No. 622,406. Patented Apr. 4, 1899.

# C. E. WARNER.

## WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 1.

Fig. 1.

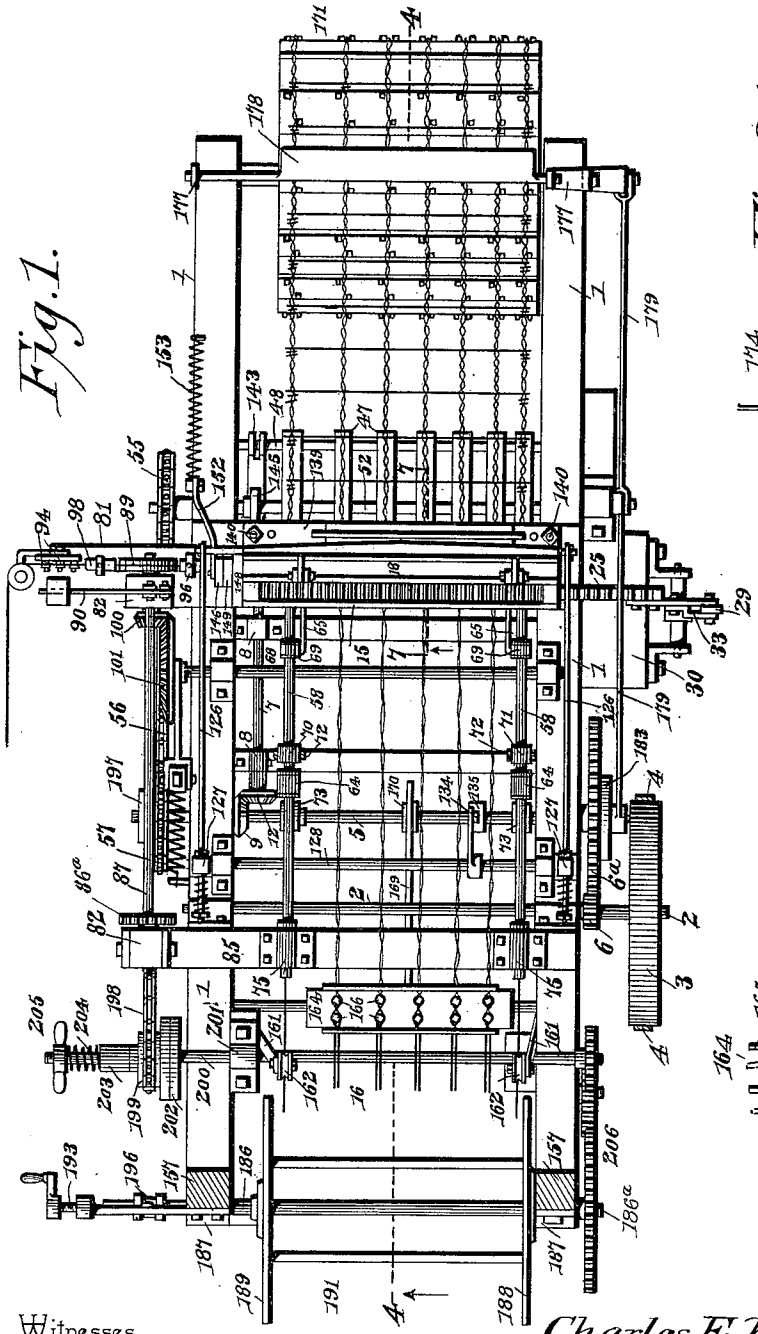


Fig. 34.

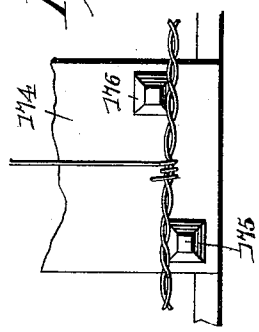
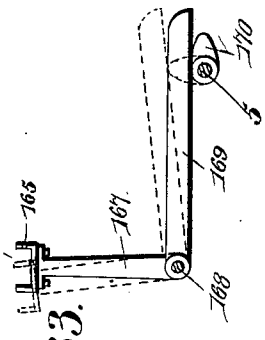


Fig. 33.



Witnesses
Jas. K. McCathran
H. E. Bowling

Charles E. Warner Inventor
By his Attorneys,
C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 2.

Fig. 10.

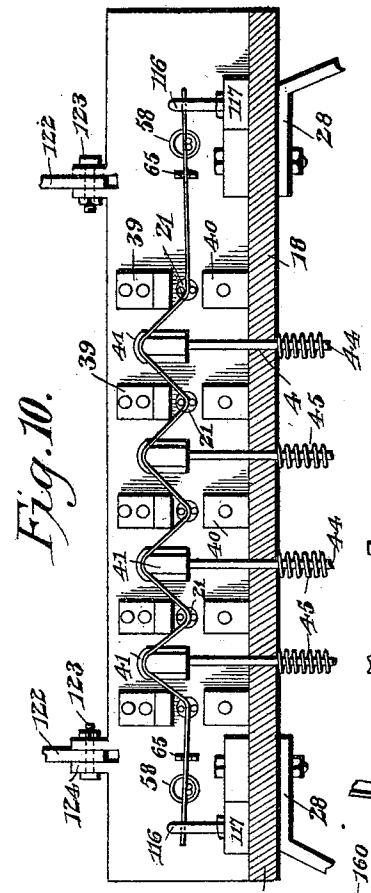
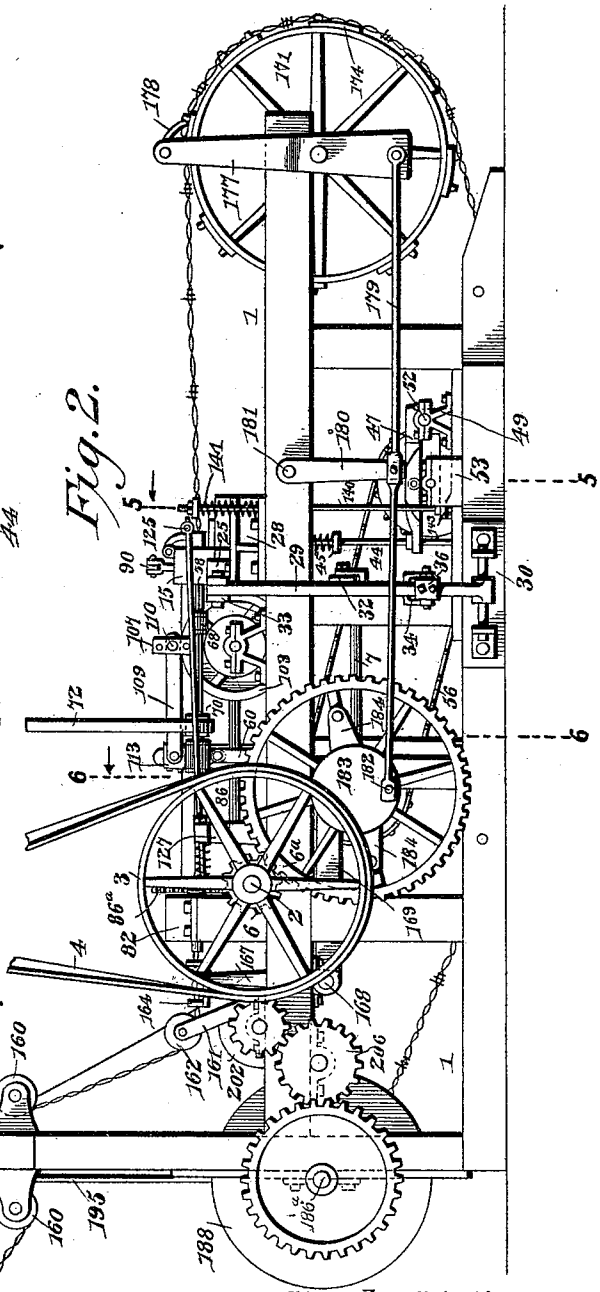


Fig. 2.



Witnesses
Jas. K. McCutchan
H. A. Brueckner

Charles E. Warner Inventor
By his Attorneys.
C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 3.

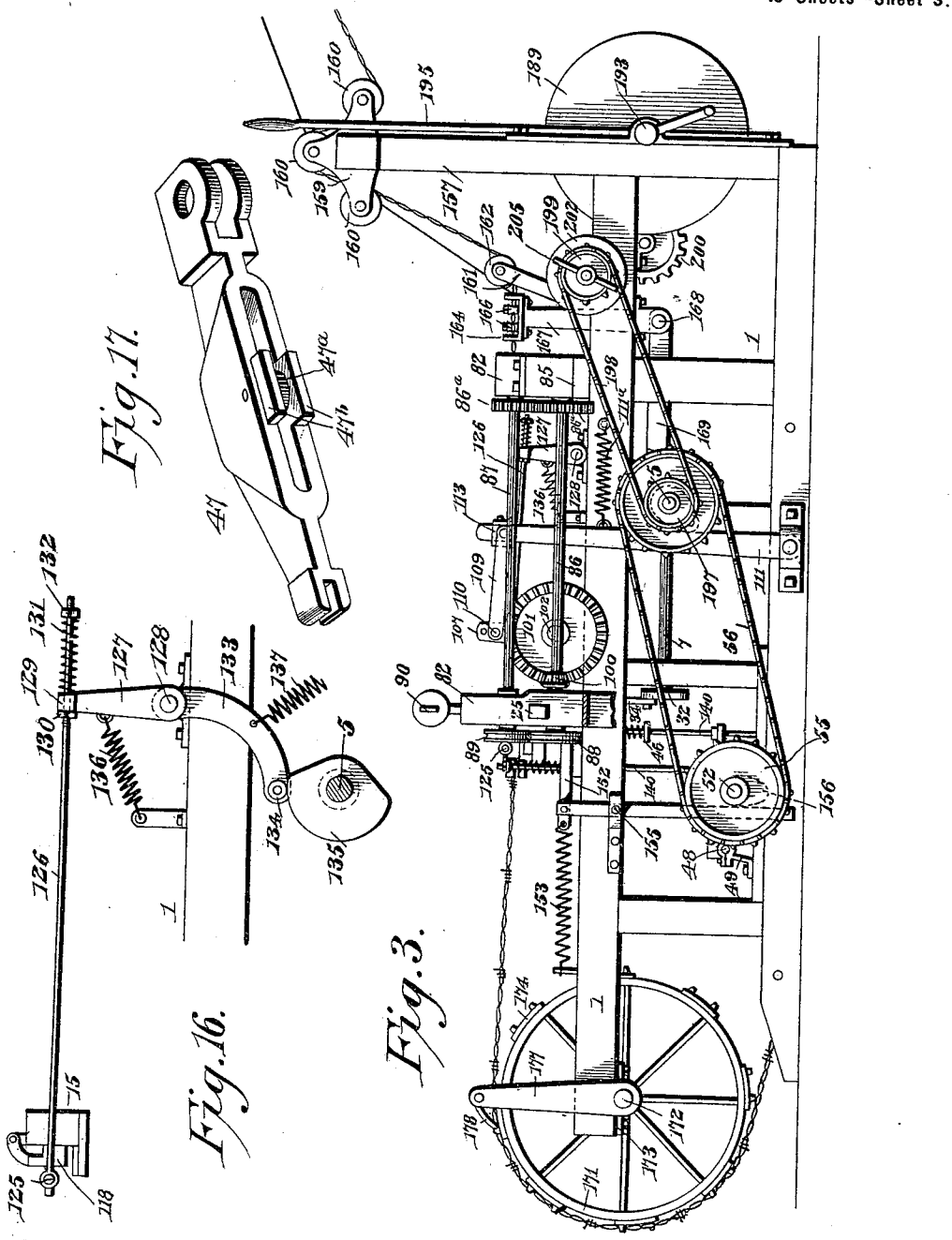


Fig. 17.

Fig. 16.

Fig. 3.

Witnesses

Jas. K. McCathran

N. C. Beaulieu

Charles E. Warner Inventor

By his Attorneys,

C. A. Snow & Co.

No. 622,406.

Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.)

10 Sheets—Sheet 4.

Fig. 1.

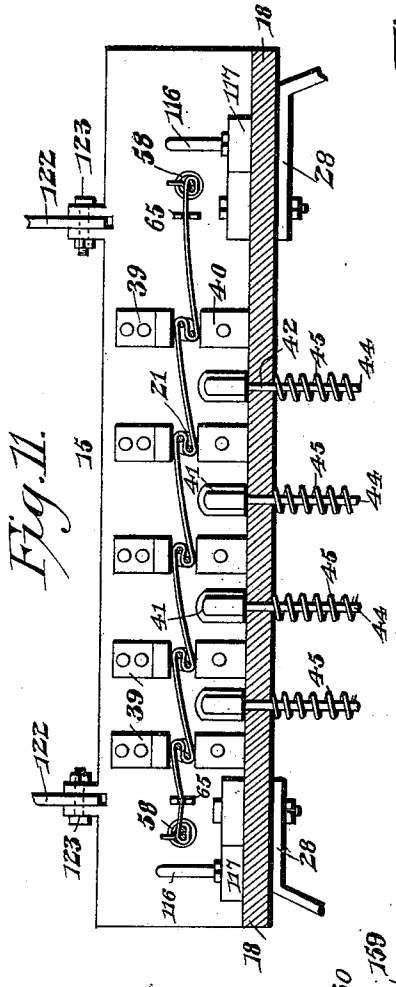


Fig. 3.

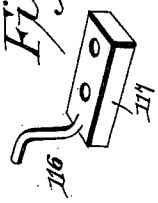


Fig. 4.



Witnesses

Jas. K. McCutchan

W. E. Beuhop

Charles E. Warner Inventor

By his Attorneys,

C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

# C. E. WARNER.

## WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 5.

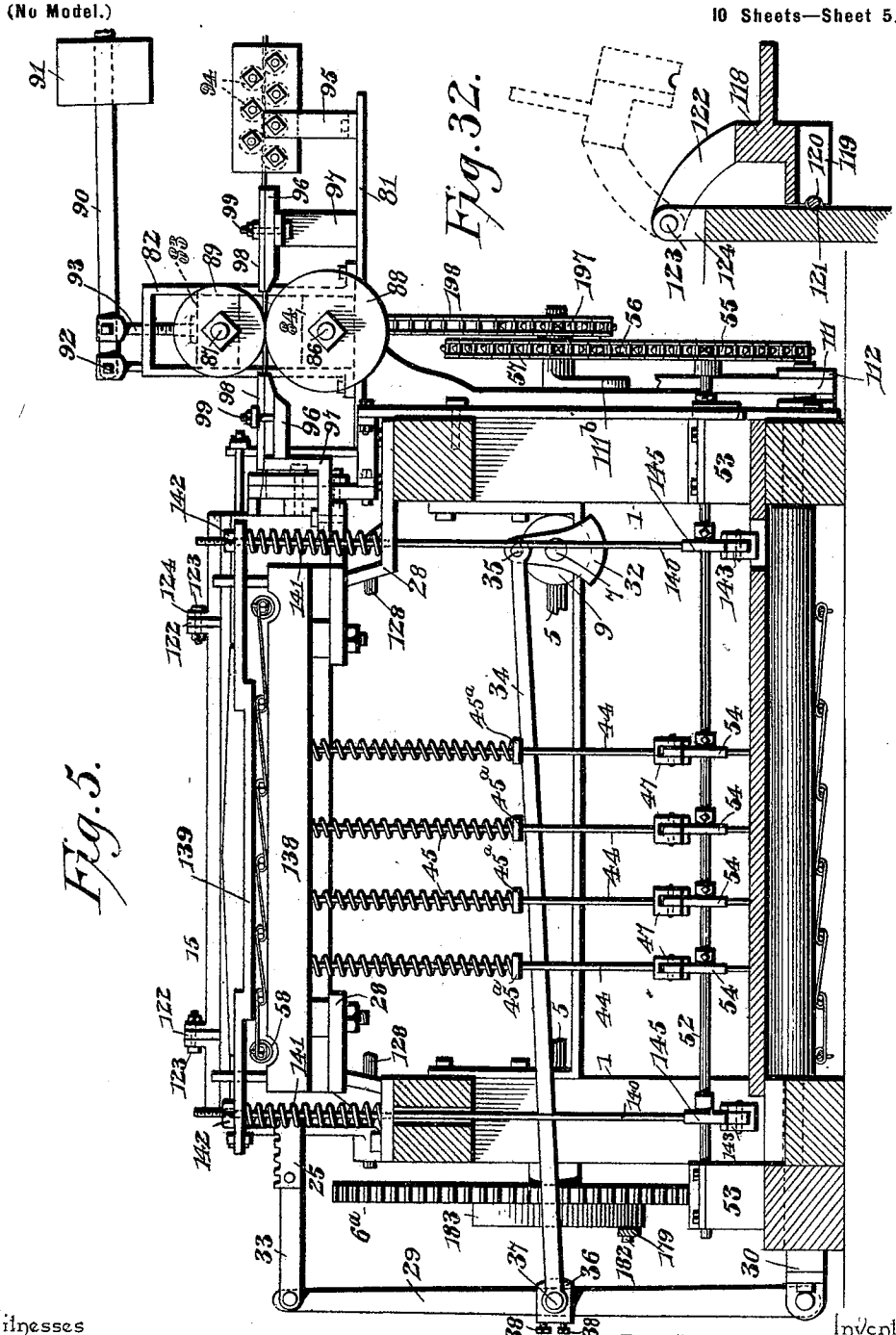


Fig. 5.



Fig. 32.

Witnesses
Jas. K. McCathran
H. E. Beuchert

Inventor
Charles E. Warner
By his Attorneys.
C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 6.

Fig. 23.

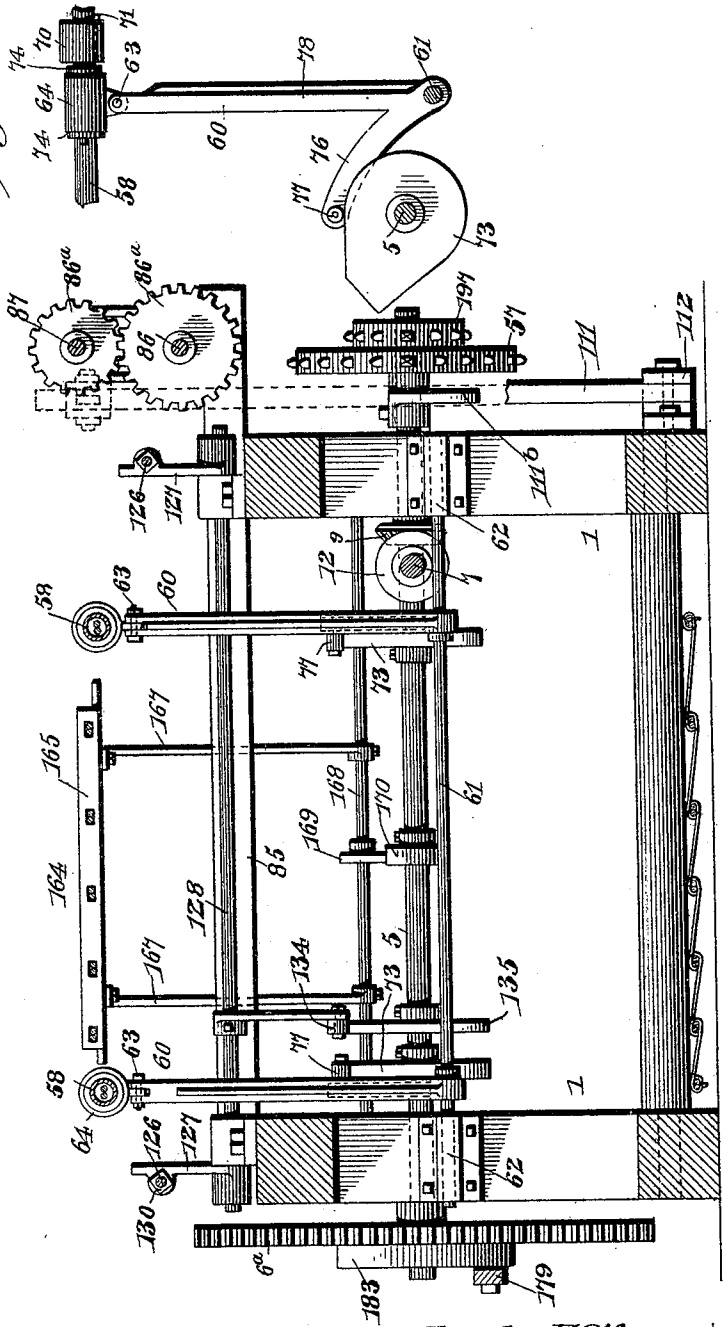


Fig. 6.

Witnesses
Jas. K. McCathran
H. C. Beuchert

Charles E. Warner Inventor
By his Attorneys.
C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 7.

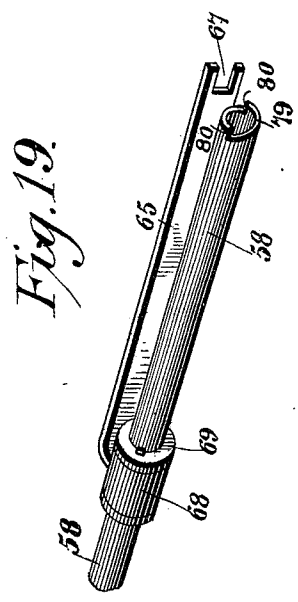



Fig. 19.

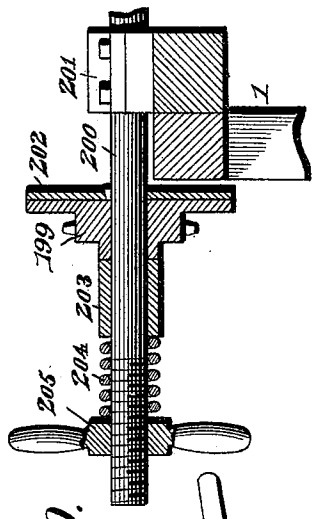



Fig. 20.

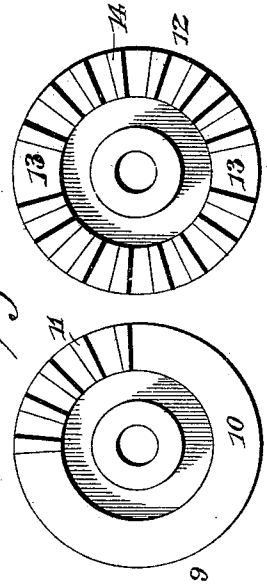



Fig. 22.

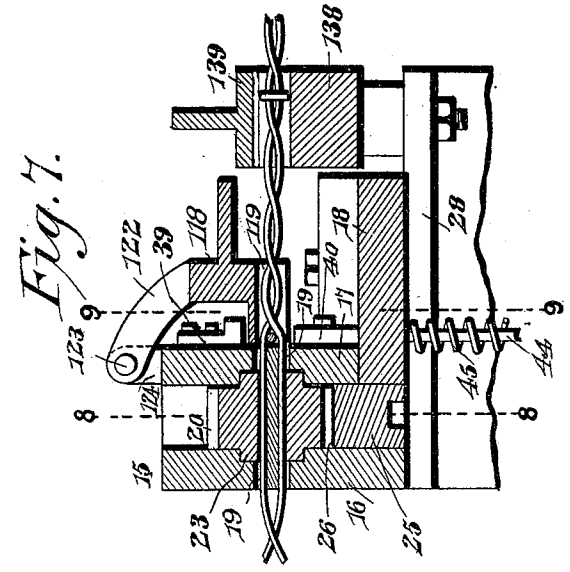



Fig. 1.

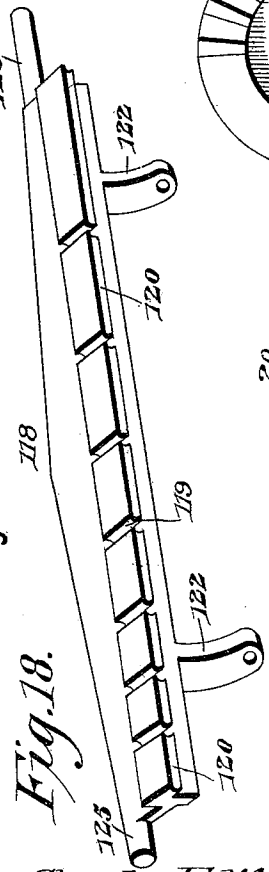



Fig. 18.

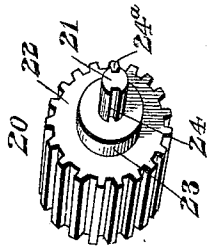



Fig. 21.

Witnesses
Jas. L. McCathran
W. J. Beuthof

Charles E. Warner Inventor.
By his Attorneys,
C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 8.

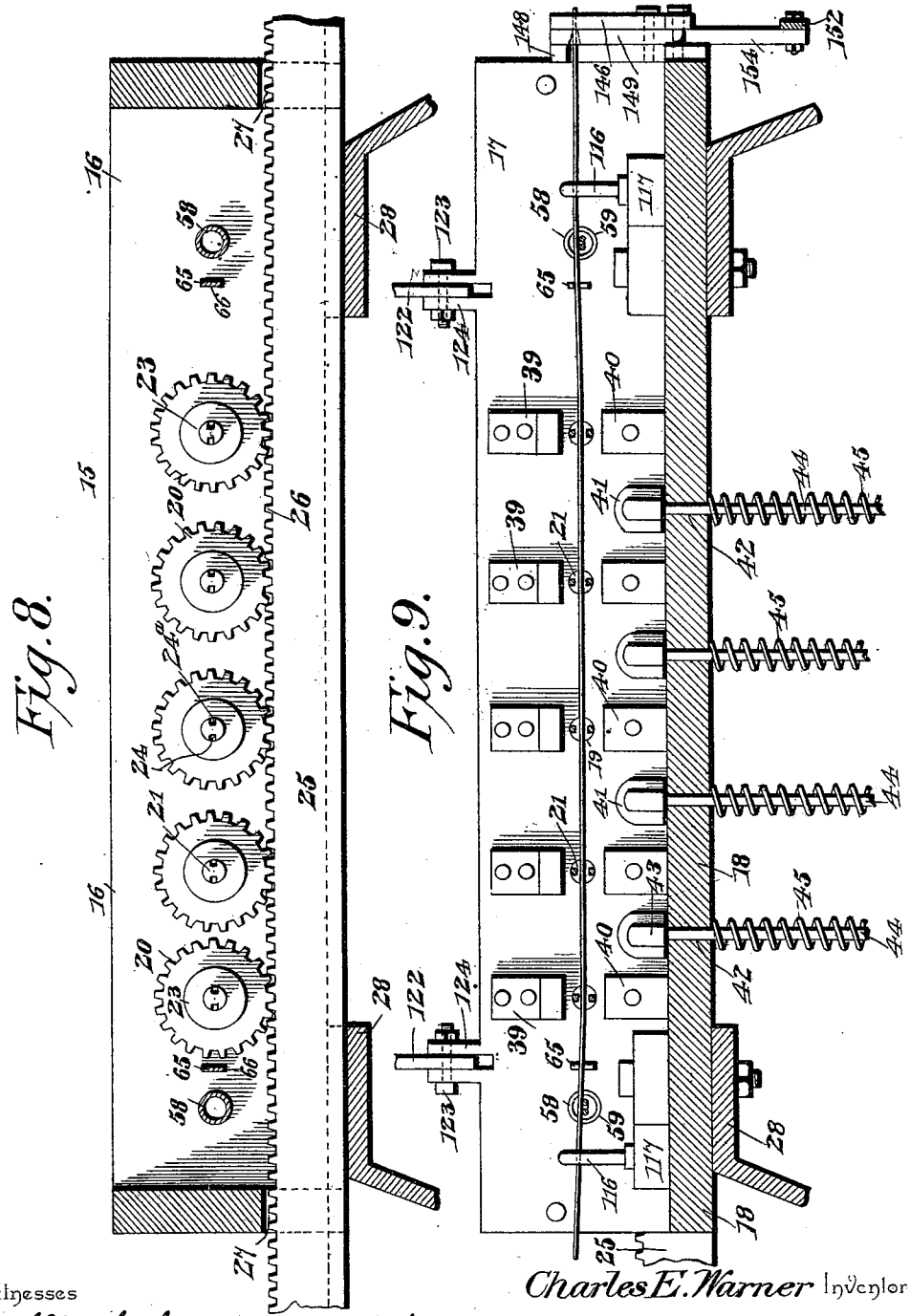


Fig. 8.



Fig. 9.

Witnesses
Jas. E. McCathran
W. J. Beuchert

Charles E. Warner Inventor
By Fris Attorneys.
C. A. Snow & Co

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 9.

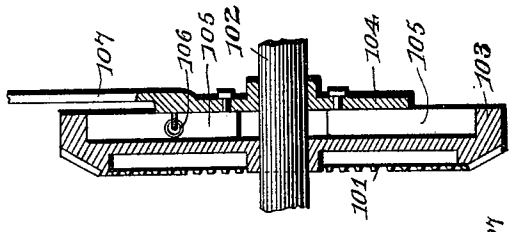



Fig. 14.

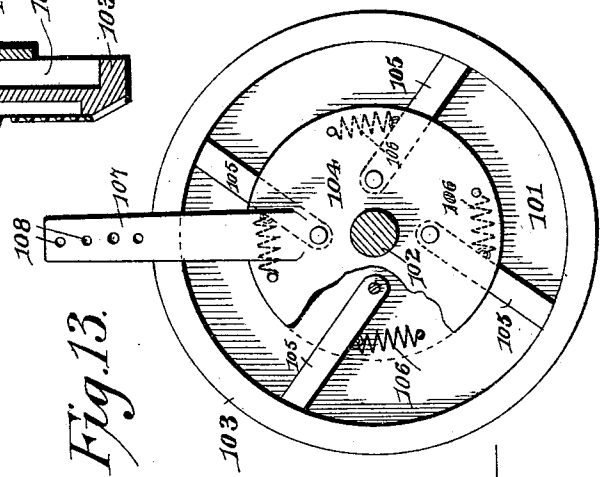



Fig. 13.

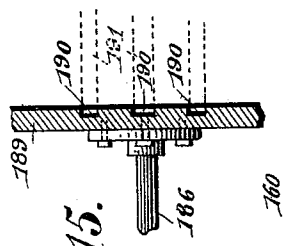



Fig. 15.

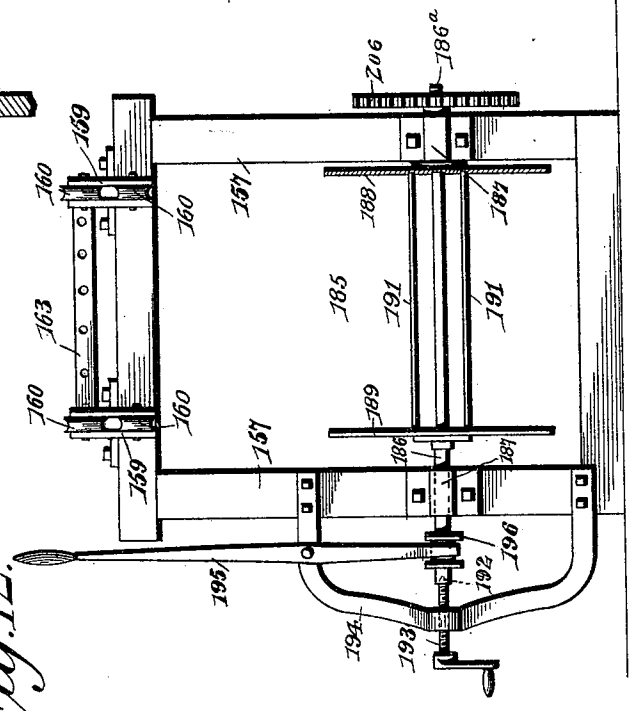



Fig. 12.

Witnesses

Jas. K. McCathran

N. A. Benchoff

Charles E. Warner Inventor

By his Attorneys,

C. A. Snow & Co.

No. 622,406. Patented Apr. 4, 1899.

C. E. WARNER.

WIRE FABRIC MACHINE.

(Application filed Sept. 24, 1898.)

(No Model.) 10 Sheets—Sheet 10.

Fig. 26.

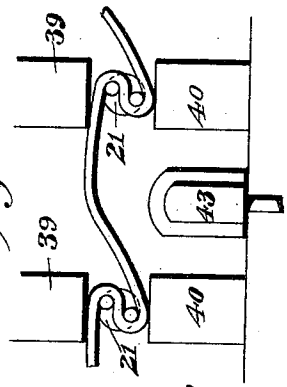



Fig. 25.

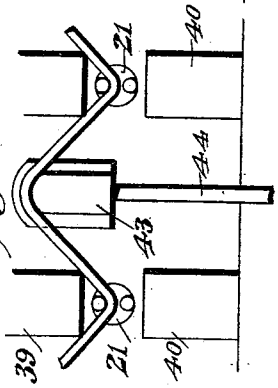



Fig. 24.

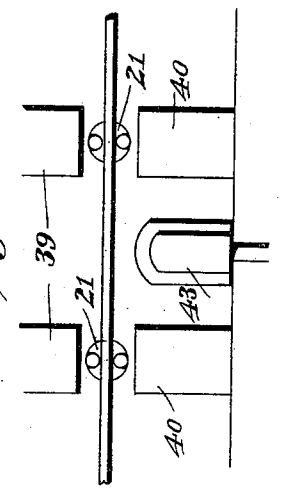



Fig. 29.

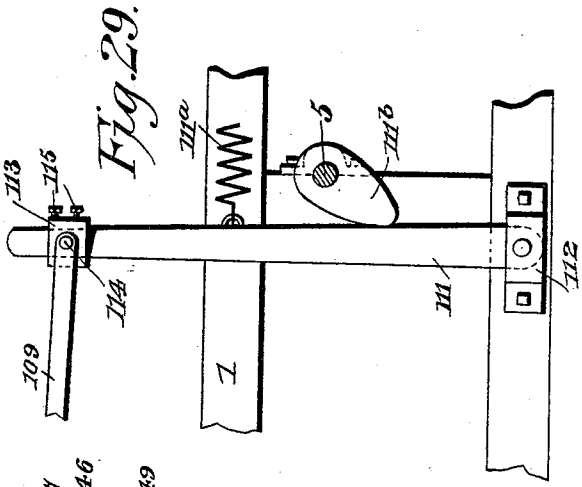



Fig. 28.

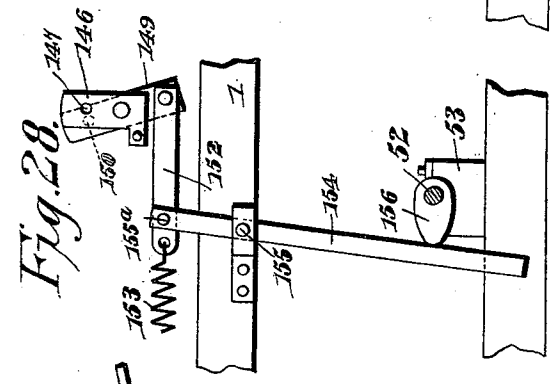



Fig. 27.

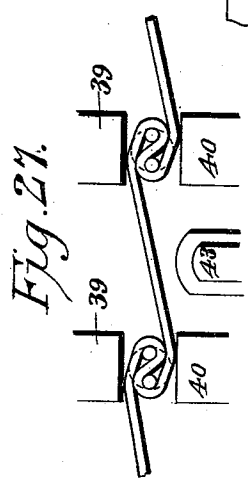
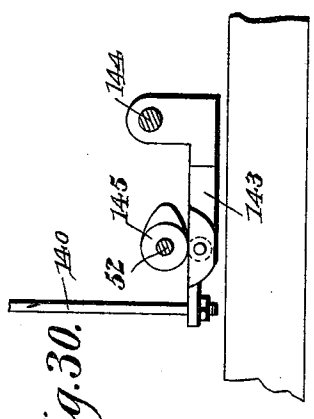



Fig. 30.




Witnesses

Jas. K. McCathran

H. C. Beachhold

Charles E. Warner Inventor

By Wis. Attorneys,

C. A. Snow & Co.

# UNITED STATES PATENT OFFICE.

CHARLES E. WARNER, OF WAVERLY, KANSAS, ASSIGNOR TO EDWARD F. SHELLABERGER, OF DE KALB, ILLINOIS.

## WIRE-FABRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 622,406, dated April 4, 1899.

Application filed September 24, 1898. Serial No. 691,807. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. WARNER, a citizen of the United States, residing at Waverly, in the county of Coffey and State of Kansas, have invented a new and useful Wire-Fabric Machine, of which the following is a specification.

My invention is a machine for making wire fabrics especially designed for use as wire fencing; and the object in view is to provide a machine by which the stay or cross filling wires may be introduced in proper relation to the longitudinal strands and at regular intervals from each other and the cross or filling wires are interlocked by substantial joints with the intermediate strands and are twisted securely at their ends around the selvage-strands, all of the operations being effected automatically, to the end that a strong and durable fence fabric of neat design may be manufactured expeditiously and economically.

The machine of my invention embodies the following instrumentalities—to wit, mechanism for introducing a regulated length of cross or filling wire between the longitudinal cables or strands; a looper mechanism by which the cross or filling wire is bent or interlocked at a number of places with such longitudinal strands, such looper mechanism embracing positively-actuated plungers, a series of rotatable twisters in the intervals between the plungers, and pairs of stationary coacting jaws in the vertical planes of the twisters and operating in unison therewith to bend or deflect the cross or filling wire around the intermediate longitudinal strands as the twisters are rotated on their longitudinal axes; a knife mechanism for the cross or filling wire, which remains stationary during the feeding of the cross-wire and the operation of the looper mechanism and which is actuated positively to cut off the proper length of the filling-wire before the fence fabric is drawn or passed through the machine; selvage-carriers and twisters for the ends of the cross filling-wire and which are advanced in a direction of the fence fabric at the proper interval and are engaged with the ends of the cross filling-wire to twist the latter around the selvage-wires in said carriers; a fabric feed mechanism embracing a step-by-step rotatable drum and feed plungers, which work in unison with the tubular selvage-carriers, the latter operating to twist the ends of the cross filling-wire around the selvage-wires; a clencher-press, situated adjacent to the looper mechanism and in the path of the cross filling-wire, to engage with the latter after it shall have been interlocked and twisted with the strands or cables, and such clencher-press being actuated positively to forcibly close and press the series of loops around the longitudinal strands or cables to make tight joints therewith; a tension device for the intermediate longitudinal strands arranged to operate in a manner to ease the strain on the strands or cables when the fabric is advanced and to exert pull or strain on such cables during the operation of the looper mechanism; a friction-clutch mechanism for actuating the winding-reel continuously and adapted to yield or slip as the bulk of the fabric increases on said reel, so as to rotate the latter with a variable speed in order to properly coil the fabric; an improved construction of the winding-reel adapted to conveniently discharge the fabric therefrom when said reel becomes filled, and various actuating devices for the several mechanisms to insure operation thereof in unison for the automatic and continuous production of the completed fabric; and the invention further consists in the novel combination of elements and in the construction and arrangement of parts, which will be hereinafter fully described and claimed.

To enable others to understand the invention, I have illustrated a preferred embodiment thereof in the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view of a wire-fabric machine constructed in accordance with my invention, the front end of such machine being in horizontal section on a plane above the winding-reel. Fig. 2 is an elevation looking at the right-hand side of the machine represented by Fig. 1. Fig. 3 is an elevation of the opposite or left-hand side of the machine. Fig. 4 is a vertical longitudinal sectional elevation, the plane of the section being indicated by the dotted line 4 4 of Fig. 1. Fig. 5

is a vertical transverse sectional elevation on a plane contiguous to the looper mechanism and the clencher-press mechanism, together with the intermittent feed mechanism for the cross filling-wire, the plane of section being indicated by the dotted line 5 5 of Fig. 2, looking in the direction indicated by the arrow. Fig. 6 is another vertical transverse section on a plane adjacent to the main driving-shaft to illustrate the several cams thereon and showing the means by which the tubular selvage-carriers are reciprocated and the tension device for the intermediate cables or strains is actuated, the plane of the section being indicated by the dotted line 6 6 of Fig. 2, looking in the direction indicated by the arrow. Fig. 7 is an enlarged detail sectional elevation on the plane indicated by the dotted line 7 7 of Fig. 1 through the stationary boxing and twisters of the looper mechanism and illustrating the clencher-press mechanism. Fig. 8 is an enlarged vertical transverse sectional view through the rotatable twisters of the looper mechanism, the plane of section being indicated by the dotted line 8 8 of Fig. 7. Fig. 9 is a similar transverse section on the plane indicated by the dotted line 9 9 of Fig. 7 and illustrating the stationary jaws in their relation to the twisters and portions of the plungers forming the looper mechanism, said view also illustrating the position of one of the cross filling-wires previous to the rotation of the twisters for interlocking said cross filling-wire with the cables or strands. Fig. 10 is a view similar to Fig. 9, but showing the plungers of the looper mechanism in their raised positions to deflect or bend the cross filling-wire in the intervals between the rotatable twisters and the jaws which coact therewith. Fig. 11 is another similar sectional view, but showing the plungers in their lowered positions, the twisters after they have been rotated to interlock the cross filling-wire with the cables or strands and with the jaws in engagement with the looped portions of the cross filling-wire, this view also illustrating the twisting of the end portions of said cross filling-wire with the selvage-strands. Fig. 12 is a detail end elevation showing the receiving end of the machine-frame with the winding-reel and its associated devices, together with the guide devices for the selvage and intermediate strands or cables. Fig. 13 is an enlarged fragmentary elevation of the clutch-controlled gear by which the cross-wire-feed mechanism is actuated intermittently from a driving-lever actuated by the main shaft. Fig. 14 is a vertical sectional elevation of the clutch-controlled gear shown by Fig. 13. Fig. 15 is an enlarged detail fragmentary section of one of the heads forming a part of the winding-reel to illustrate the detachable connection of the reel-bars to the reel-head. Fig. 16 is a diagrammatic detail elevation of the means by which the guide-plate for the cross filling-wire may be actuated automatically and be lifted out of the path of the cross-wire after the latter has been locked with the longitudinal strands or cables for the purpose of retracting the guide-plate previous to advancing or feeding the fabric through the machine. Fig. 17 is a detail perspective view of one of the lifting-levers, which is designed to be operatively connected to one of the plungers of the looper mechanism and to be actuated from a cam-shaft which controls the looper-plungers, the knife mechanism, and the movable head of the clencher-press. Fig. 18 is a detail perspective view of the swinging guide-plate for the cross filling-wire and which lies adjacent to the plungers and twisters of the looper mechanism. Fig. 19 is a detail perspective view of one of the tubular selvage-carriers and twisters for the end of a cross filling-wire and showing the feed-bar associated therewith by which the fence fabric may be in part advanced in the direction of the length of the machine. Fig. 20 is an enlarged detail sectional elevation through the reel-driving shaft and the spring-controlled friction-clutch therefor. Fig. 21 is a detail perspective view of one of the series of the rotatable twisters. Fig. 22 shows views in elevation illustrating the mutilated bevel-gears on the main driving-shaft and the longitudinal counter-shaft, respectively, to show the peculiar formation of the working faces of said gears by which the counter-shaft is driven intermittently. Fig. 23 is a fragmentary detail of the means for reciprocating the tubular selvage-carriers and twisters for the ends of the cross filling-wire. Figs. 24 to 27, inclusive, are enlarged diagrammatic views illustrating the several positions of a pair of the twisters and the plunger working in the interval between said pair of twisters and two pair of the jaws, such views illustrating the various steps in the formation of interlocking the cross filling-wire with two adjacent strands or cables. Fig. 28 is a fragmentary elevation of the knife mechanism by which the proper length of the cross filling-wire is cut off subsequent to the interlocking of such filling-wire with the longitudinal strands and previous to the advancement of the fabric to permit the tubular selvage-carriers to twist the ends of such cross filling-wire around the strands and to present the looped filling-wire and the strands in proper position to the bed and movable jaw of the clencher-press for the latter to tightly clench the cross looped filling-wire around the strands. Fig. 29 is a detail fragmentary elevation of the driving-lever by which the clutch-controlled gear for the cross-wire-feed mechanism is actuated from a cam on the main driving-shaft. Fig. 30 is a detail fragmentary view of one of the levers, cams, and connecting-rods for the movable head of the clencher-press. Fig. 31 is a detail perspective view of one of the fixed guide-fingers for the cross filling-wire, which finger lies adjacent to one of the tubular selvage-carriers and the looper mechanism. Fig. 32 is a detail fragmentary section of a part of

the stationary boxing and housing and the swinging guide-plate, which is hinged to said boxing or housing, the dotted lines representing the raised position of said guide-plate. Fig. 33 is a detail elevation, on a reduced scale, of the rocking tension device for the intermediate strands or cables and illustrating the means by which this tension device is operated automatically. Fig. 34 is an enlarged detail view of one of the lags which enters into the construction of the take-up drum and showing the position of the strand and one crossed filling-wire to the lugs on said drum-lag.

Like numerals of reference denote like and corresponding parts in each of the several figures of the drawings.

1 designates a suitable frame which may be constructed substantially as represented by the figures of the drawings to sustain the several operating mechanisms of the machine; but as the details of this main frame may be varied by the skilled constructor in many respects I do not deem it necessary to specifically describe each part of this main frame except as it relates to the operating mechanisms, as will hereinafter appear. The power necessary for the operation of the machine is communicated to a suitable power-shaft 2, which is arranged transversely across the machine near its front end and is journaled in proper bearings on the frame 1, and, as represented more clearly by Figs. 1 and 2 of the drawings, this shaft 2 is equipped with the power-pulley 3, around which travels the belt 4, adapted to be driven from an overhead line of shafting. (Not shown.)

5 designates the main driving-shaft, which is arranged transversely across the machine, contiguous to the power-shaft 2, and is journaled in proper bearings on the frame, and this driving-shaft carries a plurality of cams, a pair of sprocket-gears, and a driving connection for the take-up drum, whereby all of the mechanisms of the machine may be actuated from the main shaft 5. This main driving-shaft is operatively connected with the power-shaft 2 through the intermeshing gears 6 $6^a$, secured, respectively, to the power-shaft and the main shaft, (see Figs. 1, 2, and 6,) and this main shaft in turn drives a longitudinal counter-shaft 7, which is arranged between the sides of the frame 1, near the left-hand side thereof, (see Figs. 1, 5, and 6,) said counter-shaft being journaled in bearings 8, which are secured to certain cross-sills of the frame 1. The main driving-shaft rotates continuously in one direction; but the counter-shaft is driven in one direction intermittently through mutilated bevel-gears, which are indicated more clearly by Figs. 4, 6, and 22. The driving bevel-pinion 9 is secured in a suitable way on the main shaft 5, contiguous to one end of the counter-shaft, and this pinion 9 is provided with a blank face 10 between the series of teeth 11. The other mutilated bevel-gear 12 is secured to the end of the shaft adjacent to the driving bevel-pinion 9 on the main shaft, and said bevel-gear 12 has two blank spaces 13, which are between the two series of teeth 14 on the working face of said bevel-gear 12, the blank spaces 13 between the series of teeth lying at diametrically opposite sides of the bevel-gear. In the rotation of the main driving-shaft the driving bevel-gear 9 engages with one series of teeth 14 on the bevel-gear 12 of the counter-shaft 7 to partially rotate the counter-shaft on each complete revolution of the main driving-shaft, and on the next complete revolution of the driving-shaft the teeth 11 of the driving bevel-gear 9 mesh with the other series of teeth 14 on the driven bevel-gear 12, whereby the counter-shaft is actuated intermittently and progressively to be turned one complete revolution on its axis as the main driving-shaft makes two revolutions. In the intervals between the semirevolution of the counter-shaft the blank faces 10 and 13 of the two gears 9 12 are opposed to each other, and thus the counter-shaft remains at rest and in a locked position while the main driving-shaft completes its rotation, whereby the counter-shaft is adapted to actuate the reciprocating rack-bar for the twisters of the looper mechanism in unison with the several working elements of the machine.

To support the rotatable twisters and the stationary jaws which coact therewith and which twisters and jaws form elements of the looper mechanism, I employ a stationary boxing or housing 15, which is arranged transversely across the machine at a suitable place between the take-up drum and the winding-reel. This boxing or housing is represented by Figs. 1 to 5 and 7 to 11, inclusive, and, as shown more clearly by Fig. 7, said housing comprises a front plate 16, a back plate 17, and a bed-plate 18, all of which are secured firmly in place in a suitable way on the main frame. The front and back plates of the housing are spaced in parallel relation to accommodate between themselves the series of rotary twisters and the rack-bar by which the twisters have axial movement imparted thereto, and said plates 16 17 are provided with series of openings 19, which are in alinement with each other to constitute the journal-openings 19 for the series of twisters 20. (See Figs. 1, 4, 7, 8, and 21.) Each twister consists of a shaft 21, a gear 22, having the journals 23, and the longitudinal grooves 24 $24^a$ in diametrically opposite faces of the twister-shaft, and each twister has its journals 23 fitted loosely in the openings or bearings 19 of the two housing-plates, so as to support said twister in the boxing or housing without permitting its grooved shaft 21 to bear in said openings 19, (see Fig. 7,) whereby the wires forming each strand or cable may slide or travel through the grooved shaft of the twister without coming in contact with the boundary-walls of the journal-openings in which the twister is mounted. The series

of twisters are arranged in the same horizontal plane within the boxing or housing for the purpose of having the toothed edge 26 of a driving rack-bar 25 mesh or engage therewith for the purpose of simultaneously rotating all the twisters of the series, and this driving rack-bar is arranged to travel in openings 27 at the extremities of the boxing or housing (see Fig. 8) and also to rest upon the extensions or brackets 28, which support the boxing or housing in a fixed position on the frame and also maintain the driving rack-bar in parallel relation to the series of twisters to attain the proper intermeshing of the gears and rack-bars. The driving rack-bar 25 is reciprocated at suitable intervals from the longitudinal counter-shaft 7 by the operative connections illustrated by Fig. 5. A driving-lever 29 is disposed in a vertical position at the right-hand side of the machine, and it is fulcrumed at its foot to a fulcrum-block 30, fixed to one of the base-sills of the main frame. The end of the counter-shaft 7 which is remote from the main driving-shaft 5 terminates substantially in the vertical plane of the rack-bar-driving lever 29, and to this end of the shaft 7 is fixed a crank-arm 32, adapted to rotate with the shaft. The upper extremity of the driving-lever 29 is connected to one end of the rack-bar 25 by a link 33, having its ends pivoted, respectively, to the rack-bar and the driving-lever, and the crank-arm 32 of the counter-shaft 7 is connected with this driving-lever by a pitman 34. One end of the pitman 34 is pivoted, as at 35, to the crank-arm 32, and the other end of said pitman is pivoted, as at 37, to a sleeve 36, which is slidably fitted on the driving-lever 29 and is adapted to be made fast thereon by the binding-screws 38, which are carried by the sleeve and adapted to impinge against the lever 29. The throw or movement of this driving-lever 29 may be varied by shifting the adjusting-sleeve 36 toward or from the fulcrum of said lever, and thus the length of the stroke of the reciprocating rack-bar 25 may be varied to rotate the twisters 20 more or less, while the rocking of the longitudinal counter-shaft remains constant; but the binding-screws 38 are adapted to hold the adjustable sleeve 36 firmly in proper position on the driving-lever 29.

The ends of the twisters 20 open through the face of the back plate 17, forming a part of the transverse boxing or housing 15, as shown by Figs. 7 to 11, inclusive, and two series of jaws 39 40 are disposed adjacent to these exposed rear ends of the twisters, as shown more clearly by Fig. 9. The upper series of jaws 39 are secured in a suitable way to the housing-plate 17 to lie above the exposed ends of the twister-shafts 21, while the other series of jaws 40 are also secured to the housing-plate 17, and they assume positions below the exposed ends of the twister-shafts. The jaws of each series are fixed to the housing-plate 17 in the same horizontal plane, and the two series of jaws are arranged in close relation to the twister-shafts 21, so as to leave narrow spaces between the twister-shaft and the opposing faces of the jaws, in which spaces the loops of the cross filling-wire are adapted to be drawn by the partial rotation of the twisters so as to bring the looped portions of the cross filling-wire in engagement with said jaws, whereby the jaws serve to deflect the looped filling-wire into contact with the wires of the cables or strands and insure the proper bending of the cross filling-wire around the strand-wires, as represented by Fig. 11. The jaws 39 40 are disposed in pairs on opposite sides of the horizontal plane of the twister-shaft, and the jaws of each pair lie in the same vertical plane with the twister-shaft, which is disposed between their working faces.

It will be understood that the several pairs of stationary jaws and the rotatable twisters constitute in part the looper mechanism, and the remaining elements of this looper mechanism of my machine are formed by a series of reciprocating plungers 41, which are arranged in the intervals between the pairs of jaws and the twisters, so as to reciprocate across the horizontal space between the working faces of the jaws and the horizontal plane of the rotatable twister-shafts, whereby the plungers, after the filling-wire shall have been introduced between the wires forming the cables or strands, are adapted to act on the filling-wire so as to bend the latter at a number of points between the series of twisters, as shown by Fig. 10, preliminary to the rotation of the twisters for the formation of the loops which are designed to be interlocked with the wires forming the intermediate strands or cables. These plungers have stems 44, which are slidably fitted in and guided by openings 42, formed in the bed-plate 18 of the housing or boxing, and each plunger is formed with an enlarged head 43, which may be grooved to insure the proper engagement of the plunger-head with the filling-wire. The plungers are normally depressed below the horizontal plane of the twister-shafts and the working faces of the jaws by coiled springs 45, which are fitted loosely on the plunger-stems to have their upper ends seated against the housing bed-plate 18, while the lower ends of said springs rest upon collars $45^a$, which are secured to the plunger-stems at points intermediate of their length. (See Fig. 5.) The plungers of this looper mechanism are positively raised at the proper interval in the operation of the machine by a series of levers 47, which are arranged in the same horizontal plane immediately above the base of the main frame 1. These levers are entirely independent one from the other, and at their rear ends they are hung loosely on a common pivot-shaft 48, which is arranged transversely across the machine near the take-up drum, and this shaft is mounted in suitable pillow-blocks 49, secured to the base of the machine-frame. One of these levers 47 is represented by Fig. 17 of

the drawings as having a slotted and perforated heel to properly fit on the pivotal shaft 48. The lever is also provided with a forked free end to receive the lower extremity of one of the plunger-stems, and at a point intermediate of its length this lever is slotted and provided with a cam-shoe $47^a$ to receive a cam on the cam-shaft, said lever being held in proper relation to its cam by means of the guide-lugs $47^b$, all as clearly shown by Fig. 17. The lower ends of the series of plunger-stems are provided with collars 50, which rest upon the forked free ends of the lifting-levers 47, and the lower extremities of said plunger-stems are loosely fitted in a guide-bar 51, which is suitably secured to the base of the main frame. The plungers are thus guided by having their stems slidably fitted in the bed-plate 18 and the guide-bar 51, and these plungers are adapted to be positively lifted by the action of the lever 47, against which act a series of cams on a cam-shaft 52. This cam-shaft is arranged transversely across the machine below the series of levers 47, and it is journaled in bearings 53, which are secured to the base of the main frame 1. The shaft 52 has a series of lifting-cams 54, which are disposed in corresponding positions in relation to each other and are spaced at proper intervals to ride against the cam-shoes of the levers 47, said cams arranged to play in the spaces between the guide-lugs $47^b$ of the lifting-levers, so that the levers cannot assume positions out of line with the cams. This cam-shaft 52 has one end thereof extended or projected beyond the bearing 53 at the left-hand side of the machine, and to this extended end of said shaft is secured a sprocket-wheel 55, which is driven by an endless sprocket-chain 56 from a sprocket-wheel 57 on the end of the main driving-shaft 5, whereby the cam-shaft is rotated continuously and its cams actuate the lifting-levers at proper intervals to raise the plungers 41.

The series of rotatable twisters are designed to carry the intermediate strands or cables which are to be joined by interlocking looped connections with the cross filling-wires; but the longitudinal selvage-strands are fed or carried through the machine without permitting them to come in engagement with the intermediate strands or cables by a pair of tubular selvage-carriers 58, which isolate the selvage strands or cables from the intermediate cables. The tubular selvage-carriers are in the form of hollow shafts arranged in substantially horizontal positions on opposite sides of the series of twisters and near the side beams of the main frame, and these tubular selvage-carriers are peculiarly constructed and operated for the purpose of twisting the ends of the cross filling-wire around the selvage-wires, whereby the selvage-carriers serve in a dual capacity to maintain the selvage-wires at the proper distance apart and to twist the ends of the filling-wires around the selvage-wires. The longitudinally-disposed selvage-carrier shafts 58 are fitted loosely in openings 59, which are formed in the transverse box or housing 15 at points beyond the journal-openings for the series of twister-shafts, and these openings 59 for the tubular selvage-carriers and cross-wire twisters lie in the horizontal plane of the journal-openings 19, so that all the strands or cables of the fence fabric may lie in the same horizontal plane as said strands are carried through the machine. The rear ends of the tubular selvage-carriers and cross-wire twisters 58 are supported in the openings 59 of the boxing or housing, so that said carriers and twisters 58 may rotate freely on their longitudinal axes, and also reciprocate endwise in the direction of their length within said opening, and the front ends of these tubular carriers and twisters 58 are supported by rocking arms 60. The means for supporting the front ends of the tubular carriers and twisters 58 and for reciprocating the same are shown by Figs. 6 and 23, by reference to which it will be seen that the levers 60 are rigidly secured to a transverse rocking shaft 61, which is supported in suitable bearings 62 on the sides of the main frame. The upper ends of the long arms 78 of said rocking levers 60 are pivotally attached at 63 to sleeves 64, which loosely embrace the hollow shafts forming the carriers and twisters 58, and said hollow shafts are thus mounted in the sleeves 64 to be rotated freely therein by the means presently described. With these reciprocating hollow shafts 58, which form the selvage-carriers and filling-wire twisters, are associated the feed-bars 65, that assist the take-up drum in advancing or feeding the fabric through the machine after the filling-wire shall have been interlocked with the intermediate cables or strands. These feed-bars 65 lie alongside of the hollow shafts 58, and they play idly through openings 66, which are formed in the transverse boxing or housing 15 in positions between the end twisters of the series and the hollow shaft 58. The free ends of the feed-bars where they protrude in rear of the boxing or housing have the notches 67, as shown more clearly by Fig. 19, to enable said feed-bars to properly engage with the cross-wire after it is interlocked with the longitudinal strands and on the rearward movement of the carriers and twisters 58. These feed-bars are loosely connected with the carriers and twisters 58 to travel therewith; but such connection does not permit the feed-bars to rotate with the twisters and carriers 58, which are driven continuously in one direction by suitable driving devices. As shown more clearly by Fig. 19, the feed-bars are provided at their front ends with the loose sleeves 68, which are fitted loosely on the tubular carriers and twisters 58, so as to permit the latter to rotate freely within the sleeves, and the travel of the feed-bar, with the carriers and twisters, is effected by means of the collars 69, secured on the carriers and twisters

at opposite ends of the sleeves 68. The means for rotating the tubular shafts 58 consist of the pulleys 70, which are keyed at 71 to said shafts 58 in order to permit the pulleys to travel on the shafts when the latter are impelled by cams on the main driving-shaft 5, and around these pulleys 70 pass the driving-belts 72, which are driven from pulleys on an overhead line of shafting. (Not shown.) These belts and pulleys serve to rotate the hollow shafts 58 continuously in one direction; but said shafts 58 are reciprocated at intervals by cam connections with the shaft 5. The cams 73 are rigidly secured on the shaft 5 in positions adjacent to the short arms 76 of the rocking levers 60, and these short arms are preferably provided with friction-rollers 77, which are arranged to ride upon the cams, so as to vibrate or rock the levers 60 in a manner to force the sleeves 64 against the collars 74, which are fast with the hollow shafts 58. The endwise movement of the hollow shaft 58 in both directions is effected positively by the rocking levers 60, which are driven by the cams 73, and the sleeves 64 are arranged to travel or play between the stop-collars 74, secured to said tubular shafts 58. These hollow shafts 58 are slidably fitted in bearings of standards 75, secured to the transverse beam 85 of the main frame, whereby the standard 75, the openings 59 in the boxing or housing, and the rocking arms or levers 60 serve to support the selvage-carrier and filler-wire-twisting shafts properly in the machine. The protruding rear end of this carrier and twister shaft 58 is provided with inclined notches or faces 79, which terminate in shoulders 80, arranged at diametrically opposite sides of the shaft, and after the filling-wire has been twisted with the strands of the twisters and said filling-wire has been severed by the action of the knife mechanism the shoulders 80 of these carrier and twister shafts 58 are caused to engage with the ends of said filling-wire, so that the shafts will twist the ends of the filling-wire around the selvage-wires, as shown by Fig. 11.

It will be understood that the tubular carrier and twister shafts 58 are maintained in their retracted positions during the operation of looping the cross filling-wire around the intermediate strands, so that the notched ends of the shaft 58 will be free from engagement with the cross filling-wire; but when the said shafts 58 are reciprocated by the cams and two-armed rocking levers the feed-bars 65 and the shafts are advanced to engage with the cross filling-wire, whereby the notched ends of the feed-bars move the filling-wire from a position between the jaws 39 40, and the shouldered ends of the rotary shafts 58 engage with the ends of the filling-wire to twist the same around the selvage-wire.

I will now proceed to describe the mechanism by which the length of wire to form the cross filling-wire may be introduced between the wires forming the intermediate cables or strands, and in this connection I desire to call attention to the fact that the pairs of wires forming such intermediate cables are held in spaced parallel positions by the pairs of grooves in the twister-shafts, so that the cross or filling wire may readily be introduced and passed between the pairs of wires of the intermediate strands when the twisters and plungers are in the positions indicated by the full view, Fig. 9, and the diagrammatic view, Fig. 24. This cross-wire feed mechanism has a bracket or frame 81, which is erected or supported at the left-hand side of the machine-frame, as shown by Fig. 5, and on this bracket is rigidly secured a vertically-slotted or open standard 82, which is adapted to carry bearing-blocks 83 84. (Indicated by dotted lines in said Fig. 5.) The transverse beam 85 on the machine-frame in advance of the boxing or housing is also provided with a pair of bearings that lie in substantially the horizontal plane of the bearings 83 84 in the standard 82, and in these pairs of bearings are journaled horizontal shafts 86 87, which are disposed longitudinally of the machine, at the left-hand side thereof. The shaft 86 is designed to be driven positively by clutch-controlled connections with a cam on the main driving-shaft 5, and this shaft 86 is geared, through the intermeshing gears $86^a$, with the shaft 87, whereby the shaft 86 serves to drive the shaft 87, and the two shafts 86 87 are rotated in opposite directions simultaneously at uniform speed. The ends of the shafts adjacent to the boxing or housing are provided with the feed-rolls 88 89, which are disposed one above the other and closely together, so as to grip and feed the wire which passes between their working faces, and the bearing for the upper shaft 87 is arranged to have a limited sliding movement in the standard 82. This bearing, the shaft, and the feed-roll 89 are normally pressed toward the feed-roll 88 of the shaft 86 by means of a lever 90, carrying the weight 91, and this lever is fulcrumed at 92 on the standard 82 and is connected with an adjustable post 93, whereby the weighted lever normally depresses the feed-roll 87 to insure the proper frictional gripping of the filling-wire by the positively-driven rolls of the feed mechanism. The wire is led from a reel or bobbin through a train of idler guide-rolls 94, which are supported in the horizontal plane of the feed-rolls 88 89 by a suitable frame 95. Tension devices 96 are disposed between the feed-rolls, the train of idler-rolls, and the knife mechanism, and the plates 96 of such tension devices are supported by standards 97, one of which is secured to the bracket 81 and the other to the bed-plate 18 of the boxing or housing. (See Fig. 5.) The adjustable clamping-plates 98 of the filling-wire tension devices are held upon the plates 96 by the bolts 99. The wire from the reel passes through the train of guide-rolls 94, thence through one tension device, thence through the feed-rolls, and finally through

the other tension device to the knife mechanism. The feed-rolls of the mechanism for the filling-wire are rotated positively at intervals, and when these rolls are at rest the feed-wire is not advanced to the twisters of the looper mechanism. The means for actuating the rotating shaft 86 of the filling-wire feed mechanism are shown by Figs. 1, 3, 13, and 14 of the drawings. On the shaft 86 is rigidly secured a bevel gear-pinion 100, which meshes with the teeth of a clutch-controlled bevel-gear 101, which is rigidly mounted on a horizontal shaft 102, arranged transversely across the machine in an elevated position between the main driving-shaft 5 and the boxing or housing 15, as shown more clearly by Figs. 1, 3, and 4 of the drawings. The clutch-controlled gear 101 is provided with an annular flange 103, (see Figs. 13 and 14,) and loosely fitted to the shaft 102, adjacent to the flanged face of this clutch-gear 101, is a clutch plate or hub 104, which is loosely mounted on the shaft 102. This clutch plate or hub carries a series of clutch-arms 105, which are disposed on that face of the plate or hub which is opposed to the flange of the gear 101, so that the clutch-arms lie in the vertical plane of the annular flange 103 and in position for their beveled outer extremities to engage with said flange. These clutch-arms are normally pressed toward the flange of the gear 101 by means of the coiled springs 106, so that as the plate or hub 104 is vibrated in one direction the clutch-arms 105 will frictionally engage with the flange of the gear 101 to turn the latter positively in one direction; but the clutch-arms 105 are pivotally attached to the plate or hub 104 to insure the disengagement of said arms from the flange of the gear 101 when the plate or hub 104 is rocked in the reverse direction, whereby the clutch mechanism operates to rotate the shaft 102 with an intermittent or step-by-step feed, and hence the shafts 86 87 may be correspondingly actuated to allow the feed-rolls to remain at rest during the period of the twisting of the filling-wire around the longitudinal strands. This loosely-mounted plate or hub 104 on the shaft 102 has an operating-arm 107, that extends radially therefrom and beyond the flanged edge of the gear 101, and this arm is provided with a series of transverse apertures 108, to either of which may be connected one end of a pitman 109 by means of a shiftable bolt 110. The pitman 109 is actuated positively by a driving-lever 111, which is disposed in a vertical position at the left-hand side of the machine and adjacent to the main driving-shaft 5. This driving-lever 111 is fulcrumed at its lower end to a fulcrum-block 112, fixed to one of the base-sills of the machine-frame, and on the upper end of said lever is fitted an adjustable collar 113, to which is pivoted, as at 114, the front end of the pitman 109, that actuates the clutch-plate or hub 104. This collar 113 is shiftable on the driving-lever 111 toward or from the fulcrum thereof to vary the throw or movement of the pitman 109, and consequently impart differential vibration or movement to the clutch-plate or hub 104, according to the adjustment of the collar 113, and binding-screws 115 are mounted in this collar 113 to hold the same firmly in its adjusted position on the driving-lever 111. The driving-lever is normally held by a coiled spring $111^a$ in contact with a cam $111^b$, which is secured to the end of the main driving-shaft 5, as indicated by dotted lines in Fig. 4 and by full lines by Fig. 29, and this cam is arranged to positively impel the lever 111 in one direction, while the spring $111^a$ retracts the lever, so that the driving-lever is actuated to properly vibrate the clutch-controlled gear which propels the shafts of the feed-rolls.

To properly direct the filling-wire from the feed mechanism to the pairs of wires of the intermediate strands or cables and to prevent the filling-wire when in position across the machine from lifting above a horizontal plane of the opening between the spaced jaws 39 40, the guide-fingers 116 are provided on the bed-plate 18 of the transverse housing. These guide-fingers are provided with the bases 117, as shown by Figs. 9, 10, 11, and 31, adapted to be secured rigidly to the bed-plate 18, and the fingers 116 are curved upward and forward, so as to fit over the filling-wire and prevent it from lifting above the desired horizontal position.

To properly direct the filling-wire when it is introduced transversely across the face of the housing to assume a position between the pairs of intermediate strands or cables from the rotary twister-shafts, I provide a guide-plate 118, which is adapted to be presented above the exposed ends of the twister-shafts and to lie in the plane of the fence fabric, and with this guide-plate are combined automatic adjusting devices for elevating said guide-plate and retracting the same out of the path of the fence fabric previous to the advancement or feed of such fabric through the machine, whereby the guide-plate is prevented from interfering with the advancing feed movement of the fabric. This guide-plate has a broad foot-flange 119, arranged to be presented edgewise in relation to the back plate 17 of the boxing or housing, and in the edge of this foot-flange is formed a longitudinal channel 120, which extends continuously of the guide-plate and is arranged to be coincident with a shallow channel 121 in the rear exposed face of the back plate 17 of said boxing 15. This guide-plate is hung or pivotally mounted on the boxing or housing to be lowered for its channel 120 to coincide with the channel 121, so that the filling-wire may be guided or directed from the feed mechanism into proper position between the pairs of wires forming the cables or strands which are led through the twister-shafts, and when the guide-plate is lowered a complete groove or passage-way is provided between the chan-

nels 120 and 121 for the passage of the filling-wire, such channel lying in a horizontal plane between the horizontal planes of the grooves in the twister-shafts, reference being had more particularly to Figs. 7 and 32. As shown by Fig. 18, the broad foot-flange of the guide-plate is notched or slotted to enable said flange to snugly fit upon the strands or cables when the plate is lowered, and thus the foot-flange of the guide-plate is adapted to lie in a horizontal of the fence fabric when lowered. This guide-plate is provided with the supporting-arms 122, which are arched to extend over and above the back housing-plate 17, and these arms are pivotally attached at 123 to short posts 124, which rise a suitable height from the back housing-plate, whereby the guide-plate is supported by hinged connections on the transverse housing to be elevated a sufficient distance for its channeled and slotted foot to lie out of the path of the cables or strands and the filling-wire of the fence fabric. The guide-plate is provided at its ends with the trunnions 125, to which are connected the rear ends of the pitmen 126. (See Fig. 16.) These pitmen extend longitudinally of the machine, near the sides thereof, and at their rear ends they pass through eyes or bearings 129 of the rocking arms 127, the latter being rigidly attached to an idler rocking shaft 128, which is suitably supported in bearings on the machine-frame, these parts being more clearly represented by Figs. 6 and 16. The longitudinal pitmen or rods 126 are provided with stop-collars 130, which are adapted to impinge against the eyes 129 of the rocking arms 127, and on the rear ends of these pitmen or rods are fitted the coiled springs 131, which have their front ends seated against the arms 127 and their rear ends bearing against the nuts 132, which are screwed on the threaded rear extremities of the pitmen 126, whereby the tension of the springs may be regulated. The rocking shaft 128, which carries the arms 127 to actuate the swinging guide-plate, are provided with downwardly-curved levers 133, which are fast to said shaft 128, and on the free ends of these levers 133 are loosely mounted the friction-rolls 134, which ride upon cams 135, fast with the main driving-shaft 5. Springs 136 are attached to the rocking arms 127 and to suitable projections on the frame in rear of said arms 127, and other springs 137 are attached to the levers 133 and to suitable places on the machine-frame. The springs 137 are attached to the levers below the rock-shaft 128 and on the opposite side of the levers and arms from the springs 136, and these springs are arranged to control the rock-shaft, the levers, and the arms to pull the rods or pitmen 126 in a rearward direction and normally tend to elevate the hinged guide-plate 118 to its raised position above and out of the path of the cross-wire; but this tendency of the springs is counteracted by the cams 135, which ride against the levers 133 to hold the rods 126 in a position to lower the plate 118. This plate is held in its lowered position by the action of the cam 135 on the operative connections shown by Fig. 16 during the interval of the feed of the filling-wire across the twisters, and said plate remains in its lowered position until the filling-wire is properly positioned between the pairs of strands or cables contained in the twister-shafts. Previous to the rotation of the twister-shafts or the advancement of the fabric by the feed mechanism provided therefor the high parts of the cams 135 clear the friction-rollers 134 and permit the springs 136 137 to act through the arms 127 against the collars 130 and move the rods or pitmen 126 in a rearward direction, thereby lifting the hinged plate 118 out of the path of the strands and filling-wire.

I will now proceed to describe the mechanism by which the looped sections of the filling-wire are forcibly and tightly pressed around the strands to secure the firm interlocking of the filling-wire with the intermediate strands. This clenching of the looped filling-wire with the strands is effected by a press mechanism which is situated in rear of the looper mechanism and in the path of travel of the fabric, and this clencher-press mechanism is operated automatically to present its working parts into position for action on the looped filling-wire after it has been twisted with the intermediate strands and the fabric has been moved away from the looper mechanism a distance equivalent to the spacing of the filling-wires from each other. This clencher mechanism comprises a stationary press-bed 138, which is arranged transversely across the machine-frame in rear of and contiguous to the bed-plate 18 of the transverse housing, and the press-bed 138 is suitably fixed to the main frame to have its upper surface lie in a plane slightly below the path of the fabric when it is advanced through the machine, whereby the fabric and the filling-wires thereof travel over the press-bed. (See Fig. 7.) The movable head or jaw 139 of the clencher-press is arranged in the vertical plane of the press-bed 138 and normally sustained above the horizontal path of the wire fabric, and this head or jaw is supported and actuated by devices which forcibly press the jaw or head upon the looped and twisted portions of the filling-wire, whereby the press-bed and the jaw or head coact to tightly clench the loops and twisted portions of the looped and twisted filling-wire around the intermediate and selvage strands. The movable jaw or head is supported by vertical rods 140, which are slidably fitted in suitable guides $140^a$ of the main frame, and these rods guide the coiled lifting-springs 141, which are interposed between the movable head or jaw 139 and the guides of the rods 140, whereby the springs act against the jaw or head 139 to normally sustain the latter in a raised position free from the path of the fabric. The upper extremities of the rods 140 are threaded for

the reception of adjusting-nuts 142, which may be rotated to regulate the tension of the springs and the position of the jaw or head 139 in relation to the press-bed 138. The lower ends of the head carrying and actuating rods 140 are connected with the free ends of the depressing-levers 143, (see Figs. 5 and 30,) and these depressing-levers lie in nearly the horizontal plane of the lifting-levers 47, which serve to elevate the plungers of the looper mechanism. The depressing-levers 143 are pivotally hung, as at 144, to the framing or pillow-blocks thereon, and these levers lie below the cam-shaft 52, near the ends thereof, as shown by Fig. 5. This shaft 52 is provided with a pair of cams 145, which are disposed in reversed or opposite positions to the cams 54 on said shaft 52, which actuate the levers that control the looper-plungers. The cams 145 lie over the depressing-levers 143, and they act on the latter at different periods of time from the action of the cams 54 on the levers of the looper-plungers, and thus the head or jaw of the clencher-press is depressed upon the filling-wire after the looper mechanism has its plungers raised to deflect the filling-wire for the twisters to loop said wire around the wires of the intermediate strands.

I will now proceed to describe the automatic knife mechanism that severs the length of filling-wire after it has been introduced between the wires of the cables which form the intermediate strands, and this knife mechanism remains at rest during the feeding of the filling-wire to its position in the looper mechanism and while the latter mechanism is in action; but before the fabric is advanced to draw on the strands or cables and to move the filling-wire from the looper mechanism to the clencher-press this knife mechanism is actuated by its connections with the cam-shaft 52 to cut off the proper length from the wire supplied by the feed mechanism, thus leaving both ends of the length of filling-wire free for the proper action of the hollow carrier and twister-shafts 58, said shafts serving to twist the ends of the length of filling-wire around the selvage-wires, as heretofore described. The knife mechanism is represented in detail by Fig. 28, and it consists principally of a fixed jaw 146 and a movable jaw 149. The jaw 146 is fixed to a part of the frame between the filling-wire feed mechanism and the transverse boxing or housing 15, and to properly direct the filling-wire from the feed mechanism to this jaw 146 of the knife mechanism one of the guide and tension devices 96 98 is arranged in the position shown by Fig. 5 to guide the filling-wire from the rolls 88 89 directly to the jaw 146. This jaw is provided with a transverse wire-opening 147, and the movable jaw 149 is provided with a similar wire-opening 150, the opening 150 being preferably beveled or tapered, as shown by dotted lines in Fig. 5, so as to make the openings of the two jaws properly coact in the severance of the length of filling-wire in the machine from that length of the wire which leads from the reel or bobbin to the feed mechanism. The movable jaw is arranged in contact with one side of the fixed jaw 146 and between the latter and a fixed guide-block 148, which is supported on one end of the boxing or housing 15. The movable jaw is longer than the fixed jaw 146 to have its heel extend below the lower edge of the fixed jaw, and said movable jaw is pivotally supported at 151, preferably on the fixed jaw, as shown by Fig. 28. To the lower end or heel of the pivoted swinging jaw is pivotally connected one end of a pitman 152, lying in a horizontal position above a part of the main frame, and to the rear end of this pitman is connected a retracting-spring 153, which is fastened in a suitable way to the main frame, so as to strain the pitman and maintain the movable jaw 149 normally in a position where its wire-opening 150 is coincident with the wire-opening 147 in the fixed jaw 146, thus maintaining the jaws of the knife mechanism in positions for the wire to pass freely therethrough. The movable jaw is actuated only at intervals for cutting the length of wire from the section contained in the feed mechanism, and this movement of the jaw 149 is effected positively by operative connections with a cam 156 on the cam-shaft 52. (See full lines in Fig. 28 and dotted lines in Fig. 3.) This cam acts on a vertically-disposed lever 154, which is fulcrumed at a point intermediate of its length at 155 on the left-hand side of the main frame, and the upper end of the cam-lever is pivoted, as at $155^a$, to the pitman 152. (See Fig. 28.)

The wires that form the intermediate cables or strands are fed in pairs from suitable reels to the twisters of the looper mechanism, and such wires should be arranged to have the members of the pairs parallel to each other and not twisted, to the end that the pairs of wires may be properly conducted through the grooved shafts of said twisters. The wires that form the selvage cables or strands are guided independently of the pairs of wires constituting the intermediate cables or strands, and the selvage-strands may be twisted and barbed before they are fed to the tubular carrier and twister-shafts 58. The devices for directing the several wires from the reels are supported on an upright frame 157, erected at the front end of the machine, as shown by Figs. 2, 3, and 4. At its sides this frame supports the plates 159, which carry the groups of guide-rollers 160, around which are conducted the twisted or barbed selvage-wires, and these selvage-wires pass under guide-rollers 162, which are loosely journaled on the arms 161, fixed to the frame 1, at the sides thereof, to sustain the guide-rollers 162 in the horizontal plane of the hollow carrier and twister-shafts 58, whereby the selvage-wires are properly directed to the shafts 58. Between the supporting-plates for the groups of selvage-wire guide-rollers is

fixed a perforated guide-bar 163, that is arranged in a horizontal position and has its openings properly spaced apart to accommodate the pairs of wires which are drawn from the reels to constitute the intermediate strands or cables, and between this fixed guide-bar and the twisters is arranged the rocking tension device 164, which is arranged in substantially the horizontal plane of said twisters and is disposed below the plane of the guide-bar 163 and contiguous to the latter. This tension device is in the form of a boxing having perforated flanges 165, the openings in which are arranged to receive and space apart the wires of the intermediate strands. This boxing carries the guide-rollers 166 between the perforated flanges, and the wires are led through the openings in the flanges and around the tension-rollers, as shown by Figs. 1 and 4. The boxing of the tension device is fixed rigidly to a pair of rocking arms 167, which are mounted on a pivotal shaft 168, suitably journaled on the main frame, and this shaft has an offstanding lever-arm 169, arranged to ride upon a cam 170 on the main driving-shaft 5. Normally the tension device assumes a canted or tilted position in order that the perforated flanges and the rollers of the boxing will bind or impinge against the wires and exert the necessary tension on the intermediate strands or cables; but when the feed-bars 65 are moved in a rearward direction and the take-up drum is turned by the step-by-step feed mechanism to advance the fabric through the machine and draw the strands or cables through the twisters previous to the attachment of another filling-wire to such strands the lever-arm is actuated by the cam 170 to turn the rock-shaft and arms, thereby moving the tension device to a horizontal position in the plane of the fence fabric and permitting the wires to be drawn freely through the tension device on the advancement or feed of the fabric, after which the tension device is turned to its canted or tilted position to strain the wires of the intermediate strands.

The feed or advancement of the fabric through the machine after the successive application of the filling-wires to the strands is effected by the rotatable step-by-step feed of a take-up drum 171, assisted by the reciprocating feed-bars 65, which work in unison with the reciprocating play of the hollow carrier and twister-shafts 58. This take-up drum 171 is arranged in a horizontal position across the rear end of the main frame, and it is carried by a horizontal shaft 172, which is journaled in bearings 173 on said frame 1. The drum has a pair or series of heads suitably attached to the shaft and carrying a series of lags or bars 174, and each lag or bar is provided with a plurality of lugs 175 176, which are arranged in groups or pairs to occupy staggered relations on the lags. Each strand-wire passes between a pair of the staggered lugs 175 176, (see Figs. 1 and 34,) and the lugs are spaced to occupy positions near the front and rear edges of the lags, so as to accommodate the filling-wires between themselves. These lugs on the take-up drum hold the strands or cables properly spaced on the take-up drum, and they also furnish the abutments or pawl-teeth with which the feed-pawl is adapted to engage in order to turn the drum on its axis and effect the proper feeding of the fabric to the machine. The lugs project outwardly from the faces of the lags to furnish the holds for the feed-pawl, and they prevent slipping of the strands or cables when the fabric is advanced on the rotation of said drum. At opposite ends of the take-up drum rocking arms 177 are arranged loosely on the shaft 172, and these rocking arms project a suitable distance above the drum to sustain a gravity feed-pawl 178, which is hung or pivoted loosely to said ends of the arm, said feed-pawl arranged to drop by gravity upon the lags and engage with the lugs thereon. The rocking arm 177 on the right-hand side of the machine is extended below the take-up-drum shaft to provide for the pivotal attachment of a pitman 179, which is arranged in a horizontal position at one side of the machine. This pitman is supported at a point intermediate of its length by a hanger 180, which is pivoted at 181 to the machine-frame, and the extreme front end of this pitman, which actuates the feed-pawl for the take-up drum, is connected by a wrist-pin 182 in a variable manner to a crank-disk or one of a series of crank-arms carried by the main driving-shaft 5 to impart variable feed motion to the take-up drum, and thus vary the rate of feed of the fabric through the machine. The crank-disk 183 is secured rigidly to the driving-shaft, and it has a series of two or more radial arms 184, as represented by Fig. 2. These arms and the crank-disk have openings at different distances from the axis of the shaft 5 for the reception of the wrist-pin 182, which may be placed in any one of said openings of the disk or its arms, according to the angular movement it is desired to impart to the feed-pawl and through the latter determine the extent of rotation of the take-up drum. By placing the wrist-pin 182 in the opening farthest from the axis of the driving-shaft the maximum motion may be given to the feed-pawl, and the movement of the take-up drum is lengthened; but by shifting the wrist-pin to the opening nearest the driving-shaft the angular movement of the feed-pawl may be reduced and the take-up drum given its minimum movement.

After the fabric traverses the take-up drum it is carried horizontally beneath the operating mechanisms of the machine and coiled on the winding-reel 185, which is situated at the front end of the machine. (See Figs. 1 to 4, inclusive.) This winding-reel has a two-part shaft 186 $186^a$, journaled in bearings 187, attached to the upright frame 157, and said reel is provided with the heads 188 and 189 to receive the removable reel-bars 191, which are

fitted loosely in sockets 190, formed coincidently in the opposing faces of the reel-heads. The shaft-section 186 is mounted in its bearing to rotate and slide therein, and the head 189 is made fast to said shaft-section 186 to slide therewith, while the other head 188 and its shaft-section 186ª are adapted to remain at rest while the head 189 travels with the shaft-section 186 in its endwise adjustment, thus providing for the withdrawal of the head 189 from engagement with the bars 191 to permit the roll of fabric to be readily disengaged from the reel. One reel-shaft section 186 is extended beyond the side of the frame 157, as shown by Fig. 12, and in this protruding end of the shaft is a socket 192, that receives the pointed end of a clamping-screw 193, the latter having a threaded bearing in a yoke 194, which is fixed to occupy a vertical position on the upright frame 157. This yoke carries a lever 195, which is fulcrumed thereto, and the lower end of said lever is forked to embrace a grooved collar 196, fixed to the protruding end of the reel-shaft section 186. The binding-screw impels the reel-shaft to a position where the reel-bars 191 force the reel-head 188 against one of the standards of the upright frame 157 in order to hold the head 188 parallel to the head 189 and sustain the bars 191 in the sockets of the two heads; but when this clamping-screw is retracted the lever 195 may be operated to move the shaft endwise a sufficient distance to free the head 188 from the bars 191, and thus permit the roll of fabric to be easily disengaged from the winding-reel, so as to be removed therefrom. This winding-reel is rotated by positive connections with the main driving-shaft 5, and to this shaft is secured a sprocket-gear 197, around which passes an endless sprocket-chain 198, that rotates a sprocket-wheel 199, which is fitted loosely on one end of a reel-driving shaft 200. (See Fig. 20.) This reel-driving shaft is journaled in bearings 201 on the main frame, (see Fig. 1,) and the end of the shaft at the left-hand side of the machine is extended some distance beyond the frame to accommodate the friction-clutch mechanism that controls the loosely-mounted driven sprocket 199, whereby the winding-reel driving mechanism is allowed to slip as the bulk of the fabric increases on the reel 185, and the latter is actuated to properly wind the fabric without exerting undue tension or strain thereon. It will be understood that the fabric when first wound on the reel the latter is driven to coil the fabric as fast as it is fed thereto by the take-up drum; but as the bulk of the fabric increases the speed of the winding-drum should be reduced in order to prevent straining the fabric and avoid interference with the proper action of the other working elements of the machine. This end is attained by the provision of the driving mechanism, of which the loosely-mounted driven sprocket 199 constitutes one of the elements. This driven sprocket has a clutch-face which is opposed to the working face of a clutch-disk 202, which is keyed or otherwise made fast to the reel-driving shaft 200, and against the hub of the loose driven sprocket bears a collar 203, which is normally pressed against said sprocket by a spiral spring 204, fitted loosely on a threaded length of the shaft 200. A regulating-nut 205 is screwed on the threaded length of this shaft to bear against the spiral spring, which normally forces the clutch-face of the driven sprocket into intimate facial contact with the clutch-disk 202, and this frictional engagement between the sprocket and the clutch-disk is sufficient to insure the rotation of the shaft 200 during the operation of coiling the fabric on the winding-reel; but when the bulk of the fabric increases and the strain or pull of the fabric counteracts the action of the spring 204 the frictional engagement between the sprocket 199 and disk 202 allows the sprocket and disk to slip, whereby the driving mechanism actuates the winding-reel at a speed proper to take up the fabric as it is advanced through the machine by the take-up drum and feed-bars. The spring-controlled clutch mechanism and the sprocket-gearing between the main shaft and the reel-driving shaft are situated at the left-hand side of the machine; but said shaft 200 extends across the machine-frame to have its other end operatively connected by the train of gears 206 to the shaft 186 of the winding-reel. One of the gears is secured fast to the reel winding-shaft, another gear is secured detachably, but in a fast position, on the reel-shaft, and the third gear is journaled idly on the machine-frame, as shown by Fig. 2, in a position to mesh with the described gears, and thereby transmit the motion of the shaft 200 to the reel-shaft 186.

The operation of the machine is as follows: The machine is first threaded by carrying the wires forming the intermediate strands to the fixed guide-bar 163, then through the rocking tension device, thence through the diametrically opposite grooves in the shafts and twisters, and finally around the take-up drum and to the winding-reel. The twisted or barbed selvage-wires are conducted around the groups of rollers 160, beneath the rollers 162, and through the hollow carrier and twister-shafts 58, thence around the take-up drum and the winding-reel. The wire which forms the filling-wires is led or conducted through the train of idler-rolls 94, one guide and tension device, the feed-rolls, the other guide and tension device, the cutter mechanism, and the fixed guide-block. The wires having been properly threaded in the machine, it is in condition for operation. As the main driving-shaft is rotated all of the working elements are set in motion from said shaft and with the swinging guide-plate 118 in its lowered position for its channeled face to abut against the back plate of the transverse housing and lie coincident with the channel 121

therein, so that as the notched or slotted foot of said guide-plate fits upon the longitudinal strands the feed mechanism advances the filling-wire transversely across the machine. This filling-wire is received in the channeled faces of the guide-plate and the transverse housing, and the twister-shafts are in the positions represented by Fig. 9 and diametrically by Fig. 24 to bring the grooves in the twister-shafts on opposite sides of the path of feed of the filling-wire. This wire is advanced by the feed mechanism through the channels of the boxing and guide-plate which direct the wire between the spaced pairs of wires forming the intermediate strands, which are led through the grooved twister-shafts, and this length of the filling-wire passes above the twisted or barbed selvage-strands and below the guide-flanges 116. During the feed of the filling-wire to the looper mechanism the knife or cutter is at rest and the looper-plungers 42 are lowered, while the head or jaw of the clencher-press is lowered. The wire having been properly positioned between the strands, as shown by Figs. 9 and 24, the feed mechanism comes to a period of rest, and the cams 54 actuate the lifting-fingers 47 to raise the series of plungers in the intervals between the twisters and the coacting fixed jaws, and these plungers lift the portions of the wires between the twisters to the inclined positions represented by Fig. 10 and diametrically by Fig. 25. While the plungers are in their raised positions, the driving rack-bar 25 is moved in one direction by its lever having the pitmen connection 34 with the crank 32 of the longitudinal counter-shaft 27, and the series of twisters are turned simultaneously by engagement with this moving rack, whereby the twisters are turned or partly turned to change the positions of the pairs of intermediate strands or cables and cause the strand-wires to draw or loop the filling-wire around said pairs of strand-wires. In this revolution of the twisters the looped portions of the filling-wire are bent or deflected by impingement against the opposing faces of the upper and lower jaws, and the looped portions of the filling-wire are thus caused to closely hug the strand-wires, as represented by Fig. 11 and diametrically by Fig. 26. The completion of the rotation of the twisters causes the looped portions of the filling-wires to be intimately bound around the pairs of strand-wires in the manner represented by the diagrammatic Fig. 27, and from the diagrams Fig. 24 to 27, inclusive, and the foregoing description it will be obvious that the filling-wire is interlocked at a number of points with the pairs of strand-wires, as distinct from a twisting of the filling and strand wires together. The driving connection from the shaft 5 to the shaft 7 and thence through the pitmen to the lever which actuates the rack-bar comes to a period of rest after the twisters assume the positions indicated by Fig. 27, and the hollow carrier and twister-shafts 58, with the feed-bars 65, are now impelled rearward by the driving connections with the main shaft 5, and simultaneously with this rearward movement of the hollow shafts and the feed-bars the feed-pawl is actuated by its driving connection with the shaft to turn the take-up drum, whereby the fabric is advanced through the machine by the take-up drum and the feed-bars. Previous to the advancing movement of the fabric by the feed-bars and the take-up drum the knife mechanism is actuated to swing the movable jaw on its pivot and sever the length of the wire, thus freeing the part of the filling-wire which is united to the intermediate stands from that length of the wire which is contained in the feed mechanism, and as the fabric is advanced by the feed-bars and the take-up drum the hollow shafts 58 have their shouldered ends engaged with the free ends of the filling-wire, whereby the rotating hollow shafts, engaging with said ends of the filling-wire, serve to carry the ends of the wire around the twisted or barbed selvage-wires, thus uniting the ends of the filling-wire to the selvage-wires. During the feeding movement of the fabric from the looper mechanism to the clencher-press the movable head of said press is in a raised stationary position, and as the fabric is advanced the plungers are lowered and the twisters are returned to their normal positions, and at the same time the knife mechanism is restored to its first position for the opening in the movable jaw to lie coincident with the opening in the fixed jaw, and the feed mechanism is also actuated to feed a new length of wire between the channeled faces of the housing and the guide-plate, the latter having been lowered previous to the feeding of the filling-wire by its feed mechanism. The fabric is advanced a distance equivalent to the space between the looper mechanism and the clencher-press, or the interval between two adjacent filling-wires, and at this period the fabric is brought to a period of rest to bring the filling-wire which has just been interlocked and twisted with the intermediate and selvage strands to a position immediately over the stationary bed of the clencher-press. The cams now actuate the depressing-levers to draw down on the rods and force the movable head of the clencher-press upon the looped and twisted portions of the filling-wire, which rests upon the bed of the clencher-press, and this head or jaw thus operates to tightly force the looped and twisted portions of the filling-wire around the pairs of intermediate strands and the twisted or barbed selvage-wires. It will be understood that the elements of the looper mechanism are returned to their normal positions, that the guide-plate is lowered opposite to the housing, and the feed mechanism supplies a new length of filling-wire to the looper mechanism during the operation of the clencher-press upon the previously-applied filling-wire, and by the time that the press

clenches such filling-wire to the strands of the fabric the other filling-wire is being interlocked with the strands at the proper place in advance of the previously applied and clenched wire. The machine now operates to advance the fabric a second time, thus bringing the second applied filling-wire in position beneath the clencher-press, and the take-up drum and the winding-reel are rotated in unison for the fabric to be advanced through the machine and to be coiled on the reel. As the fabric is drawn in a rearward direction the intermediate and selvage strands pass through the tension devices and the hollow shafts, thus maintaining the proper tension on the intermediate strands. It is evident that as the bulk of the fabric increases on the winding-reel the friction feed mechanism for such reel is allowed to slip and the reel is rotated at a rate of speed commensurate with the feed of the fabric to said reel of the take-up drum.

Changes may be made in the form of some of the parts, while their essential features are retained and the spirit of the invention embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

Having thus described the invention, what I claim is—

1. In a wire-fabric machine, a looper mechanism embracing a series of twisters arranged to carry pairs of strand-wires, a series of plungers for deflecting a filling-wire in relation to the twisters, and pairs of jaws which coact with the twisters in interlocking loop portions of a filling-wire with the strand-wires, in combination with a filling-wire feed mechanism to deliver a filling-wire in a plane between the pairs of strand-wires, substantially as described.

2. In a wire-fabric machine, the combination of a loop-forming mechanism arranged to carry pairs of strand-wires, a filling-wire feed mechanism for delivering a length of filling-wire transversely across the strand-wires and between the members of the pairs of said strand-wires in the looper mechanism, and a clencher mechanism adjacent to the looper mechanism to receive the filling-wire subsequent to its union with the strand-wires by the action of the looper mechanism and arranged to tightly clench the interlocked portions of the filling-wire with said strand-wires, substantially as described.

3. In a wire-fabric machine, the combination of a looper mechanism, a filling-wire feed mechanism to position the length of filling-wire between pairs of strand-wires carried by said looper mechanism, a knife mechanism situated between the looper mechanism and the filling-wire feed mechanism, and twister devices independent of the looper mechanism and serving to unite the ends of the length of filling-wire with the selvage-wires of the fabric, substantially as described.

4. In a wire-fabric machine, the combination of a looper mechanism arranged to accommodate a series of strand-wires, a filling-wire feed mechanism to deliver to the looper mechanism a section of filling-wire greater in length than the space between the selvage-wires, a knife mechanism actuated in unison with the feed mechanism to sever the filling-wire in predetermined lengths, and twister devices independent of the looper mechanism and situated at the sides of the machine to engage with the ends of the filling-wire and unite the same to the selvage-wires, said twister mechanism being advanced and retracted in the line of feed of the fabric, substantially as described.

5. In a wire-fabric machine, the combination of a looper mechanism for interlocking the looped portions of a filling-wire with intermediate strands of a fence fabric, a feed mechanism for the filling-wire to direct the latter between the pairs of strands carried by the looper mechanism, a knife mechanism between the feed and looper mechanisms, twisting devices independent of the looper mechanism for uniting the ends of a filling-wire with selvage-wires, and a clencher mechanism adjacent to the looper mechanism and arranged to receive a filling-wire after its union with the longitudinal strands by the action of the looper and twister mechanisms, substantially as described.

6. In a wire-fabric machine, the combination of a looper mechanism and a filling-wire feed mechanism, of a guide arranged to direct the wire from said feed mechanism between pairs of strands carried by the looper mechanism, and means for retracting said guide out of the path of the fabric on the advancement of the latter through the machine, substantially as described.

7. In a wire-fabric machine, the combination of a looper mechanism, a filling-wire feed mechanism, a swinging guide-plate arranged to be presented in operative relation to the looper and feeder mechanisms to direct a filling-wire between the wires of strands in said looper mechanism, and operating mechanism operatively connected with the swinging guide-plate to retract the latter from the path of the fabric prior to the advancement of the latter through the machine, substantially as described.

8. In a wire-fabric machine, the combination of a looper mechanism, a filling-wire feed mechanism, a movable pivoted guide-plate having a channeled face which is presented in operative relation to the looper mechanism to direct a filling-wire from the feed mechanism between the pairs of wires forming the strands or cables in the looper mechanism, a cam-shaft, and lever connections from said cam-shaft to the pivoted guide-plate, substantially as described.

9. In a wire-fabric machine, the combination with a looper mechanism and a filling-wire feed mechanism, of a pivoted guide-plate to direct a wire from the feed mechanism between the wires of strands in said looper mech-

anism, a cam-shaft, a rock-shaft having levers arranged to ride upon the cams of said shafts, pitmen between the pivoted guide-plate and said rock-shaft, and springs normally acting against said levers to impel the guide-plate out of operative position relatively to the looper mechanism, substantially as described.

10. In a wire-fabric machine, the combination with a looper mechanism and a filling-wire feed mechanism, of a swinging guide-plate, a cam-shaft, a rock-shaft having levers arranged to ride upon the cams of said shaft, arms attached to the rock-shaft, pitmen connected to the guide-plate and supported in said arms of the rock-shaft, springs fitted to said pitmen to bear against the latter and the arms, and other springs disposed on opposite sides of the rock-shaft and connected with the arms and the levers to normally impel the pitmen in a direction to lift the guide-plate out of the path of the fabric, substantially as described.

11. In a wire-fabric machine, the combination of a looper mechanism arranged to interlock a filling-wire with pairs of strand-wires, and a clencher mechanism acting on the filling-wire subsequent to the union of said filling-wire with the strand-wires, substantially as described.

12. In a wire-fabric machine, a looper mechanism comprising a series of twisters adapted to carry pairs of strand-wires, plungers arranged in the intervals between said twisters to deflect a filling-wire between the strand-wires of said twisters, and coacting jaws opposite to the twisters to bend the looped portions of the filling-wire around the strand-wires on the rotation of the twisters, in combination with a feed mechanism, a knife mechanism, and means for uniting the ends of a filling-wire to selvage-wires, substantially as described.

13. In a wire-fabric machine, a looper mechanism comprising a series of rotatable twisters adapted to carry pairs of strand-wires, pairs of jaws having their working faces disposed opposite to the twisters and arranged to deflect the looped portions of a filling-wire around the strand-wires which may be carried by said twisters, plungers arranged to deflect the filling-wire in the intervals between the twisters, means for simultaneously turning the series of twisters on their axes, and means for reciprocating the plungers prior to the rotation of the twisters, in combination with a feed mechanism to direct a filling-wire between the pairs of wires forming the strands in said twisters, substantially as described.

14. In a wire-fabric machine, a looper mechanism embracing a series of rotatable twisters adapted to carry pairs of strand-wires, and devices coacting with said twisters to deflect looped portions of a filling-wire around the strand-wires on the rotation of said twisters, in combination with means for feeding a filling-wire between the strand-wires carried by said twisters, a knife mechanism for cutting off the length of filling-wire between the looper and feed mechanisms, means for uniting the ends of the filling-wire with selvage-wires, and a clencher mechanism to tightly unite the looped and twisted portions of a filling-wire with the intermediate and selvage strands, substantially as described.

15. In a wire-fabric machine, a looper mechanism comprising a series of rotatable twisters, a plurality of jaws arranged in pairs to have their working faces lie on opposite sides of the twisters, a series of plungers arranged in the intervals between the twisters to deflect a filling-wire, a driving rack-bar to actuate the series of twisters simultaneously, and lifting devices to raise the plungers prior to the rotation of the twisters on their axes, in combination with a filling-wire feed mechanism, means for advancing the fabric and moving a filling-wire from position between the elements of the looper mechanism, a knife mechanism to sever the wire between the looper and feed mechanisms prior to the advancement of the fabric, and twisters independent of the looper mechanism to unite the ends of the filling-wire with selvage-wires, substantially as described.

16. In a wire-fabric machine, the combination of a looper mechanism embracing rotatable twisters and a driving rack-bar geared thereto, a filling-wire feed mechanism, a main driving-shaft, a counter-shaft geared to the main driving-shaft to be driven at intervals thereby, a driving-lever operatively connected with the counter-shaft and with the driving rack-bar of the twisters, a knife mechanism, and a filling-wire feed mechanism, substantially as described.

17. In a wire-fabric machine, a looper mechanism embracing a series of rotatable twisters, a driving rack-bar which meshes with said twisters, a driving-lever connected with said rack-bar, and a counter-shaft having operative connection with said driving-lever, in combination with a filling-wire feed mechanism, and a knife mechanism, substantially as described.

18. In a wire-fabric machine, the combination with a series of twisters and a driving rack-bar constantly in mesh with said twisters, of means for reciprocating said driving-rack intermittently comprising a counter-shaft, a main shaft, gearing between the counter-shaft and main shaft to rotate the counter-shaft progressively and at intervals in the continuous rotation of the main shaft, a pitman having connection with the counter-shaft to be reciprocated thereby at intermittent intervals, and a driving-lever connected with the pitman and the driving rack-bar, substantially as described.

19. In a wire-fabric machine, the combination with reciprocating plungers of a looper mechanism, of a series of levers to which said plungers are operatively connected, and a

cam-shaft acting against said levers to positively raise the plungers, substantially as described.

20. In a wire-fabric machine, a looper mechanism having a series of rotatable twisters, a series of plungers arranged to travel in the intervals between said twisters and across the path of feed of the filling-wire to the twisters, a cam-shaft, a series of levers connected with the plungers and lying in the path of the cams on said shaft to positively raise the plungers prior to the rotation of the twisters, a driving rack-bar geared with the series of twisters to rotate the latter on their axes, a counter-shaft connected operatively with the driving rack-bar, a main driving-shaft to which the counter-shaft is geared for rotation at intervals thereby, a filling-wire feed mechanism, and a knife mechanism, substantially as described.

21. In a wire-fabric machine, a transverse housing provided with a series of journal-openings, a series of twisters mounted in said journal-openings and having the grooved shafts, means for rotating said twisters on their axes simultaneously, and plungers operating in the intervals between the twisters and across the path of a filling-wire adapted to be supplied between the pairs of strand-wires in the grooved twister-shafts, in combination with a filling-wire feed mechanism, and a knife mechanism, substantially as described.

22. In a wire-fabric machine, a transverse boxing or housing, a series of twisters journaled therein and having the grooved shafts adapted to carry pairs of strand-wires, a driving rack-bar guided in said boxing or housing, and a guide-plate pivotally supported on the boxing or housing, in combination with means for reciprocating the rack-bar, a series of plungers arranged to be projected across the path of feed of the filling-wire and in the intervals between the twisters, a filling-wire feed mechanism to supply a filling-wire to the guide-plate by which said wire is directed between the pairs of strand-wires in the twister-shafts, and means for moving the guide-plate out of the path of the filling and strand wires, substantially as described.

23. In a wire-fabric machine, the combination with a looper mechanism adapted to carry a series of strand-wires, and a feed mechanism, of a movable guide-plate having a channel in one edge thereof to receive a filling-wire from said feed mechanism and provided with a series of notches or slots adapted to fit the strand-wires of the looper mechanism, and means for moving the guide-plate out of the path of the filling and strand wires, substantially as described.

24. In a wire-fabric machine, the combination of a loop-forming mechanism, a clencher mechanism adjacent thereto, an adjustable guide-plate arranged in operative relation to the looper mechanism and in advance of the clencher mechanism, a filling-wire feed mechanism, and means for moving the guide-plate out of position between the clencher and looper mechanisms to free it from the path of the strand and filling wires as the fabric is advanced from the looper mechanism to the clencher mechanism, substantially as described.

25. In a wire-fabric machine, the combination with a looper mechanism and a filling-wire feed mechanism thereto, of a clencher mechanism lying in the path of the fabric as it is moved from the looper mechanism, and twister devices independent of the looper mechanism to unite the ends of a filling-wire with selvage-wires as the fabric travels from the looper mechanism to the clencher mechanism, substantially as described.

26. In a wire-fabric machine, the combination with a loop-forming mechanism adapted to carry the strand-wires, and a filling-wire feed mechanism to introduce a filling-wire transversely to the strand-wires for union therewith by the looper mechanism, of a clencher mechanism adjacent to the looper mechanism and embracing a bed, a movable head or jaw, and means for forcibly compressing the interlocked portions of the filling-wire with the strand-wires between the bed and head of the clencher mechanism, substantially as described.

27. In a wire-fabric machine, the combination with a looper mechanism and a filling-wire feed mechanism of a clencher mechanism situated adjacent to the looper mechanism and having a bed, a reciprocating head or jaw opposite to the bed, depressing rods and levers connected with said reciprocating head or jaw, and a cam-shaft arranged to move the levers and forcibly impel the head or jaw upon a filling-wire when the latter is between the bed and head in said clencher mechanism, substantially as described.

28. In a wire-fabric machine, the combination with a looper mechanism and a clencher mechanism, of a cam-shaft having two sets of cams arranged opposite to each other, a series of levers lying in the path of one set of cams and connected with plungers of the looper mechanism, and another series of levers lying in the path of the other series of cams and connected with devices to depress the head or jaw of the clencher mechanism, substantially as described.

29. In a wire-fabric machine, the combination with a looper mechanism, a clencher mechanism, and a knife mechanism, of a single cam-shaft having three groups of cams, levers acted on by one group of cams to control the plungers of the looper mechanism, other levers acted on by another group of the cams to depress the head of the clencher mechanism, and a third lever controlled by the remaining cam on said shaft and connected with a movable element of the knife mechanism, substantially as described.

30. In a wire-fabric machine, the combination with a filling-wire feed mechanism, of a

looper mechanism embracing revoluble twisters and plungers movable relatively to said twisters, a cam-shaft in active relation to the plungers of the looper mechanism, a knife mechanism situated between the looper mechanism and the filling-wire-feed mechanism, and a driving-lever connected with a movable element of the knife mechanism and actively arranged to the cam-shaft, whereby the knife and looper mechanisms are actuated from a single cam-shaft, substantially as described.

31. In a wire-fabric machine, the combination with a cam-shaft, a looper mechanism, and a filling-wire feed mechanism, of a knife mechanism between the looper and feed mechanisms and embracing a fixed knife-block having a transverse opening, a pivoted knife-block also provided with an opening arranged to normally lie coincident to the opening in the fixed knife-block, and a lever fulcrumed at a point intermediate of its length and having one end connected to the movable knife-block and its other end fitted actively to a cam on the cam-shaft, substantially as described.

32. In a wire-fabric machine, the combination with a looper mechanism and a filling-wire feed mechanism, of a knife mechanism between said looper and feed mechanisms and comprising a stationary perforated knife-block, a movable perforated knife-block, a spring to normally hold the movable knife-block in a position for its opening to coincide with the opening of the fixed knife-block, a driving-lever connected with the movable knife-block, and a cam arranged to vibrate the driving-lever, substantially as described.

33. In a wire-fabric machine, the combination with a loop-forming mechanism and a clencher mechanism, of a filling-wire feed mechanism, and hollow shafts supporting the selvage-wires and arranged to engage with the ends of a filling-wire to twist the latter around the selvage-wires as the fabric moves from the looper to the clencher mechanism, substantially as described.

34. In a wire-fabric machine, the combination with a looper mechanism and a filling-wire feed mechanism, of rotatable and reciprocating hollow shafts arranged to carry the selvage-wires and to engage with the ends of the filling-wire to twist the latter around the selvage-wires, substantially as described.

35. In a wire-fabric machine, the combination with a looper mechanism, and a filling-wire feed mechanism, of hollow shafts arranged to carry the selvage-wires, means for reciprocating the hollow shafts, and means for rotating said hollow shafts on their axes to twist the ends of the filling-wire around the selvage-wires, substantially as described.

36. In a wire-fabric machine, the combination with a loop-forming mechanism arranged to carry the intermediate strand-wires, and a filling-wire feed mechanism, of hollow shafts having the twisters at the ends thereof and supporting the selvage-wires of a fabric, means for reciprocating the hollow shafts to present the twisters thereof in operative relation to the ends of a filling-wire subsequent to its union, and means for rotating said hollow shafts and the twisters thereof on their axes to unite the ends of the filling-wire with the selvage-wires, substantially as described.

37. In a wire-fabric machine, the combination with a loop-forming mechanism and a filling-wire feed mechanism, of hollow shafts arranged to carry the selvage-wires and twist the filling-wires around said selvage-wires, and pusher or feed bars arranged to reciprocate with said hollow shafts, substantially as described.

38. In a wire-fabric machine, the combination with a looper mechanism, and a filling-wire feed mechanism, of hollow shafts having means for twisting the ends of a filling-wire around the selvage-wires, means for reciprocating said hollow shafts, means for rotating the hollow shafts on their axes to bring the twisters thereof into service, and pusher or feed bars loosely connected with the hollow shafts to reciprocate therewith and arranged to be presented in engagement with a filling-wire, substantially as described.

39. In a wire-fabric machine, the combination with a loop-forming mechanism and a filling-wire feed mechanism, of pusher or feed devices which are presented to engage with the filling-wire and move the latter from the looper mechanism, and twister devices to unite the ends of the filling-wire to selvage-wires of a fabric, substantially as described.

40. In a wire-fabric machine, the combination with a loop-forming mechanism, and a filling-wire feed mechanism, of reciprocating feed devices or pushers arranged to move a filling-wire from engagement with the looper mechanism subsequent to the union of such filling-wire with the strand-wires by the action of the looper mechanism, and a knife mechanism to sever the length of filling-wire prior to the reciprocating movement of the pusher devices, substantially as described.

41. In a wire-fabric machine, the combination with a loop-forming mechanism, and a filling-wire feed mechanism, of a clencher mechanism adjacent to the loop-forming mechanism, pusher devices to move a filling-wire from the looper mechanism toward the clencher mechanism, twister devices independent of the loop-forming mechanism and arranged to unite the ends of the filling-wire with selvage-wires in the movement of a fabric from the loop-forming to the clencher mechanisms, and a knife mechanism to sever the length of filling-wire previous to the engagement of the pusher devices with said filling-wire, substantially as described.

42. In a wire-fabric machine, the combination with a loop-forming mechanism, and a filling-wire feed mechanism, of a knife mechanism to sever the wire subsequent to its union with the loop-forming mechanism, hol-

low shafts having the twisters at one end thereof and arranged to be reciprocated and rotated on their axes, a clencher mechanism adjacent to the loop-forming mechanism, and pusher devices loosely connected with said shafts to partake of their reciprocating play and arranged to be presented in engagement with a filling-wire subsequent to its union with strand-wires and to move said filling-wire from the loop-forming mechanism toward the clencher mechanism, substantially as described.

43. In a wire-fabric machine, the combination with a loop-forming mechanism arranged to carry the strand-wires, and a filling-wire feed mechanism, of a take-up drum around which pass the strand-wires or fabric, a knife mechanism, pusher devices in active relation to the filling-wire in said loop-forming mechanism, means for reciprocating the pusher devices in unison with the rotation of the take-up drum, a feed mechanism for said take-up drum to rotate the latter with a step-by-step motion, and means for uniting the ends of a filling-wire with selvage-strands, substantially as described.

44. In a wire-fabric machine, the combination of a loop-forming mechanism, a filling-wire feed mechanism arranged to feed a filling-wire transversely across strand-wires in the loop-forming mechanism, a clencher mechanism situated at one side of the loop-forming mechanism and arranged in the path of feed of the fabric as it is advanced from the loop-forming mechanism to the clencher mechanism, and a fabric-feed mechanism to advance the fabric with a step-by-step motion through the machine, substantially as described.

45. In a wire-fabric machine, the combination with a loop-forming mechanism having a series of rotatable twisters, of a driving-shaft having a continuously-rotating, mutilated, bevel-gear, a counter-shaft having a mutilated bevel-gear arranged to be rotated at intervals by the continuously-rotated gear of the driving-shaft, a driving-lever connected operatively with the counter-shaft, and a rack-bar which meshes with the twisters of the looper mechanism and is connected with said driving-lever, substantially as described.

46. In a wire-fabric machine, the combination with a loop-forming mechanism, of hollow shafts having twisters and arranged to carry the selvage-wires of the fabric, a rock-shaft having arms loosely connected with said hollow shafts to permit the latter to rotate on their axes, a cam-shaft to rock said arms and reciprocate the hollow shafts, and rotary driving connections to rotate the hollow shafts and actuate the twisters thereof to unite the ends of the filling-wires with selvage-wires in said hollow shafts, substantially as described.

47. In a wire-fabric machine, the combination with a loop-forming mechanism, of tubular shafts having twisters at their ends, a pivotal shaft, a cam-shaft, arms or levers mounted on the pivotal shaft to engage with the cam-shaft, sleeves which engage with the hollow shafts and are pivotally attached to said arms or levers, and driving devices connected with said hollow shafts to rotate the latter on their axes, substantially as described.

48. In a wire-fabric machine, the combination with a main driving-shaft and a loop-forming mechanism, of a filling-wire feed mechanism having the feed-rolls, and a clutch-controlled driving mechanism between the main shaft and the feed-roll shafts of said feed mechanism, substantially as described.

49. In a wire-fabric machine, the combination with a loop-forming mechanism and a main driving-shaft, of a filling-wire feed mechanism having the roll-carrying shafts, a driving-lever in operative relation to the main shaft, and a clutch-controlled gear connected with said driving-lever and meshing with a gear on one of the roll-shafts, substantially as described.

50. In a wire-fabric machine, the combination with a main driving-shaft and the roll-shafts of a filling-wire feed mechanism, of a driving-lever in operative relation to a cam on said main shaft, a bevel-gear meshing with a gear on one of the roll-shafts, and a vibratory clutch connected with said driving-lever and having yieldable clutch-arms arranged to engage with the driving-gear as the clutch is moved in one direction and to free themselves from the driving-gear on the reverse movement of the clutch, substantially as described.

51. In a wire-fabric machine, the combination with a main driving-shaft and a roll-shaft of a filling-wire mechanism, of a driving-lever in active relation to the cam on said main shaft, a driving-gear meshing with a gear-pinion on one of the roll-shafts, a clutch in active relation to the driving-gear, and a shiftable connection between the lever and said clutch to vary the angular movement of the driving-gear through such clutch and shiftable connection, substantially as described.

52. In a wire-fabric machine, the combination with a main driving-shaft, and a filling-wire feed mechanism, of a driving-gear meshing with a gear on one of the roll-shafts of said feed mechanism, a lever in active relation to the cam on the driving-shaft, a clutch engaging with the driving-gear, and a pitman connected with said clutch and having a shiftable pivotal engagement with the driving-lever, substantially as described.

53. In a wire-fabric machine, the combination with a loop-forming mechanism, of a filling-wire feed mechanism, a main driving-shaft, a take-up drum, pivoted arms carrying a feed-pawl in operative relation to such take-up drum, a pitman connected to the pivoted arms, and means whereby the pitman may be connected with the main driving-shaft at variable distances from the axis thereof, substantially as described.

54. In a wire-fabric machine, the combina-

tion with a main driving-shaft, a loop-forming mechanism and a filling-wire feed mechanism, of a crank-disk carried by the driving-shaft and having arms, a pitman having a wrist-pin to be attached to said crank-disk or the arms thereof, a take-up drum, a feed-pawl, and operative connections between the pitman and the feed-pawl, substantially as described.

55. In a wire-fabric machine, a take-up drum having a series of lags or bars and a plurality of lugs arranged in staggered relation to each other on said lags or bars, in combination with a loop-forming mechanism, a main shaft, a feed-pawl, and operative connections from the feed-pawl to the main driving-shaft, substantially as described.

56. In a wire-fabric machine, the combination with a loop-forming mechanism having a series of twisters and a main driving-shaft, of a rocking tension device carried by a rock-shaft, and levers from the rock-shaft to cams on the main driving-shaft whereby the tension device may assume an angular position with relation to the line of feed of the wires to their respective twisters, substantially as described.

57. In a wire-fabric machine, the combination with twisters of a loop-forming mechanism and a driving-shaft having a cam, of a rock-shaft provided with a lever to ride upon said cam, arms movable with the rock-shaft and carrying a tension device which is arranged to assume a canted or tilted position with relation to the line of feed of the wires to said twisters, and a guide-bar elevated above and situated adjacent to the rocking tension device, substantially as described.

58. In a wire-fabric machine, the combination with a main driving-shaft, of a reel-driving shaft, a driving connection from the main driving-shaft to the reel-driving shaft and embracing a yieldable clutch connection, and a two-part reel-shaft, one member of which is geared to the reel-driving shaft and the other member of the reel-shaft is shiftable for the ready removal of the reeled or coiled fabric, substantially as described.

59. In a wire-fabric machine, the combination with a main driving-shaft, and a reel-driving shaft, of an intermediate driving connection between the two shafts and said driving connection having a yieldable clutch connection between fast and loose members fitted to the reel-driving shaft, a two-part reel-shaft having one member shiftable relatively to the other member, and gearing between the non-shiftable member of the reel-shaft and the reel-driving shaft, substantially as described.

60. In a wire-fabric machine, the combination with a main driving-shaft, a reel-driving shaft, and a driving connection between said shafts, of a two-part reel-shaft having a non-shiftable member geared to the reel-driving shaft and a shiftable member in alinement with the non-shiftable member, means for clamping the two members of the reel-shaft against endwise movement relatively one to the other, and reel-bars confined removably on the two members of the shaft, substantially as described.

61. In a wire-fabric machine, a winding-reel comprising a shiftable shaft, heads mounted on said shaft and having reel-bars interlocked detachably therewith, means for holding the reel-shaft in a position to insure the engagement of said reel-bars with the heads, and a lever connected with the reel-shaft to give endwise movement thereto, substantially as described.

62. In a wire-fabric machine, the combination of a slidable and rotatable winding-reel shaft, the socketed heads mounted on said shaft, a series of reel-bars fitted detachably to the sockets of said heads, a yoke, a clamping-spindle mounted in the yoke to engage with the reel-shaft, and a lever fulcrumed on the yoke and connected loosely with said reel-shaft, substantially as described.

63. In a wire-fabric machine, the combination with twisters of a looper mechanism, of hollow shafts having twisters independent of the looper mechanism, a fixed guide-bar arranged to receive the pairs of wires which are supplied to the twisters of the looping mechanism, a rocking tension device situated between the guide-bar and said looper-twisters, and independent guides arranged to direct selvage-wires to the hollow shafts, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CHARLES E. WARNER.

Witnesses:
WM. WALLACE,
W. B. KILER.