W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

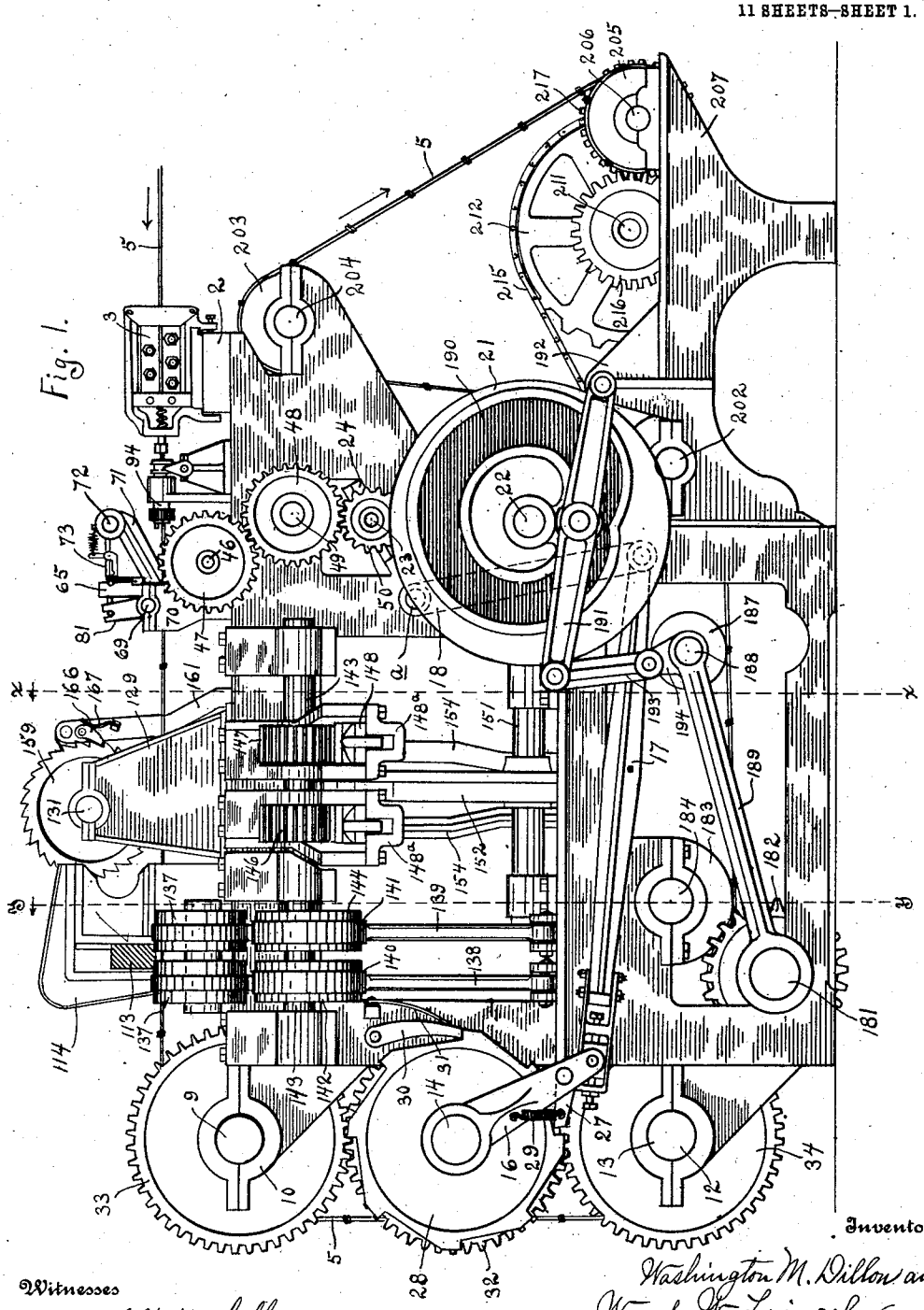
APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Frank V. Haskell.

Inventors

Washington M. Dillon and

Ward W. Lincoln.

By Walter N. Haskell.

their Attorney

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734. **Patented Dec. 5, 1911.**

11 SHEETS—SHEET 2.

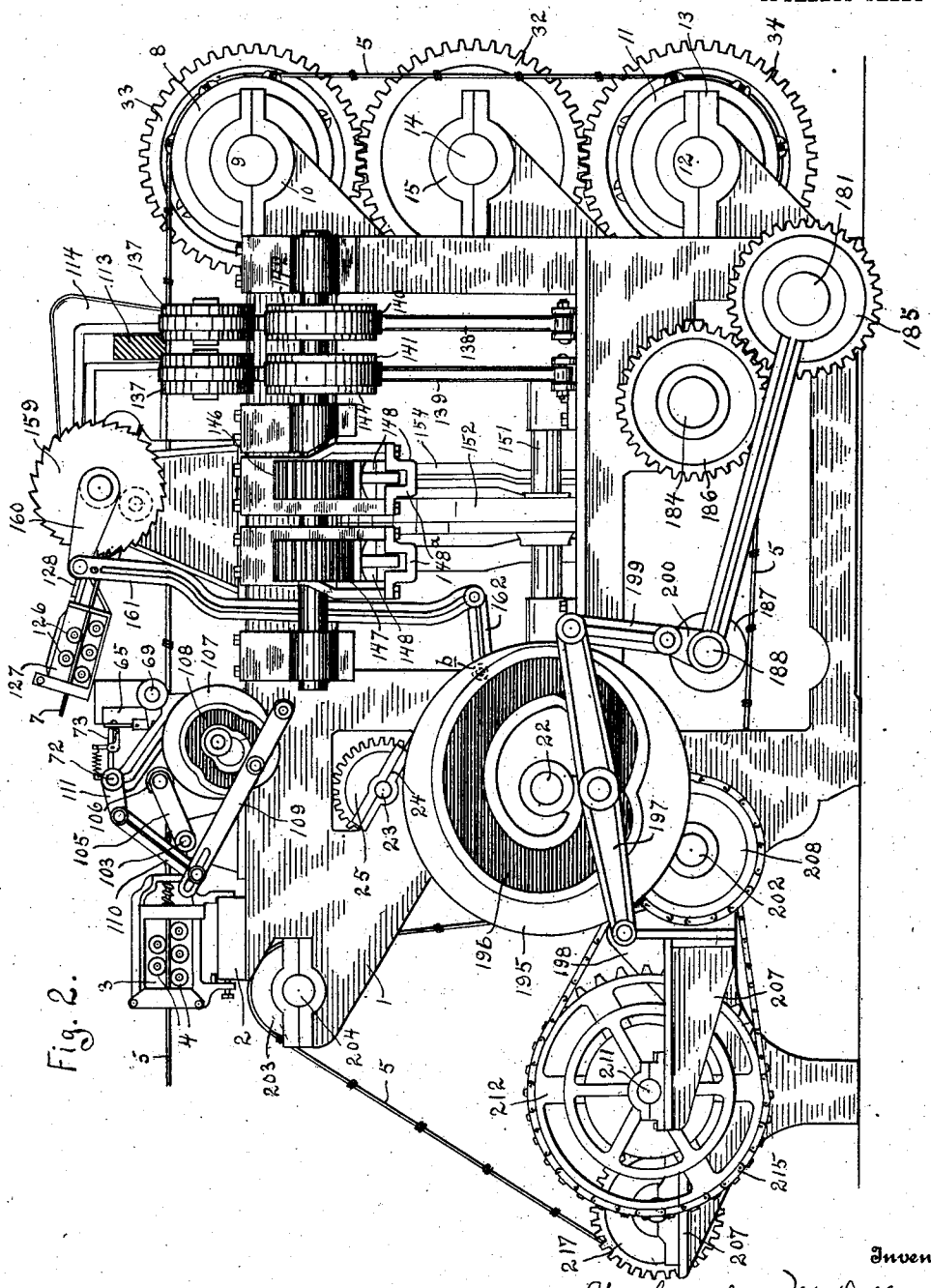


Fig. 2.

Witnesses

Frank W. Haskell.

R. W. Mitchell

Inventors

Washington M. Dillon and

Ward W. Lincoln,

By Walter N. Haskell,

their Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 3.

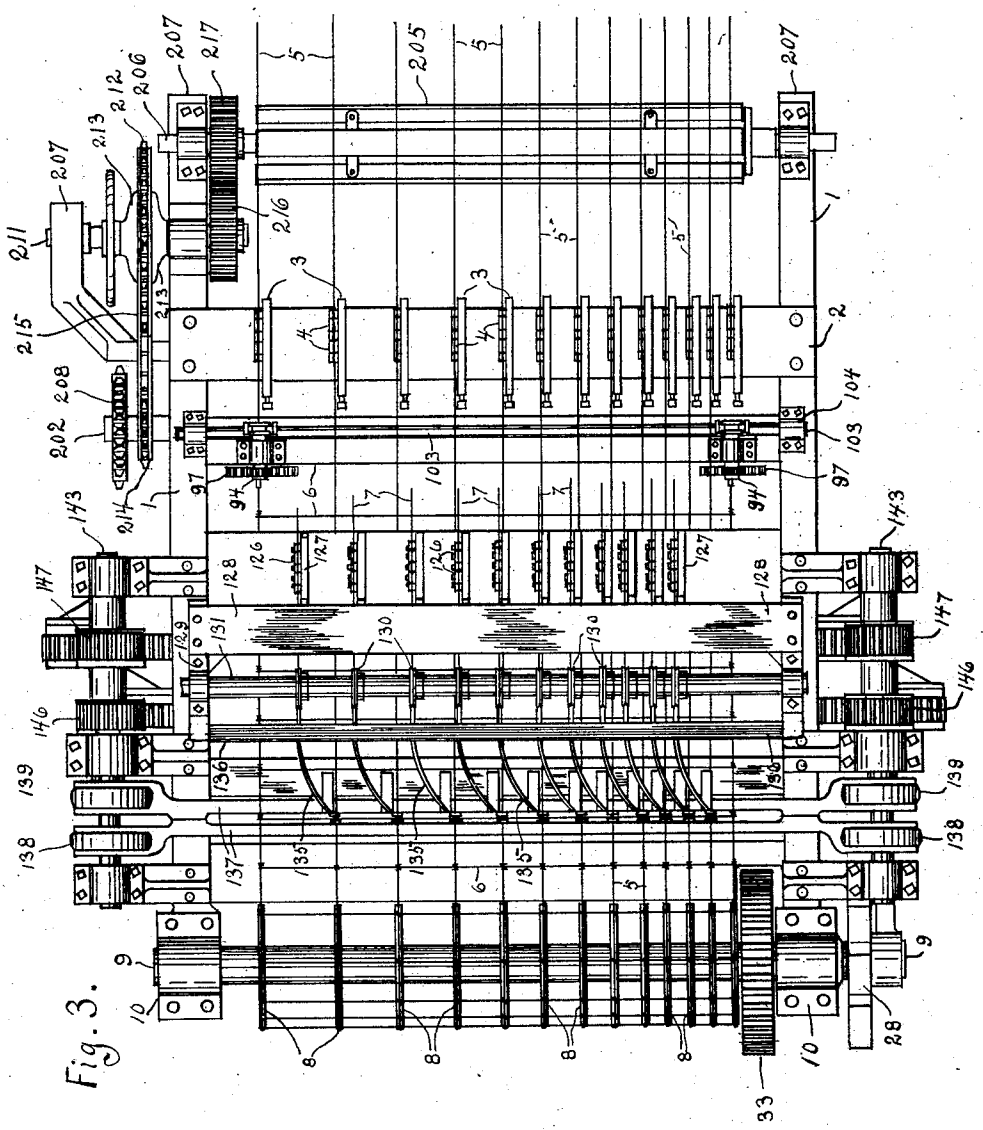


Fig. 3.

Witnesses

Frank W. Haskell.

R. W. Mitchell

Inventor

Washington M. Dillon and

Ward W. Lincoln,

By Walter N. Haskell,

their Attorney

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 4.

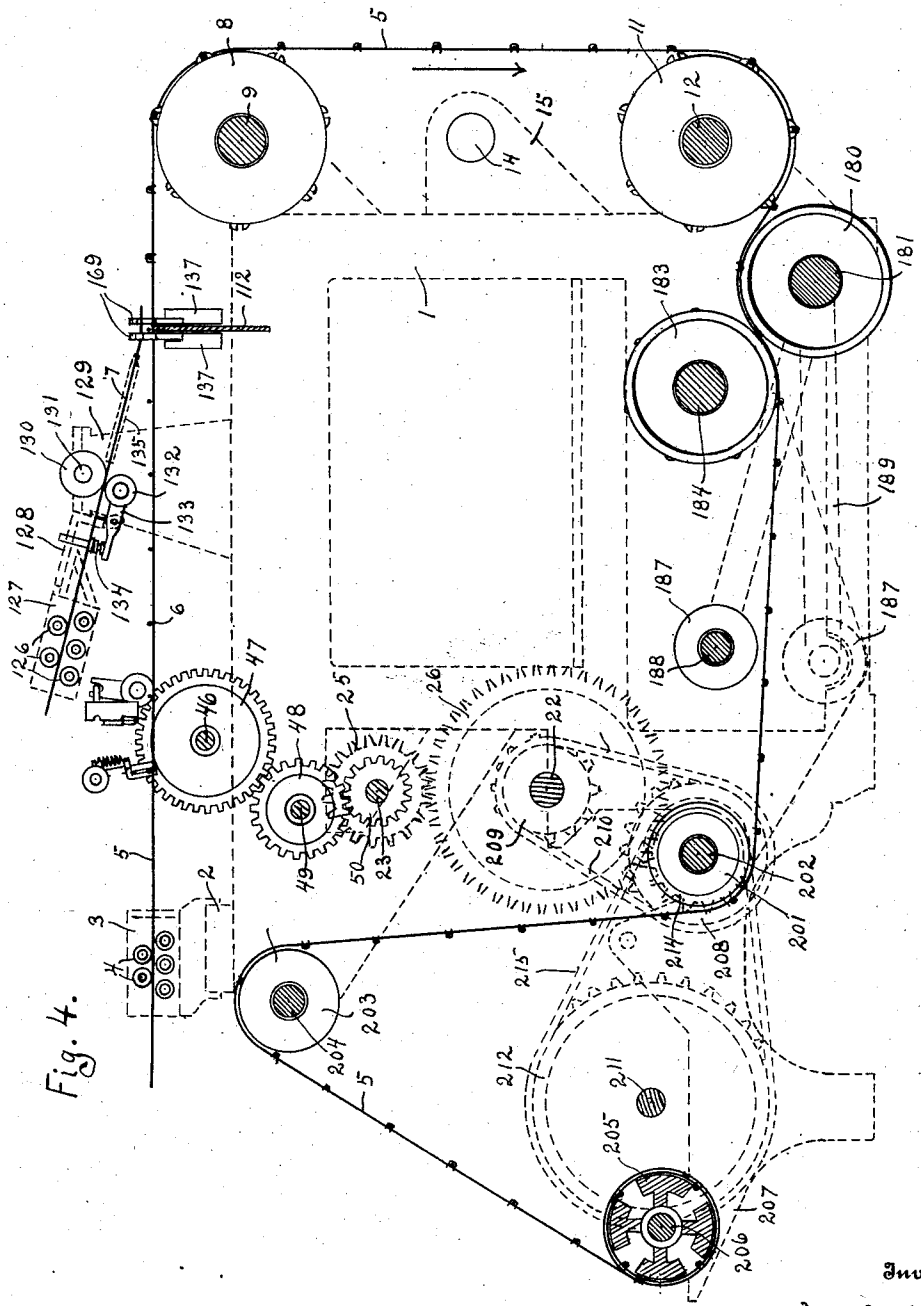


Fig. 4.

Witnesses

Frank W. Haskell.

R. W. Mitchell

Inventors

Washington M. Dillon and
Ward W. Lincoln,
By Walter N. Haskell,
their Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 5.

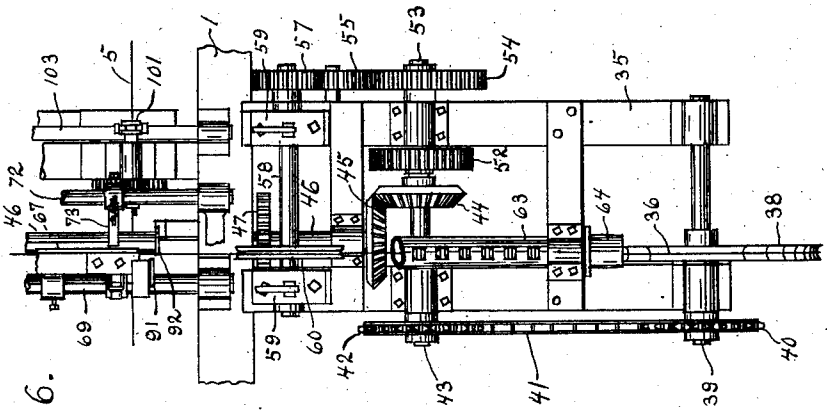


Fig. 6.

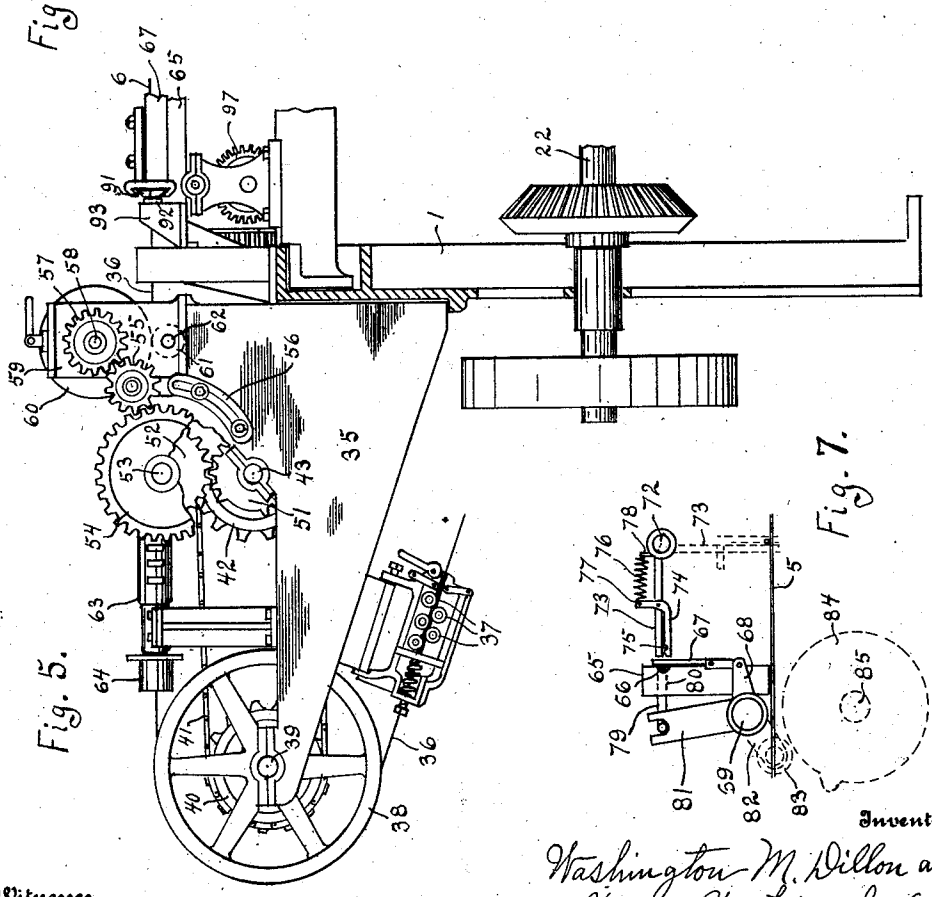


Fig. 5.

Fig. 7.

Witnesses

Frank W. Haskell.

R. W. Mitchell

Inventors

Washington M. Dillon and

Ward W. Lincoln,

By Walter N. Haskell

their Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. M. DILLON & W. W. LINCOLN.

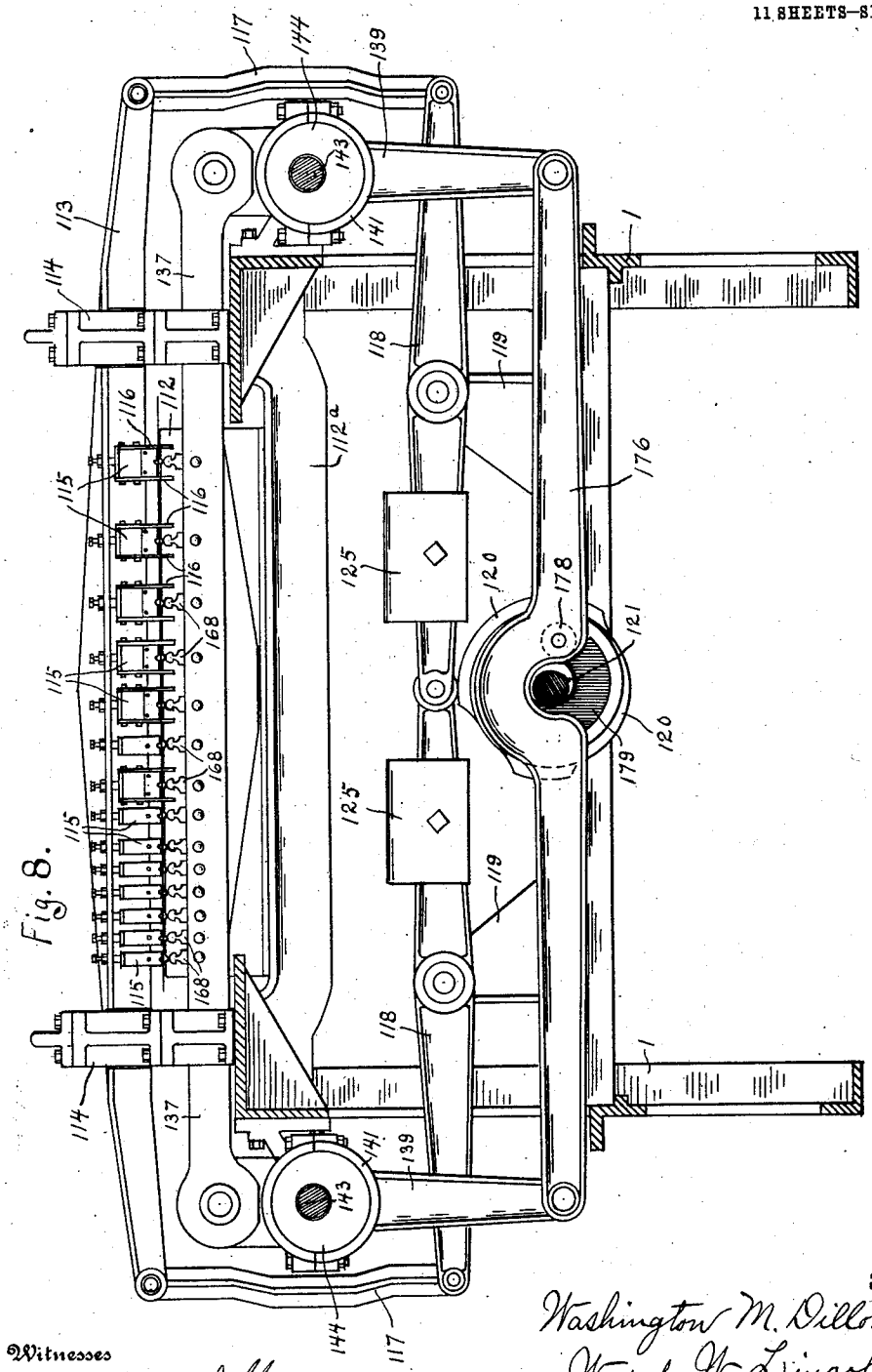
WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 6.



Witnesses

Frank W. Haskell.

R. W. Smith

Inventors

Washington M. Dillon and

Ward W. Lincoln,

By Walter N. Haskell,

their Attorney

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 7.

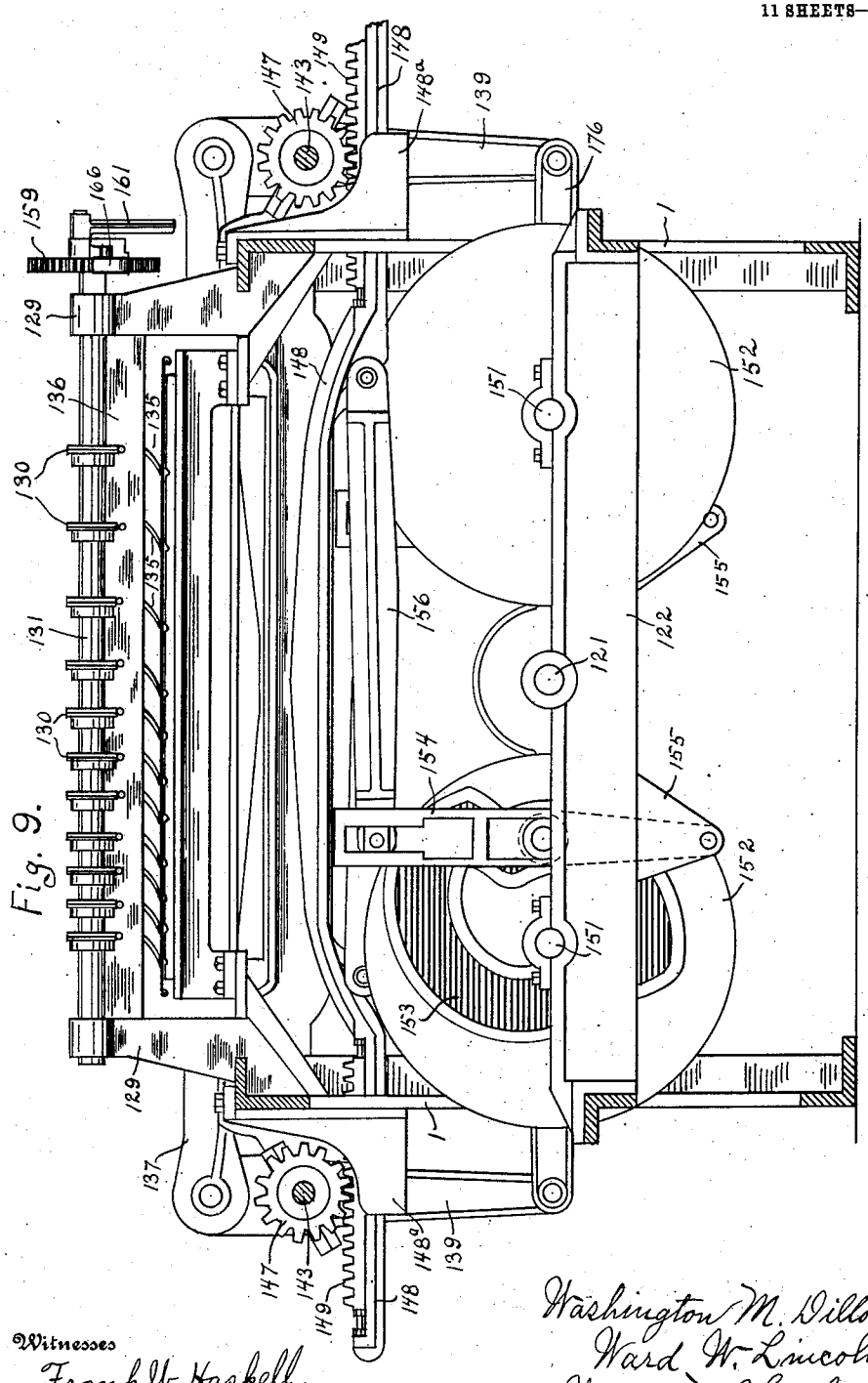


Fig. 9.

Witnesses

Frank W. Haskell.

Inventors

Washington M. Dillon and
Ward W. Lincoln,

By Walter N. Haskell,

their Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 8.

Fig. 10.

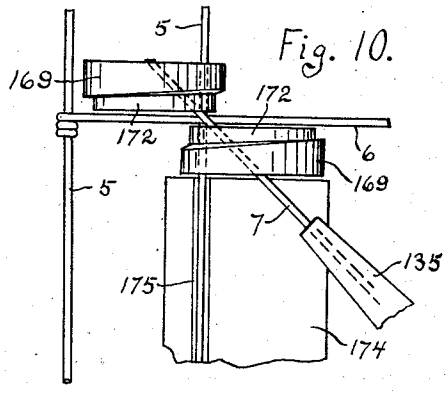


Fig. 11.

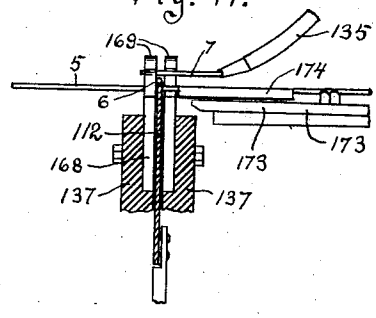


Fig. 12.

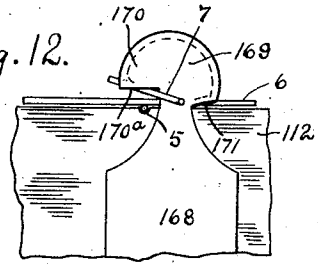


Fig. 13.

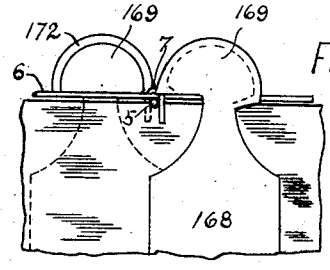


Fig. 14.

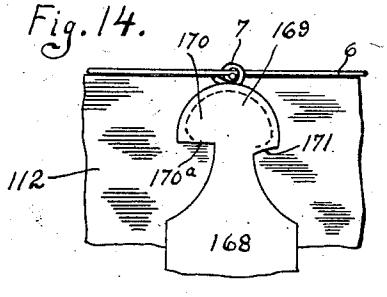
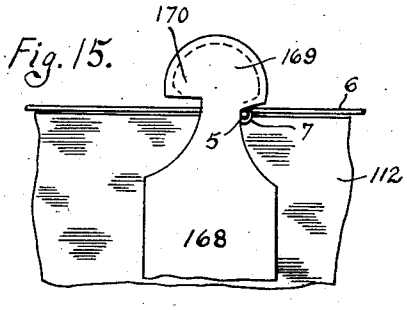


Fig. 15.



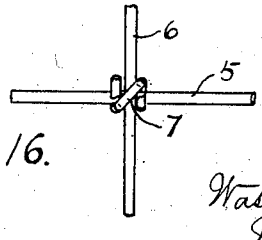


Fig. 16.

Witnesses

Frank W. Haskell.

R. W. [illegible]

Inventors

Washington M. Dillon, and

Ward W. Lincoln,

By Walter N. Haskell,

their Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 9.

Fig. 17.

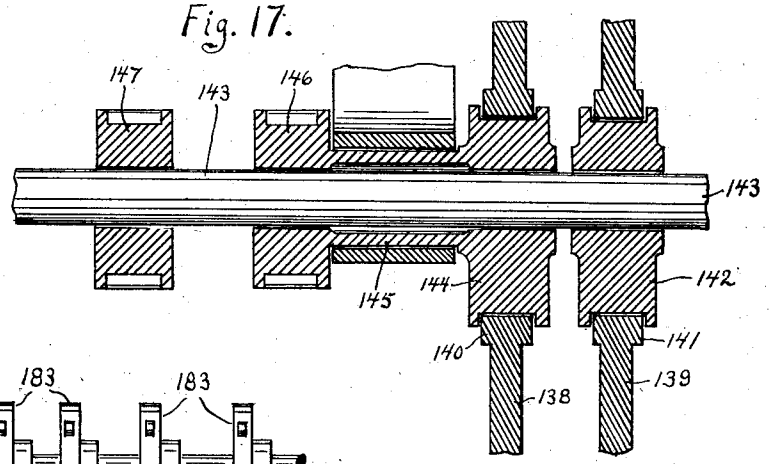


Fig. 19.

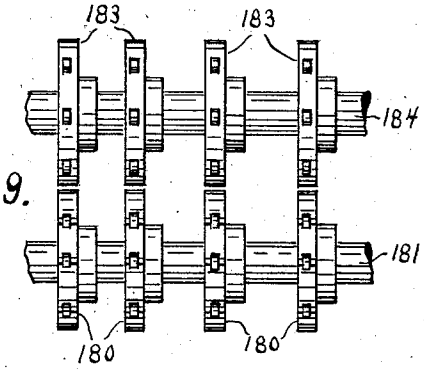


Fig. 18.

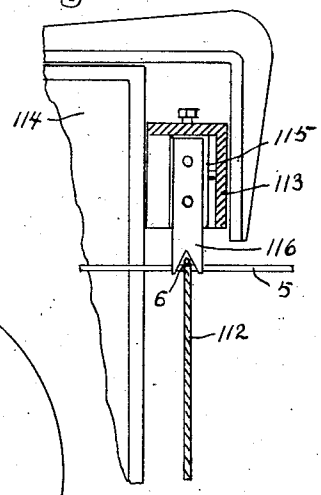
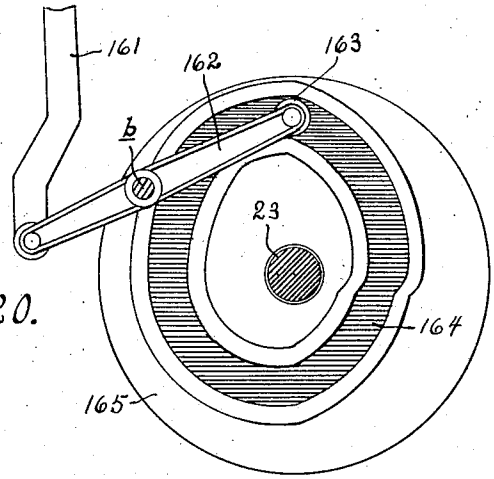


Fig. 20.



Witnesses

Frank W. Haskell.

Inventors

Washington M. Dillon and

Ward W. Lincoln,

By Walter N. Haskell,

their Attorney

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734. **Patented Dec. 5, 1911.**

11 SHEETS—SHEET 10.

Fig. 21.

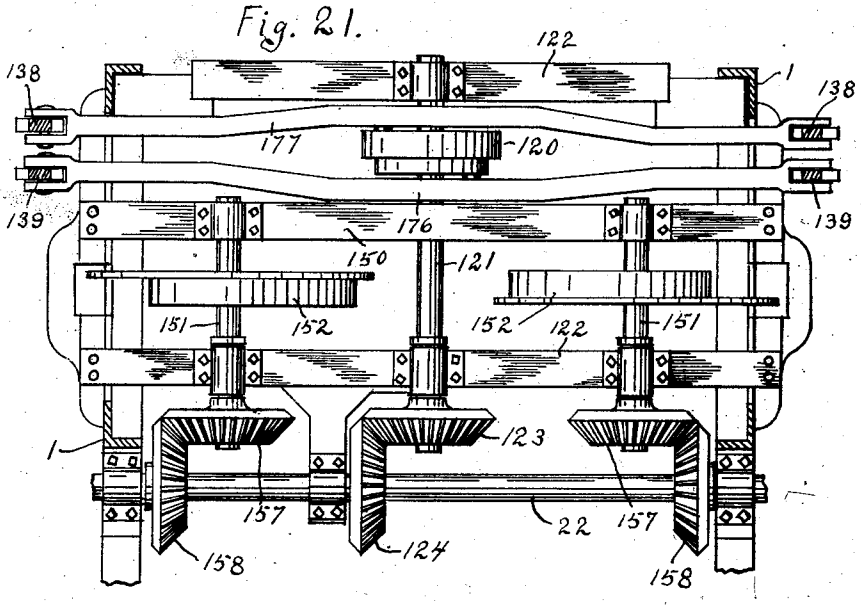
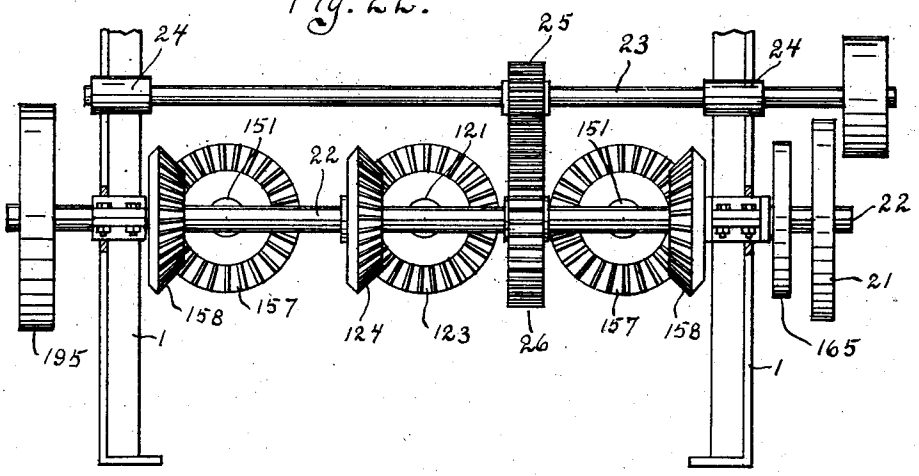


Fig. 22.



Witnesses

Frank W. Haskell.

R. W. Mitchell

Inventors

Washington M. Dillon, and

Ward W. Lincoln

By Walter N. Haskell,

their Attorney

W. M. DILLON & W. W. LINCOLN.

WIRE FENCE MACHINE.

APPLICATION FILED MAR. 15, 1909.

1,010,734.

Patented Dec. 5, 1911.

11 SHEETS—SHEET 11.

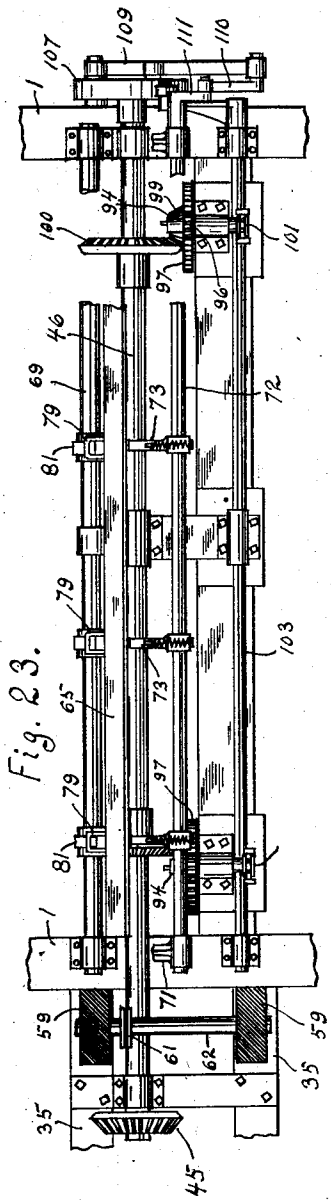


Fig. 23.

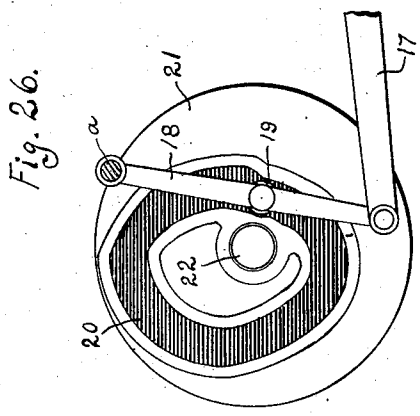


Fig. 26.

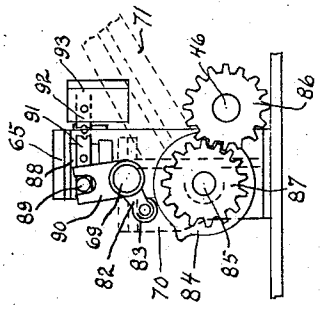


Fig. 25.

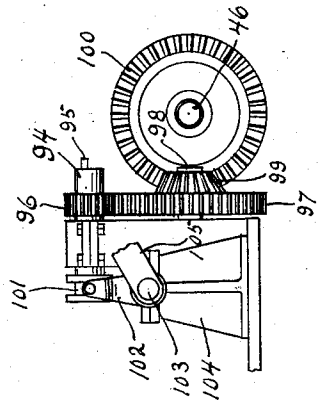


Fig. 24.

Witnesses

Frank W. Haskell.

Rewm Tibbetts

Inventors

Washington M. Dillon and

Ward W. Lincoln

By Walter N. Haskell.

their Attorney.

UNITED STATES PATENT OFFICE.

WASHINGTON M. DILLON, OF STERLING, AND WARD W. LINCOLN, OF ROCK FALLS, ILLINOIS; SAID LINCOLN ASSIGNOR TO SAID DILLON.

WIRE-FENCE MACHINE.

1,010,734. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed March 15, 1909. Serial No. 483,666.

To all whom it may concern:

Be it known that we, WASHINGTON M. DILLON and WARD W. LINCOLN, citizens of the United States, residing, respectively, at Sterling and Rock Falls, in the county of Whiteside and State of Illinois, have invented certain new and useful Improvements in Wire-Fence Machines, of which the following is a specification.

Our invention has reference to wire fence machines which are capable of producing that class of fences that are comprised of a series of longitudinal strand wires, and stay wires extending transversely thereof at regular intervals, the stay wires being secured to the strand wires at the points of intersection therewith by independent fastening means.

The present machine is specially designed for the manufacture of that style of fence wherein the wires are united by means of a tie in the shape of a letter **S**, also formed of wire, and commonly known in the wire fence art as the "**S**" tie.

In the construction of the fence the tie wire is fed diagonally across the intersection of the strand and stay wires, and the ends thereof coiled in opposite directions about the strand wire.

There is embodied in the present invention mechanism for simultaneously securing in position all of the wire ties by which one of the stay wires is attached to one of the strand wires of the fence. Other mechanisms are provided for feeding the strand wires into and through the machine, for feeding the stay wires transversely of the strand wires, into position to be attached thereto, and cutting the same; for feeding a plurality of wires into the machine, to be formed into tie wires, and cutting the same into suitable lengths; and for crimping the fence wires at the points of intersection, after the same have been united by the tie wires. The groups of mechanism by which the various operations are performed, and the several functions thereof will more fully appear from the following specification and drawings accompanying the same, in which drawings similar parts are designated by corresponding numbers throughout.

Figure 1 is a side elevation, showing the right-hand side of the machine, with the stay wire feed mechanism detached. Fig. 2 is a similar view of the left-hand side thereof. Fig. 3 is a plan view of the main part of the machine, with some of the superstructure removed. Fig. 4 is a diagrammatic view, in longitudinal section, showing the course of the strand wires through the machine. Fig. 5 shows the feed mechanism for the stay wires, in side elevation, with a portion of the wheel 54 broken away. Fig. 6 is a plan view of said feed wire mechanism. Fig. 7 is an end view, in detail, of the mechanism by which the stay wires are received and delivered to the strand wires. Fig. 8 is a vertical cross-section in the line *x*—*x* of Fig. 1. Fig. 9 is a similar view in the line *y*—*y* of Fig. 1. Fig. 10 is an enlarged detail, showing one of the pairs of coiling heads 169, in plan view. Fig. 11 is a detail, showing a pair of coiling heads, in elevation, and parts appurtenant thereto. Figs. 12 to 15, inclusive, illustrate the mode of operation of one of the coiling heads 169. Fig. 16 is a detail, showing two of the fence wires at the point of intersection thereof, with the perfected tie secured thereto. Fig. 17 is a longitudinal section through the eccentrics 142 and 144, and accompanying rack pinions 146 and 147 on one side of the machine. Fig. 18 is a detail, showing one of the plates 115. Fig. 19 represents a portion of the shafts 181 and 184, and crimping rolls thereon. Fig. 20 shows the inner face of the cam wheel 165. Figs. 21 and 22 are details, showing parts of the power transmitting mechanism of the machine. Fig. 23 is a detailed plan view, showing the means for securing the ends of the stay wires to the outside, or selvage wires of the fence. Fig. 24 is a side view of one of the coiling spindles 94, and parts for actuating the same. Fig. 25 is a detail, showing the means for severing the stay wires, and mechanism for rocking the shaft 69. Fig. 26 shows the inner face of the cam-wheel 21.

In the operation of the machine the strand wires are fed in at one end thereof, and the completed fabric is delivered from the same end. This end of the machine will be treated as the front or forward end thereof in the following description, and the sides of the machine will be referred to as the right or left side according as they would be on the right or left hand side of a central longitudinal line through the machine, looking toward the forward end thereof.

1—1 represent the side plates of the frame,

and 2 a cross-plate thereon. Upon the cross-plate 2 are supported a plurality of straightening heads 3, each provided with the usual rolls 4, through which a series of wires 5 are introduced into the machine. The stay wires are represented by the numbers 6 and the tie wires by the numerals 7. Movement is given to the wires 5, longitudinally of the machine, by means of a series of reels 8 mounted on a shaft 9, journaled in bearings 10 at the rear end of the machine, and a series of similar reels 11, mounted on a shaft 12, journaled in bearings 13, fixed to the frame below the bearings 10. Intermediate the shafts 9 and 12 is a shaft 14, journaled in bearings 15, also fixed to the frame.

Loosely mounted on the shaft 14 is an arm 16, (Fig. 1) connected by means of a pitman 17 with the lower end of an arm 18, pivoted to the frame 1, as at *a*. The arm 18 is provided on its outer face with a roller 19, engaged by a cam-track 20 on the inner face of a wheel 21, fixed on the end of a rotary shaft 22, journaled in the frame of the machine. (Fig. 26.) Movement is imparted to the shaft 22 from a shaft 23, mounted in bearings 24 on the frame, by means of a gear wheel 25 on the shaft 23 actuating a gear wheel 26 on the shaft 22. Power is applied to the shaft 23 in any usual manner to operate the same.

Pivoted on the arm 16 is a pawl 27, engaging the teeth of a ratchet wheel 28, fixed on the shaft 14, such pawl being held in engagement with the wheel by means of a spring 29 attached thereto at one end, and at its opposite end to the arm 16. The rotation of the wheel 21 imparts to the arm 16 a swinging movement, giving to the wheel 28 and shaft 14 an intermittent movement. A rearward rotation of the wheel 28 is prevented by a dog 30, controlled by a spring 31. On the shaft 14 is fixed a gear wheel 32, meshing with similar wheels 33 and 34 on the shafts 9 and 12, respectively. The movement of the shaft 14 is thus communicated to the shafts 9 and 12, and to the reels thereon, to give the desired movement to the wires 5.

The mechanism by means of which the stay wires are fed into the machine is specially shown in Figs. 5 and 6. A wire 36 is supplied continuously from a suitable reel or other receptacle, such wire passing through a plurality of straightening rolls 37, supported beneath a frame 35, attached to the frame 1 of the machine, on the left side thereof. A grooved wheel 38 is fixed on a shaft 39, journaled in the outer end of the frame 35. On the end of the shaft 39 is a sprocket wheel 40, actuated by a sprocket chain 41 from a sprocket wheel 42 on the end of a shaft 43, also journaled on the frame 35. On the shaft 43 is secured a miter-gear wheel 44, actuated by a similar wheel 45 on the end of a rotary shaft 46, journaled transversely of the main part of the machine, and operated by means of a gear wheel 47 fixed thereon, (Fig. 1) and actuated by a similar wheel 48 on a stud-shaft 49, supported in the frame 1, the wheel 48 being in turn operated by a gear wheel 50 on the shaft 23. On the shaft 43 is a multilated gear wheel 51, (Fig. 5,) actuating a gear wheel 52 on a shaft 53, journaled in the frame 35 above the shaft 43. On the outer end of the shaft 53 is a gear wheel 54, in mesh with a gear pinion 55, supported on a slotted frame 56, secured to the frame 35. The pinion 55 engages a gear wheel 57, fixed on a shaft 58, journaled in a pair of supports 59 on the frame 35. Fixed on the shaft 58 is a feed-roll 60, beneath which a smaller roll 61 is secured on a shaft 62, journaled in the supports 59. From the straightening rolls 37 the wire 36 passes around the wheel 38 and between the rolls 60 and 61. Between the wheel 38 and the feed-rolls is supported a rotatable cylinder 63, provided with a pulley 64 by means of which power may be applied thereto, independently of the main power of the machine. The cylinder 63 is provided with dies, extending into the interior thereof, and operating upon the wire 36, which passes through said cylinder, to further straighten the same. The last-named mechanism is not deemed to be novel, and the operating parts thereof are not shown. By the rotation of the shaft 43 movement is imparted to the shaft 39 and wheel 38 thereon, and also through the wheels 51 and 52 to the shaft 53, and from said shaft through the wheels 54, 55 and 57 to the shaft 58, causing the rotation of the feed-roll 60, whereby the wire 36 is fed into the machine. At the point where the wire 36 enters the main part of the machine a cross-plate 65 is mounted thereon, provided with a longitudinal channel 66, normally closed by a plate 67. (Fig. 7.) At each end of the plate 65 the plate 67 is supported by an arm 68, fixed on a rock-shaft 69, mounted in a support 70, fixed on the frame 1. (Figs. 1 and 25.) Projected upwardly from the supports 70 are arms 71, in the upper ends of which is journaled a shaft 72, on which are fixed a plurality of plates 73, to which are pivoted jaws 74, provided near their free ends with notches 75. The jaws 74 are held normally in contact with the plates 73 by means of coiled springs 76 attached at one end to extensions 77 of said jaws, and at the other end to posts 78 on said plates. Opposite each of the plates 73 is a double pin 79, supported in perforations 80 in the cross-plate 65, such perforations opening into the channel 66. Each of said pair of pins is actuated by an arm 81, fixed on the shaft 69. At one end the shaft 69 is provided with an arm

82, having a roller 83, engaged by the periphery of a cam-wheel 84, fixed on a shaft 85, journaled in the support 70. A gear-wheel 86 on the shaft 46 actuates a similar wheel 87 on the shaft 85, whereby rotation is imparted to said last-named shaft. At that end of the cross-plate 65 at which the wire 36 is introduced into the machine, a block 88 is slidably supported, and provided with a pin 89, engaged by an arm 90 on the shaft 69. Secured to the block 88 is a knife 91, and a similar knife 92 is fixed to a support 93, mounted on the frame of the machine. (Figs. 5 and 25.) The wire 36 is introduced into the channel 66, and forced through the same until the end thereof projects beyond the outer or selvage strand wire at the opposite side of the machine. At the point of entrance the wire passes between the knives 91 and 92, and when a sufficient length of the wire has been attained the arm 82 is actuated by the cam 84, rocking the shaft 69, and causing the severing of the wire by the closing of the knife 91 upon the knife 92. While the cutting operation is being performed the blank portion of the gear wheel 51 of the feed mechanism is in engagement with the wheel 52, causing a momentary cessation of movement of the feeding devices. The rocking movement of the shaft 69 also causes the arms 68 to draw the plate 67 downwardly, permitting the release of the severed wire from the channel 66. At the same time the pins 79, actuated by the arms 81, force the wire out of the channel, and into the jaws 74. By the rocking of the shaft 72, by means hereinafter set forth, the plates 73 are then swung downwardly, bringing the wire 6 into position transversely of the strand wires, and with its ends projecting beyond the selvage wires thereof. Just in front of the point where the stay wire is delivered to the strand wires the selvage wires pass through perforations in coiling spindles 94, supported on the frame 1, and provided with coiling pins 95. Fixed on each of the spindles 94 is a gear pinion 96, operated by a gear wheel 97, loosely supported on a shaft 98, mounted in the frame. Integral with the wheel 97 is a bevel-gear wheel 99, actuated by a bevel-gear wheel 100 on the shaft 46. Upon the stay wire 6 being delivered to the strand wires the coiling pins 95 engage the ends of said wire, and coil them upon the outer strand wires in the usual way. As the coiling proceeds the spindles are drawn gradually away from the stay wire by means of collars 101 on the rear ends of the spindles actuated by yoke-arms 102, fixed on a shaft 103, mounted in bearings 104 on the frame. At one end of the shaft 103 is secured thereto an arm 105, provided with a roller 106, engaged by a cam-wheel 107 fixed on the shaft 46. The operation of the arm 105 by the cam rocks the shaft 103 with the result just set forth. The wheel 107 is provided on its face with a cam-track 108, engaging a roller on an arm 109, fulcrumed at one end on the frame, and connected at the other end by a link 110 with an arm 111 fixed to one end of the shaft 72. By the action of the arm 109 the arm 111 is caused to rock the shaft 72, swinging the plates 73 downwardly, as hereinbefore described. After the stay wires are attached to the selvage wires, in the manner just described, they are carried along by the strand wires, in the movement thereof. After several intermittent movements, the wires are finally arrested with the stay wire in position on a plate 112, supported on a cross-bar 112ª transversely of the machine, the upper edge of such plate being notched to permit the passage of the strand wires. Above the plate 112 a bar 113 has vertical play in brackets 114, supported on the frame 1. (Fig. 8.) Secured to the bar 113 is a plurality of plates 115, adapted to engage the stay wire 6 with their lower edges when the bar 113 is lowered. Attached to a part of said plates are plates 116, provided in their lower ends with angular recesses, which aid in holding the wire 6 in place on the plate 112, and in alining the same with said plate. The ends of the bar 113 are connected with arms 117, which are pivoted at their lower ends to the outer ends of a pair of levers 118, fulcrumed on supports 119. The inner ends of the levers 118 are engaged by a cam-wheel 120 on a shaft 121, journaled on cross-beams 122, supported by the frame 1. (Figs. 8 and 21.) On one of its ends the shaft 121 is provided with a miter-gear wheel 123, actuated by a similar wheel 124 fixed on the shaft 22. By the action of the cam-wheel 120 the outer end of the levers 118 are drawn downwardly, bringing the bar 113 down upon the stay wire 6, and holding the same from movement. By means of weights 125 on the inner ends of the levers 118 the outer ends of said levers and the bar 113 can be raised to their former position when the action of the cam-wheel 120 ceases.

The wires 7 are fed in from a point above the plane of the strand wires, through straightening rolls 126, on frames 127, secured to a cross-plate 128, attached at its ends to supports 129 on the side-plates 1 of the frame. (Figs. 2, 3 and 4.) After leaving the rolls 126 the wires 7 pass beneath a plurality of feed-rolls 130, fixed on a shaft 131 journaled in the supports 129. The wires are held in contact with the feed-rolls 130 by means of idler rolls 132, supported on the ends of arms 133, pivotally supported below the plate 128. At that end of the arms 133 opposite to the rolls tension is applied thereto by means of coiled springs 134 interposed between said arms and the

plate 128. From the feed-rolls the wires 7 pass through a series of tubes 135, supported in a cross-plate 136, mounted on the supports 129. (Fig. 9.) The tubes 135 are inclined downwardly and are adapted to deliver the wires 7 at the point where the stay wire 6 is supported by the plate 112, and just above such wire. The tubes are also curved laterally so as to cause the wires 7 to cross the intersection of the strand and stay wires at an angle approximately forty-five degrees thereto, as shown in Fig. 10.

On each side of the plate 112 bars 137 are supported by arms 138 and 139 pivoted thereto at their upper ends, the arms 138 being provided with eccentric hoops 140, and the arms 139 with similar hoops 141. The hoops 140 are engaged by a pair of eccentrics 142, fixed on shafts 143, journaled on each side of the frame, and the hoops 141 are engaged by a pair of eccentrics 144 mounted on sleeves 145, loosely mounted on the shafts 143. (Fig. 17.) On that end of the sleeves 145 opposite to the eccentrics 144 are fixed rack-pinions 146, and a similar pair of pinions 147 is fixed on the shafts 143. Engaging the pinions 146 and 147 is a pair of rack-bars 148, supported on brackets 148ª, mounted on the frame 1, said bars being provided at their ends with rack-teeth 149.

Mounted on one of the cross-plates 122 and a similar plate 150 is a pair of shafts 151, on which is fixed a pair of cam-wheels 152, provided on opposite faces with cam-tracks 153, (one only being shown.) Figs. 9 and 21. A pair of rock-arms 154 is fulcrumed on supports 155 fixed to the cross-plates 122 and 150, said arms being provided with rollers adapted to be engaged by the cam-tracks 153, to rock said arms. The rocking movement of said arms is imparted to the rack-bars 148, to give a reciprocating movement thereto, by means of links 156, loosely connected with the upper ends of the arms 154 at one end, and pivotally connected with said rack-bars at their other ends. The shafts 151 are provided at one end with miter-gear wheels 157, actuated by similar wheels 158 on the shaft 22. By the action of the cam-wheels 152 movement is imparted to the rack-bars 148, causing the same to reciprocate in opposite directions, and through the rack-bars and pinions rotation is imparted to the eccentrics 142 and 144, giving to the bars 137 eccentric movements in contrary directions, and return movements thereof, for the purpose hereinafter more fully shown.

The feed-rolls 130 are operated by the following means: Fixed on the shaft 131, at one end thereof, is a ratchet-wheel 159, and outside of said wheel an arm 150 is swingingly supported on said shaft, the outer end of said arm being connected with the upper end of a bar 161, the lower end of which bar is connected with an arm 162, fulcrumed on the frame 1, as at *b*. The arm 162 is provided with a roller 163 on its inner face, engaged by a cam-track 164 on the inner face of a wheel 165, fixed on the shaft 22. (Figs. 20 and 22.) Near its upper end the bar 161 is provided on its inner face with a pawl 166, held in contact with the teeth of the ratchet-wheel 159 by means of a spring 167, fixed on said bar. Each rotation of the shaft 22 causes the cam-wheel 165 to actuate the arm 162, drawing the bar 161 downwardly, and giving to the shaft 130 and feed-rolls thereon a partial rotation. The wires 7 are thus advanced a step into the machine, the movement thereof being coincident with that of the wires 5.

Secured to the inner faces of each of the bars 137 is a plurality of plates 168, provided at their upper ends with heads 169, Figs. 8 and 13. Each of said heads is provided at one side with a projection 170, having a shoulder 170ª, and at the other side with a shoulder 171, the general form of said heads being semi-circular. A cross-plate 173 is mounted on the side plates 1, just below the tubes 135, and on such cross-plate are supported a plurality of cutting dies 174, provided with channels 175 for the passage of the strand wires 5. (Fig. 10.) The dies 174 are spaced apart so that each one of such dies will be adjacent to one of the heads 169 on that side of the plate 112 from which the wires 7 are fed into position. The heads 169, are arranged in pairs, in staggered relation, as shown in Fig. 10, and with the projections 170 facing oppositely, and toward each other. When in this position the wires 7 are fed between the several pairs of heads, and beneath the shoulders 170ª of each pair. When the bar 113 is lowered all of the wires are held rigidly thereby at the points of intersection, the wires 7 being accommodated by small recesses in the lower edges of the plates 115. The eccentric movement is then imparted to the bars 137, causing the two series of heads 139 to describe small circles around the strand wires adjacent thereto, the movement of the heads on one of the bars 137 being in a direction contrary to that of the heads on the other bar. As the bars 137 begin to move downwardly the wires 7 are severed by the shoulders 170ª passing downwardly along the ends of the dies 174. The pieces of wire thus severed are then formed into ties by having their ends coiled about the strand wires in opposite directions by the circular movements of the heads 169, resulting in the union of the wires as shown in Fig. 16.

Each of the heads 169 is provided on its inner face with a channel 172, the widest part of which is at the point of the projection 170, from which point it gradually decreases in width toward the shoulder 171, at

which point it is equal in width to the thickness of the wire. As the heads 139 begin to move downwardly the ends of the wires 7 are bent in the same direction until the tie assumes the form of a staple, as shown in Fig. 13. The heads next pass below the strand wires, partially coiling the ends of the tie wire, as shown in Fig. 14, and end with the ends of the wires 7 completely coiled upon the strand wire, as shown in Fig. 15. In the movement of the heads just described the ends of the wire 7 are engaged by the channels 172, with the effect of gradually drawing such ends inwardly toward each other, as the movement continues, resulting in a more perfect tie. In the last movement of the heads in coiling the ends of the wires 7 it is necessary to give to the heads a short horizontal movement, in order to firmly fix the extreme ends of the tie, and this is accomplished by the following means: Attached to the lower ends of each of the pairs of arms 138 and 139 are bars 176 and 177, each provided on its inner face by a roller 178, engaged by cam-tracks 179 in the faces of the wheel 120. (One only shown. Figs. 8 and 21.) When the circular movement of the heads 169 ceases, the action of the cams 179 gives to the bars 176 and 177 a slight longitudinal movement, in opposite directions, which movement is imparted to the bars 137 and heads 139, causing them to give the final movement to the ends of the tie wires, as above mentioned. When the tie wires have been secured in place, the movement of the rack-bars 148 is reversed, giving to the bars 137 and heads thereon a return circular movement. When they are at their lowest points the strand wires, with the stay 6 recently attached thereto, are advanced a step in the machine, and a new stay wire brought into position, between the coiling heads 169. From the tie-fastening mechanism the strand wires 5, with the stay wires attached thereto, pass partially around the reels 8 and 11, before referred to, and over a plurality of crimping rolls 180, fixed on a shaft 181, journaled in the plates 1, and provided at one end with a gear wheel 182, shown in part in Fig. 1. Registering with the rolls 180 are similar rolls 183 on a shaft 184, also journaled in the plates 1. Movement is imparted to the shaft 184 to rotate the same, by means of a gear-wheel 185 on the shaft 181, actuating a similar wheel 186 on the shaft 184. Fig. 2. The several pairs of crimping rolls are provided on their peripheries with suitable dies for crimping the strand and stay wires at the points of intersection, as they pass between the same. From the crimping rolls the wire fabric passes below a roller 187 on a shaft 188, supported at its ends by a pair of arms 189, loosely supported on the shaft 181. The cam-wheel 21 is provided on its outer face with a cam-track 190, engaging a roller on the inner face of an arm 191, fulcrumed on a support 192, and connected by a link 193 with a short arm 194, fixed on the shaft 188. (Fig. 1.) On that end of the shaft 22 opposite to the wheel 21 is a similar wheel 195, provided with a cam-track 196, similar to the cam-track 190. (Fig. 2.) The track 196 engages a roller on the inner face of an arm 197, fulcrumed at one end on a support 198, and connected at its other end by a link 199 with a short arm 200 on the shaft 188. At each rotation of the shaft 22 the action of the cam-tracks 190 and 196, acting simultaneously, causes the shaft 188 and roller thereon to be lowered, as shown in broken lines in Fig. 4, and again raised to their former position. The downward movement of the roller 187 forces the fence fabric downwardly, taking up any slack therein. From the roller 187 the fencing passes beneath a roller 201 on a shaft 202, rotatably mounted in the machine, and from thence upwardly and over a roller 203 on a shaft 204, also journaled in the frame of the machine. From the roller 203 the wires pass downwardly and are formed into rolls on a reel 205 on a shaft 206, journaled on extensions 207 of the frame.

On the shaft 202 is a sprocket-wheel 208, actuated from a similar wheel 209 on the shaft 22, by means of a sprocket-chain 210. Journaled on the frame extensions 207 is a shaft 211, on which is supported a sprocket-wheel 212, between a pair of friction disks 213, adapted to engage the faces of the wheel 212. The wheel 212 is actuated by a sprocket-wheel 214 on the shaft 202 by means of a sprocket-chain 215. When there is a sufficient pressure exerted by the disks 213 upon the wheel 212 the rotation of such wheel is imparted to the disks, and through them to the shaft 211. On the inner end of the shaft 211 is a gear wheel 216, engaging a similar wheel 217 on the shaft 206, whereby the movement of the shaft 211 is communicated to the shaft 206 and reel 205 thereon, to cause the rotation thereof. The degree of tension with which the fabric is wound upon the reel may be regulated by the amount of pressure exerted by the disks 213 upon the wheel 212. Said last-named devices are not considered to be novel, however, and nothing is herein claimed broadly thereon.

In recapitulation, the operation of the machine is briefly as follows: A plurality of strand wires with predetermined spacings are introduced into and carried through the machine by an intermittent or step-by-step movement. At one point in the progress of the strand wires a stay wire is fed transversely of the line of movement of such strand wires, and delivered thereto, in position to be fixed thereon. The ends of the stay wires are then coiled upon the selvage

wires of the fence, and the wires advanced to a point where a plurality of tie wires are conducted thereto, in position to be secured at the points of intersection of the strand and stay wires. The tie wires are then severed, and the ends thereof simultaneously coiled into position to form the fastenings, after which the coiling mechanism is depressed, permitting a farther movement of the wires. At the same time that the operation of coiling the tie wires is being carried on another stay wire is being fed into the machine, and located upon the strand wires, so that the operation of the machine is practically continuous. The completed fabric then passes through the crimping rolls, beneath the "take-up" roll, and to the winding reel as hereinbefore described.

What we claim as our invention, and desire to secure by Letters Patent of the United States, is:

1. In a wire fence machine, a pair of bars, eccentrically movable, in contrary directions; a plurality of coiling heads, supported on said bars, in opposite pairs; and means for imparting movement to said bars.

2. In a device of the class named, a pair of bars, supported in parallel relation; two sets of coiling heads, mounted on said bars, in opposing pairs, and provided with guide channels on their peripheries; and means for giving to said bars eccentric movements, in opposite directions.

3. In a wire fence machine, a plurality of coiling-heads, arranged in opposite pairs, one pair for each of the strand wires, except the selvage wires, said coiling-heads being semi-circular in form, and adapted to engage the opposite ends of the tie wires, to wrap the same upon the strand wires; and means for giving to said pairs of coiling-heads an eccentric movement, in contrary directions, to produce said last-named effect.

4. In a device of the class named, a pair of coiling-heads, supported on opposite sides of a strand wire, and adapted to engage the opposite ends of a tie wire, to wrap them upon the strand wire; means for support of a stay wire, transversely of the strand wire, and between said coiling-heads; and means for imparting to said coiling heads eccentric movements in opposite directions, around the strand wire.

5. In a device of the class named, a pair of coiling-heads, supported on opposite sides of a strand wire, and adapted to engage the opposite ends of a tie wire, to wrap the same upon said strand wire; means for supporting a stay wire, transversely of said strand wire, between said coiling heads; means for delivering to said coiling heads a tie wire, in position to be secured on said strand wire; and means for imparting to said coiling heads eccentric movements in contrary directions, about said strand wire.

6. In a device of the class named, a pair of coiling heads, supported on opposite sides of a strand wire, said coiling heads being semi-circular in form, and adapted to engage the opposite ends of a tie wire, to wrap the same about said strand wire; means for supporting a stay wire transversely of said strand wire, between said coiling heads; means for delivering to said coiling heads a tie wire, in position to be secured on said strand wire; means for imparting to said coiling heads eccentric movements, in contrary directions, about said strand wire, to cause the wrapping of the ends of the tie wire thereon; and means for gradually guiding the ends of said tie wire toward each other, as the same are being coiled.

7. In a device of the class named, an eccentrically movable bar; a plurality of coiling heads, supported on said bar, and receiving therefrom a circular movement; means for supporting a plurality of strand wires centrally of the line of movement of said coiling heads; means for supporting a stay wire transversely of said strand wires and adjacent to said coiling heads; means for feeding one end of a series of tie wires to said coiling heads; and means for imparting an eccentric movement to said bar.

8. In a device of the class named, a pair of coiling heads, supported on opposite sides of a strand wire, said coiling heads being semi-circular in form, and adapted to engage the opposite ends of a tie wire, to wrap the same about the strand wire; means for supporting a stay wire transversely of said strand wire, between said coiling heads; means for delivering to said coiling heads a tie wire, in position to be secured to said strand wire; means for imparting eccentric movements to said coiling heads, in contrary directions, about said strand wire; and means for giving to said coiling heads additional horizontal movements in continuation of said eccentric movements, to fix the ends of the tie wire in place tightly against the strand wire.

9. In a wire fence machine, a coiling-head, comprising a semi-circular wrapping member; a shoulder, forming a radial extension thereof, and adapted to bend the end of a tie wire upon a strand wire, in position to be operated upon by said wrapping member, and a shoulder, opposite to said first-named shoulder, adapted to complete the wrapping operation.

10. In a wire fence machine, a coiling head, comprising a circular wrapping member; a shoulder, forming a radial extension thereof, and adapted to bend the end of a tie wire upon a strand wire, in position to be operated upon by said wrapping member; a shoulder, opposite to said first-named shoulder, adapted to complete the wrapping operation; and a channel, on the inner edge of

said wrapping member, gradually decreasing in width toward said last-named shoulder, and adapted to draw the end of the tie wire gradually in the direction of the stay wire.

11. In a machine of the class named, a vertical plate, mounted transversely of the machine, and adapted to support a stay wire and series of strand wires beneath the same; a horizontal bar, supported above said plate, and provided with a plurality of downwardly projected engaging members; means for lowering said bar, to bring said members in contact with said stay wire, and hold the same from movement, and means for raising said bar to its former position.

12. In a device of the class named, a stay wire supporting plate, mounted transversely of the machine; a cross-bar, provided at its lower edge with a plurality of plates, adapted to engage the stay wire, and hold the same from movement while the tie wires are being secured in place; a vertical pair of bars, supporting said cross-bar; a pair of levers, supporting said vertical bars; a cam, engaging the inner ends of said levers, and adapted to actuate the same to lower said cross-bar; and means for actuating said cam.

13. In a wire fence machine, a pair of rotary shafts, mounted at the sides of the machine; a pair of eccentrics, fixed on said shafts; a vertical pair of arms, provided with hoops engaging said eccentrics; a bar, supported on the upper ends of said arms; a plurality of coiling heads, mounted on said bar; and means for operating said shafts, to cause said coiling heads to describe a circular movement, and return movement thereof.

14. In a wire fence machine, a pair of shafts, mounted at the sides of the machine; a pair of eccentrics, fixed on said shafts; a pair of vertical arms, provided with hoops engaging said eccentrics; a bar, supported on the upper ends of said arms; a plurality of coiling heads, mounted on said bar, a cross-bar, uniting the lower ends of said vertical arms; means for operating said shafts, to cause said coiling heads to describe a circular movement, and return thereof; and means for oscillating said connecting bar, to cause a limited horizontal movement of said heads, in continuation of said circular movement thereof.

15. In a wire fence machine, a pair of shafts, mounted at the sides of the machine; a pair of eccentrics, fixed on said shafts; a pair of vertical arms, provided with hoops engaging said eccentrics; a bar, supported on said arms; coiling heads, supported on said bar; sleeves on said shafts; eccentrics on said sleeves; a pair of vertical arms, provided with hoops engaged by said last-named eccentrics; a bar, supported on said arms; coiling heads, mounted on said bar; oppositely to said first-named coiling heads, and arranged in pairs therewith; means for operating said shafts, to give to said first named coiling heads a circular movement, and return movement thereof; and means for actuating said sleeves, to impart to said last-named coiling heads a circular movement, contrary to that of said first named coiling heads, and a return movement thereof.

16. In a wire fence machine, a pair of shafts, mounted at the sides of the machine; a pair of eccentrics, fixed on said shafts; a pair of vertical arms, provided with hoops engaging said eccentrics, a bar, supported on said arms; coiling heads, supported on said bar; a bar, connecting the lower ends of said vertical arms; sleeves on said shafts; eccentrics on said sleeves; a pair of vertical arms, provided with hoops engaged by said last-named eccentrics; a bar, supported on said arms; coiling heads, mounted on said bar, oppositely to said first-named coiling heads, and arranged in pairs therewith; a bar, connecting the lower ends of said last-named vertical arms; means for operating said shafts, to give to said first-named coiling heads a circular movement, and return movement thereof; means for actuating said sleeves, to impart to said last-named coiling-heads a circular movement, contrary to that of said first-named coiling-heads, and a return movement thereof; and means for actuating said connecting bars, to cause a limited horizontal movement of said coiling heads, in continuation of said circular movements.

17. In a machine of the class named, mechanism for feeding a series of wires into the machine, to be formed into tie wires, comprising a rotary shaft; a plurality of feed-rolls, fixed thereon; a plurality of idler rolls, engaging said feed-rolls; a plurality of tubes, adapted to receive the wires from said feed-rolls and guide them to the points of intersection of the strand wires and stay wire, obliquely to the line of movement of the strand wires; and means for suitably rotating said shaft.

18. In a machine of the class named, mechanism for delivering a plurality of tie wires to the strand wires of the fence, in position to be attached thereto, comprising a plurality of feed-rolls, and means for operating the same; a plurality of tubes, adapted to guide the tie wires to the point of intersection of the stay wire with the strand wires, and obliquely thereto; a plurality of cutting dies, supported near the point of delivery of said wires; and a plurality of coiling heads, provided with shoulders adapted to move across the ends of said cutting dies, and sever said wires.

19. In a wire fence machine, a pair of coiling head bars; a plurality of coiling heads, mounted on said bars, and oppo-

sitely disposed in pairs, on opposite sides of the strand wires; means for supporting a stay wire, between said series of coiling heads; a plurality of tubes, adapted to guide the tie wires diagonally between the several pairs of coiling heads; means for conducting the tie wires through said tubes; a plurality of cutting dies, adjacent to the coiling heads on that side from which the tie wires are conducted to the strand wires; shoulders on said coiling heads, adapted to pass downwardly across the ends of said cutting dies, and sever said wires, and means for imparting to said coiling-head bars eccentric movements in contrary directions, to lend a circular movement to said coiling-heads.

20. In a wire fence machine a vertical plate, mounted transversely thereof, and adapted to support a stay wire while the same is being secured to the strand wires; a cross-bar, mounted above said plate; engaging plates, on the lower edge thereof, adapted to hold the stay wire in position on said support; auxiliary plates, provided in their lower ends with angular recesses, adapted to bring the stay wire into alinement with the supporting plate; and means for suitably lowering and raising said bar.

21. In a wire fence machine, a vertical plate, mounted transversely thereof, and adapted to support a stay wire while the same is being attached to the strand wires; a cross-bar mounted above said plate and provided with means for engaging said stay wire, to hold the same in place; means for suitably lowering and raising said bar; and means for guiding said bar in its vertical movement.

22. In a device of the class named, a pair of shafts, mounted on the sides of the machine; a pair of sleeves, loosely supported on said shafts; a pair of pinions fixed on said shafts; a similar pair of pinions fixed on said sleeves; a pair of rack-bars, actuating said pairs of pinions; means for reciprocating said rack-bars, in contrary directions; a bar, supported on said shafts, and provided with a plurality of coiling-heads; means for imparting the movement of said shafts to said bar, to cause said coiling heads to describe a circular movement; a similar bar, supported on said sleeves, and provided with a plurality of coiling-heads, oppositely disposed to said first-named coiling-heads; and means for imparting the movement of said sleeves to said last-named bar, to cause the coiling-heads thereon to describe a circular movement.

23. In a wire fence machine, mechanism for feeding a wire into the machine, to be formed into stay wires, comprising a plurality of straightening rolls; a straightening wheel, contiguous to said rolls; a straightening cylinder, contiguous to said wheel; a pair of feed rolls; means for operating said straightening wheel; and means for operating said rolls.

24. In a wire fence machine, mechanism for feeding a plurality of strand wires through the machine, and mechanism for feeding a plurality of stay wires transversely of the strand wires, comprising a pair of feed rolls, a guide-plate, in line with said rolls; cutting mechanism, at that end of said guide-plate at which the stay wire is delivered thereto; means for ejecting the stay wire from said guide-plate; and means for actuating said cutting mechanism simultaneously with the ejection of said wire.

25. In a wire fence machine, having a series of strand wires passing therethrough, with an intermittent movement; mechanism for delivering to said strand wires a plurality of stay wires, in succession, comprising feed-roll mechanism, for introducing a wire continuously to the machine; a guide-plate, in line with said feed-roll mechanism; cutting mechanism, at that end of said guide-plate at which the wire passes into said plate; mechanism for ejecting said wire from said guide-plate; mechanism for actuating said cutting mechanism, to sever said wire simultaneously with the ejection thereof; and mechanism for delivering the severed wire to the strand wires.

26. In a wire fence machine, having a series of strand wires passing therethrough with an intermittent movement; mechanism for guiding and delivering to said strand wires, in succession, a plurality of stay wires, comprising a cross-plate, having a channel in one face thereof; means for holding said channel normally closed; means for opening said channel, to permit the removal of a stay wire therefrom; means for ejecting said stay wire, simultaneously with the opening of said channel; and gripper mechanism, adapted to receive said stay wire, upon being ejected from said channel, and conduct the same to the strand wires.

27. In a wire fence machine, having a plurality of strand wires passing therethrough with an intermittent movement, a cross-plate having in one of its faces a channel adapted to guide a stay wire transversely of said strand wires; a cutting knife, rigidly supported at the receiving end of said cross-plate; a movable knife, adapted to engage the stay wire, and shear the same upon said fixed knife; a rock-shaft, supported transversely of the machine, and means for suitably rocking the same; means for imparting the movement of said shaft to said movable knife, to cut said wire; a plate adapted to normally close said guide channel; means for imparting the movement of said rock-shaft to said plate, to open said channel; a plurality of pins, supported in said cross-plate, and adapted to eject the stay wire from said channel, and means for imparting

the movement of said rock-shaft to said pins, to perform said last-named operation.

28. In a wire fence machine, having a plurality of strand wires passing therethrough with an intermittent movement, a cross-plate provided in one of its faces with a channel adapted to guide a stay wire transversely of said strand wires; cutting mechanism, supported at the receiving end of said cross-plate; a plate, normally closing said guide-channel; a plurality of pins, supported in said cross-plate, and adapted to eject said stay wire from said channel; a rock-shaft, supported transversely of the machine; means for imparting the movement of said rock-shaft to said cutting mechanism, to sever said stay wire; means for simultaneously imparting the movement of said shaft to said plate, to open the channel; means for imparting the movement of said rock-shaft simultaneously to said pins, to eject said stay wire; means for suitably actuating said rock-shaft; and means for receiving said stay wire, when ejected from said guide-plate, and conducting the same to the strand wires in position to be attached thereto.

29. In a device of the class named, mechanism for feeding a series of strand wires through the machine; a pair of coiling spindles, mounted on said machine, and engaging the outer wires of said series; means for feeding a stay wire transversely of said strand wires, in position to be attached thereto; means for rotating said spindles, and means for moving said spindles gradually away from the stay wire as the coiling operation proceeds.

30. In a device of the class named, the combination with the frame of the machine and a main power shaft, journaled transversely thereof, of a parallel shaft, actuated from said main shaft; a pair of arms, loosely supported at one end on the ends of said shaft; a take-up roller, supported at the free ends of said arms; a pair of cam-wheels, fixed on said last-named shaft; and provided in their outer faces with similar cam-tracks; a pair of arms fulcrumed on the frame, and adapted to be actuated by said cam-wheels, and means for imparting the movement of said arms to said take-up roller, to alternately lower and raise the same.

31. In a device of the class named, the combination with the frame thereof, of a pair of rotary shafts, mounted therein, longitudinally thereof; a pair of cam-wheels, mounted on said shafts, and provided with cam-tracks on opposite faces; a pair of vertical arms, adapted to be actuated by said cam-wheels; a pair of rack-bars, reciprocatingly supported transversely of the machine, and provided with rack-teeth at each of their ends; means for connecting the upper ends of said vertical arms with said rack-bars; means for rotating said shafts, to cause said cam-wheels to impart to said arms a rocking movement, in opposite directions; a pair of shafts on the outside of said frame; a pair of pinions on said shafts, actuated by the teeth on one of said rack-bars; a pair of sleeves, loosely mounted on said shafts; pinions on said sleeves, actuated by the teeth on the ends of the other rack-bar; a pair of coiling head bars, supported transversely of the machine, each provided with a plurality of coiling heads; means for imparting the movement of said last-named shafts to one of said bars, to give an eccentric movement thereto; and means for imparting the movement of said sleeves to the other of said bars, to give a similar movement thereto, but in a direction contrary to that of said first-named bar.

32. In a machine of the class named, a rotary shaft centrally supported in the machine, longitudinally thereof; a cam-wheel, fixed on said shaft; a pair of levers, actuated by said cam-wheel; a pair of vertical arms, supported by the outer ends of said levers; a bar supported by said arms, transversely of the machine, and adapted to be lowered and raised by the movement of said levers; a vertical plate, supported transversely of the machine, below said cross-bar, and adapted to support a stay wire while the same is being secured to the strand wires; and a plurality of plates, projected downwardly from said cross-bar, and adapted to hold said stay wire in place on said cross-plate when said bar is lowered.

In testimony whereof we affix our signatures in presence of two witnesses.

WASHINGTON M. DILLON.
WARD W. LINCOLN.

Witnesses:
W. N. HASKELL,
A. H. DILLON.