(No Model.) 4 Sheets—Sheet 1.

B. SCARLES.

WIRE NETTING MACHINE.

No. 380,664. Patented Apr. 3, 1888.

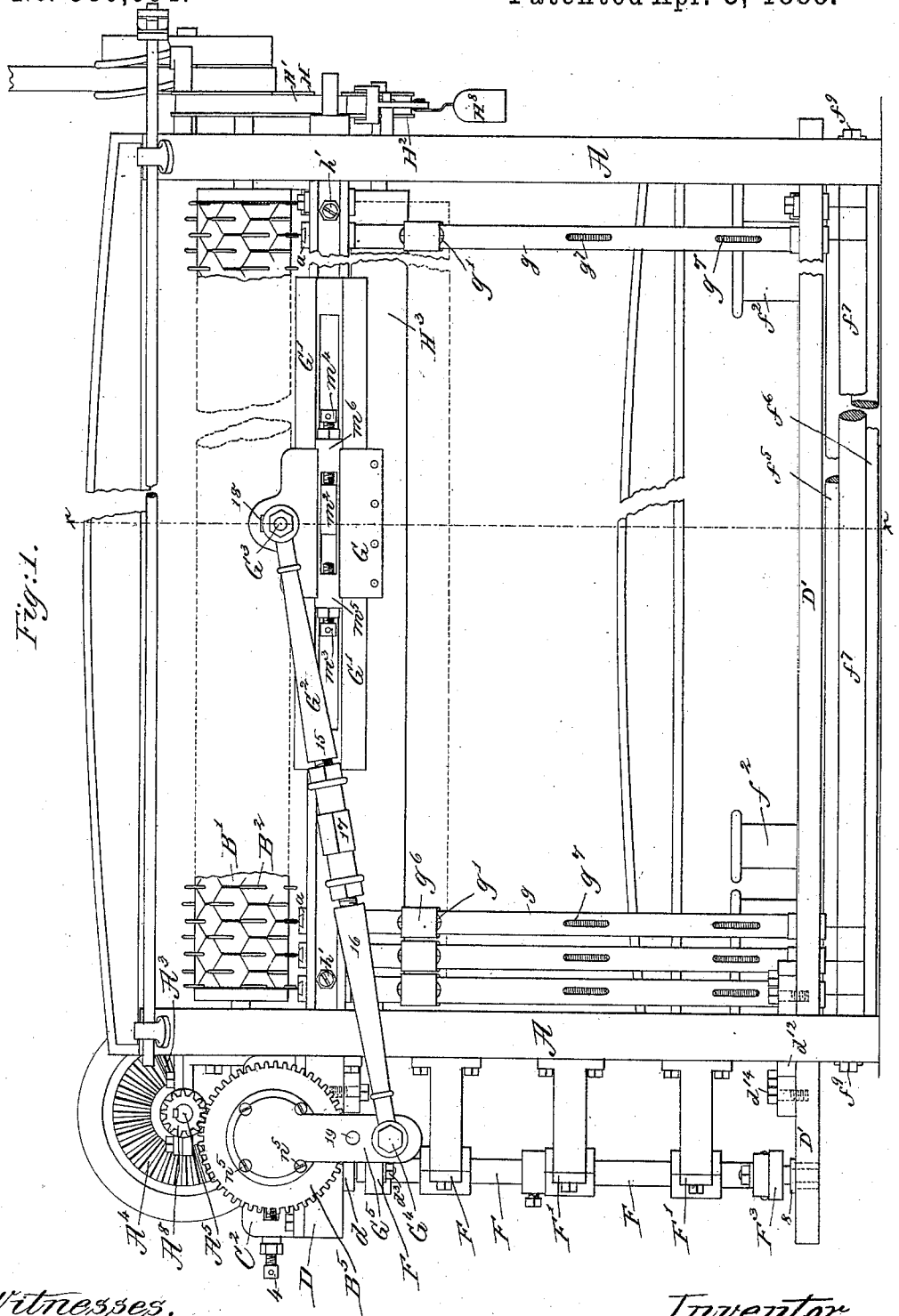


Fig. 1.

Witnesses.
Arthur Zipperlen.
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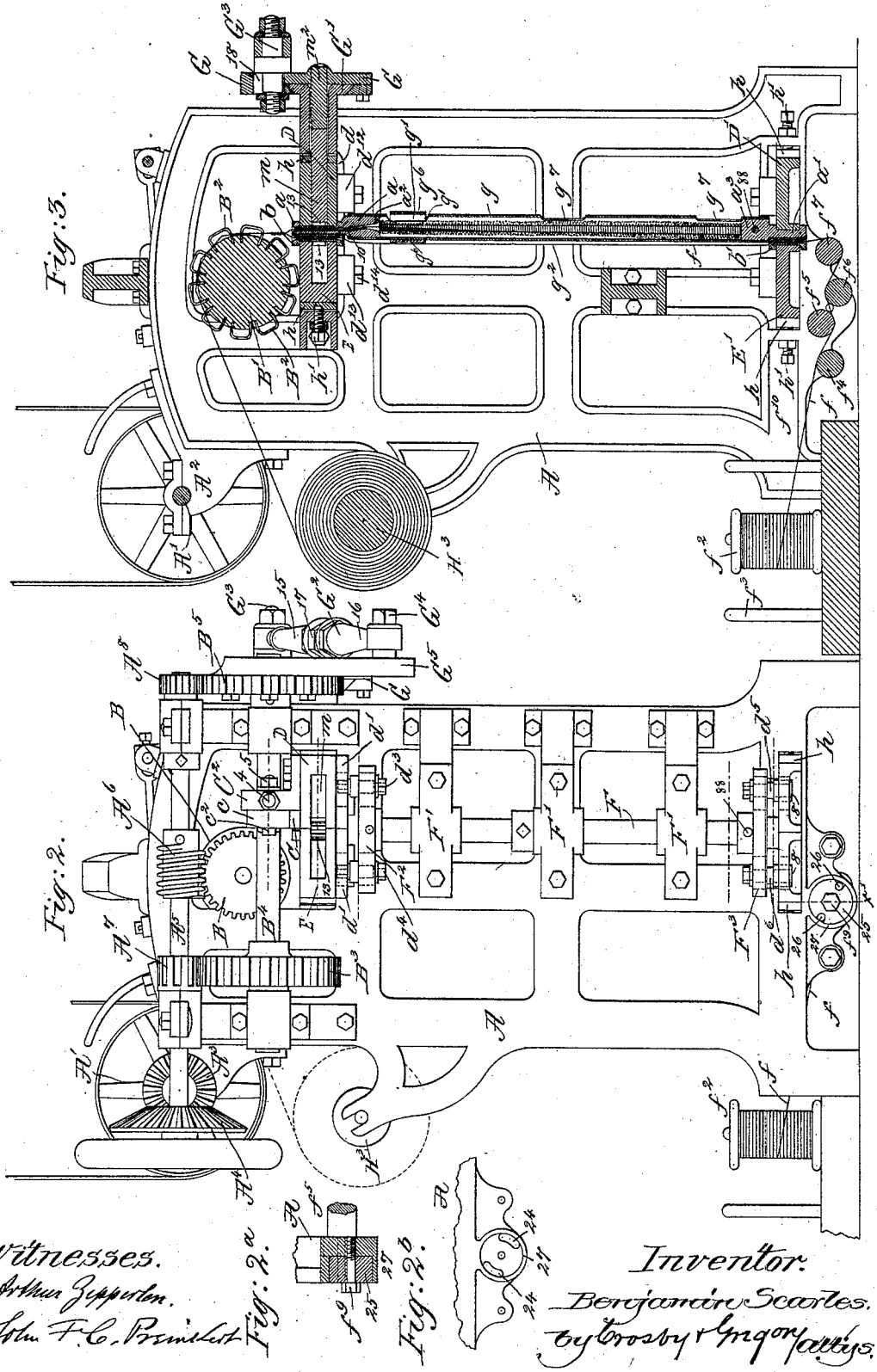
N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 2.

B. SCARLES.

WIRE NETTING MACHINE.

No. 380,664. Patented Apr. 3, 1888.



Witnesses.
Arthur Zipperlen.
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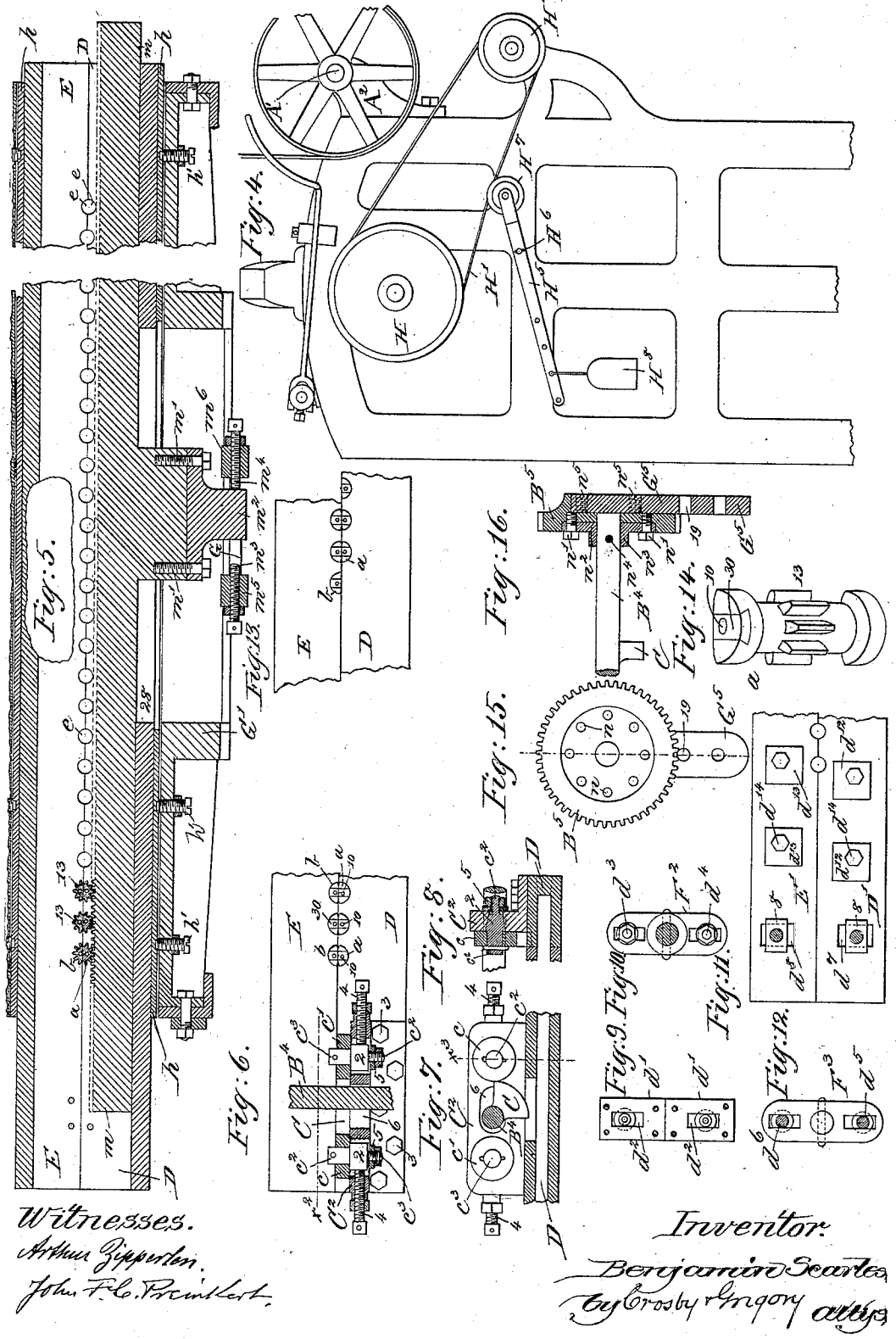
N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 4 Sheets—Sheet 3.

B. SCARLES.

WIRE NETTING MACHINE.

No. 380,664. Patented Apr. 3, 1888.



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(No Model.)

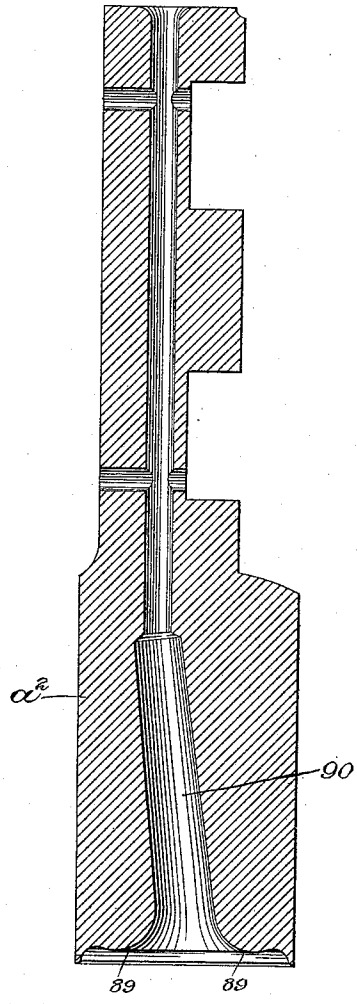
4 Sheets—Sheet 4.

B. SCARLES.

WIRE NETTING MACHINE.

No. 380,664. Patented Apr. 3, 1888.

Fig: 17.



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UNITED STATES PATENT OFFICE.

BENJAMIN SCARLES, OF CLINTON, MASSACHUSETTS, ASSIGNOR TO THE CLINTON WIRE CLOTH COMPANY, OF SAME PLACE.

WIRE-NETTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 380,664, dated April 3, 1888.

Application filed December 3, 1886. Serial No. 220,584. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN SCARLES, of Clinton, county of Worcester, and State of Massachusetts, have invented an improvement in Wire-Netting Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object the production of an improved machine by which to automatically manufacture wire-netting.

In the improved machine to be herein described each cop-holding tube is provided at its side near its upper end with an opening for the insertion of a cop of wire, such opening enabling the cop to be readily and quickly inserted, the operator retaining the wire at the delivery end of the cop in his hand in position ready to be inserted through the twisting-segment above the tube.

In the manufacture of wire-netting great difficulty has been experienced in producing perfect netting, because of inequality of tension upon the bobbin and cop wires. To obviate such difficulty, the machine has been provided with tension-rolls, one set operating upon all the bobbin-wires, thus regulating and keeping uniform the tension on all the bobbin-wires, and to compensate for the free delivery of the cop-wires as the cops are being unwound the cop-holding tubes are provided each with a block having a bulged or convexed surface against which the wire issuing from the cop is gradually bent more and more, thus adding tension, which counteracts the greater freedom of delivery of the cop as the diameter of the central opening in the cop increases. The greater the extent of contact between the wire and the said bulged surface, which constitutes a compensating tension-surface for the cop-wire, the greater the friction, and so also the greater the diameter of the central opening in the cop caused by the withdrawal of the wire the more easily the wire is uncoiled; but as the wire being unwound from the cop approaches the periphery of the coil it is obvious that the increase of tension made by the increased contact of the wire with the compensating tension-surface may be made to counteract any evil which would otherwise be effected by the greater freedom of delivery of the wire from a cop.

In my invention one of the segments in one of the upper carriages is connected positively to a cop-holding tube, and the said tube in turn is connected positively to a semicircular foot which takes its bearing in a recess in one of the under carriages, the said foot being made instrumental in rotating the lower twisting segment-carrying one of the bobbin-wires.

Other features of my invention will be hereinafter described, and particularly designated in the claims at the end of the specification.

Figure 1, in front elevation, represents a sufficient portion of a machine embodying my invention to enable the same to be understood, the machine being broken out between the ends to save space upon the drawing, the mesh-roll being shown partially by dotted lines, some wire-netting being also shown; but the said figure shows but four cop-holding tubes, as they will all be alike. Fig. 2 is a left-hand elevation of Fig. 1. Fig. 2^a is a sectional detail in the line x', Fig. 2. Fig. 2^b is a detail of part of the frame with the circular plate shown in Fig. 2 removed. Fig 3 is a section of Fig. 1 in the dotted line $x\,x$, looking to the right. Fig. 4 is a right-hand end elevation of Fig. 1. Fig. 5 is a partial section of Fig. 1, the section being longitudinally through the center of the carriages. Fig. 6 is a horizontal sectional detail showing part of the shaft and means for operating one of the carriages. Fig. 7 is a section of Fig. 6 in the line x^2. Fig. 8 is a section of Fig. 7 in the line x^3. Figs. 9 to 12, inclusive, show details of connecting devices, to be described, instrumental in operating the carriages. Fig. 13 shows two of the carriages moved into a different position from the position shown in Fig. 6 to enable the next mesh to be twisted. Fig. 14 shows one of the upper twisting-segments removed; Fig. 15, an inner side view of the gear B^5; Fig. 16, a sectional detail of the same and its attached crank; and Fig. 17 is an enlarged section of the bulged surface to automatically effect the increase of tension of the cop-wires.

The frame-work A is of suitable shape to contain the working parts and furnish bearings for the shafts and carriages.

The power-shaft A′, having suitable bearings, as A^2, and driven in any usual manner, has at one end a bevel-pinion, A^3, which engages a bevel-gear, A^4, on a shaft, A^5, having a worm, A^6, and two spur-pinions, A^7 and A^8, of like diameter. The worm A^6 engages a worm-gear, B, fast to the end or journal of the mesh-roll B′, provided with suitable teeth, B^2, herein shown as made of wire and adapted to enter the mesh of the net, the said teeth entering the meshes of the net acting thereon to pull both the bobbin and cop-wires through the twisting-segments *a a′ b* and from the bobbins f^2 and cops g^2, to be described.

The worm A^6 is herein shown as having a single thread of ordinary pitch; but if a larger mesh should be desired for the netting I may provide it with a double thread, which would enable me to rotate the gear B and mesh-roll at an increased speed, or the worm may be made finer and left single to correspond with a shorter mesh.

The spur-pinion A^7 engages a gear, B^3, fast on the cam-shaft B^4 and aids in rotating the said cam-shaft, the latter also having fast on it a spur-gear, B^5, which is engaged by the spur-pinion A^8, the two spur-pinions operating in unison to rotate the said shaft very steadily and positively, thus obviating any lost motion because of twisting of the shaft, and also preventing torsions of the shaft B^4. The shaft B^4 has fast on it a cam, C, made, as herein shown, (see Fig. 7,) of segmental shape, the said cam in the rotation of the said shaft acting on one and then on another of two friction-rollers, *c c′*, mounted upon studs c^2 c^3, having dovetailed bodies 2, (see Fig. 8,) which are fitted into slots (see Fig. 6) in an ear, C^2, attached to or forming a part of the main carriage D, it being herein shown as attached by screws 3 to the upper side of the said main carriage. The studs *c c′* are made adjustable as to their position in the said ear C^2 by the adjusting-screws 4, the studs when in adjusted position being clamped by the clamping-nuts 5. The ear C^2 has a slot, 6, at the point where the shaft B^4 is extended through it, so as to provide for the longitudinal movement of the said ear and main carriage to which it is attached.

The main carriage D and the co-operating carriage E, arranged in the upper part of the machine, rest at their under sides upon suitable supporting-ledges, as *d*, from end to end of the machine. The carriages D and E, at their under sides, have attached to them a plate, as *d′*, having slots, as d^2. (See Fig. 9, where the said plates are shown in detail.)

Outside the end of the frame A is a vertical shaft, F, having three bearings, as at F′. The shaft F has attached to it two slotted cross-arms, F^2 F^3, (see Figs. 1 and 2,) the said arms being shown separately in Figs. 10 and 12. The slots of the cross-arm F^2 receive and have fastened in them two adjustable collared studs, d^3 d^4, which at their upper ends are provided with suitable friction-rolls to enter the slots d^2 in the plate *d*, one attached to the carriage D and the other to the carriage E. The slots of the cross-arm F^3 have fastened in them two studs, d^5 d^6, which are provided with loose blocks 8, (see Fig. 11,) which enter slots d^7 d^8 made in the under carriages, D′ E′. If desired these rolls and loose blocks may be omitted; but their use is preferred. These studs d^3 d^4 d^5 d^6 will be adjusted in the slots of the cross-arms to insure for the carriages the necessary movement to insure uniformity of mesh as well as proper size.

The main carriage D is moved, as described, positively by the cam C, and as the said carriage is so moved the plate *d′*, attached to its under side, acting upon the stud d^3, effects the partial rotation of the shaft F, and consequently the stud d^4 in the slot of the plate *d′*, attached to the under side of the carriage E, causes the latter carriage to be moved in a direction opposite to that of the carriage D, each moving the same distance. In like manner the studs in cross-arm F^3, entering the slots d^7 d^8 in the under carriages, D′ E′, cause the said carriages to be moved in like manner.

Each carriage in practice, as best shown in Fig. 11, is provided with two adjustable stops, d^{12} d^{13}, which are attached by suitable screws, d^{14}, to the said carriages at each side of the end frame of the machine, so that in the movement of the carriages the said stops strike first one and then the other against the end frame, and are there held while the bobbin and cop-wires are being twisted together. These carriage stopping devices d^{12} d^{13} are, as shown, composed of blocks having each a hole at one side of its center, and thereby it is obvious that a quarter-turn of a block will permit of a slightly-different throw of a carriage before a stop meets the end frame.

The carriages referred to are provided at their working-edges (see Fig. 5) with a series of semicircular recesses, as *e*, to receive in them twisting-segments *a b b′* and the foot *a′* of the cop-holding tube *g*. The segments *a* and the foot *a′* are contained, respectively, in the carriages D D′, and the twisting-segments *b b′*, respectively, in the carriages E E′.

The twisting-segments *b b′* are in fact short tubes, substantially semicircular in cross-section, each tube having a longitudinal hole for the reception of a bobbin-wire, *f*, taken from a suitable spool or bobbin, f^2, free to turn on suitable pins or studs, f^3, each tube having suitable flanges (see Figs. 3 and 14) at each end to embrace the edge of the carriage in which it is loosely mounted, the said flanges preventing longitudinal movement of the segment. The twisting-segments *b b′* derive their movement of rotation by the pressure against them, respectively, of the twisting-segment *a* and the foot *a′*.

Each twisting-segment *b* and twisting-segment *a* (see Figs. 3 and 14) is provided between its flanges with a semi-gear, 13, the two semi-gears, when any two segments *a b* are directly opposite each other, forming, as it were, one

complete gear to be engaged by the teeth of a rack, *m*, to be described, such rack in engagement with the said gear effecting one or more rotations of the said twisting-segments, according to the length of stroke of the said rack. The twisting-segment *a*, also provided with suitable flanges to rest above and below the carriage D, has attached to or forming a part of it a compensating tension device, a^2, for the cop-wire, the said device being herein shown as a block, to which is secured rigidly, by brazing or in other well-known manner, the upper end of the cop-holding tube *g*, the said tube being extended down to nearly the bottom of the machine, where it is suitably attached to a block, a^3, forming a part of the segmental foot *a'*, the latter having suitable flanges to embrace the carriage D'. The lower end of the tube is rigidly connected to the foot *a'*, the connection being preferably by means of a pin, as 88.

To enable the tension on all the bobbin-wires *f* to be maintained uniform, I have provided a series of rolls, $f^4 f^5 f^6 f^7$, (see Fig. 3,) between which all the bobbin-wires are led and treated alike. The central rollers, $f^5 f^6$, between which the wires *f* are led, have their journals 26 extended through slots 24 (see Fig. 2^b) in a part of the frame-work or a stand bolted thereto, the said journals entering notches in an annular plate, 25, one at each end of the frame, and pivoted on studs f^9, held in the frame-work, the frame-work, as shown, having an annular projection, 27, to aid in retaining the journals 26 in the notches of the annular plate 25. These rollers f^4 f^5 f^6 f^7 act not only to regulate the tension on the bobbin-wires, but also straighten the said wires, and by turning the annular plates, the screws f^9 being first loosened, the wires may be bent more or less and the tension increased or diminished at will.

By inspection of Fig. 3 it will be seen that the block connected to the twisting-segment *a* and extended below the carriage D, to form not only a compensating tension device, but also a means for the attachment to it of the tube *g*, is located at one side or eccentrically to the dividing-line of the semi-gear described, such location of the block a^2 and a corresponding location of the block a^3 enabling the cop-holding tube to be made to rotate entirely about the bobbin-wires extended between the twisting-segments *b' b* without coming in contact with the bobbin-wires, thus obviating any friction which would change the tension on the bobbin-wires.

All the carriages referred to are acted upon at their outer sides by suitable gibs, as *h*, made adjustable in usual manner by adjusting-screws *h'*, the purpose of the gibs being to keep the meeting edges of the pairs of carriages D E and D' E' pressed closely together during their sliding movement, notwithstanding wear, the withdrawal of the screws, and with them the gibs, enabling the separation of the carriages sufficiently for the removal of the twisting-segments.

Each cop-holding tube *g* is provided near its upper end (see Fig. 3) with an opening, *g'*, of suitable size to permit the ready and easy introduction therein of the wire cop g^2, the said cop being wound in usual manner, so that the wire is drawn out from the interior of the cop, the cop being of suitable size to substantially fill the said tube *g*. By providing the tube with an opening, as described, near its top, the cop may be readily introduced and the delivery end of the wire be retained in the hand of the operator to be easily inserted up through the block a^2 and the hole 10 in the twisting-segment *a*.

The lower end of the block a^2 (see Fig. 3) is provided with a surface of peculiar shape—viz., it has an abrupt convex annular ridge, 89, (see Fig. 17) which is extended into the space between the tapering throat 90 of the block a^2 and the tube *g*, the said ridge being so shaped and located close to the end of the cop of wire in the tube *g*, so that as the wire being unwound from the interior of the cop in the tube *g* approaches the periphery of the cop, where the power required to draw the wire from the cop is lessened, the said wire will be gradually bent more and more across the said abruptly-convexed surface, thereby putting upon the wire an increased amount of friction to compensate for the more free delivery of the wire from the cop.

I am aware that a cop of wire has been placed in a tube having a conical end with a narrow tube at the apex of the conical end, as in United States Patents Nos. 209,520 and 341,230; but with only a conical surface at the end of the tube, as shown in the said patents, it is impossible to automatically vary the tension, as when the surfaces have an abrupt convex annular ridge, as herein provided for.

The abrupt convex surface of the block a^2 constitutes a compensating tension device, and is of special importance in machines of the class herein described, because by its use it is possible to insure substantial uniformity as to the tension exerted upon the cop-wires, which results in greater uniformity in the mesh of the netting, the said bulging surface also acting to take out any bends or crooks in the cop-wire.

It is absolutely essential for the production of good work that the tension on the two sets of wires being united to form the netting, the one set coming from the bobbins f^2 and the other from the cops g^2, be alike and uniform and constant, for otherwise the slacker wire, whichever it may be, will be twisted about the more taut wire.

The opening *g'* in the tube *g* is closed by means of a cover, g^6, herein shown as made tubular, it being free to be raised by hand above and thus uncover the opening *g'*. The tube g^2 is provided with open slots or spaces, as g^7, to enable the operator to see as to the quantity of wire remaining therein, and also to enable him to insert into the tube a pin or

other suitable device to lift the cop in case of breakage of wire or for other reasons.

Each twisting-segment *a b* is provided with a series of teeth, as 13, (see Fig. 5,) constituting a semi-gear or one-half of a pinion, the teeth projecting from the said twisting-segments, when the said twisters are in contact with and practically opposite each other, forming a full pinion, which is engaged by teeth of a longitudinal sliding rack-bar, *m*, the reciprocation of which causes the positive rotation in unison of the said twisting-segments, the wires issuing from the said twisting-segments *a b* above the carriages D E being at such time twisted together, the number of twists depending upon the number of rotations given to the said twisting-segments, the number of rotations depending upon the length of the stroke of the rack-bar *m*.

It is frequently necessary to alter the stroke of the rack-bar according to the number of twists desired in the wire.

As herein shown, the carriages D and E are slotted from their inner edges in the direction of their width throughout their length, the slots so made in the said carriages serving as chambers to receive the semi-gears attached to the twisting-segments *a b*, the width of the said slots in the thickness of the rail being enough larger than the length of the semi-gears to enable them to be rotated without friction against the carriages, the shoulders of the said segments retaining them in place in the carriages. The chamber in, as herein shown, the front upper carriage, D, is broad enough to receive and constitute a guide for the rack-bar *m*, and the front side of the carriage D is slotted, as at 28, (see Fig. 5,) to enable connection to be made between the said rack-bar and the devices employed to reciprocate it, the slot 28 being long enough to permit the rack-bar to be moved while the carriages are stationary, and vice versa. The rack-bar *m* has attached to it by screws *m'* (see Fig. 5) a lug, m^2, which is struck first at one and then at its other side by the screws m^3 m^4, held in ears m^5 m^6 of a slide, G, mounted upon suitable guideways, G', attached to or forming part of the main frame-work. The slide G derives its movement of reciprocation from an adjustable link, G^2, attached at one end by stud G^3 to the slide, and at its other end by a stud, G^4, to a crank, G^5, suitably secured to and rotating in unison with the shaft B^4, before described. The link G^2 is composed of three parts, 15 16 17. The parts 15 and 16, at their inner ends, have, respectively, right and left hand threads, which are engaged with screw-threaded projections at the ends of the part 17, (see Fig. 1,) the part 17 constituting a nut, the rotation of which in one or the other direction enables the link G^2 to be made longer or shorter to thus enable the crank G^5, operating the rack *m* through the said link G^2, to leave the rack in exactly the proper position to enable the contacting faces of the twisting-segments to lie parallel and flush with the contacting faces of the carriages D and E, so that as the said carriages are to be moved, as previously described, in opposite directions, the said twisting-segments do not constitute any barrier to their movement.

While the carriages opposed to each other are being reciprocated in opposite directions by the devices described, it is obvious that the twisting-segments must not rotate, but as soon as the proper two twisting-segments arrive opposite each other in the shifting of the carriages then the rotation of the twisting-segments must commence.

To arrest the longitudinal movement of the rack-bar for a sufficient length of time to enable the movement of the carriages to take place, I have provided the screws m^3 m^4, which are made adjustable in the ears m^5 m^6, so as to leave spaces between their inner ends, which shall be more or less in excess of the width of the lug m^2, attached to the said rack, the distance between the points of the screws and the lug m^2 determining the amount of lost motion between the carriage and the rack. It is obvious that the effect would be just the same were the screws m^3 m^4 supported by the lug m^2 rather than by the ears m^5 m^6.

In the class of machine herein described the strains are very considerable, and to compensate for wear in the cam C, which operates the main carriage D positively, I have made the bolt G^3, which connects the link G^2 with the slide G, adjustable in the slot 18 in the said slide. To lessen the number of twists in each mesh, the stud G^4, connecting the link G^2 with the crank G^5, may be placed in the hole 19 of the said crank. When the stud G^4 is adjusted to occupy the hole 19 of the crank G^5 to give a definite length of stroke to the rack-bar, it has sometimes been found necessary to change the position of the crank G^5 with relation to the shaft B^4 driving it in order to preserve correct timing of movements of the operative parts. To provide for this the gear B^5 (see Fig. 15) is provided at one side with a series of holes, *n*, which receive in them screws *n'*, attached to a plate, n^2, forming part of a collar, n^3, fixed by a screw, n^4, to the shaft B^4, the loosening of the said screws enabling the gear B^5 to be turned either forward or backward the distance of one or more of the holes *n*, the adjustment of the gear taking with it the crank G^5, the latter, as herein shown, being attached to the gear B^5 by screws n^5, the face of the said gear being recessed or slotted to receive within it a suitable portion of the hub and arm of the crank G^5. The twisting-segments *a b* will in practice be provided each at its upper side with a removable eye-plate, 30, preferably of steel and of dovetail shape, as shown in Fig. 14, the said eye-plate being easily changed when one has been worn by the wire.

The journal or shaft of the mesh-roll has attached to it a pulley, H, which receives a belt, H', that is extended over a pulley, H^2, fast upon and so as to rotate the take-up roll H^3 frictionally, the effective power of the said

belt in rotating the said take-up roll being regulated and determined according to the requirements of the netting, being made by means of a tension device composed, essentially, of a lever, H^5, pivoted at H^6 and provided with a sheave, H^7, the lever having at its opposite end an adjustable weight, H^8.

The mesh of the netting may be more or less elongated and the width correspondingly narrowed by increasing the speed of the take-up roll H^3 driven by the band.

As herein shown, the rack-bar *m* is placed in the carriage D and is moved by a crank at the left-hand end of the machine; but I wish it to be understood that I do not desire to limit my invention to locating the said rack-bar in the said carriage, for the rack-bar might be located in the carriage E, and the driving mechanism for the rack might be located at the opposite end of the machine. With the rolls *c c'* in the position, Fig. 6, the carriages will be moved a distance to carry one twisting-segment in one carriage from one to another adjacent segment of the opposite carriage; but by placing the said rolls closer together the movement of the carriages may be increased to enable a segment to be brought into line with only each alternate opposed segment, or one segment may be skipped to thus make a larger mesh, the segment so skipped not carrying a wire. The cover for closing the opening *g'* of the tube prevents the cop being thrown out of the said opening by centrifugal action.

Prior to my invention the bobbin-wires used in machines for the manufacture of wire-netting, such as herein described, have been each controlled independently by a separate tension device, such construction requiring constant attention of an experienced operator to produce netting of uniform mesh.

The bulging surface a^2 herein shown is first shown by me in connection with application Serial No. 209,303, filed July 28, 1886, for an improved shuttle for wire, the said surface being claimed in connection with a shuttle.

I claim—

1. In a machine for the manufacture of wire-netting, a tube, *g*, to contain a cop of wire, the said tube having an opening at its side for the insertion of a cop, substantially as described.

2. In a machine for the manufacture of wire-netting, two twisting-segments, *a b*, provided with semi-gear, carriages in which the said segments are mounted loosely, and means, substantially as described, for rotating the said twisting-segments, combined with a hollow tube, *g*, rigidly attached to and rotated in unison with and by the twisting-segment *a*, the said tube being provided with an opening at one side for the introduction of a cop, substantially as described.

3. In a machine for the manufacture of wire-netting, two twisting-segments, *a b*, provided with semi-gear, carriages in which the said segments are mounted loosely, and means for rotating the said segments, combined with a hollow tube, *g*, connected to and rotated in unison with the twisting-segment *a*, the said tube being provided at its side near its upper end with the opening *g'*, for the introduction of the cop, and with a cover for the said opening, substantially as described.

4. In a machine for the manufacture of wire-netting, two twisting-segments, *a b*, provided with semi-gear, carriages in which the said segments are mounted loosely, and means, substantially as described, for rotating the said segments, combined with a hollow tube, *g*, connected to and rotated in unison with the twisting-segment *a*, the said tube being provided at its side near its upper end with the opening *g'*, for the introduction of the cop, and with slots or openings, and with a cover for the opening *g'*, substantially as described.

5. In a machine for the manufacture of wire-netting, reciprocating carriages D D' and E E', the twisting-segment *b b'*, the twisting-segment *a*, the foot *a'*, and the cop-holding tube *g*, rigidly and permanently connected with the twisting-segment *a*, and the foot *a'*, combined with the rack and with a semi-gear connected to the twisting-segments *a* and *b*, the said rack rotating both the said segments, the segment *a* carrying with it the cop-holding tube and its attached foot *a'*, the said foot rotating the segment *b'*, substantially as described.

6. The carriage E', the twisting-segment *b'* therein, the carriage E, the twisting-segment *b* therein, provided with a semi-gear, the carriage D, the twisting-segment *a* therein, provided with a semi-gear, a reciprocating rack, the cop-holding tube *g*, having an opening at its side for the insertion of the cop and being connected to the said twisting-segment *a* and having a foot, *a'*, and a carriage, D', the said foot *a'* fitting against the twisting-segment *b'*, combined with the rack *m* and with means to move it and the said carriages, substantially as described.

7. In a machine for the manufacture of wire-netting, a cop-holding tube and a twisting-segment, combined with an intermediate block or device having an abrupt convex annular surface, 89, located between the end of the block next the tube and the throat 90 of the block, the said convex surface constituting a compensating tension device to automatically increase the tension upon the cop-wire being drawn from the cop contained in the said tube, substantially as described.

8. In a machine for the manufacture of wire-netting, a series of twisting-segments, *b b'*, and means to support and actuate them, combined with the roll f^7, and roll f^6, parallel thereto and extending through the machine longitudinally, the said rolls acting upon opposite sides of the bobbin-wires passing to all the segments *b'*, whereby the said wires are all subjected to like and uniform tension.

9. In a machine for the manufacture of wire-netting, a series of twisting-segments, *a b*, carriages to support them, means to move the

carriages to change the position of the twisting-segments with relation to each other in the formation of the mesh, a rack-bar to effect the rotation of the said twisting-segments, and a rotating crank, G^5, combined with an adjustable link and a slide, and with two adjusting-screws, m^3 and m^4, to alter the effective stroke of the rack with relation to the rotation of the crank in both the directions of movement of the said link, substantially as described.

10. In a machine for the manufacture of wire-netting, a series of twisting-segments, *a b*, carriages to support them, means to move the carriages to change the position of the twisting-segments with relation to each other in the formation of the mesh, a rack-bar to effect the rotation of the said twisting-segments, the gear B^5, the rotating crank G^5, and means, substantially as described, for adjustably connecting the said crank to the said gear, combined with an adjustable link and a slide, the said slide acting upon and moving the rack-bar in the carriage, substantially as described.

11. In a machine for the manufacture of wire-netting, the carriages D E D′ E′, the segmental twisters *b b′*, mounted in the carriages E E′, the series of tubes *g*, to contain cops of wire and having openings at their sides to receive the cops of wire, and the twisting-segments *a* and feet a^3, secured to the said tubes, means, substantially as described, to actuate the carriage E, the rock-shaft F, having attached arms F^2 F^3, a series of studs to connect the said carriages, and cross-arms, combined with a single rack-bar located within the carriage D, and with means to reciprocate the said rack-bar, it engaging and rotating both series of segmental twisters *a b*, and, through the tubes *g*, rotating the segmental twister *b* and feet a^3, to operate substantially as described.

12. In a machine for the manufacture of wire-netting, a series of twisting-segments, *b b′*, and means to support and actuate them, combined with the roll f^7, and a roll, f^6, parallel thereto and extending through the machine longitudinally, and means, substantially as described, to adjust the centers of the said rolls relatively the one to the other to adjust the degree of tension to which all the said wires are subjected, for the purposes set forth.

13. The main carriage and the rack-bar and slide to engage and move it, and a link and crank, G^5, and the gear B^5, combined with the shaft B^4, provided with a cam, C, the gear B^3, and with the shaft A^5, provided with the two pinions A^7 A^8, to operate substantially as described.

14. The main carriage and the rack-bar and slide to engage and move it, and a link and crank, G^5, and the gear B^5, combined with the shaft B^4, provided with a cam, C, the mesh-roll, its attached gear B, and the shaft A^5, having two pinions, A^7 A^8, and a worm, A^6, to operate substantially as described.

15. In a machine for the manufacture of wire-netting, the carriages D E, a series of twisting-segments therein, the shaft B^4, its attached collar, screws *n′*, and gear B^5, provided with a series of holes and made adjustable with relation to the said shaft, and a crank attached to the said gear, combined with a rack-bar to effect the rotation of the twisting-segments of both the said carriages, a slide to move it, and a link to connect the said crank and slide, the said link being adjustably connected to the said crank, as and for the purpose set forth.

16. In a wire-netting machine, a series of carriages and twisting-segments therein and means to move the said carriages, combined with adjustable stops connected directly to the said carriages, interposed between the said carriages and the frame to arrest the movement of the carriages, substantially as described.

17. In a machine for the manufacture of wire-netting, two sets of carriages, D E and D′ E′, twisting-segments *a b*, mounted in the carriages D E, and twisting-segment *b′*, combined with a series of tubes located between the said sets of carriages and provided with openings at their sides for the reception of the cop-wires, and with means to rotate the said tubes and cause the cop-wires to be carried about the bobbin-wires extended through the segments *b* and *b′*, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BENJAMIN SCARLES.

Witnesses:
BURT CHELLIS,
JOHN W. FORRESTER.