 cut in a bracket 187 extending rearwardly from the rail frame 3′, see Figs. 10, 11 and 12. The left arm of the latch member has a locking shoulder 188 at its front edge which is held in engagement with a locking shoulder 189 on the base of shelf 171 when the cam roller is out of or at the front end of the cam slot 186. When the roller is carried through said slot toward the left the latch member is moved rearwardly and the shoulder disengaged whereupon the spring 180 becomes effective to move the hub 170 to the right until the stop nuts 177 engage the arm 169. Extending rearwardly from the hub 170 is a lug 190 which is engaged by a cam arm at the proper time so that the hub 170 is returned to the left until the locking shoulders 188 and 189 reëngage.

The left end transfer mechanism shown in Figs. 19, 20 and 21 has the same construction as the right end transfer mechanism just described, the similar parts being designated by primed reference characters, the parts, however, operating toward the left, of the hub 170′ being moved to-

ward the left by spring 180′. Coöperating with this transfer mechanism, and immediately at the left thereof, is a frame 191 secured to shaft 144 and to which is pivoted on pin 192 a forwardly extending assistant pick up finger 193 having upwardly extending pins 194 at its end between which a chain link is received, this finger being spring actuated upwardly by a spring 195 secured to the frame 191.

The mechanism for restoring hub 170 to its locking position is best shown in Figs. 5 and 12. Mounted on the cylindrical cam shaft 151 adjacent the standard 26 is a disk 196 having a leftwardly extending cam ridge 197. Extending forwardly from cross bar 147 is a bearing bracket 198 in which journals a shaft 199 at whose front end is secured the upwardly extending actuating arm 200 and at whose rear end is secured a cam arm 201 pivoting at its end a cam roller 202 positioned in the path of the cam ridge 197. Engagement of the cam roller with this cam ridge will result in rotation of shaft 199 and leftward swinging of actuating arm 200, this arm at the proper time engaging lug 190 on the right end transfer mechanism to restore hub 170 to its locked position. Similar mechanism for controlling re-locking of the left end transfer mechanism is best shown in Figs. 7 and 10. On the cylindrical cam shaft 151 near the standard 20 is secured a cam disk 196′ having the rightwardly extending cam ridge 197′. Secured to the cross bar 147 is a forwardly extending bearing bracket 198′ which pivots shaft 199′ carrying at its front end the actuating arm 200′ and at its rear end the cam arm 201′ pivoting at its end cam roller 202′ for coöperating with the cam ridge 197′. Upon engagement of the cam roller with the ridge the arm 200′ is swung rightwardly to engage with the lug 190′ of the left transfer mechanism to re-lock the hub 170′. A spring 203 connects between arm 201 and standard 26 which tends to hold the cam roller against the cam disk 196. Likewise a spring 203′ connects between arm 201′ and the standard 20 and tends to hold cam roller 202′ against the disk 196′.

The operation of the transfer mechanisms and their coöperation with the carriers of the feed mechanism can now be understood. The cylindrical cam 150 rotates in the direction of the arrow (Fig. 2) and in clockwise direction (Fig. 11). This cylindrical cam has the inner and outer straight cam slots 204, 205, respectively (Fig. 7), and the two diagonal or transverse slot sections 206 and 207 (Fig. 2). The transfer shaft 144, therefore, makes two complete longitudinal oscillations for each rotation of the cylindrical cam. Referring to Figs. 2, 3 and 4 the cam roller 155 is midway in slot 206 and the transfer shaft is midway on its journey to the left, the transfer mechanisms and the carriers being in corresponding positions. The position of the cam 162 with reference to the rack bar 159 is at this time in the position shown in Fig. 11. When the cam roller 155 was at the left end of the slot section 207 the cam roller 161 had just come into engagement with the innermost surface 162^a of the cam disk 162, and the transfer mechanisms were swung down to their lowermost position by spring 165, and during downward swing of the transfer mechanisms the pick up fingers 173, 173 and 193 engaged the chain, but by virtue of the rounded lower edges of these fingers the chain was pushed aside so that the fingers could pass below the chain. When the cam roller 155 passed through slot section 206 of the cylindrical cam from the left to the right the transfer shaft with the transfer mechanisms was carried to the right and remained in such position while the cam roller traveled in the inner straight slot section 204. The cam roller 161 then engaged with the cam point 162^b of cam 162 and the rack bar 159 moved forwardly a distance to cause rotation of the transfer shaft and upward swing of the transfer mechanisms to carry the pick up fingers toward the chain to receive the chain in the slots 174 and 174′ and between the pins 194 of the pick up finger 193. However, just before the pick up pins engage the chain the cam roller 155 enters the transverse cam slot section 206, and when the pick up fingers receive the chain, the transfer shaft and transfer mechanisms are being carried to the left with the carriers of the feed mechanism and at the same speed. This engagement of the pick up fingers with the chain is made just after the sliding block of the left end carrier has been moved leftwardly to disengage the hook of the clamped link from the eye of the link clamped to the left section L of said carrier, and just a short time before the roller 40 will engage cam projection 64 on cam bar 55.

The positions of the parts are now as shown in Figs. 2, 3 and 4. Upon further movement to the left of the carriers and of the transfer mechanisms roller 40 will engage cam projection 64 to withdraw the locking bar 50 and the cam roller 113 of the preceding carrier will engage cam strip 135 to cause withdrawal of locking bar 122 of said carrier, the chain section between the two carriers being then unclamped therefrom. The cam roller 161 was engaged by the cam point 162^b (Fig. 11) to cause a slight movement of the pick up fingers beyond the path of the chain so as to insure thorough engagement of the chain in the pick up finger slots. The cam roller then comes into engagement with the surface section 162^c to drop the pick up fingers to al-

low the chain to assume its natural path and this position is maintained for a short time. When the transfer mechanisms were swung upwardly pick up fingers 173 engaged with the link on section L of the right end carrier at a point a distance to the left of the eye of said link, and pick up fingers 173′ of the left end carrier received the link next to the right of the link engaged by section R of said carrier and at a point a distance to the right of the hook of said link. The assistant pick up finger 193 received the link clamped to section R at a point to the right of the hook of said link. Now, as the transfer mechanisms were carried to the left the cam rollers 185 and 185′ were carried through the cam grooves 186 and 186′ and the latch members thereby actuated to unlock shoulders 188, 189 and 188′ and 189′. This unlocking released the pick up finger supporting hubs 170 and 170′, the hub 170 being pushed to the right by spring 180 and the hub 170 being forced to the left by spring 180′, and, therefore, pick up fingers 173 and 173′ will be spread apart to engage, respectively, against the eye at the right end of the section and against the eye of the link at the left end of the section, the section being thus held taut between the pick up fingers as soon as the locking bars have been withdrawn to release the section from the carriers. Immediately upon such release the surface section 162^d of cam disk 162 (Fig. 11) comes into engagement with roller 161 and the transfer mechanisms are swung upwardly, the cam roller 155 having just before this upward movement entered the outer straight slot section 205 of the cylindrical cam so that there is no longitudinal movement of the transfer shaft. At the end of this upward swing the eye at the right end of the chain section and hook at the left end of said section will be carried, respectively, into engagement with carrier heads whose construction and operation will be shown later. The radius of the surface section 162^d is slightly longer so that the section will be carried a distance beyond its natural position on the carriers to insure thorough engagement of the section ends with the carriers, and thereafter the cam roller 161 engages the surface section 162^e whose radius is such that the pick up fingers will allow the section to assume its natural position on the carriers. After the chain section has been properly landed on the carriers the cams 196 and 196′ (Figs. 10 and 12), become effective to engage the cam rollers 202 and 202′, respectively, to cause inward swing of the actuating arms 200 and 200′ to engage the lugs 190 and 190′, respectively, to restore the pick up finger supporting hubs 170 and 170′ to their locked position, this locking occurring while the transfer mechanisms are still in their upper position with the cam rollers 185 and 185′ away from the cam slots 186 and 186′, respectively. When such re-locking has been accomplished the cam roller 161 again comes into engagement with the innermost cam surface section 162^a and the transfer mechanisms are swung downwardly to their lowermost position, the carrier fingers wiping past the succeeding chain section which has been fed in by the carriers, and then when the cam roller 155 reëngages in the transverse cam slot 207 the transfer shaft will carry the transfer mechanisms to the right where they are again actuated to engage with the chain and then to receive the succeeding severed chain section. The above cycle of operations is repeated, section after section, after it is severed from the fed in chain being transferred to the receiving mechanism.

The receiving mechanism and its operating mechanisms are best shown in Figs. 1, 2, 4, 8 to 12, and particularly Figs. 22 to 25. The cylindrical cam shaft 151 at its extreme right end bears also in standard 26 and this shaft is driven from the main driving shaft 22 through pinion 30, gears 31 and 208 on the feed mechanism, driving shaft 17 and the large gear 209 on the cylindrical cam shaft. Referring particularly to Figs. 2, 7, 8 and 10, the cam shaft 151 carries, just to the left of the standard 20, a disk 211 and a locking disk 212. Extending along the front of the cam shaft and having bearing at its ends in the standards 20 and 26 is a shaft 213 carrying in line with the locking disk a star wheel 214, having two diametral cam slots 215 and 216 at right angles to each other. Pivoted to the side of the disk 211 is a cam tooth 217 which is adapted for engaging in the cam slots so that rotation of the disk will cause rotation of the star wheel and shaft 213. The star wheel between the ends of the slots is cut out to form locking surfaces 218 whose radius is equal to the radius of the locking disk 212. The surfaces at the ends of the slots are cylindrical and of the same radius as the concave surface 219 cut in the edge of the locking disk. This mechanism forms a well known intermittent Geneva movement. In the position shown in Fig. 8, the star wheel is being rotated in clockwise direction by the disk 211, as a cylindrical surface of the star wheel is in engagement with the release surface 219 of the locking wheel. When the roller leaves the slot the adjacent locking surface 218 will engage the locking disk 212 of the locking wheel, and the star wheel will be locked against rotation, but the disk will continue until the cam roller passes into the next slot. The arrangement gives a one-quarter revolution of the star wheel for each complete revolution of the cam shaft. Mounted on the intermittent shaft 213, just

inside the standards 20 and 26, are pinions 220 and 221, respectively, for driving the left and right chain sections receiving drums D^l and D^r.

The construction of the left receiving drum D^l is best shown in Figs. 1, 7, 10, 11 and particularly in Figs. 22 and 24. The drum comprises a hub 222 on which is supported a rim 223 having a plurality of longitudinal passage-ways 224 for receiving spindles 225. Each spindle carries at its inner end a head 226 having a diametrical pocket 227 and a longitudinal pocket 228 extending from the diametrical pocket to the outer end of the head. The diametrical pockets receive the hooks of the chain sections delivered by the transfer mechanisms and the slots 228 receive the body part of the link adjacent the hook, the sides 229 of the slots flaring so that the links can more readily be deposited. At the left end of each passage-way 224 is an enlargement 230 for receiving a guide flange 231 on the corresponding pin 225, this flange forming also an abutment for a compression spring 232 which rests in the pocket 233 about the spindle and abuts at its inner end against the rim, these springs tending to hold the heads 226 against the front face of the rim. Extending to the left from each pin beyond the flange 231 is a tongue 234, the tongues having cylindrical faces 235. The hub 222 of the drum is secured to the right end of a stub shaft 236 which is journaled in a bearing frame 237 mounted on the front of the standard 20, and secured to the right face of the bearing frame is a disk 238 having a cylindrical locking flange 239 for engaging the surfaces 235 of tongues 234 to lock the spindles and to hold them in proper position for receiving the links of the sections. In the locked position of the spindles the passage-ways 227 extend radially and the link hooks lie in radial planes within these passage-ways. Cut in the periphery of the rim 223 are gear teeth 240 with which meshes the pinion 220 of the intermittent shaft 213. The right end drum D^r comprises a hub 241 from which is supported a rim 242 having longitudinal passage-ways 243 in each of which is journaled a spindle 244. Each passage-way has an enlargement 245 at its right end receiving the flange 246, while at the outer end of each spindle is pinned a collar 247 engaging the left face of the rim, the flanges and collars preventing longitudinal movement of the pins in the passage-way. Each pin outside of its collar is also cut away on one side along a diametrical plane to leave a semi-cylindrical shelf 248, and extending centrally from each shelf is a pin 249. The eyes at the right ends of the sections delivered by the transfer mechanisms pass over these pins and against the shelves 248. Extending to the right from each spindle and beyond the rim is a tongue 250 having a cylindrical inner locking surface 251. The hub 241 is secured to the left end of a stub shaft 252 which is journaled in bearing frame 253 secured to the front of standard 26 directly opposite the bearing frame 237 of the left end drum. The rim 242 has gear teeth 242′ cut about its periphery which mesh with the pinion 221 of the intermittent shaft 213 so that both drums will be driven in unison. Secured to the left side of the bearing and concentric with the stub shaft is a disk 254 having the cylindrical locking flange 255 for engaging the surfaces 251 of the tongues 250 to lock the spindles in position in which the pins 249 will extend radially outwardly.

Referring particularly to Figs. 2, 8 and 10 the disk 211 has a cam projection 256 for engaging with a cam roller 257 at the rear end of the horizontal lever 258. This lever is pivoted at an intermediate point to the end of a bracket 259 extending rearwardly from a slide frame 260 bolted to the front of standard 20. The front end of the lever is clamped to a pusher rod 261 which slides in frame 260 in the horizontal axial plane of the carriers, the right end of the rod being adapted to pass over the locking flange 239 to abut against the tongues 234 and to push the spindles to carry the heads 226 inwardly to the right against the force of springs 232. The adjustment of the cam extension 256 on disk 211 is such that the lever 258 will be rocked to move in the pusher rod just before a chain section is to be delivered by the transfer mechanisms to the drum heads which are at the front and in the receiving plane X (Fig. 10), the rod pushing the head into position so that the hook end of the link at the left end of the chain section can pass readily into pockets 227 and 228. The head is held inwardly only during the time that the chain section is being applied, and immediately after the cam extension 256 leaves the roller, the spring 232 becomes effective to force back the pusher rod and to apply its tension to the chain section to keep the section taut after it has been delivered from the transfer mechanism. Each drum has 16 heads equally spaced and the drum is driven by the intermittent shaft 213 which makes a quarter revolution for each revolution of the cam shaft, the drum making 1/64 revolution for each complete revolution of the cam shaft. This rotation of the drums will cause the opposite heads to be brought successively into the horizontal receiving plane X and the heads of the left end drum are successively forced inwardly by the pusher rod and returned by their springs so that the successive chain sections are received by the heads of the drums and stretched between the heads.

It is desirable that indication be given and the machine stopped if a chain section is not properly received by the drum heads. For this purpose I provide electrical mechanism for controlling the solenoid 141 already referred to. Over slide frame 260 I secure a contact frame 262 to the bearing frame 237, this frame having a plate 263 extending forwardly in line with the right end of slide frame 260. The contact frame is insulated from the machine frame and has a slot 264 through which the push rod may pass without making contact with the plate. If a chain section has been properly received by the drums the receiving head of the left end drum will be held by the section a distance away from the drum rim, (Fig. 2), and as the drum rotates the tongue of the head spindle will not engage the contact plate 264 above the slot. Should, however, the heads fail to receive the chain section the left drum receiving head will immediately be retracted entirely to the left upon recession of the pusher rod and its tongue will then engage the contact plate to close a circuit at this period. During the head actuating period the cam roller 155 rides in the outer straight cam slot 205 of the cylindrical cam 250. At the left end of the slide bar 148 which mounts the roller 155 is an actuating extension 265 of insulating material, this extension passing beyond the left end of the slide frame 149 when the roller is in slot 205. Secured to, but insulated from the slide frame 149 and projecting across the end thereof are contact springs 266 and 267 which are normally disengaged, but which are brought into contact with each other when engaged by the actuating extension 265. The contact frame 262 connects through a conductor *d* with the contact spring 266, and the contact spring 267 connects through a conductor *e* with one terminal of current source S whose other terminal connects through a conductor *b* with one terminal of the solenoid whose other terminal connects with the machine frame through the conductor *a* as has already been described. Now, therefore, if the receiving heads fail to receive the section, the circuit just traced will be finally closed by the engagement of the springs 266 and 267, and the solenoid will be energized to un-clutch the driving pulley whereupon the machine stops.

As best shown in Figs. 1 to 7, and 10, 11 and 12, an anvil bar 268 extends across the machine within and between the receiving drums and above the axis thereof. This anvil bar is supported at the upper ends of a plurality of vertical rods 269 slidable in bearing frames 270 secured to the upper and lower cross bars 147 and 271. Below these frames and journaled in the standards 20 and 26 and in an intermediate bearing standard 272 is a rock shaft 273 carrying a plurality of forwardly extending arms 274 for engaging with the lower ends of the anvil supporting rods. As best shown in Figs. 4, 5 and 9, this rock shaft is actuated by a cam 275 carried on the cam shaft 151 at the right end of the machine, this cam engaging a cam roller 276 at the end of the arm 277. Rotation of the cam shaft will, therefore, at the proper time cause the anvil bar to be raised, the return of the anvil being accomplished partly by its weight and partly by springs 278 connecting between the bar and the machine bed plate. The anvil is further guided and held against transverse displacement by means of bands 279 extending upwardly from cross bar 147, as best shown in Figs. 5, 7 and 11. Secured in the anvil by set screws 280 and extending upwardly therefrom are pairs of anvil pins 281, said pairs being in the vertical planes of the eyes of the chain sections carried by the drums, the chain sections being carried about the anvil block to carry their heads into longitudinal alinement with the front and rear members of the anvil pin pairs. Referring to Figs. 2 and 4, and to Figs. 8 and 10, the carriers and transfer mechanisms have not yet reached the positions in which the pick up fingers will be in the vertical transfer planes, and the driving disk 211 is still rotating the intermittent shaft 213. When the pick up fingers reach the transfer planes the intermittent shaft will have been rotated and the drums will have been rotated to carry two opposed heads into the plane *x* to receive a chain section from the pick up fingers. Referring to Figs. 10 and 12 the left and right heads 226^a and 248^a will have been rotated into the plane *x*, and left and right heads 226^b, 226^c and 248^b and 248^c, respectively, (Figs. 28, 29 and 30) will have been carried into the vertical planes of the front and rear anvil pins, respectively, so that the eyes of the chain sections between said heads will be in position over the anvil pins to have connecting cross links applied thereto in a manner which will be explained later.

Extending at intervals through the anvil bar and pivoted to slide and rotate therein are pairs of vertical shafts 283 secured at their upper ends to one end of gripper fingers 284 whose other ends have longitudinal grooves 285 for receiving the chain sections held between the drum heads over the anvil bar (Figs. 10, 11, 26 and 27). The fingers at the right end of the anvil bar extend to the left while the intermediate fingers and those at the left end extend to the right, the right end fingers being adjacent the right receiving drum and outside the anvil pins, and the left end fingers being adjacent the left receiving drum and also out-

side the anvil pins. Journaled at its ends in the standards 20 and 26 and also in an intermediate bearing frame 286 mounted on the frame 146 (Fig. 11) is a rock shaft 287 from whose left end adjacent the standard 20 a cam arm 288 extends downwardly and pivots a cam roller 289 coöperating with cam 290 on the large cam shaft. Referring to Figs. 2, 7 and 10, an arm 291 pivots on shaft 287 between collars 292 and 293 and is held against collar 292 by a spring 294 which spring is also secured to collar 293 and to the arm to swing said arm upwardly. The front end of this arm is bifurcated to receive a block 295 which slidably receives the shafts 283^l of the left end gripper fingers, these shafts each having a collar 296 secured thereto and engaging the block 295 so that upward swinging of the arm 291 will result in upward longitudinal movement in shafts 283^l, (Fig. 10). The arm 291 on account of the torsional spring 294 will actuate these shafts yieldingly. Referring to Figs. 4, 5 and 12, a similar arm 291′ is mounted between collars 292′ and 293′ at the right end of shaft 287 with a spring 294′ interposed between collar 293′ and the arm to yieldingly swing the arm upwardly. The end of the arm is bifurcated to receive the block 295′ which slidingly receives the shafts 283^r of the right end gripping fingers which have collars 296′ similarly secured thereto and engaging the block so that upward swing of the arm will raise the shafts and the fingers thereon. Shafts 283^l extend downwardly through a shelf 297 and at their lower ends are both engaged by a spring 298 which fastens to the bed plate, (Fig. 10) and secured to the outer and inner shafts, respectively, and above the shelf are pinions 299 and 300 which mesh together. The spring 298 tends to pull the shafts down with the pinions resting against the shelf 297. Secured to and extending rearwardly from the rear shaft 283^l is an arm 301, having a slot 302 through which passes a longitudinal rod 303 to which the arm is pinned, this rod being reciprocated, as will be shown later, to rotate the pins 299 and 300 and to swing the gripping fingers from an outer to an inner position. As the right end gripper fingers extend in a direction opposite to that of the left end fingers, the outer shaft 283^r instead of the inner shaft has an arm 301′ which pivots to the slide rod 303 so that pinions 299^r on said shafts will be actuated to close the gripper fingers and at the same time that the left end gripper fingers are closed. Shafts 283^r are connected at their lower ends to a spring 304 which is anchored to the machine bed (Figs. 1, 7 and 12).

As shown in Figs. 3, 11 and 12, the intermediate finger shafts have pinions 305 secured thereto, the rear pinion of each set having an arm 306 extending therefrom, all these arms being pinned at their rear ends to the shaft 303 so that upon longitudinal movement of said shaft the pinions and the shafts are rotated simultaneously to carry the outer and inner fingers toward each other from the positions shown in Fig. 27 to that shown in Fig. 26. As best shown in Figs. 3, 11 and 12 each pair of the intermediate pinions normally rests on the front end of the plate 307 suspended from a block 308 secured to the rock shaft 287, so that upon actuation of arm 288 by the cam 290, all the finger shafts will be raised simultaneously, the left and right shafts being raised by the arms 291 and 291′, as has already been explained.

The mechanism for oscillating the rod 302 is best shown in Figs. 3, 6 and 11. Pivoted to the frame 146 at an intermediate point is a cam lever 309 having a bifurcated front end forming an elongated vertical slot 310 for receiving a roller 311 at the end of the arm 306 extending from one of the gripping finger shaft pinions. The other end of this lever pivots a cam roller 312 which rides in the cam slot 313 on the cam 314 carried on the cam wheel shaft 151. Movement of the cam roller in this cam slot will cause oscillation of the lever and longitudinal reciprocation of the slot 303. The timing of the cams 290 and 314 and of the mechanism driving the receiving drums is such, that after the drums come to rest to carry two chain sections in position over and in the planes of the front and rear anvil pins, the cam 290 will first become effective to rock the shaft 287 to raise all the gripping fingers to receive the chains in their slots, and then cam 314 will become effective to move the rod 303 longitudinally to cause rotation of the shafts to swing the fingers and the chain sections held thereby, the fingers and chain sections being swung from the out position to that shown in Fig. 26. The rod 303 resting in the slots of the arm 301, 301′ and 306 is carried upwardly with these arms against the tension of the springs 298 and 304 connected with the left and right end finger shafts, respectively. The rod 303 is shifted to rotate the fingers inwardly when the cam roller 312 engages in the groove section 313′ of the cam 314, and when the roller again leaves this section, the rod will be returned to again swing the fingers outwardly, and then cam 290 will release the arm 288 so that the springs 298 and 304 will become effective to pull down the end pins, this downward movement being transmitted to the arms 301 and 301′, and then, by way of the rod 303 engaged by all the arms, to the remaining rear shafts of the sets, the intermediate front shafts of the sets falling by their own weight.

Referring to Figs. 2, 4, 8 and 9 and to

Figs. 24 and 25 the bearing frame 237 which journals the left receiving drum also journals two parallel shafts 315 and 316 carrying at their outer ends pinions 317 and 318, respectively, which are in mesh. These shafts are in the planes of the anvil pins and will register with the two adjacent spindles 225 of the heads which support the chain sections over the anvil pins. Each shaft at its inner end has a cylindrical head 319. These heads extend to the left end of the drum rim 223 and have slots 320 which are normally positioned so that the tongues 234 of all the spindles of the drum will slide therethrough, the locking flange 239 being cut away to leave a space 321 for receiving the heads. The mechanism for turning these heads is best shown in Figs. 2 and 8. A bell crank cam lever 322 is pivoted on a stub shaft 323 extending to the left from the standard 20 below the pinions 317 and 318. One arm of this lever terminates in a gear segment 324 which meshes with pinion 317 and the end of the other arm 322^a coöperates with a cam 325 carried on the cam shaft 151. The engagement of the cam with the arm 322^a will cause forward movement of the segmental end 324, and rearward movement of this end is caused by engagement of the cam with an arm 322^b extending from lever 322. The right drum bearing frame 253 is fitted with similar heads, rotating shafts and pinions and similar driving mechanism, the corresponding reference characters being primed. The stub shaft 323′ carrying the cam lever 322′ extends to the right from standard 26, and the lever engages cam 325′ on the shaft 151, while the heads at the ends of the shaft 315′ and 316′ are adapted for receiving the tongues 250 of the right drum spindles. In the positions shown the arms 322^b and $322^{b'}$ are engaging with the cams 325 and 325′ and the heads 319 and 319′ are in position to receive the tongues of heads 226^b, 226^c and 248^b, 248^c, respectively. Referring to Fig. 8 the intermittent mechanism is being driven to carry the above mentioned drum heads to their positions in line with the anvil pins, and as soon as the cams 325 and 325′ engage with the arms 322^a and $322^{a'}$ of levers 322 and 322′, respectively, the pinions 317, 318 and 317′ and 318′ will be rotated to rotate the heads 319 and 319′, and the left and right drum spindles and heads engaged thereby. When the chain sections first reach the position over the anvil pins the link eyes will be parallel with the anvil block. The form of cross link which I use is shown in Figs. 23, 29 and 30 and these cross links are fed in vertical planes in a manner which will be described later, and, therefore, the links of the chain sections must be moved inwardly to clear the ends of the cross link hooks and the sections must also be turned sufficiently so that the eyes can enter the hooks.

The mechanism for turning the chain sections has just been described, and the manner of moving the chain sections inwardly by means of the gripping fingers has also been described. At about the same time that the drum heads are rotated to rotate the supported chain sections, the gripping finger shafts are raised to receive the sections. The heads 276^b rotates in counter-clockwise direction and 226^c rotates in the opposite direction, heads 248^b and 248^c rotating in corresponding direction. When the fingers now swing inwardly with the engaged chain sections, the eyes of the chain section links will be in upright position adjacent the hook ends g and h of the links l, as shown in Fig. 28. Immediately after this position is reached the rod 303 is returned and the gripping finger shafts rotated to swing the gripping fingers outwardly to spread the chain sections to cause the eyes of the links to pass over the hook ends to assume the positions shown in Fig. 29. During or immediately after this movement of the eyes into the cross link hooks the cam levers 322 and 322′ will be returned to normal position and the mechanism controlled thereby will be restored to normal position to rotate the chain section supporting heads to return the eyes of the sections to horizontal position as shown in Fig. 30. After this position is reached the cam 290 releases the arm 288 and the gripping finger shafts are dropped to their normal positions on the anvil bar. The upper ends 326 of the anvil pins of each pair are beveled outwardly and downwardly, as shown in Figs. 28 to 30 and have grooves 327 which will be in the plane of the associated cross link. After the links have been received by the chain sections as shown in Fig. 29, the cam 275 becomes effective to rotate the lever 277 and shaft 273 to cause the arms 274 to engage with the lower ends of the anvil block supporting shafts 269, the anvil block with the anvil pins being raised to carry the anvil pins against the hook ends of the cross links, other mechanism which I will describe later, being brought down against the tops of the cross links to form an abutment for the anvil pins. The cross link hooks are, therefore, closed to form eyes and to be locked to the chain section links. After closing of the cross link hooks the shaft 273 is released and the anvil block is lowered to its normal position by the springs 278. It is not necessary that the various movements of the gripping fingers and the chain sections supporting the heads be in succession, but the various cam and driving mechanisms can be so timed that these movements over-lap, this producing smoother operation besides saving time. When the chain sections are carried to-

gether by the gripping fingers the drum heads of the left end drum will be pulled inwardly to the position indicated by the top head in Fig. 24. The tongues 234 of the head spindles are of sufficient length to remain in the slot 320 when the heads are pulled out to this position.

While the cross links are being applied to the top chain sections the feeding mechanism is operating to transfer another section to the drums, and when this is accomplished, the drums are given another advance by the intermittent driving mechanism to bring the heads 226^b and 248^b into the position just before occupied by the heads 226^c and 248^c, respectively, the opposed heads following the heads 226^b and 248^b assuming the position over the anvil pins just left by the head 226^b and 248^b, and when the gripper mechanisms again become effective, cross links will be applied between the chain sections held between the heads 226^b and 248^b and the next succeeding heads.

The mechanism for releasing chain sections from the heads after the sections leave the planes of the rear anvil pins is best shown in Figs. 2 and 7. Secured to the inner side of the standard 20 in the path of the tongues 234 of the left end head spindles after they leave the plane of the rear anvil pins, is a ridge piece 327 over which the tongues engage to force the heads inwardly to the position shown in Figs. 2, 7 and 24, and while in this position, releasing bars 328 and 328′ provided adjacent the left and right drums, respectively, are actuated. Referring to Fig. 7 the releasing bar 328 for the left end head is carried on a hub 329 pivoted on the intermittent shaft 213 and has a forwardly extending arm 330 which coöperates with a cam roller 331 pivoted on a block 332 secured to the cylindrical cam shaft 151, the arm being held in the path of said roller by means of a spring 333 connecting between the arm and a ring 334 on rack shaft 287. The releasing bar 328 extends to the left and upwardly so that when the hub 329 is rotated by engagement of the roller with arm 330, the bar will swing forwardly against the chain section carried by the left end head which has been pulled inwardly by the ridge piece 327 and this end of the chain section is then carried out of the retaining pockets in the head and thus released therefrom. The releasing bar at the right end drum and its operating mechanism are exactly similar to the arm of the left end releasing bar and its mechanism, the reference characters for the right end bar and its operating mechanism being pinned. The discharge sections are received by an apron 335 which is supported by means of extensions 336 secured over the anvil bar, (Fig. 12), and the finished fabric slides down the apron to a suitable receiving table. The heads of the left drum should be retracted by their springs to their left position upon release therefrom of the chain sections. Referring to Fig. 7, a contact wire 337 extends, but is insulated from the machine frame. If for any reason the head, after disengagement from ridge 327, fails to return to its left position, the head will strike the end of the wire and connect the wire with the frame thereby closing a circuit through the solenoid 141, the wire being connected through a conductor g with the battery S.

Referring to Fig. 1, a cross beam 338 is secured to the tops of standards 20 and 26 and supports a row of cross link feed mechanisms 339, one for each pair of anvil pins. The detailed construction of these feed mechanisms is best shown in Figs. 31 to 35. Each mechanism comprises left and right halves 339^l and 339^r, respectively, held together by bolts 340. The part 339^r has a lateral and upwardly extending arm 341 through whose lower end and into the cross beam 338 pass screws 342 for holding the feed mechanism in place. The base block has parallel webs 343 and 344 extending from its inner face and through the lower part of the base between the webs is an opening 345. Held to the lower end and at the back of the part 339^r by the bolts 340 is a casting 346 which has a central supporting web 347 which projects into the opening 345 and which deflects rearwardly and upwardly, a feed bar 348 engaging along the top of this web, the end of this bar 348^e projecting a distance beyond the web, as best shown in Fig. 32. The bar is secured to the web in any suitable manner and extends upwardly, with its upper ends secured to a block 349, these blocks being all carried on a horizontal bar 350 secured to sleeves 351 and 352, respectively, these sleeves engaging upright rods 353 and 354, respectively, extending upwardly from the standards 20 and 26, (Figs. 1 and 37). The upper ends of the bars coöperate with cross-link replenishing mechanism which will eventually be described, the links falling by gravity down the bars 348, the weight of the upper links forcing the lower links forwardly along the longitudinal end of the bar, as shown in Fig. 32. The links are further held in place on the longitudinal end of each bar by means of a guide plate 355 secured to the back of the member 339^r, its end 355^e extending parallel with and over the horizontal end of the bar 348 to leave a slot 356 through which the links pass. Both the end 355^e and the web 347 are narrower than the bar 348 so that the hook ends of the links will hang downwardly and free. The left half 339^l of each feed mechanism has a channel 357 which at its lower end has a central slot 358 in which

is pivoted an escapement tongue 359 mounted on a shaft 360 which extends forwardly and terminates at the outside in an arm 361 whose end connects with a spring 362 fastened at its other end by screw 363 to the feed mechanism frame, as best shown in Figs. 31 and 33. This spring tends to rotate the escapement tongue 359 upwardly to carry its end against the end 348e of the feed bar 348. In the upper edge of this tongue are two grooves 364 and 365 separated by the escapement tooth 366. Referring to Figs. 33 and 35, guide bars 367 and 368 are suspended from pins 369 and 370, respectively, in the corners of the channel 357, there being spaces between these bars and the back wall of the channel for accommodating an anvil plate 371 having the forwardly extending block 372 engaging between the bars 367 and 368. The lower end 371e of the anvil plate extends a distance below the block 372 and the plate travels in a plane directly in front of the end 348e of the feed bar 348. The lower ends of bars 367, 368 have outwardly extending pins 375 and 376, the ends of these pins projecting a distance beyond the left face of the half 339[1] to be engaged by the ends of flat springs 377 and 378, respectively, whose other ends are clamped to the part 339[1] by the bolts 340.

Each anvil plate is normally held in upper position by a spring 379, (Figs. 1 and 11), secured at its upper end to a longitudinal rod 380 extending between sleeves 381 secured to the uprights 353 and 354, the lower end of each spring engaging a shackle wire 382 whose lower ends hook about a pin 383 extending through the anvil plate and its guide block. Each anvil plate is also in the plane of the grooves 327 formed in the top faces of each pair of anvil pins, (Fig. 30). In the position shown in Fig. 32, the anvil plate is in its normal up position and a cross link has been fed to the slot 364 of the escapement tongue, the tooth 366 locking the next link to the end 348e. As the anvil plate descends it will engage the top of the link held on the escapement tongue and will force this link downwardly between the sides of the casting 346 and the spring pressed blocks 367 and 368, the escapement tongue being swung out of the way and the next link being still prevented from engaging the end 348e by the anvil plate. The anvil plate passes down far enough to carry the link so that its hook ends will project beyond the lower end of the escapement mechanism frame so that eyes of the chain sections can be applied, as shown in Figs. 28 and 29, the link being held against escapement by the spring pressed blocks referred to. When the anvil plate is in its down position the anvil bar is raised in a manner already described to carry its anvil pins against the hook ends to close the hook ends, as illustrated in Fig. 30. When the anvil plate again rises the escapement tongue follows, and as soon as the lower end of the plate leaves the plane of the fed in links the next link will be forced from the end 348e into the path of the slot 364 of the returning escapement tongue, the escapement tooth 366 entering between this link and the next succeeding link to lock this next succeeding link to the end 348e and to hold the engaged link in the path of the anvil bar ready for the next descent thereof. Thus, one link at a time is fed downwardly into the operating field of the anvil pins, each link having its hook ends closed between the anvil plate end and the anvil pins.

The mechanism for forcing the anvil plates downwardly is best shown in Figs. 1, 5 and 11. Journaled on the tops of standards 20 and 26 is a shaft 384 having at its right end outside the standard 26 an arm 385 pivoting at its end a cam roller 386, cooperating with a cam 387 carried on the cam shaft 151 adjacent the cam roller of the arm 277 which actuates the anvil bar as already explained. On the shaft 384 an arm 388 is pivoted, one for each anvil plate 371, each arm at its front end having an abutment 389 engaging with the top of the corresponding anvil plate, the springs for returning the anvil plate being curved, as shown in Fig. 11, to make way for the arms. Referring to Fig. 9, the roller 276 of the anvil block controlling arm 277 has just engaged its cam 275, but before the anvil block reaches its uppermost position the cam 387 will have acted on arm 385 to rotate the arms 388 to push the anvil plates down to their lowermost position, so that the anvil block during the last part of its movement will force the anvil pins against the cross link hooks to close them. After release of the arm 385 from its cam the springs 382 will restore the anvil plates to their upper position and will rotate shaft 384 back to its normal position.

Cross links are applied to a suitable number of chain sections, which after receiving the cross links, are fed to the apron as already described. In order to separate the fabric into sections it is necessary, only, to prevent the feeding of cross links after each certain number of chain sections have been linked together. This can be accomplished by preventing at the proper time the restoration of the anvil plates to their upper position, so that during one cycle of operation of the machine no cross links will be fed. In Fig. 5 mechanism for accomplishing this is shown. On the rear of the standard 26 above the end of the arm 385 is a ratchet wheel 390 pivoted on a pin 391, this pin 391 has also pivoted thereto an arm 392 pivoting a pawl 393 held against the ratchet wheel by a spring 394 secured to the arm. Se-

cured to and extending rearwardly from the shaft 273 is an arm 395 whose end receives a rod 396 having connection at its upper end with the end of the arm 392, so that when the anvil block controlling arm 277 is swung rearwardly, the arm 395 will be swung downwardly to swing the arm 392 downwardly, so that the ratchet wheel 390 is given an angular advance by the pawl 393. When the arm 392 is returned by the spring 397 a detent pawl 398 pivoted on the standard 26 prevents return of the ratchet wheel. This ratchet wheel also carries a single cam tooth 398 which is adapted for engagement with the end of a locking plunger 399 passing through a bearing 400 and having its outward movement resisted by a spring 401. The number of advancements per revolution of the ratchet wheel is adjusted to correspond to the number of chain sections desired in each fabric section, and when such number of sections have been cross linked the cam tooth 398 will come into engagement with locking plunger 399 to move said plunger outwardly to carry its outer end into the path of the arm 385 when said arm is in its out position to carry down the anvil plate pressing arms 388. The arm 385 will, therefore, be locked against return during one advance of the ratchet wheel so that the anvil plates 371 will be prevented from returning to their upper position to allow feeding in of links, and no cross links being applied during such periods the fabric will be delivered in sections. As soon as the cam tooth leaves the plunger the arm 385 will be freed and the anvil plates can ascend to allow feeding in of cross links ready for the next fabric section. It is desirable to check and to count the number of chain sections which are fed to the machine or which are cross linked, and for this purpose a counter K is conveniently mounted on the machine with its actuating arm 402 connected through suitable lever mechanism with the rod 396.

The replenishing mechanism for supplying links to the feed bars 348 is best shown in Figs. 1, 36 to 41. Slidably mounted on slide bars 403 and 404 extending between sleeves 351 and 352 are blocks 405, each having an L shaped extension 406, (Fig. 40), to whose outer end is secured the lower end of a replenishing bar 407 in such manner that the end of the bar will register with the upper ends of feed bars 348 as the block is slid along the rods 403 and 404. As shown there are three such blocks connected together by a connecting bar 408 so that each can supply its third of the whole number of feed bars 348. This bar 408 is pivoted to one end of a link bar 409 pivoted to an intermediate point of an actuating lever 410 pivoted at its upper end, and forming a handle 411 at its lower end, so that swinging of this lever will cause simultaneous sliding of the blocks 405. Extending through each block is a shaft 412 carrying at its front end a detent hook 413 whose end 413^e is held toward the corresponding replenishing bar by force of a spring 414 connected to the block and to the arm. The other end of each shaft carries an actuating arm 415, all these arms being pivoted to a connecting rod 416 having connection through bar 417 with the upper end of a supplemental lever 418 pivoted at an intermediate point to the lever 410 and having its front end 418^e adjacent said lever 410. Rotation of this supplemental lever will cause swinging of the arms 413 away from the replenishing bars so that links on said bars can flow past the ends 413^e, but upon release of the supplemental lever the hooks 413 will again be brought into contact with the replenishing bars and further flow of the links stopped.

In Figs. 37 and 41 means are shown for simultaneously guiding and controlling the operation of the levers. Mounted from the upright 354 is a horizontal plate 419 having notches 420 in its front edge, there being five such notches to equal the number of feed bars 348 controlled by each detent block. Adjacent each slot there is also a cam plate 421. When it is desired to move the detent blocks into a certain position in connection with feed bars, the lever is pushed into the corresponding notch 420 and during entry the end 418^e will pass along the adjacent cam plate 421 to rotate the supplemental lever so that when the main lever reaches the bottom of the slot the supplemental lever will have been actuated sufficiently to cause release of the detent arms to allow flow of links from the replenishing bars to the feed bars. In the position of the bars shown in Fig. 36, the main lever 411 is in position in the inner notch. The replenishing bars 407 may receive their supply from any suitable source, but I prefer to connect the upper ends of these bars directly with machines M, which manufacture the cross links, such machines being described in detail in my before mentioned Patent No. 957,203. The machines are preferably mounted on a floor above the fabric machine, so that the links as they are fed from the machines will flow down the replenishing bars to be fed to the various feed bars of the fabric machine. No intermediate feed mechanism is, therefore, necessary for transferring links from the link machines to the fabric machines.

I thus produce a machine which is entirely automatic in its operation from beginning to end to receive links and to assemble these links into fabric sections which are ready for use. The various operation steps closely follow each other, and where possible they overlap so that the work is ac-

complished in the shortest time. The attachments for indicating when imperfect operation takes place and for automatically stopping the machine at this time, will prevent the manufacturing of imperfect fabric and will prevent injury to the machine. The cross link feed mechanism is such that the cross links can be fed directly to the machine from the cross link manufacturing machines.

I do not limit myself to the particular constructions, mechanisms and arrangements which I have shown and described, as many changes could be made which would still come within the scope of my invention, and I desire to secure the following claims by Letters Patent.

1. In a metallic link fabric machine, the combination of means for feeding chain sections one at a time, means for feeding cross links, and means for connecting the cross links and sections to form a fabric.

2. In a metallic link fabric machine, the combination of means for feeding endless chain formed of links, means for separating the chain into sections, and means for applying cross links to said sections to form a fabric.

3. In a wire link fabric machine, the combination of means for feeding endless chain formed of links, means for separating the chain into sections, means for arranging the sections in parallel order, and means for applying cross links to the links of the sections to form fabric.

4. In a metallic link fabric machine, the combination of means for feeding endless chain composed of links, means for severing sections from said chain, receiving mechanism for receiving and for arranging the sections, and means for applying cross links to the sections to connect them together to form a fabric.

5. In a metallic link fabric machine, the combination of feed mechanism for feeding endless chain, means for severing sections from said chain, receiving mechanism for receiving each section after severing thereof from the chain and for arranging the sections in regular order, and means for applying links to the sections to connect them together to form fabric.

6. In a metallic link fabric machine, the combination of feed mechanism for feeding endless chain composed of links, means for disconnecting the ends of said chain to form sections, receiving mechanism for receiving the sections after disconnection from the chain and for arranging said sections in regular order, and means for applying cross links to adjacent sections to form fabric therewith.

7. In a metallic link fabric machine, the combination of receiving mechanism, means for feeding chain sections one at a time to said receiving mechanism, and means for applying cross links for connecting together adjacent sections to form fabric.

8. In a metallic link fabric machine, the combination of receiving mechanism, means for feeding chain sections one at a time to said reeeiving mechanism, means for applying cross links for connecting together adjacent sections to form fabric, and means for separating the fabric into fabric sections.

9. In a metallic link fabric machine, the combination of receiving and arranging mechanisms, means for feeding chain sections to the receiving mechanism, means for moving the receiving mechanism after the application of each section whereby said sections are arranged thereon in regular order, and means for applying cross links to the adjacent sections to connect said sections to form fabric.

10. In a metallic link fabric machine, the combination of receiving and arranging mechanism, means for feeding chain sections to the receiving mechanism, means for moving the receiving mechanism after application of each section whereby said sections are arranged thereon in regular order, means for applying cross links to the adjacent sections to connect said sections to form fabric, and means for preventing the application of cross links between certain adjacent sections thereby separating the fabric into sections.

11. In a metallic link fabric machine, the combination of receiving mechanism having a plurality of receiving planes, feed mechanism for feeding and applying chain sections to said receiving mechanism in succeeding receiving planes, and means for applying cross links to adjacent sections to connect such sections together to form fabric.

12. In a metallic link fabric machine, the combination of receiving mechanism having a plurality of receiving planes, feed mechanism for feeding chain sections to said receiving mechanism in said receiving planes, means for rotating said receiving mechanism step by step to carry its receiving planes successively into position to receive the chain sections whereby said chain sections are arranged in regular order on said receiving mechanism, and means for applying cross links to the sections to form fabric therewith.

13. In a metallic link fabric machine, the combination of receiving mechanism having a plurality of receiving planes, feed mechanism for feeding chain sections to said receiving mechanism in said receiving planes, means for rotating said receiving mechanism step by step to carry its receiving planes successively into position to receive the chain sections whereby said chain sections are arranged in regular order on said

receiving mechanism, and means for applying cross links to adjacent sections during periods between the advancements of said receiving mechanism whereby the sections are connected together to form fabric.

14. In a metallic link fabric machine, the combination of cylindrical receiving mechanism having a plurality of receiving planes, means for rotating said mechanism step by step to carry its planes successively into a receiving field, feed mechanism for successively feeding chain sections into the receiving field and for successively applying the sections to the receiving mechanism, said machine having a cross link applying field through which the received chain sections are carried by said receiving mechanism, and means for applying cross links to adjacent sections when they are in said cross link field whereby the successive sections are connected together to form a fabric.

15. In a metallic link fabric machine, the combination of feed mechanism for receiving endless chain and for dividing said chain into sections, receiving mechanism with receiving heads for receiving the ends of the sections from the feed mechanism, cross link applying mechanism, means for moving said receiving mechanism to successively carry the sections into the operating field of said cross link applying mechanism, and means for actuating said cross link applying mechanism to apply cross links to the sections to connect said sections together.

16. In a metallic link fabric machine, the combination of receiving drums adapted to rotate about a common axis, means for intermittently rotating said drums, feed mechanism for feeding wire sections toward said drums, receiving heads on said drums for receiving the ends of the fed sections after each rotation of the drums and for stretching said sections between the drums in parallel order, cross link applying mechanism through whose operating field the sections are carried by said drums, and means for actuating said cross link mechanism to apply cross links to the sections to connect adjacent sections together to form fabric.

17. In a wire fabric machine, the combination of feed mechanism for feeding strand sections, means for receiving the strand sections one at a time and for arranging them in regular order, and means for cross connecting the sections to form fabric.

18. In a wire fabric machine, the combination of feeding mechanism for feeding strand sections, receiving mechanism, transfer mechanism for receiving the sections one at a time from the feeding mechanism and for transferring said sections to the receiving mechanism, and means coöperating with the receiving mechanism for cross connecting the chain sections thereon to form fabric.

19. In a wire fabric machine, the combination of feed mechanism for feeding strand sections one at a time, transfer mechanism for picking up the sections from the feed mechanism, receiving mechanism for receiving the sections from the transfer mechanism and for arranging the sections in parallel order, and cross link applying mechanism coöperating with the receiving mechanism to apply cross links to the sections to form fabric.

20. In a link fabric machine, the combination of continuously traveling feed mechanism for feeding chain sections, reciprocating transfer mechanism adapted to travel through periods with the feed mechanism to receive the sections therefrom, receiving mechanism for receiving the sections from the transfer mechanism, means for periodically advancing the receiving mechanism to cause the sections to be arranged in parallel order thereon, and means for cross connecting said sections to form fabric.

21. In a link fabric machine, the combination of continuously traveling feed mechanism for feeding chain sections, reciprocating transfer mechanism adapted to travel through periods with the feed mechanism to receive the sections therefrom, receiving mechanism for receiving the sections from the transfer mechanism, means for periodically advancing the receiving mechanism to cause the sections to be arranged in parallel order thereon, and cross link applying mechanism coöperating with the receiving mechanism to apply cross links to adjacent sections to connect said sections together to form fabric.

22. In a link fabric machine, the combination of continuously traveling feed mechanism for feeding chain sections, reciprocating transfer mechanism adapted to travel during periods with said feed mechanism to pick up the fed sections, rotatable receiving mechanism for receiving the sections from the transfer mechanism and for arranging said sections in regular order, and cross link mechanism coöperating with the receiving mechanism to apply cross links to the sections to connect said sections together to form fabric.

23. In a link fabric machine, the combination of continuously traveling feed mechanism for feeding endless chain, means carried by the feed mechanism for separating the chain into sections, transfer mechanism coöperating with the feed mechanism to pick up the sections therefrom, receiving mechanism for receiving the sections from the transfer mechanism, means for periodically advancing the receiving mechanism to cause the sections to be arranged thereon

in parallel order, and cross link mechanism coöperating with the receiving mechanism to apply cross links to connect the sections together to form fabric.

24. In a link fabric machine, the combination of feed mechanism for feeding endless chain, means operating during travel of the feed mechanism for separating the chain into sections, pick up mechanism for picking up the sections from the feed mechanism, receiving mechanism for receiving the sections from the transfer mechanism and for arranging said sections in parallel order, and cross link mechanism for applying cross links to the sections on the receiving mechanism.

25. In a link fabric machine, the combination of feed mechanism for feeding endless chain, means operating during travel of the feed mechanism to open links of the chain, to cause separation of the chain into sections, receiving mechanism for receiving the sections and for arranging them in regular order, and means for applying cross links to the sections when on the receiving mechanism.

26. In a link fabric machine, the combination of feed mechanism for feeding chain sections, pick up mechanism adapted to travel with the feed mechanism to pick up the sections, receiving mechanism, spring actuated heads on said receiving mechanism for receiving and for stretching the sections, and means for applying cross links to the sections when on the receiving mechanism.

27. In link fabric machinery, the combination of means for feeding longitudinal links, a plurality of cross link manufacturing machines, means for feeding cross links directly from said machines to the longitudinal links, and means for securing the cross links and longitudinal links together to form fabric.

28. In link fabric machinery, the combination of receiving and arranging mechanism, means for feeding chain sections to said receiving and arranging mechanism, a cross link manufacturing device, means for feeding cross links directly from said device to said receiving and arranging mechanism, and means for uniting the cross links with said chain sections to form fabric.

29. In link fabric machinery, the combination of receiving and arranging mechanism, means for feeding longitudinal links to said receiving and arranging mechanism, a plurality of cross link feeding mechanisms, means for connecting together cross links and longitudinal links to form fabric, a plurality of replenishing mechanisms less in number than the cross link feed mechanisms, and means for associating said replenishing mechanisms with any of said cross link feed mechanisms to supply cross links thereto.

30. In a wire fabric machine, the combination of means for feeding chain sections, means for feeding open-ended cross links, means for applying the links to the sections, and means for closing the links after application.

31. In a metal fabric machine, the combination of means for feeding an endless strand, means for separating the strand into sections, and means for cross-connecting the sections.

32. In a wire fabric machine, the combination of traveling feed mechanism for feeding an endless metallic strand, means carried by the feed mechanism to separate said strand into sections, receiving mechanism for receiving the sections and for arranging them in regular order, and means for applying cross-connectors to the sections when on the receiving mechanism.

33. In a wire fabric machine, the combination of traveling feed mechanism for feeding an endless metallic strand, means traveling with the feed mechanism for separating the strand into sections, receiving mechanism for said sections, transfer mechanism for transferring the sections from the feed mechanism to the receiving mechanism, and means for cross-connecting the sections on the receiving mechanism to form fabric.

34. In a wire fabric machine, the combination of a traveling receiving member having receiving jaws for receiving the ends of strands, feed mechanism for feeding strands to said jaws, and means for applying cross-connectors to the strands when held by said jaws.

35. In a wire fabric machine, the combination of continuously traveling carriers, means for feeding an endless strand into the path of said carriers to be successively associated with the traveling carriers, clamping means for each carrier for clamping the endless strand at two points, means on each carrier for severing the strand between the two points of clamping by the carrier whereby the endless strand is divided into sections, receiving mechanism for receiving and arranging the sections, and transfer mechanism adapted to become associated with each section after severance thereof from the endless strand and to transfer said section to the receiving mechanism.

36. In a wire fabric machine, the combination of a plurality of carriers, means for causing continuous travel of said carriers through a fixed path and at regular intervals, means for associating an endless strand with said carriers, means on each carrier for clamping said strand at two points, severing mechanism for each carrier opera-

tive between the clamping points thereof, actuating mechanism for said severing mechanism disposed in the path of travel of said carriers to actuate said severing mechanism to sever the strand between the clamping points of the carriers, transfer mechanism operative intermittently to receive a severed section from adjacent carriers, means in the path of said carriers for actuating clamping mechanism of adjacent carriers to release the section after association thereof with the transfer mechanism, receiving mechanism for receiving the sections from the transfer mechanism and for arranging said sections, and means for cross-connecting said sections.

37. In a wire fabric machine, the combination of a plurality of carriers, means for causing said carriers to travel through a fixed path, an endless chain arranged to be associated with said carriers, clamping mechanism for each carrier for clamping said chain at two points, opening mechanism on each carrier between the clamping points thereof, means arranged in the path of said carriers for actuating said opening mechanism to open the chain between the clamping points of the carriers to thereby cause division of the endless chain into sections, transfer mechanism, means for carrying said transfer mechanism into engagement with the chain sections, means in the path of the carriers for actuating the clamping mechanism thereof to release the sections after the engagement of said sections with the transfer mechanism, receiving mechanism for receiving the sections from the transfer mechanism, and means for cross-connecting the sections when on said receiving mechanism.

38. In a wire fabric machine, the combination of a plurality of carriers, means for causing said carriers to travel successively through a fixed path, means for associating an endless chain with said carriers, clamping mechanism on each carrier for clamping said endless chain at two points, means on each carrier for opening the chain between the clamping points of the carrier whereby the chain is divided into sections, receiving mechanism for receiving and arranging the sections, and means for cross-connecting the sections.

39. In a wire fabric machine, the combination of a plurality of carriers, means for causing said carriers to repeatedly travel through a fixed path, means for associating an endless chain with said carriers, clamping mechanism for each carrier for clamping adjacent links of the chain upon association therewith, opening mechanism for each carrier between the clamping points thereof, means for causing actuation of said opening mechanism to open one of the clamped links, means for actuating each carrier to bring its clamping points together after opening of one of said links to cause disconnection of said link from the other clamped link whereby the chain is divided into sections, receiving mechanism, transfer mechanism for engaging with the sections, means for releasing the sections from the carriers after engagement thereby of the transfer mechanism and means for causing operation of the transfer mechanism to convey the sections to the receiving mechanism, and means for cross-connecting the sections when on the receiving mechanism to form fabric.

40. In a wire fabric machine, the combination of a plurality of carriers, means for causing said carriers to travel continuously at regular intervals and in the same direction through a fixed path, an endless chain composed of links each having a hook in one end and an eye at the other, clamping mechanism for each carrier mechanism for clamping adjacent links of said chain, opening mechanism for each carrier mechanism controlled upon travel of the carrier mechanism to open the hook of one of the clamped links, means operative after such opening of the hook for moving together the clamping points of the carrier to disconnect the opened hook from the eye of the other clamped link whereby the chain is divided into sections, receiving mechanism, and transfer mechanism for transferring the sections from said carriers to the receiving mechanism.

41. In combination, a plurality of carriers, means for causing said carriers to travel successively and repeatedly through a fixed path, clamping mechanism for each carrier adapted to clamp adjacent links of an endless chain introduced into the path of said carriers, and means operative after the clamping engagement of a carrier with the chain for disconnecting the clamped links whereby said chain is divided into sections.

42. In combination, a plurality of carriers, means for causing said carriers to travel successively and repeatedly through a fixed path, an endless strand with which said carriers are successively associated, clamping mechanism for each carrier adapted upon association of the carrier with the endless strand to clamp said strand at two points, and means for each carrier operative after clamping of the strand by the carrier to open the strand between the clamping points whereby the endless strand is divided into sections.

43. In combination, a plurality of carriers, means for causing said carriers to travel in regular and repeated succession through a fixed path, an endless strand adapted to be successively engaged by the

carriers, two clamping jaws on each carrier adapted to clamp the strand at two points upon engagement of the carrier with the strand, means operative during travel of the carriers to open the strand between the clamping jaws of the carriers whereby the endless strand is divided into sections, means for releasing the sections from the jaws of adjacent carriers, and means for receiving the released sections.

44. In combination, a fixed track, a plurality of carriers, means for causing successive and repeated travel of the carriers over said track, means for feeding an endless strand adjacent said track, clamping mechanism for each carrier mechanism, means for actuating the clamping mechanism of each carrier to clamp the strand at two points as the carrier enters the track, means for each carrier actuated just after clamping of the strand by the carrier to open the strand between the two clamping points of the carrier whereby the endless strand is divided into sections, means for simultaneously actuating the clamping mechanism of adjacent carriers on said track to release the sections therefrom, and means for receiving the released sections.

45. In combination, a stationary track, endless chains, a plurality of carriers connected at regular intervals with said chains, means for continuously rotating said chains to cause the carriers to travel repeatedly over said track, an endless strand adjacent said track, two clamping jaws for each carrier, cam mechanism for causing actuation of the clamping jaws of each carrier to clamp the endless strand at two points as the carrier enters the track, opening mechanism for each carrier mechanism between the clamping jaws thereof, cam mechanism for causing actuation of said opening mechanism to open the strand between the clamping jaws of the carriers immediately after clamping engagement of said jaws with the strand whereby the endless strand is divided into sections, means for releasing sections from adjacent carriers on said track, and means for receiving the released sections.

46. In combination, a fixed track, a plurality of carriers, means for causing said carriers to travel in repeated succession over said track from one end to the other, an endless strand adjacent said track, two clamping jaws for each carrier, opening mechanism for each carrier between the clamping jaws thereof, cam mechanisms at the entrance end of said track adapted to cooperate successively with each carrier as it engages the entrance end of the track to cause first actuation of the clamping jaws of each carrier to clamp the strand at two points, then actuation of the opening mechanism to open the strand between the clamping jaws, and then release of the severed section by the advance clamping jaw, cam mechanism at the outlet end of the track for coöperating with the preceding carrier to release the advanced end of each section, and receiving means for receiving the released sections.

47. In a wire fabric machine, the combination of receiving mechanism, means for causing intermittent travel of said receiving mechanism, means for feeding wire sections to said receiving mechanism between intervals of travel thereof, anvil mechanism disposed in the path of travel of the sections on said receiving mechanism, means for applying cross-connectors to adjacent sections, and means for actuating said anvil mechanism between intervals of travel of said receiving mechanism to secure the cross-connectors to the sections to form fabric.

48. In a wire fabric machine, a receiving drum, means for intermittently causing rotational advance of said drum, feed mechanism for successively applying wire sections to said drum, anvil mechanism through whose field the wire sections are carried by said drum, means for feeding cross-connectors to said wire sections, and means for causing operation of the anvil mechanism to apply the cross-connectors to the wire sections between intervals of rotation of said drum.

49. In a chain fabric machine, the combination of opposed drums, rotational heads extending inwardly about the periphery of each drum, means for causing intermittent rotational advance of said drums, feed mechanism for feeding chain sections to opposite heads on said drums whereby chain sections are arranged in parallel order between said drums, anvil mechanism into whose field adjacent chain sections are intermittently carried by said drums, means for feeding open ended cross-links into said anvil mechanism field, means for rotating the drum heads of the adjacent chain sections in said field and means for moving said adjacent chain sections toward each other whereby the chain section links may receive the open ended cross links, and means for actuating the anvil mechanism for closing the cross links after application thereof to the chain sections whereby to form fabric.

50. In a chain fabric machine, the combination of a receiving member having a plurality of receiving planes, feed mechanism for delivering chain sections to said receiving mechanism in its receiving planes, anvil mechanism, means for causing the receiving mechanism to carry adjacent chain sections into the field of said anvil mechanism, means for feeding open hook ended cross links into said anvil mechanism field, means for moving adjacent chain sections in such anvil field toward each other and means for simultaneously axially rotating the adjacent chain sections whereby said cross links are en-

gaged with the adjacent sections, and means for causing operation of the anvil mechanism to close the open ended cross links after application thereof to the adjacent chain sections whereby to form fabric.

51. In a wire fabric machine, the combination of a traveling member, means for applying strands to said member transverse to the direction of travel thereof, and means for cross-connecting the strands to form fabric.

52. In a wire fabric machine, the combination of a traveling cylindrical receiving mechanism, means for stretching metallic strands in parallel order on said mechanism lengthwise thereof, and means for cross-connecting said strands to form fabric.

53. In a wire fabric machine, the combination of opposed cylindrical drums, means for stretching strands between said drums, stationary cross-connecting mechanism, means for rotating said drums to carry the strands successively through the field of said cross-connecting mechanism, and means for actuating said cross-connecting mechanism to cross-connect the strands to form fabric.

54. In a wire fabric machine, the combination of a traveling receiving member, cross-connecting mechanism in the path of said traveling member but disconnected therefrom, means for applying strands to said traveling member transversely to the direction of travel thereof, and means for actuating the cross-connecting mechanism to cross-connect the strands to form fabric.

55. In a wire fabric machine, the combination of a traveling receiving member, cross-connecting mechanism disconnected from the traveling member and through whose field said traveling member passes, means for applying strands to the traveling member, means for actuating said cross-connecting mechanism to cross-connect adjacent strands to form fabric, and means for periodically preventing cross-connection of adjacent strands whereby the fabric is divided into fabric sections.

56. In a metal fabric machine, the combination of a traveling member for receiving strands, jaws between which said strands are successively carried by the receiving member, means for feeding cross connectors between said jaws, and means for actuating the jaws to apply the cross connectors to cross connect said strands.

57. In a wire fabric machine, the combination of a traveling member adapted to support strands, jaws through whose field the strands are carried by said member, means for feeding open ended cross links between said jaws and to the strands in the field thereof, and means for actuating the jaws to close the links to cross connect the strands to form fabric.

58. In a wire fabric machine, the combination of a traveling member adapted to support strands, jaws through whose field the strands are carried by said member, means for feeding open ended cross links between said jaws and to the strands in the field thereof, means for actuating the jaws to close the links to cross connect the strands to form fabric, and means for periodically preventing feeding of links to said jaws whereby said fabric is divided into fabric sections.

59. In a wire fabric machine, the combination of receiving mechanism, feed mechanism for feeding chain sections to said receiving mechanism, means for applying previously formed open cross links to said sections, and means for closing said cross-links after application whereby to combine the sections to form fabric.

60. In a wire fabric machine, the combination of a traveling receiving member, means for feeding link strands to said receiving member, a row of cross connecting jaws through whose field the link sections are carried by the receiving member, a supply member for each jaw for supplying cross connectors thereto, a number of cross connector replenishing heads, a cross connector supply source connected with each head, means for shifting said heads into register with the jaw supply members, and means for controlling the feed of cross connectors from said heads to said supply members.

61. In a fabric making machine, the combination with operating mechanism for arranging linked strands in substantial parallelism, of mechanism for feeding to said operating mechanism an uninterrupted linked chain from which said linked strands are formed, and mechanism for feeding and applying cross-connecting links to adjacent parallel links of said strands whereby a fabric is progressively built up.

62. In a fabric making machine, the combination with operating mechanism for arranging linked strands in substantial parallelism, of mechanism for feeding to said operating mechanism an uninterrupted linked chain from which said linked strands are formed, and mechanism for feeding and applying independently formed cross-connecting links to adjacent parallel links of said strands whereby a fabric is progressively built up.

In witness hereof, I hereunto subscribe my name this 30 day of July A. D. 1909.

JOHN F. GAIL.

Witnesses:
GUS JACOB,
C. E. HAWLEY.