No. 788,305. PATENTED APR. 25, 1905.

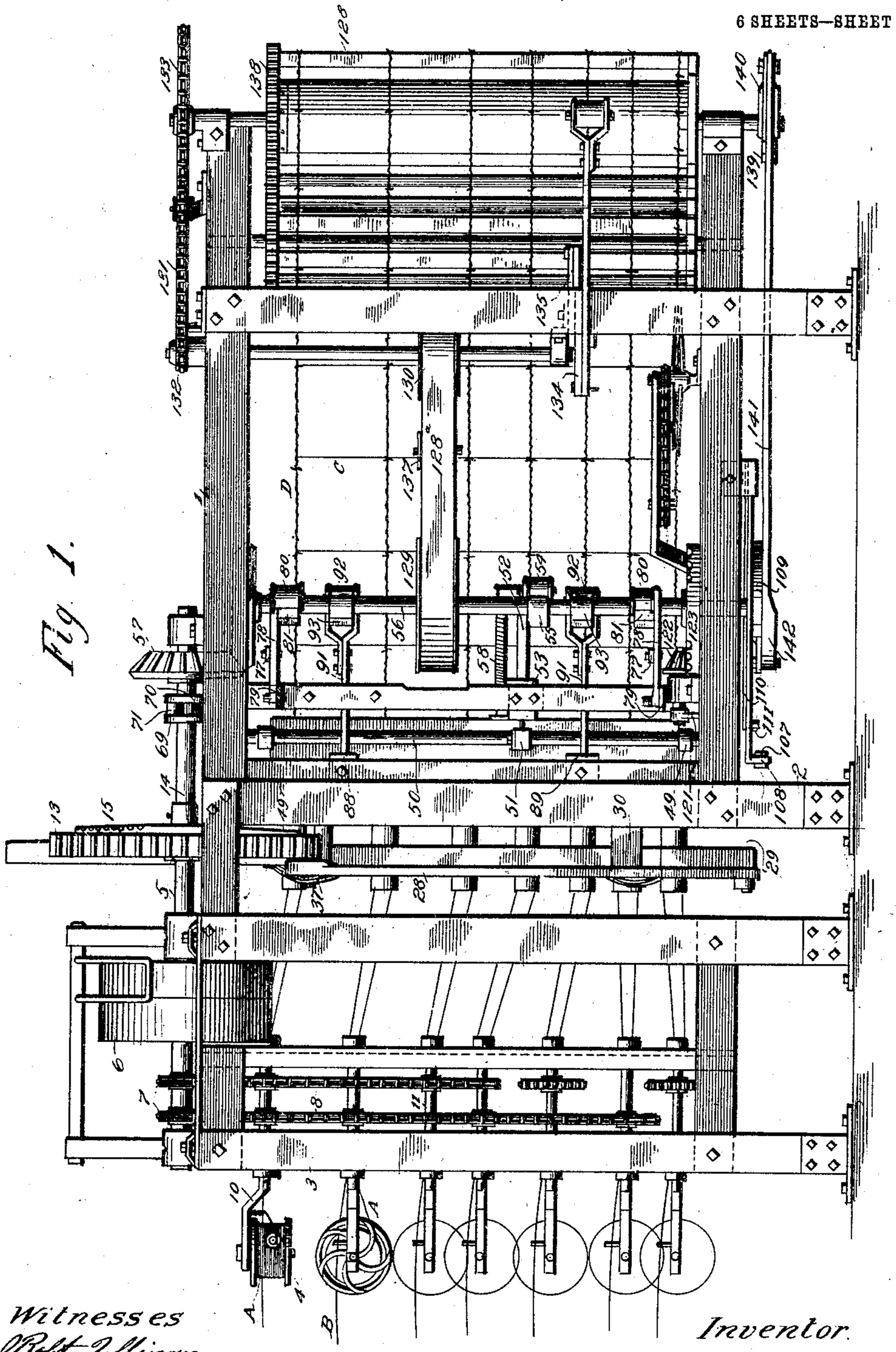
J. M. DENNING.

WIRE FENCE MACHINE.

APPLICATION FILED FEB. 29, 1904.

6 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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6 SHEETS—SHEET 2.

Fig. 2.

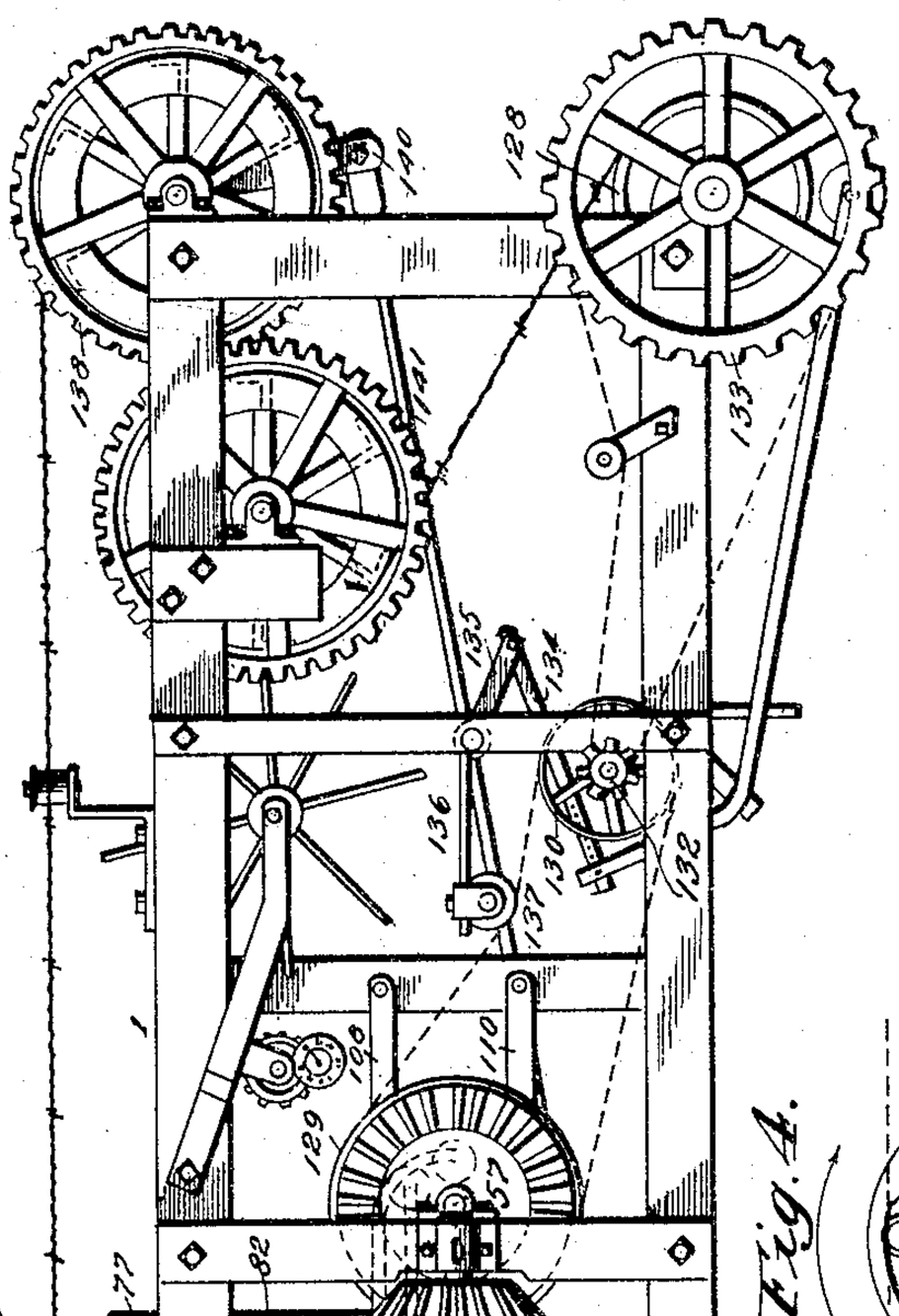


Fig. 4½

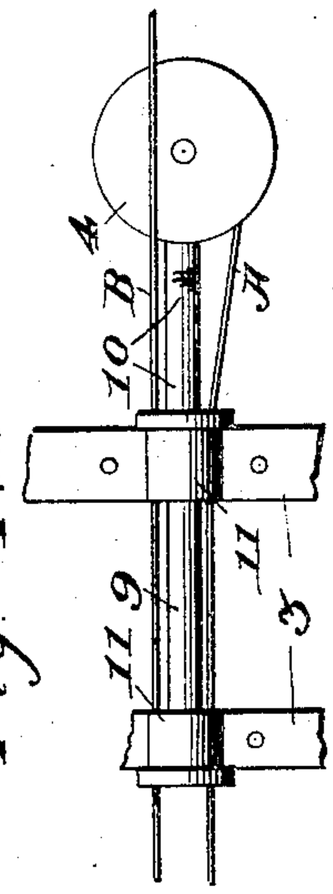


Fig. 4.

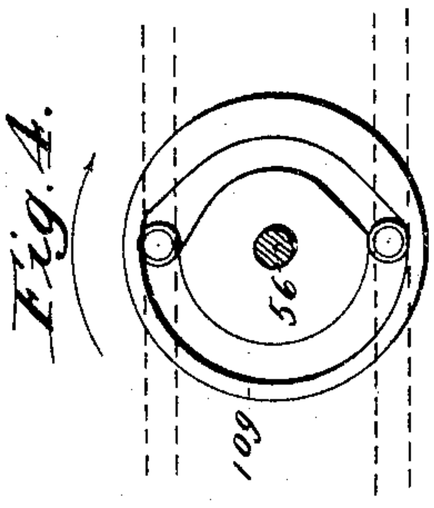
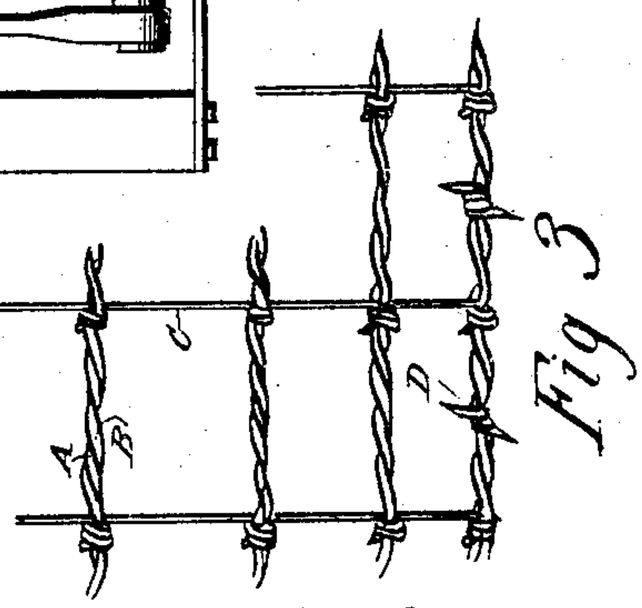


Fig. 3



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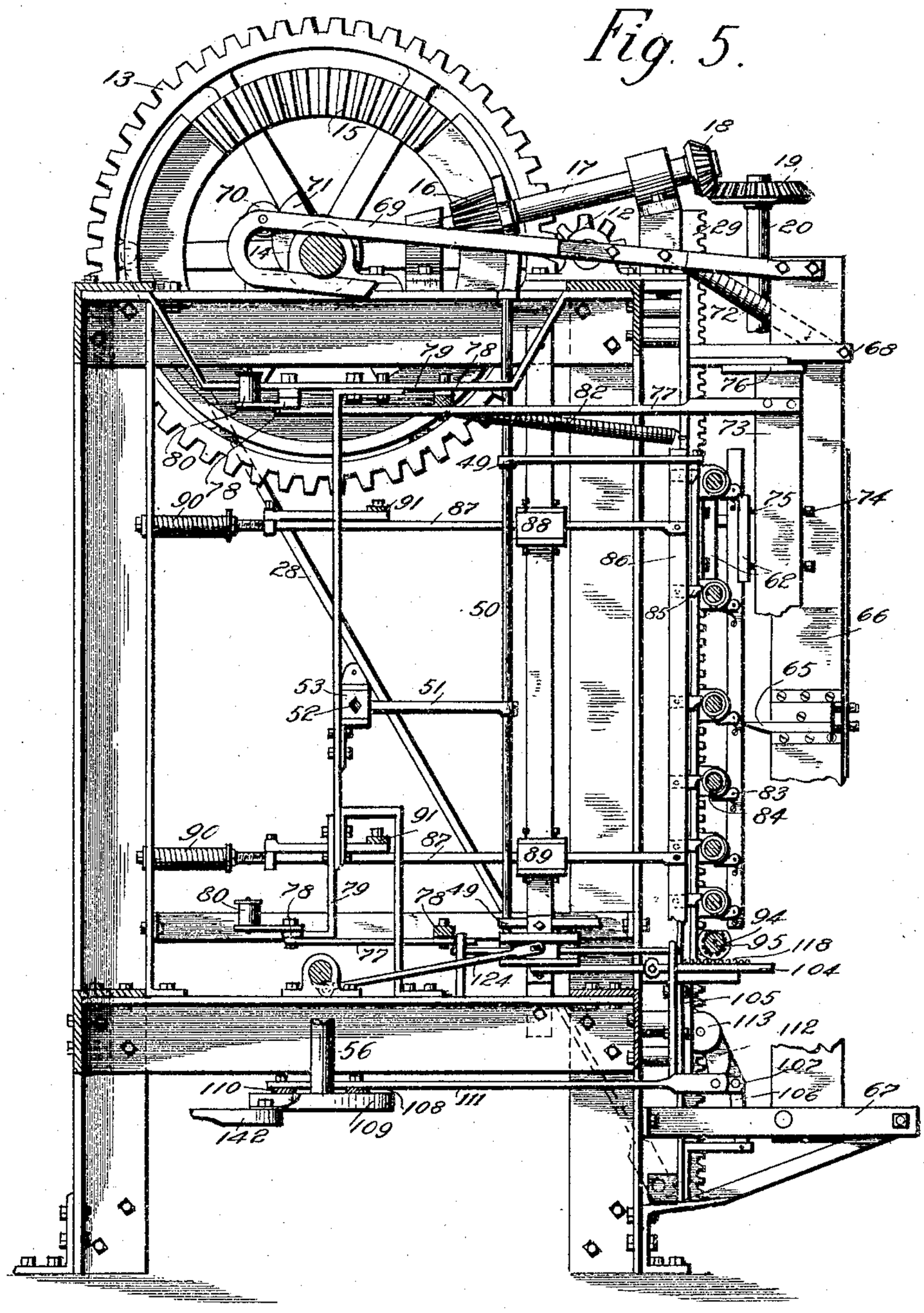
6 SHEETS—SHEET 3.

Fig. 5.



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6 SHEETS—SHEET 4.

Fig. 6.

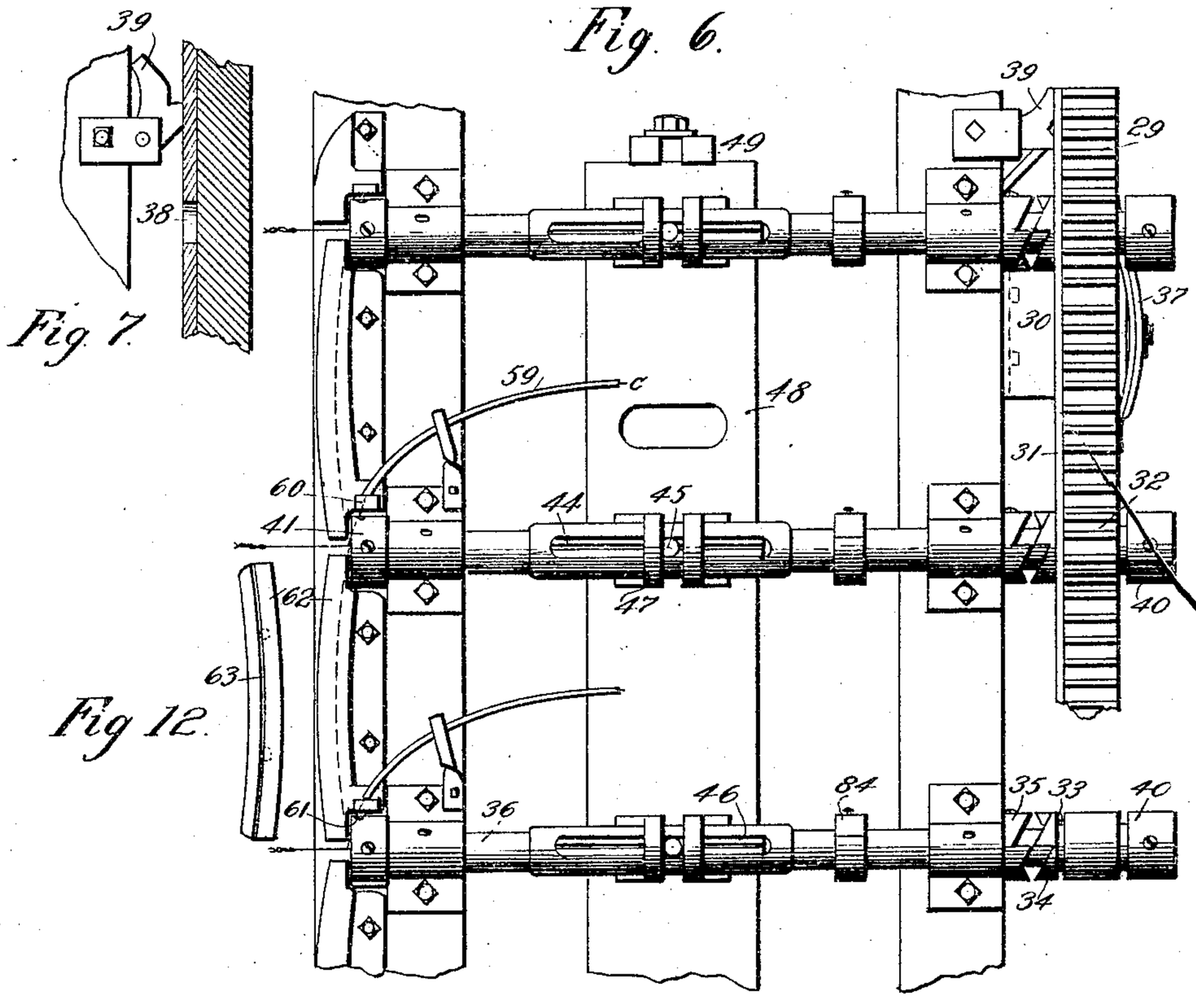


Fig. 7.

Fig 12.

Fig. 8.

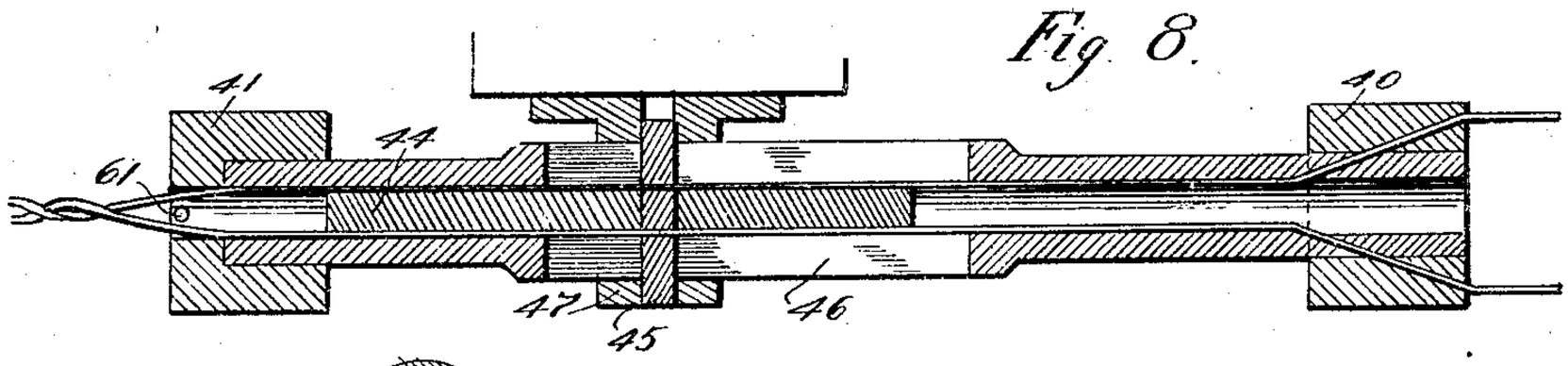
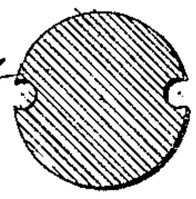


Fig. 9.



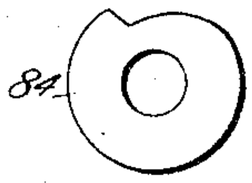
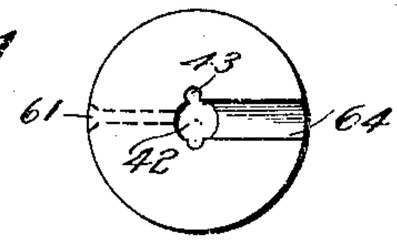


Fig 10.

Fig. 11



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6 SHEETS—SHEET 5.

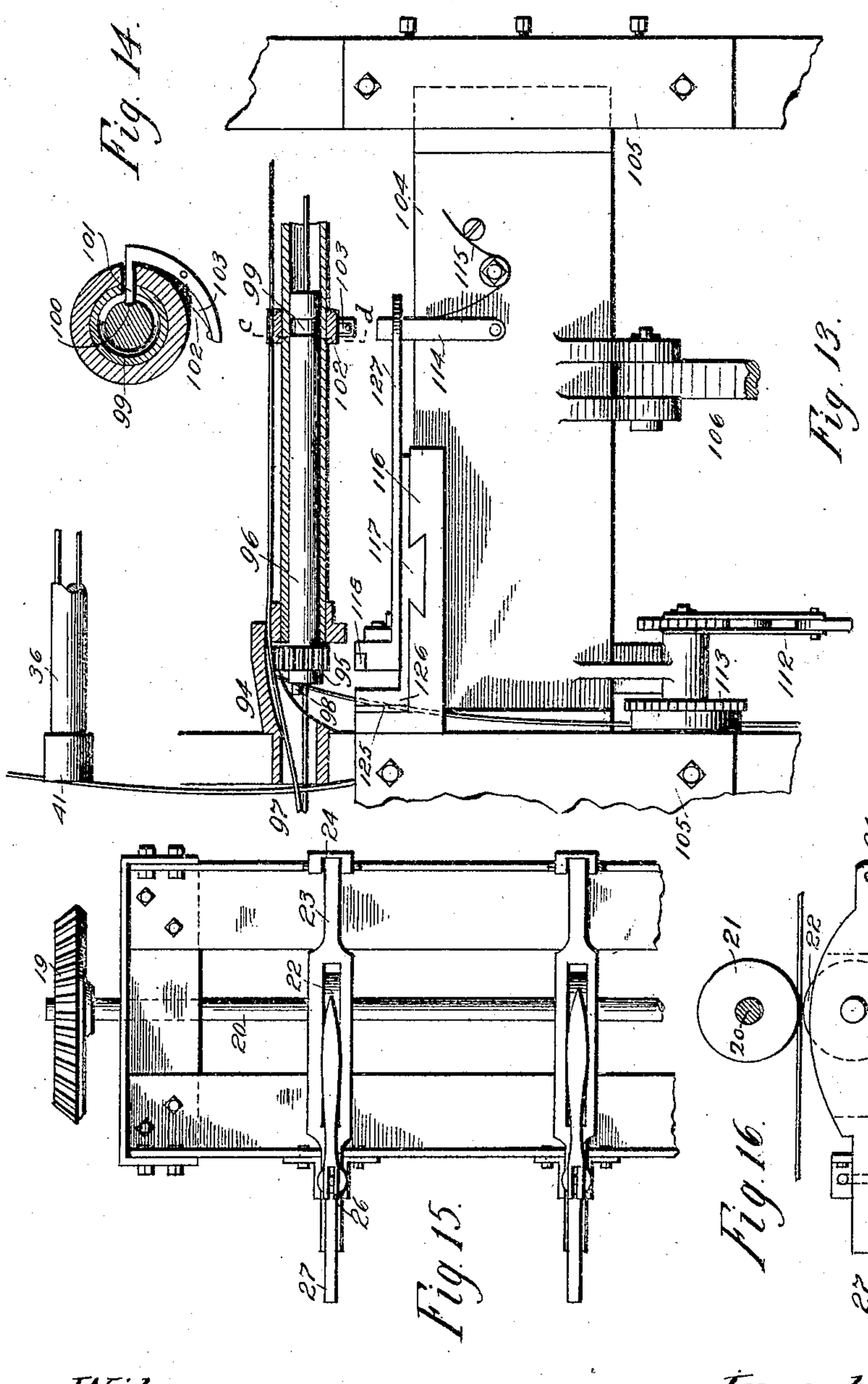

Fig. 14.

Fig. 13.

Fig. 15.

Fig. 16.

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No. 788,305. PATENTED APR. 25, 1905.

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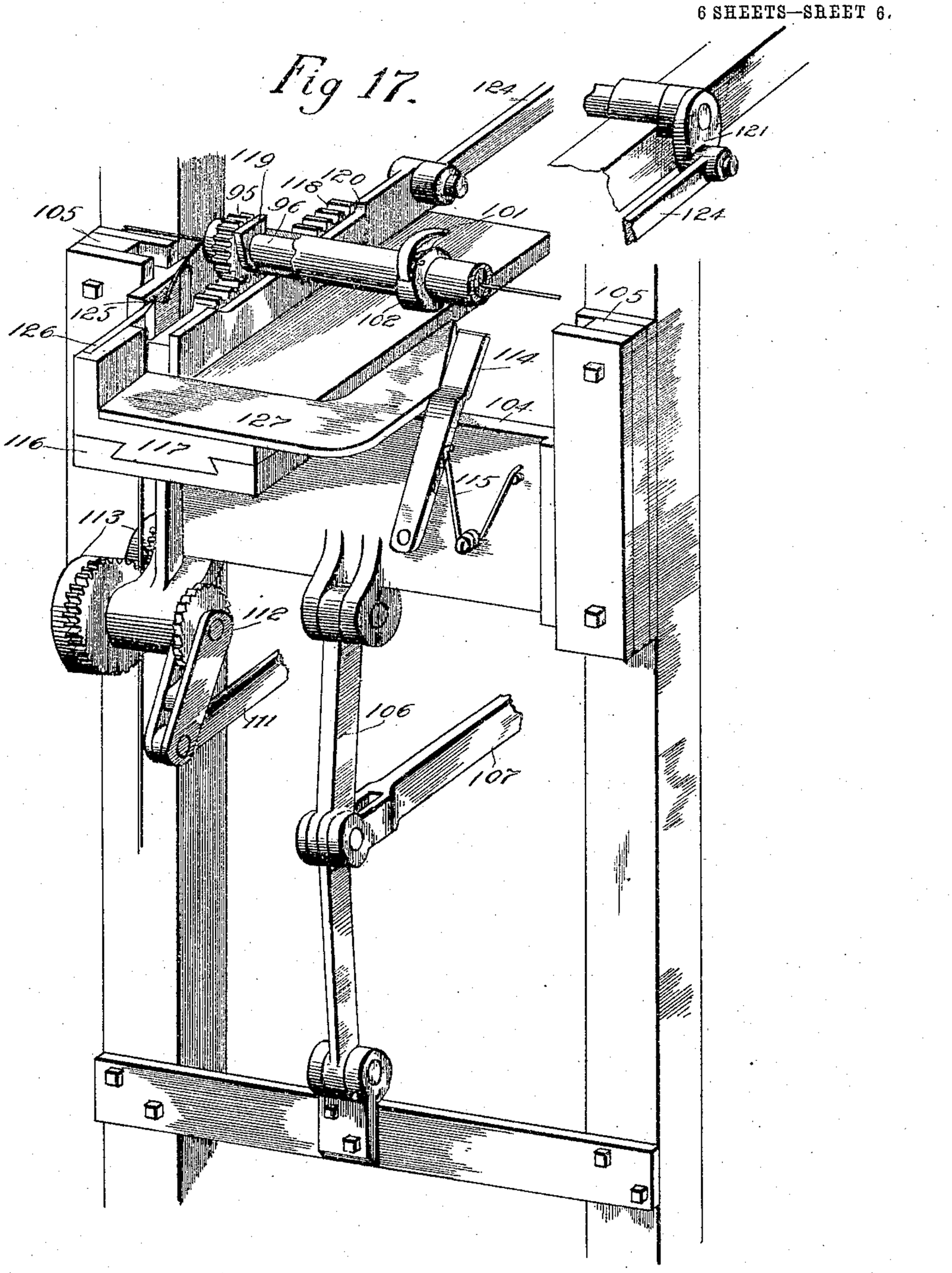
APPLICATION FILED FEB. 29, 1904.

6 SHEETS—SHEET 6.

Fig 17.



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UNITED STATES PATENT OFFICE.

JOSEPH M. DENNING, OF CEDAR RAPIDS, IOWA.

WIRE-FENCE MACHINE.

SPECIFICATION forming part of Letters Patent No. 788,305, dated April 25, 1905.

Application filed February 29, 1904. Serial No. 195,954.

To all whom it may concern:

Be it known that I, JOSEPH M. DENNING, a citizen of the United States, residing at Cedar Rapids, in the county of Linn and State of Iowa, have invented certain new and useful Improvements in Wire-Fence Machines, of which the following is a specification.

This invention relates to the manufacture of wire fence with twisted cables or longitudinal strands and cross or stay wires connecting them at regular intervals, the stays being formed of pieces of wire corresponding to the interspaces between the longitudinal wires and suitably secured at the ends thereto.

The object of this invention is to produce a machine by which wire-fence material of the sort above described may be made rapidly and automatically.

The full nature of the invention will appear from the description and claims following, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is an elevation of the machine as seen from the back side. Fig. 2 is a plan view of the same. Fig. 3 shows a fragment of the fence. Fig. 4 illustrates a cam which actuates mechanism connecting with the barbing apparatus hereinafter to be described. Fig. $4\frac{1}{2}$ is a sectional view showing detail of the spool-shaft and its connections. Fig. 5 is a section of the machine in the main general plane *a b*, but with parts broken away and showing parts in other planes. Fig. 6 is a front view showing a portion of the apparatus for attaching the stay-wires to the strand-wires or cables and for twisting the latter. Fig. 7 is a fragmentary sectional view showing mechanism for intermittently engaging and disengaging from actuating the mechanism driving the coiling-spindles. Fig. 8 is a longitudinal section of said spindle. Fig. 9 is a cross-section of the core thereof. Fig. 10 is a stop-collar mounted on said spindle. Fig. 11 is a view of the outer end of a coiler-head. Fig. 12 is a view of the inner side of one of the stay-wire guides. Fig. 13 is a front elevation of the barbing mechanism and coiler parts, being mainly in section. Fig. 14 is a cross-section of said coiler in the line *c d*. Fig. 15 is a front view of a portion of the stay-wire-feed mechanism. Fig. 16 is a plan view of the same. Fig. 17 is a front view of the barbing mechanism in perspective.

In the type of machine herein illustrated the fence is made in vertical position, as it stands when attached to fence-posts. The longitudinal stands are composed of a plurality (preferably two) of wires twisted to form cables. The cross-wires, commonly called "stay-wires," are formed of pieces of wire extending from cable to cable and secured at the intersections, as above mentioned. The machine is designed to perform this operation automatically, taking each stay-section from a separate coil of wire and attaching them simultaneously. Provision is also made for barbing the lower cable, and this with suitable modifications might be applied to other cables, if desired.

Referring now to the drawings, 1 is a rectangular frame supported on posts 2. An extension of this frame, 3, carries the spools 4 for one strand of each cable. The other strand is brought direct from the original coil. (Not shown.) For convenience the spooled strand may be designated by the reference-letter A, the other strand by B, the stay-wires by the letter C, and the barb by the letter D. Of these only one wire for each cable need be spooled. The others may all come directly from the main coil.

In suitable bearings at the top of the main frame is mounted the driving-shaft 5, provided with pulleys 6. On the same shaft are sprockets 7, connecting by link belts 8 with similar sprockets on different gangs of spool-shafts 9, which are arranged in staggered order, owing to the comparative closeness of the cables to each other. The spool-shaft has an offset arm at 10 to take the stud on which the spool is mounted. The journals of the spool-shaft 11 are in the nature of collars, with holes adjacent to the shaft to allow the wires to pass through. These spool-shafts being in direct connection with the main driving-shaft have a continuous rotation, and thus twist the two strands of the cable in the space between them and the coilers, to be described hereinafter. It may be re-

marked here that the coilers are geared to untwist intermittently as fast as the spool-shafts twist. On the other side of the pulleys the driving-shaft has a pinion 12, meshing with a large gear 13 on a shaft 14, mounted on top of the main frame. Adjacent to the large spur-gear is a mutilated bevel-gear 15, meshing intermittently with a bevel-pinion 16 on a shaft 17. A pinion 18 at the other end of this shaft meshes with a bevel-gear 19 on a vertical shaft 20, provided with feed-rolls 21. In Figs. 15 and 16 the companion rolls 22 are shown mounted in a yoke 23. This yoke is hinged at 24 to a part of the frame, so that the roll 22 may be swung in and out of juxtaposition with the fixed roll on the shaft 20. The forked free end of the yoke straddles a link 25, pivoted at one end to a part of the frame and at the other end to a cam 26. Between the cam and the yoke is a stirrup-shaped spring 27, and by this means the rolls are made to pinch tightly on the wire running between them. A pair of these rolls is provided for each stay-wire. Any pair of rolls is quickly shifted from the operative position shown by turning back the cam and swinging the link and its connection out over the forked end of the yoke.

To a wrist on the spur-gear 13 is coupled a long connecting-rod 28, engaging the lower end of the rack 29, mounted in suitable guides 30, Fig. 1. This rack is provided with a rib 31 adjacent to the teeth, and the pinion 32 meshing with the rack has a groove 33 to take this rib. The clutch-faced end of the pinion 34 is adapted to engage a similar-shaped clutch-collar 35, secured to the coiler-spindle 36. The rack is so mounted as to admit of its moving a limited distance sidewise as well as endwise, and springs 37 are provided to press it inwardly, so as to throw the pinions into engagement by the clutch with said spindles, it being understood that there is such a spindle for each fence-cable, as indicated in Fig. 6. In the plate forming the rib 31 are two holes 38, and adjacent to the rib-plate on the frame is pivoted a pair of shoes 39. In the drawings but the upper hole and shoe are shown; but it is to be understood that the construction is duplicated near the lower end of the rack, so that the latter is moved in and out parallel with the adjacent part of the frame, simultaneously engaging and disengaging the coilers. In Fig. 7 the section of rack is supposed to be on the upstroke. At the limit of this stroke the heel of the shoe drops by gravity into the hole in the rib-plate, and on the downstroke the rack is of course forced outwardly, disengaging the clutches. On the upstroke the action is reversed, the clutches being all engaged by the movement of the rack through the action of the springs 37, as above mentioned. In practice the coiler-spindles are given four revolutions, consuming practically all of the upstroke of the rack and half the revolution of the gear 13. Of this time two revolutions are required to coil the stay-wire ends and the whole four to twist the strands of the cables. As before mentioned, this twist exactly untwists that formed farther back by the continuous revolution of the spool-shafts.

The coiler-spindles are made tubular, as clearly shown in Fig. 8, and at the rear ends have collars 40 with diagonal holes to take the strand-wires. The purpose of the collars is to separate the strand-wires, so that as twisted by the spool-shafts the twist is not too close to be untwisted by the coilers. At the other ends the coilers are provided with heads 41, having each a central hole 42 with lateral notches 43, into which the strand-wires may retreat as forced apart by a spreader 44, mounted to slide endwise in the coiler-spindles. The spreader is moved back and forth by a pin 45, projecting through slots 46 in the sides of the spindle-tube. The ends of the pin engage collars 47, attached to a vertical bar or plate 48, hung on parallel arms 49, attached to a vertical rock-shaft 50. To this shaft is secured another arm, 51, pivoted to a slide-bar 52, mounted in a guide 53 and provided at its free end with a roller 54 to engage a cam 55 on a vertical shaft 56, driven by the shaft 14 through the medium of bevel-gears 57. The device is moved in the opposite direction by a spring 58. The cam is timed to move the spreader toward the coiler-head while the coiler is at rest, so as to separate the strand-wires for the free admission of the crossing stay-wires fed between them during the same interval of time. As soon as such stay-wire feed is completed, however, the high point of the cam passes, and the spreaders are moved back through the medium of the spring, as above mentioned, allowing the strand-wires to twist back of the connection with the stay-wires. The cam is similar to that shown in Fig. 10.

The stay-wires after leaving their feed-rolls pass through curved tubes 59 across a die 60, where they are cut off at the proper time. From this point each wire passes through a hole in one side of the head 61, thence between a pair of guide-blocks 62, one of which, preferably the movable one, has a curved groove 63 therein. This directs the wire to the next head below, where it enters a channel 64, formed in the head opposite the hole 61. The curved ends of the stay-wires therefore cross each other between the strand of all the cables except the top and bottom ones, where there is of course but a single end.

The stay-wires are cut off by cutters 65, attached to a bar 66, pivoted in a bracket 67 and moving between guides 68 near the top of the machine. The upper end of the bar has an arm 69, provided with a roller 70 to engage a cam 71 on the shaft 14 and swing the bar inwardly to cut-off. The bar swings

back by gravity when the high point of the cam has passed the roller. The weight of the bar may be aided by a spring 72, as shown in Fig. 5.

On the completion of the stay-wire-coiling operation the guides 62 open to allow the completed fence to move forward. To this end the outer set of guide-blocks is connected to a bar 73 by stems 74, mounted to slide with respect to said bar. Between the bar and the guide-blocks are springs 75, tending to press the guides inwardly, so that when all are drawn to the guiding position they make close contact with their companion guide-blocks, but at the same time allow for kinks or other obstructions to interpose without danger of breaking any of the parts. The bar is mounted at the top and bottom in guides 76 (the one at the top only being shown) and is connected near the upper and lower ends with arms 77, the free ends of which couple to levers 78, pivoted to fixed brackets 79. The free ends of the levers are provided with rollers 80 to engage cams 81, which are of the same type as that shown in Fig. 10. The bar is moved outwardly by a spring 82.

The coilers are prevented from turning backwardly on the downstroke of the rack by pawls 83, engaging stop-collars 84. Provision is also made for preventing any premature forward movement of the coilers. Stop-collars similar to the cam, Fig. 10, are attached to the coiler-spindles. Adjacent to these are stops 85, attached to a bar 86. This connects with slide-rods 87, running in guides 88 and 89. Springs 90 tend to force them outwardly to the holding position. To move them in the opposite direction, the slide-rods are linked to levers 91, having each a roller 92 at the free end to engage a cam 93. The cam is timed to move the stops out of the arresting position during the normal movement of the coilers. In fence of this nature it is sometimes desirable to barb one or more of the cables, usually the lowest one. The mechanism for this purpose is described as follows: To the tubular coiler-spindle is attached a hollow cut-away head 94, large enough at the throat to allow the finished barb to pass through and enlarging backwardly therefrom to give room for a pinion 95 near the end of the barb-coiling spindle 96 and allow one of the strand-wires to pass between the pinion and said head. The outer end of the head, which serves as one of the bearings for the spindle, has a suitable plate 97 to coil the stay-wire. The end of the barbing-spindle has a stud 98 for coiling the barb about the cable. Near the other end the spindle is provided with a groove 99 and a hole 100 therein to take the nose of a latch 101, adapted to lock the spindle while the barb-wire is feeding and to hold the spindle endwise at other times. The latch is pivoted in lugs 102 and has a spring 103 to bring it to locking position. This serves as a means for engaging and disengaging the barbing-spindle and the stay-wire coiler, so that a part of the time they may act independently and a part of the time concurrently. Below the spindle a cross-head 104 is mounted to slide in guides 105, moved up and down by toggle-levers 106, connecting by a rod 107 with a lever 108, actuated by a cam 109 at the lower end of the vertical shaft 56. The same cam also actuates another lever 110, connecting by a rod 111 with the pawl-arm 112, by which intermittent movement is imparted to the barb-wire-feed rolls 113, mounted on the same cross-head. Pivoted to the cross-head is a finger 114, controlled by a spring 115, to swing under the latch 101, above described, and disengage it as the cross-head moves to its uppermost position. In guides 116 at the top of the cross-head is mounted a slide 117, provided with a rack 118 to engage the pinion of the barbing-spindle. Adjacent to the pinion is a shoulder 119 to engage plane faces of ribs 120 in line therewith at either terminus of the rack. By this means the spindle is brought positively to proper position for the pinion to engage the rack as it moves forward. On the back stroke it is not in engagement, the whole cross-head being dropped by the action of the cam and its connections. The slide is moved back and forth by a crank 121, revolving intermittently through the medium of a pinion 122 on the same shaft, and an engaging mutilated bevel-gear 123, the crank being coupled to the slide by a suitable connecting-rod 124. Near one side of the slide is a plate 125 with a hole in it to allow the barb-wire to pass through in a diagonal direction, and in line with it is a cutting-die 126, secured to the slide. A cam 127, attached to the slide, serves to move the finger 114 out of the path of the latch, so that when the stay-wire coiler comes into action after the barb is made the coiler and the barbing-spindle may automatically interlock. The order in which these operations take place is as follows: During the interval of time in which the cross-head is elevated the barb-wire is fed forward. The slide then moves forward and coils it about one of the strand-wires, cutting it off near the end of its movement and in its course moving the finger out of the path of the latch. The cross-head then descends and the coiling mechanism coils the stay-wire about the strand-wires and twists them, as heretofore described. The completed fence-web passes now to the reel 128, which is driven by a friction-belt 128^a, pulleys 129 and 130, link belt 131, and sprockets 132 and 133 in a manner so simple as to require no description. To give additional friction as the roll of wire enlarges on the reel, an arm 134 is pivoted to a bracket 135 and linked to a lever 136, carrying an idler-pulley 137 to engage the looser side of the friction-belt. The fence is paid out intermit-

tently and in uniform spaces by a cylinder 138, around which the web is trained. The cylinder is one of a pair geared together and is driven by a ratchet and pawl 139, connecting by an arm 140 and rod 141 with a wrist 142 on the under side of the cam 109.

The fence made by the machine above described is that shown in United States Patent No. 617,084, issued to me on the 3d day of January, 1899, to which reference may be had, if desired.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a wire-fence machine, in combination with mechanism for attaching stay-wires to a plurality of strand-wires, a spool for one of the strand-wires of each longitudinal cable, and an offset rotating shaft therefor holding the spool practically central to the axis of said shaft and adapted to rotate the spool about the other strand of the cable.

2. In a wire-fence machine, in combination with mechanism adapted to attach stay-wires to a series of longitudinal cables and for feeding the finished fence forward intermittently, a twisting device for each cable, comprising a single spool of strand-wire and a rotating shaft on which it is mounted to turn sidewise and around the other strand-wire.

3. In a wire-fence machine, the combination with mechanism adapted to attach stay-wires to a series of longitudinal cables, and for feeding the finished fence forward intermittently, twisting mechanism for the strand-wires of the cables, comprising a single spool for each cable, a shaft on which it is mounted so as to rotate around the other strand sidewise, and bearings for the series of spool-shafts arranged in staggered order, with means for rotating them.

4. In a wire-fence machine adapted to attach stay-wires to a plurality of longitudinal cables each composed of a plurality of strand-wires, spools for one strand of each cable, means for rotating them continuously to twist the wires together, and mechanism independent thereof adapted to intermittently fasten the stay-wires and twist the cables, untwisting thereby the twist made by the rotation of the spools.

5. In a wire-fence machine adapted to attach stay-wires to a plurality of twisted longitudinal cables and to feed the finished fence forward intermittently, twisting mechanism for the cables, comprising a single spool for each cable, a shaft on which it is mounted to rotate sidewise, and having enlarged bearings with holes therein for the strand-wires external to the shafts.

6. In a fence-machine adapted to attach stay-wires to a series of strand-wires, and to feed the finished fence forward intermittently, a series of coilers for attaching said stay-wires and for twisting the strands of the longitudinal cables, pinions on said coilers adapted to make a clutch connection therewith, a rack engaging said pinions, means for reciprocating said rack continuously, and mechanism adapted to shift said rack and pinions sidewise during a part of its movement.

7. In a fence-machine adapted to attach stay-wires to a series of longitudinal cables and to feed the finished fence forward intermittently, coilers adapted to attach said stay-wires and twist the strands of the cables, pinions on said coilers, engaging therewith by clutches, a rack engaging said pinions both to rotate them and to move them sidewise, means for reciprocating said rack, springs to hold them sidewise in one direction and tilting shoes adapted to throw the rack in the opposite direction during a part of its stroke.

8. The herein-described mechanism for intermittently rotating the coilers of a fence-machine, comprising a clutch-collar on each coiler-spindle, a pinion loosely mounted adjacent thereto, having a lateral clutch with a circumferential groove therein, a rack engaging said pinions, with an adjacent rib entering said clutch-groove, guides for the rack, springs to hold it sidewise in one direction, shoes opposite thereto adapted to tilt and push the rack outwardly during a part of its stroke, depressions in the face of the rack next to said shoes, and means for reciprocating the rack.

9. In a fence-machine, the combination with a series of coilers adapted to attach stay-wires to longitudinal cables, and to twist the cables, pinions on said coilers engaging therewith by a clutch connection, a reciprocating rack to rotate the pinions in alternate directions, means for shifting the rack sidewise during a part of its stroke and for disengaging the clutches, and a stop-collar and pawl for each coiler, adapted to prevent movement thereof during the back stroke of the rack.

10. In a fence-machine having coilers adapted to attach stay-wires to longitudinal cables and to twist the cables, the combination of pinions engaging said coilers by a clutch connection, a reciprocating rack engaging said pinions, means for shifting it and the pinions sidewise to disengage the clutches, and mechanism adapted to lock said coilers from turning in either direction until moved forward by said rack and pinions.

11. In a fence-machine adapted to attach stay-wires to a plurality of longitudinal cables and to feed the fence intermittently forward, a gang of coilers adapted to attach the ends of stay-wires to the cables and to twist the latter, a spreader working inside each coiler, to separate the strands and allow the stay-wires to feed between them, and means for advancing said spreader for the feed, and retiring it after the feed is completed.

12. In combination with the stay-wire coiler

and twister of a fence-machine, substantially as described, a cable-wire spreader mounted to slide inside the coiler, and groove at the sides for the passage of the strand-wires, studs projecting from said spreader laterally, slots in the walls of the coiler for said studs, and collars embracing the coiler-spindle and connecting with mechanism adapted to move them endwise thereon.

13. A stay-wire coiler and cable-twister for a fence-machine, comprising a tubular shaft or spindle, a coiler-head at one end, a collar at the other end with diagonal wire-holes therein leading to the inside of the tube, a plunger mounted to slide inside said tube, and grooved at the sides for the passage of wires, and mechanism connecting with said plunger adapted to advance it toward the head to separate the wires at that point, and to retire it later to allow the wires to twist together.

14. A stay-wire coiler and cable-twister for fence-machines, comprising a tubular shaft or spindle, a coiler-head at one end with a central hole therein and having lateral recesses therein to take the strand-wires as spread apart, a transverse hole to receive the stay-wire, a spreader mounted to slide endwise inside said spindle, and means for moving it toward the head to separate the wires at that point and for retiring it to normal position.

15. In a fence-machine the combination of mechanism to attach stay-wires to plural longitudinal cables and to feed the finished fence forward intermittently, an independent barbing device, comprising a wire-feed, a cut-off for the barb, a coiler to coil it on one of the cable-wires, and means for actuating the barbing mechanism intermittently, and independent of the stay-wire-attaching mechanism.

16. In a fence-machine adapted to attach stay-wires to plural longitudinal cables and to feed the finished fence forward intermittently, a coiler adapted to secure the stay-wires to the cables, and twist the latter, a barbing-spindle mounted inside the coiler, and adapted to rotate independently thereof, and mechanism adapted to successively rotate the barbing-spindle and the coiler.

17. In a fence-machine adapted to attach stay-wires to plural longitudinal cables and feed the finished fence forward intermittently, a coiler adapted to attach said stay-wires to said cables, and twist the latter, a barbing-spindle mounted to revolve inside the coiler, feed mechanism for the barb-wire, a cut-off therefor, and mechanism adapted to first rotate the barbing-spindle to form the barb, and then rotate the coiler.

18. In a fence-machine adapted to attach stay-wires to plural longitudinal cables and to advance the finished fence intermittently, a coiler adapted to attach a stay-wire to one of said cables and to twist the cable, a barbing-spindle rotatably mounted therein, a latch to lock it to the coiler, and mechanism for feeding the wire to said spindle, cutting it off, and successively rotating the barbing-spindle and the coiler and spindle concurrently, and for engaging and disengaging the latch.

19. In a fence-machine adapted to make fence having longitudinal twisted cables and transverse stay-wires, the combination with a tubular coiler for attaching said stay-wires, of a barbing-spindle rotatively mounted therein, a pinion on said spindle, a reciprocating rack adapted to engage said spindle, and means for successively actuating said rack and rotating the coiler.

20. In a machine adapted to make wire fence having twisted longitudinal cable-strands and transverse stay-wires, the combination with a coiler for attaching said stay-wires, of a barbing-spindle rotatably mounted inside the coiler, a pinion on said spindle, a reciprocating rack to engage the pinion, a cross-head carrying said rack, and mechanism adapted to advance the cross-head to engage the rack and pinion, for reciprocating the rack, and for rotating the coiler.

21. In a fence-machine substantially as described, the combination of a stay-wire coiler adapted to twist the strand-wire cables, a barbing-spindle mounted to rotate inside the coiler, a pinion on said spindle, a flat-faced shoulder adjacent to the pinion, a rack adapted to engage the pinion and having terminal flat-faced ribs adjacent to its ends to engage the pinion-shoulder, a cross-head carrying said rack, and means for advancing the cross-head, reciprocating the rack and rotating the coiler.

22. In a fence-machine, the combination of mechanism for intermittently advancing and twisting together in pairs a plurality of longitudinal cable-strands, mechanism for feeding, cutting off and attaching to said cables separate pieces of stay-wire spanning the spaces between the cables, said pieces of wire being crossed between the strand-wires and the crossed ends coiled about the strands.

23. In a fence-machine, the combination of mechanism for intermittently advancing and twisting together pairs of longitudinal strand-wires, mechanism for feeding between said strand-wires separate stay-wires, for cutting off said wires in lengths to span the spaces between the strand-wires, for coiling the crossed ends about the strand-wires, and for attaching barbs to one or more strands in the space between two stay-wires.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH M. DENNING.

Witnesses:
J. M. St. John,
F. J. Kubrick.