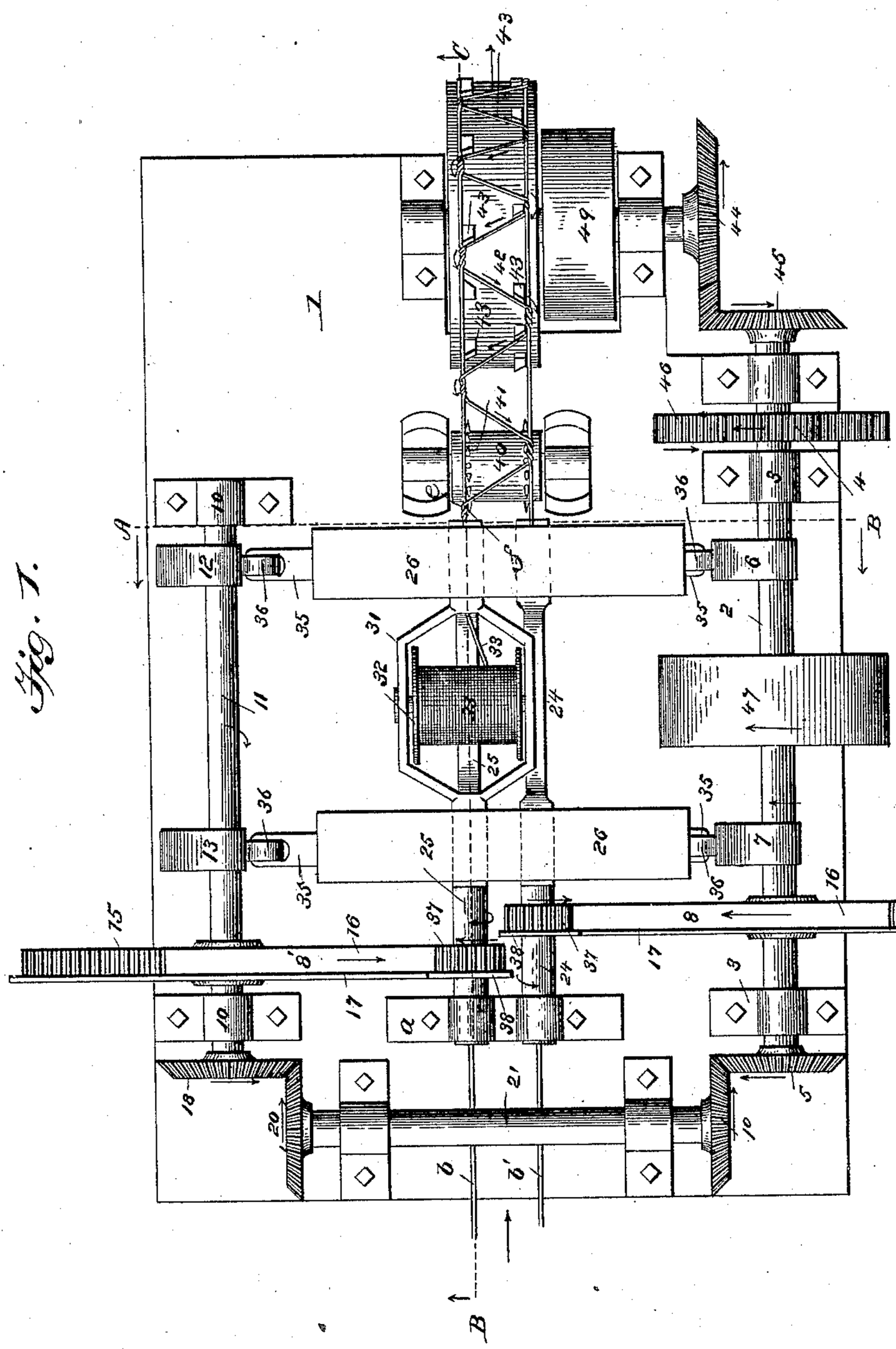
(No Model.) 6 Sheets—Sheet 1.

# H. E. SCHNABEL.

## MACHINE FOR FORMING WIRE FENCING BANDS.

No. 468,696. Patented Feb. 9, 1892.

Fig. 1.




Witnesses:
Guy A. Johnson
Howell Bartle

Inventor:
Herman Ernst Schnabel
By Johnson & Johnson
his Attorneys.

(No Model.) 6 Sheets—Sheet 2.

# H. E. SCHNABEL.

## MACHINE FOR FORMING WIRE FENCING BANDS.

No. 468,696. Patented Feb. 9, 1892.

Fig. 2.

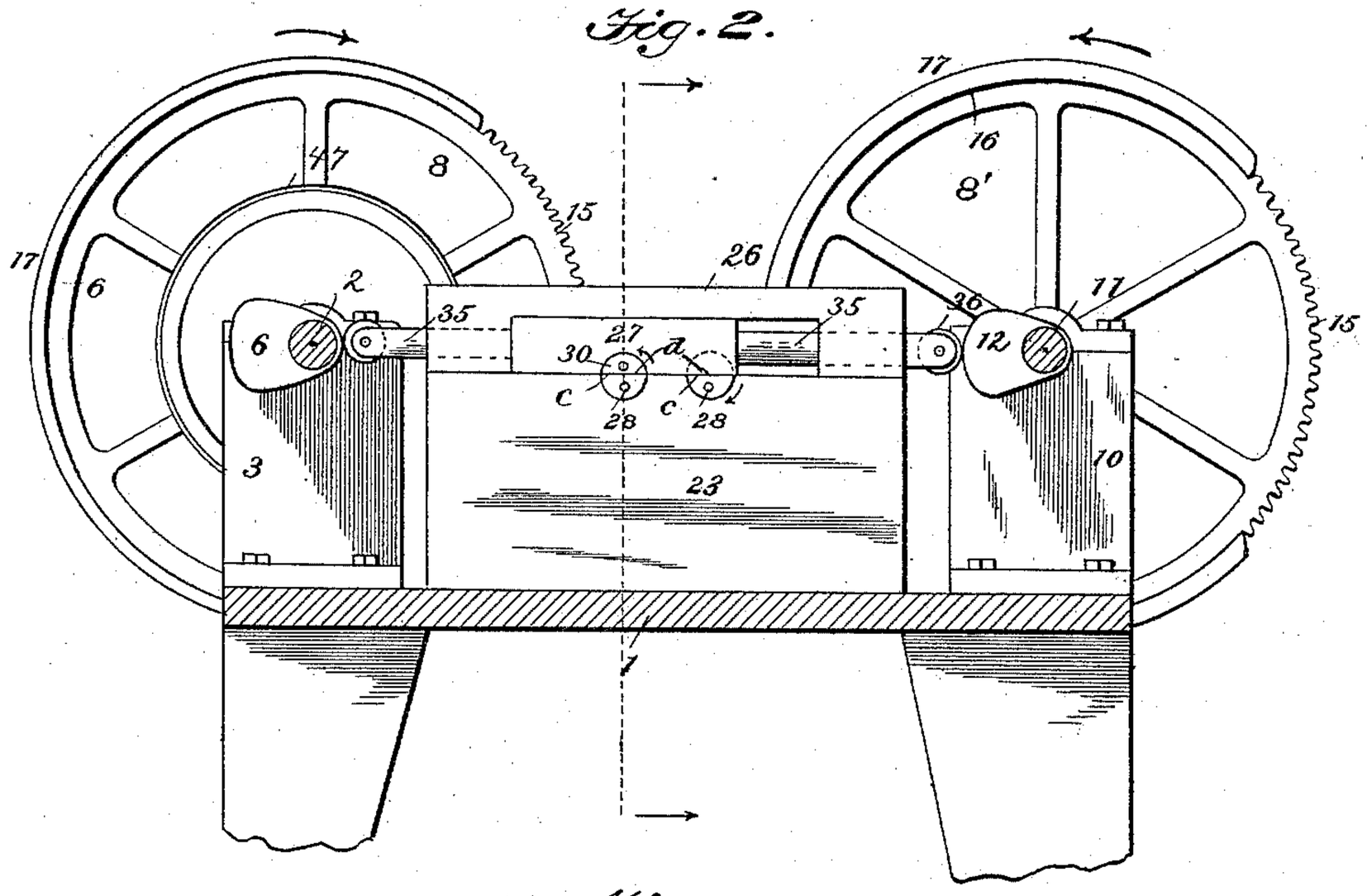



Fig. 10.

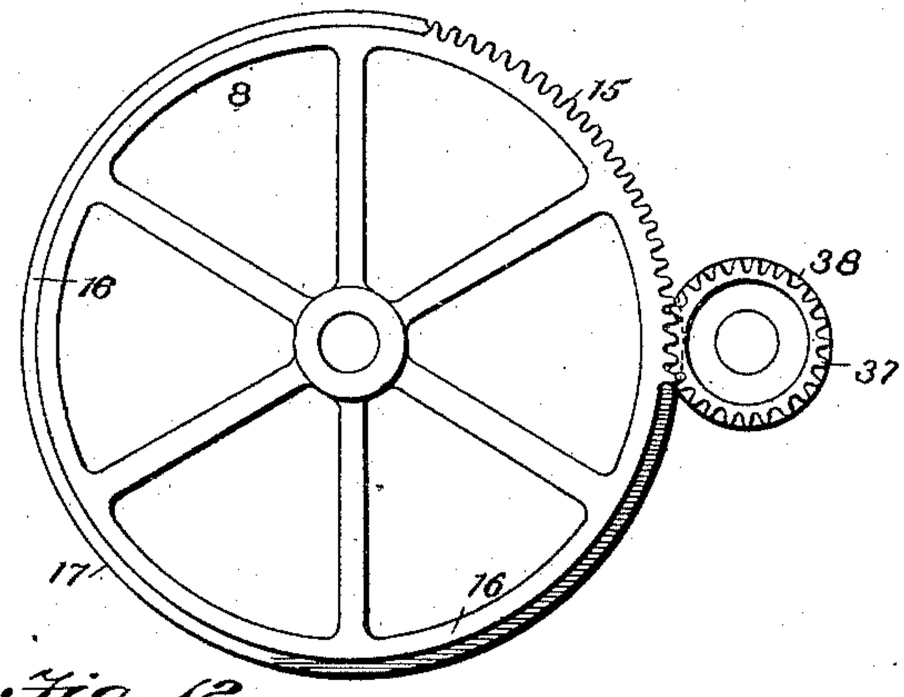



Fig. 11.

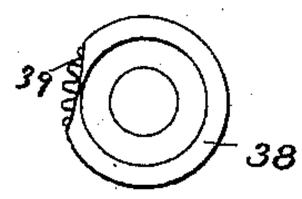
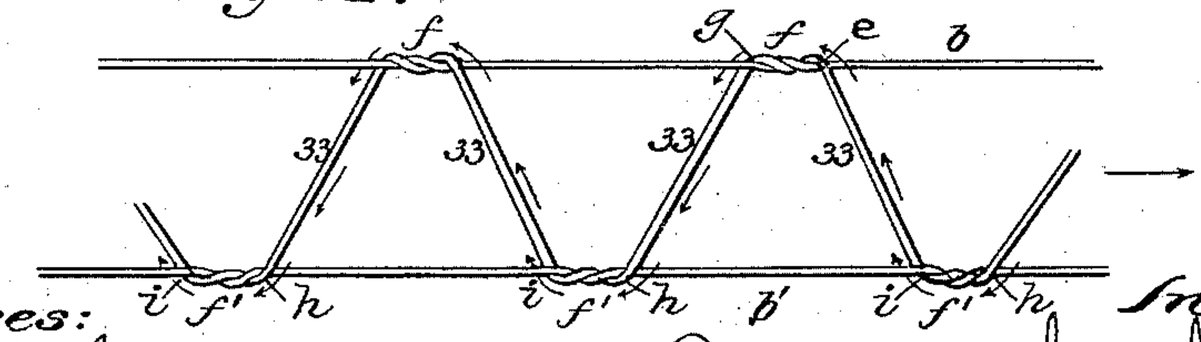



Fig. 12.




Witnesses:
Geo. H. Johnson
Lowell Little

Inventor:
Herman Emil Schnabel
By Johnson & Johnson
his Attorneys.

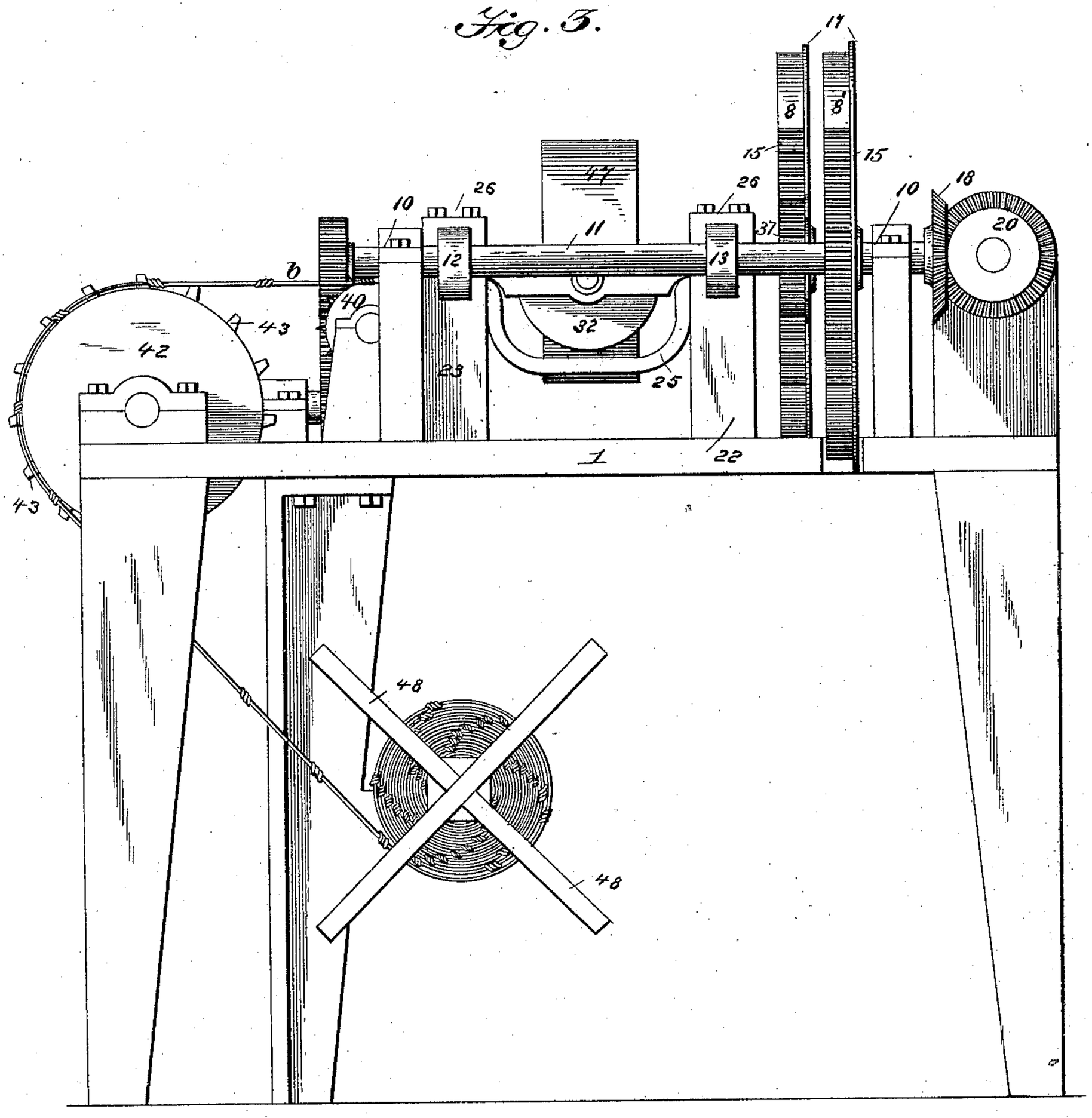
(No Model.) 6 Sheets—Sheet 3.

# H. E. SCHNABEL.

## MACHINE FOR FORMING WIRE FENCING BANDS.

No. 468,696. Patented Feb. 9, 1892.

Fig. 3.




Witnesses:
Guy St. Johnson
Lowell Battle

Inventor:
Herman Emil Schnabel
By Johnson & Johnson
his Attorneys.

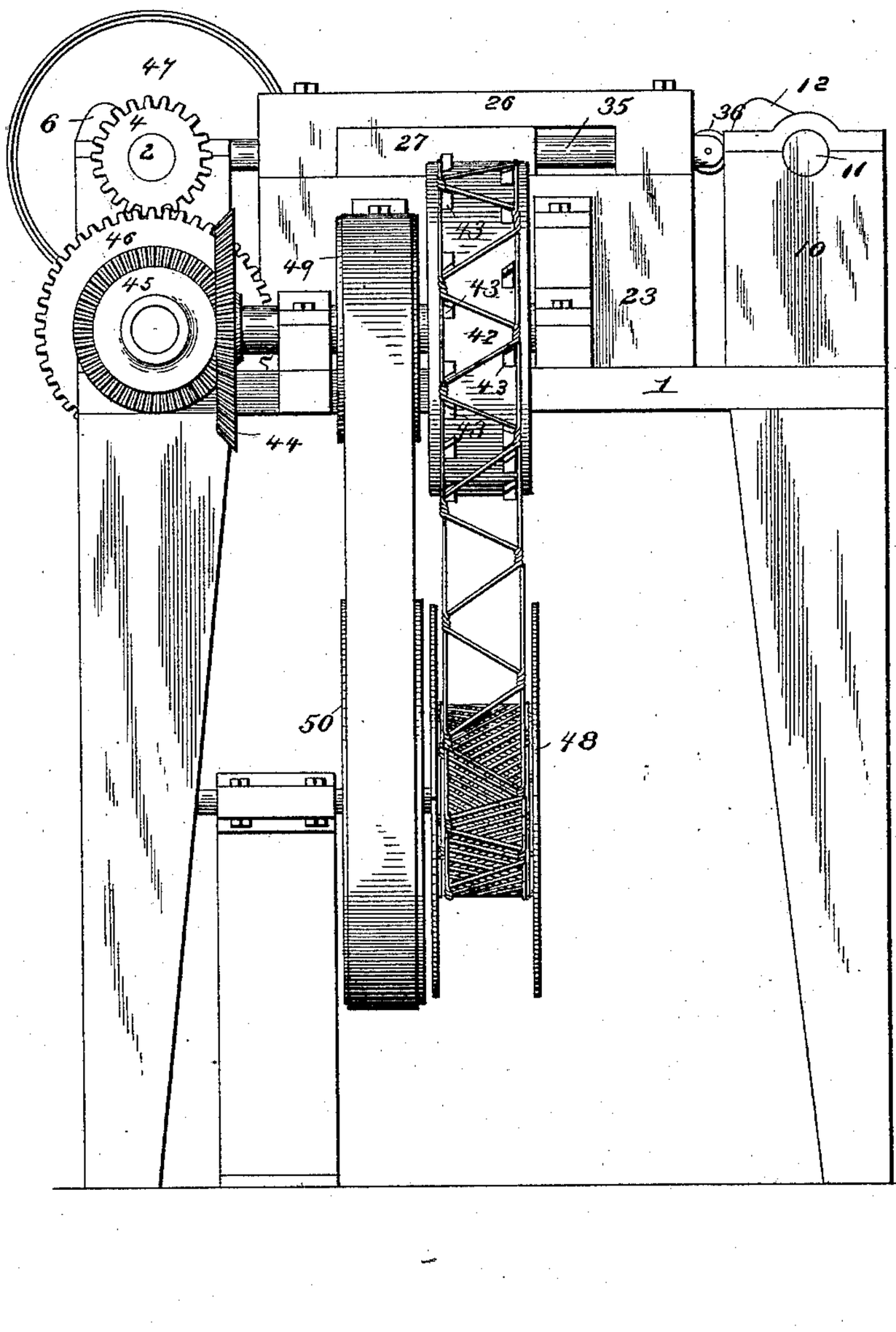
(No Model.) 6 Sheets—Sheet 4.

# H. E. SCHNABEL.

## MACHINE FOR FORMING WIRE FENCING BANDS.

No. 468,696. Patented Feb. 9, 1892.

Fig. 4.




Witnesses:
Geo. A. Johnson
Lowell Baitle

Inventor:
Herman Emil Schnabel
By Johnson & Johnson
his Attorneys

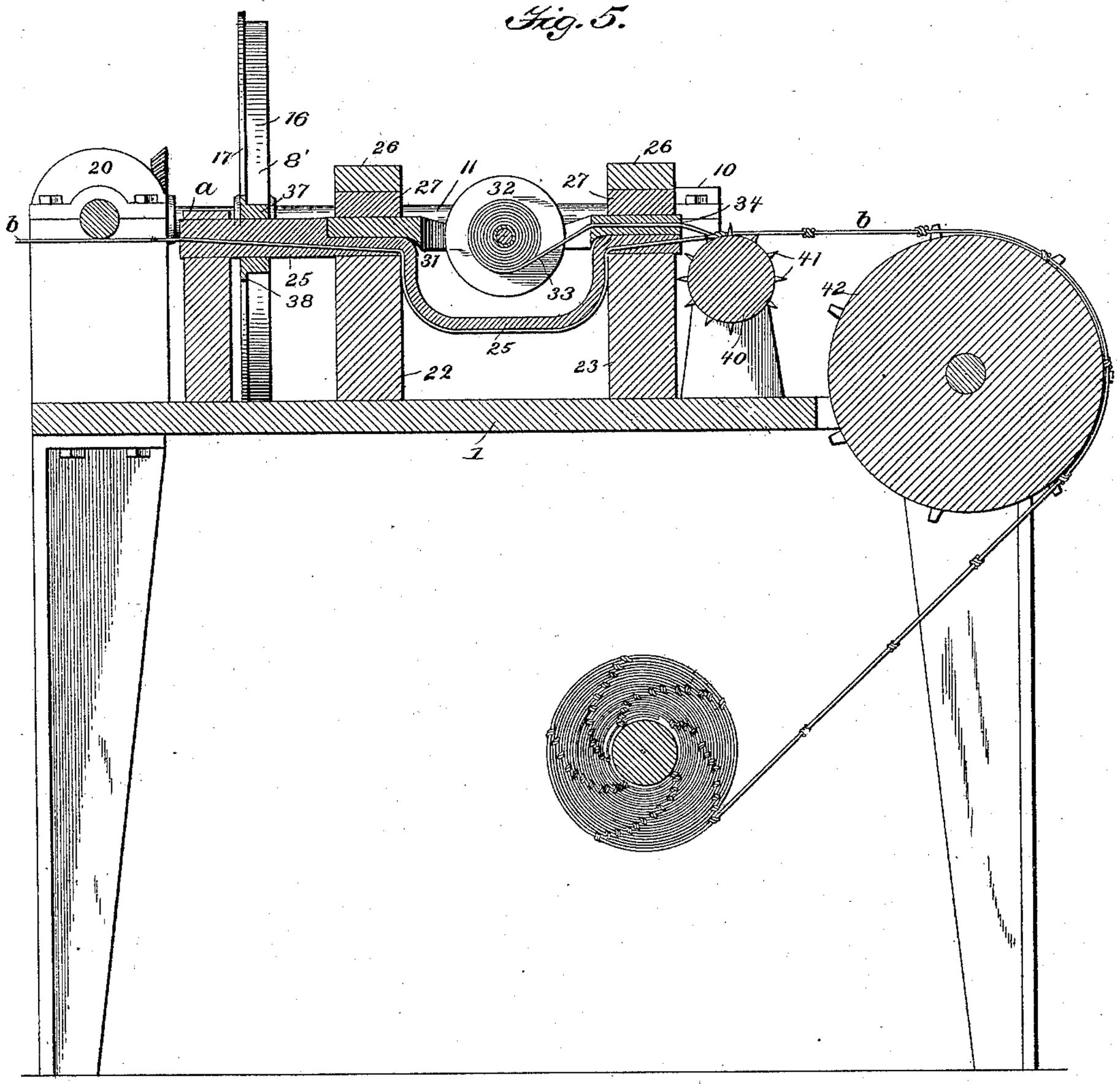
(No Model.) 6 Sheets—Sheet 5.

# H. E. SCHNABEL.

## MACHINE FOR FORMING WIRE FENCING BANDS.

No. 468,696. Patented Feb. 9, 1892.

*Fig. 5.*




Witnesses:
Geo. A. Johnson.
Lowell Battle.

Inventor:
Herman Emil Schnabel
by Johnson & Johnson
his Attorneys.

(No Model.) 6 Sheets—Sheet 6.

# H. E. SCHNABEL.

## MACHINE FOR FORMING WIRE FENCING BANDS.

No. 468,696. Patented Feb. 9, 1892.

Fig. 6.

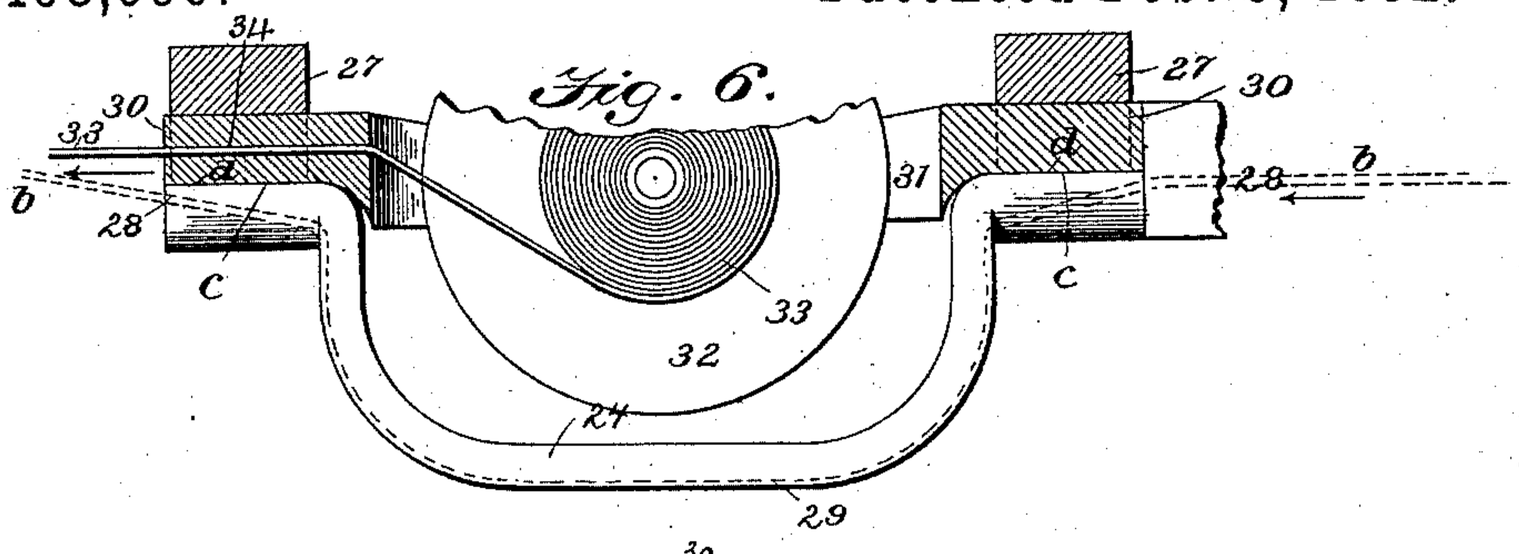



Fig. 7.

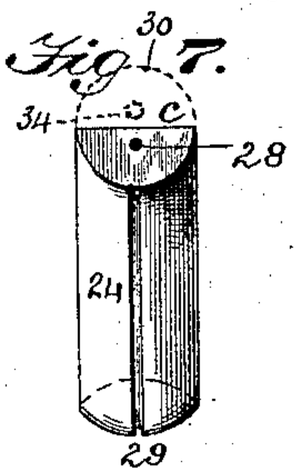



Fig. 8.

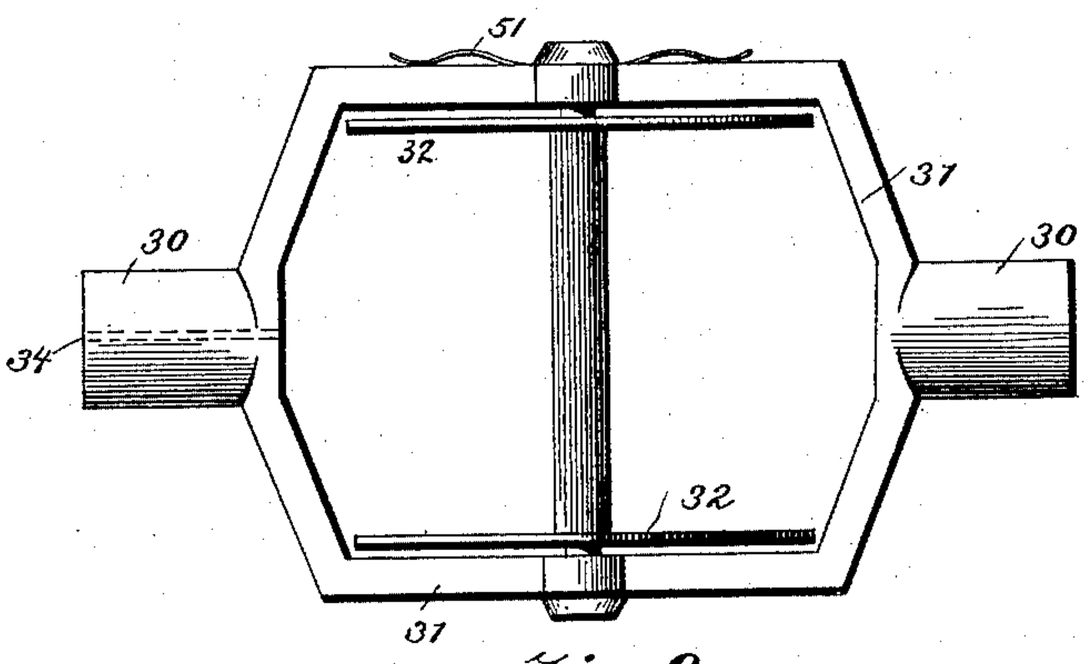
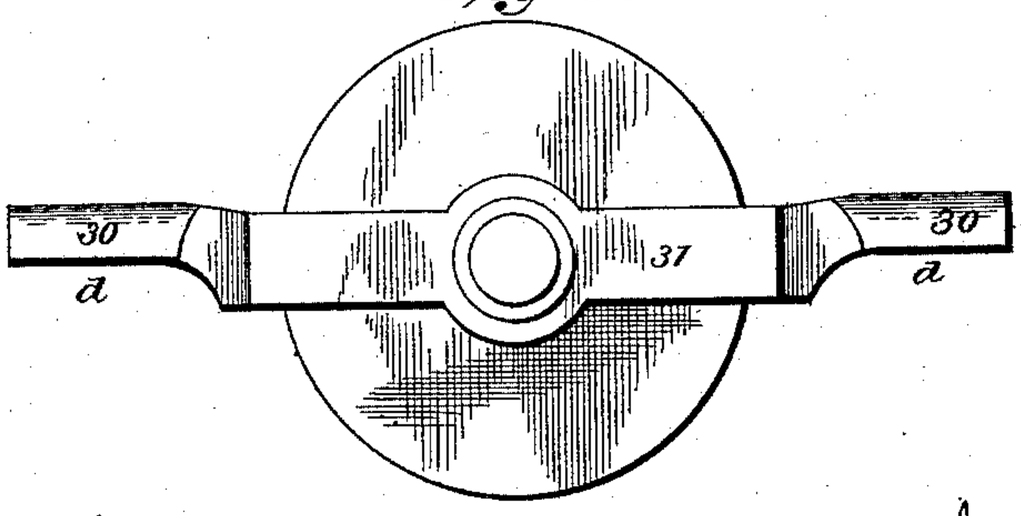



Fig. 9.




Witnesses
Guy A. Johnson
Howell Battle

Inventor
Hermann Emil Schnabel
By His Attorneys.
Johnson & Johnson

# UNITED STATES PATENT OFFICE.

HERMAN EMIL SCHNABEL, OF BEAVER FALLS, PENNSYLVANIA, ASSIGNOR TO THE HARTMAN MANUFACTURING COMPANY, OF SAME PLACE.

## MACHINE FOR FORMING WIRE-FENCING BANDS.

SPECIFICATION forming part of Letters Patent No. 468,696, dated February 9, 1892.

Application filed July 23, 1891. Serial No. 400,653. (No model.)

*To all whom it may concern:*

Be it known that I, HERMAN EMIL SCHNABEL, a citizen of the United States, residing at Beaver Falls, in the county of Beaver and State of Pennsylvania, have invented a new and useful Improvement in Machines for Forming Wire-Fencing Bands, of which the following is a specification.

The invention herein described is directed to the production of a machine for forming wire bands or ribbons for use particularly in the construction of fences, and wherein the organization of the automatic mechanism is designed for the production of such band, consisting of two parallel line-wires and a third intermediate wire so formed and intertwisted as to render the band strong, stiff, and not liable to buckle and having greater comparative lightness and of less cost than any similar band of which I have knowledge.

My said invention comprises, in combination, devices whereby a single intermediate or filling wire is shifted diagonally and alternately from one to the other of the parallel line-wires at regular spaces, and in which a pair of spindles for said line-wires are adapted to be alternately rotated each in a constant direction opposite to the other in the operation of twisting the said wires, and in which the said twisting is made so that the intermediate or filling wire is caused to embrace and be intercoiled with similar coils in the parallel line-wires from opposite sides of the band at each alternate point of twisting—that is to say, the filling intermediate wire is caused to pass over at one side of the band and be intertwisted with one of said line-wires and then pass diagonally under it to the opposite side of the other of said line-wires and be intertwisted with it in successive engaging coils, so as to brace and stiffen the formed band against its tendency to buckle or twist.

The provision for effecting the intertwisting or engaging of the wires at the successive coils, as above stated, is an essential feature of my invention and is effected by the delivery of the wires through passages arranged eccentrically in the journals of their rotating carriers, in connection with a shuttle shifted alternately in co-operating relation with a pair of spindles adapted to be alternately rotated each in a constant direction opposite to the other, as I shall more fully explain herein.

For the production of such a band or ribbon I have devised an organized machine of comparatively simple construction, which, after commencing the operation and engaging the end of the formed band or ribbon with a matrix-wheel device, which acts to pull the band forward, requires no attention until the intermediate or filling wire carried by the twisting-shuttle is exhausted from its spool, when a filled spool is substituted, its wire connected with the end of the filling-wire in the band, and the machine again put in motion, all the wires being drawn forward by the continuous rotation of the matrix-wheel in the operation.

My invention consists of certain parts and combinations of parts, the several features of which will be separately and specifically pointed out in the claims concluding this specification, in connection with the accompanying drawings, which illustrate the several features of my said invention in the form in which I at present prefer to embody them in total combination.

Referring to the drawings, Figure 1 is a plan or top view of a machine embodying my invention, showing a portion of the wire band as formed and drawn forward from the forming devices. Fig. 2 is a vertical cross-section of the machine, taken on the line A B, Fig. 1, looking toward the rear of the machine, and shows in side view the sliding shuttle device for shifting the intermediate or filling wire in relation to and between the parallel line-wires. This figure also shows the eccentric relation of the wire-passages in their respective delivery-journals at the point of twisting. Fig. 3 is an elevation of the right side of the machine. Fig. 4 is a front elevation of the machine. Fig. 5 is a vertical longitudinal section of the machine, taken on the line B C, Fig. 1, showing the relative positions of the shuttle and spindle parts when twisting the wires. Fig. 6 is a side view of one of the spindles, which carries one of the line-wires, and a section of the shuttle; and Fig. 7 is an end view of one of the spindles. In these two fig-

ures can be seen the eccentric relation of the wire-delivery passages in the journals of the shuttle and of one of the spindles. Fig. 8 is a face view of the twisting-shuttle for the filling-wire, and Fig. 9 is a side view of the same. Fig. 10 shows one set of the gear-wheels by which the spindles are rotated each in a constant direction opposite to the other in twisting the wires. Fig. 11 shows the segment in the flange of the pinion seen in Fig. 10, whereby the rotation of the spindle is prevented while shifting the filling-wire from one of the parallel wires to the other; and Fig. 12 shows a portion of the band produced by my machine.

Upon an iron bed 1, suitably supported, is erected the operating mechanism, which comprises the organized machine. Upon this bed at one side and standing longitudinally of the machine is mounted in suitable standards 3 a shaft 2, having at one end a pinion 4, at its other end a bevel-wheel 5, and between these gears cams 6 and 7, of identical form, are secured in identical positions, so as to act simultaneously. Between one of these cams and the bevel-wheel 5 a segmentally-toothed large wheel 8 is secured upon this shaft and has a face-flange around the non-toothed part of its circumference. Upon this bed, at the other side thereof, is mounted in suitable standards 10 a shaft 11 in parallel relation with the shaft 2 and having cams 12 and 13, of identical form in identical positions, in coincident relation to the cams 6 and 7 and for simultaneous action, and these cams 6, 7, 12, and 13 form the shuttle-throwing device. On this shaft 11 is secured a segmentally-toothed large wheel 8′, of identical construction to that on shaft 2, and these two large wheels are formed with gear-teeth 15 for one-fourth of their circumference, and the remaining three-fourths of such circumference is an unbroken surface 16, in a line coincident with the base of the teeth, and bounding this unbroken surface is a face-flange 17, the circumference of which is coincident with the crown of the teeth for a purpose which I shall presently state. A bevel-gear 18 is mounted on this shaft 11 in coincident relation to the bevel-gear 5 on the shaft 2, and these two bevel-gears are engaged by like bevel-gears 19 and 20, respectively, on a cross-shaft 21, mounted in bearings at the rear of the table, whereby the two shafts 2 and 11 are caused to rotate continuously in unison and in opposite directions toward each other for a purpose to be presently stated.

Within the space between the parallel cam-shafts are secured two head-blocks 22 and 23, each in coincident relation to each coincident pair of cams, and within and between these head-blocks are fitted in parallel relation two spindles 24 and 25, standing longitudinally and centrally between the cam-shafts, for carrying and guiding the parallel band-wires. The receiving ends of these spindles are mounted in a pillar-block *a*, and the wires *b* *b′* are supplied to the bores thereof from spools (not shown) mounted in any convenient way at the rear of the bed, and it will be understood that the distance between the axis-bores of these spindles is just equal to the width of the band to be formed and that said spindles are adapted to be alternately rotated each in a constant direction opposite to the other. Each head-block has a cap or housing 26, open at its under side, joining the head-block, and within this opening is fitted a shuttle-block 27, so as to have a lateral sliding movement within said caps a distance just equal to the width of the band to be formed, and the ends of this opening form stops to determine the stroke or throw of the shuttle-block for a purpose which I will presently state. Each spindle is preferably bow-shaped between its journals, and its journals are of semicircular form in cross-section, Figs. 2 and 7, and fitted in semicircular cavities in the upper face of the head-blocks 22 23, Fig. 2, so that in the depending or normal positions of the bowed spindles the flat sides *c* of their journals will be flush with the upper faces of the head-blocks, as seen in Fig. 2.

The journal of each spindle has a bore 28 eccentrically placed, which leads to and intersects a groove 29, around the outer side of the bowed part to hold and guide the line-wires *b* *b′* to the eccentric points at which the filling-wire is twisted at the outer side of the front-delivery shuttle-block, and for this purpose the said spindle terminates outside of the shuttle-blocks, while the bowed parts of the spindles stand between them, as seen in Figs. 1 and 6. The under side of each shuttle-block has a semicircular cavity, which forms bearings for the journals 30 30 of an open frame 31, within which is mounted a spool 32, which carries the filling-wire 33, and this journaled frame and spool forms a rotating twisting-shuttle, which delivers the filling-wire 33 through a bore 34 in the front journal eccentrically with and just over the wire of the front-delivery-spindle journal, where the twisting of the two wire strands is effected by the eccentric relation of both wires to their delivery-journals.

It is to permit the arrangement of the filling-wire spool within the open frame 31 that I make the spindles bow-shaped, so that the spool-frame can be shifted sidewise over the spindles to shift the filling-wire alternately in coincident relation to the line-wires and bring the filling-wire so as to enter the eccentric journal-bore of the open frame, as in Fig. 1.

The shuttle-blocks 27 are reciprocated simultaneously back and forth within their housings 26 by the cams through the intervention of the push-pins 35 35, fitted to slide within the opposite ends of said housings in abutting relation to the opposite ends of the sliding shuttle-blocks 27 and to the said cams, the push-pins having anti-friction rolls 36 to receive the action of said cams. The throw

of these cams is just equal to the distance between the centers of the spindles, and the throw of the shuttle-blocks is thereby made to bring the journals 30 of the twisting-shuttle 31 in alternate coincident relation to the journals of the spindles, and for this purpose the journals of the spindles are made of semicircular form in cross-section, so that their flat faces *d d* will be coincident with the under sides of the sliding shuttle-blocks, which, in the movement of the latter, permits the journals 30 of the twisting-shuttle to be moved over and into coincident relation to the journals of the spindles, so that the two half parts of these journals match with their flat faces *c* and *d* joining and form a single journal-bearing to permit the bowed spindle to be revolved together and with the twisting-shuttle as an entirety for the purpose stated. In this operation each spindle is caused te rotate in a constant direction opposite to the other in alternate order, so that the device as an entirety has an alternate rotation, each being in a constant direction opposite to the other to intertwist one diagonal filling-wire in successive engaging coils with two straight line-wires, so that the said filling-wire will pass from one side of the band at one line-wire to the opposite side of the band at the other line-wire.

The spool for the filling-wire is mounted in the shuttle-frame by a removable bolt.

On the wire-receiving end of each bowed spindle is secured a pinion 37, which engages the teeth of the segmentally-toothed wheels, and these pinions have each a face-flange 38, the circumference of which is flush with the crown of its teeth and is in coincident relation and revolves on the flange 17 of its coacting segmentally-toothed wheel.

Each of these pinion-flanges has its circumference interrupted or cut away by an arc 39, coincident to the radius of the flange of the segmentally-toothed wheel, for the purpose of allowing the flange 17 of the latter wheel to enter the segmental cut 39 in the flange of the pinion 37 and thus arrest its rotation and hold it from turning so long as the said wheel-flange is in engagement with the said cut in the pinion-flange, Figs. 10 and 11. The effect of this flange engagement is to cause the pinions to make intermittent revolutions. While the motion of the segmentally-toothed wheels is continuous, because as this wheel is toothed over a portion of its circumference only and flanged only over the remainder of its circumference, it therefore rotates its coacting pinion over the toothed circumference 15 only, and locks said pinion from rotation over the flanged circumference. This relation and duration of rotation to rest may be changed by changing the relative sizes of the wheels and pinions or by changing the relative proportions of toothed and flanged circumference.

Immediately in front of the delivery ends of the spindles is mounted an idle-cylinder 40, so that its upper side is preferably on a plane with the line-wires *b b'* emerging from said spindles, and near each end said cylinder has a circumferential row of radial pins 41, outside of which the parallel wires are led and by which said wires are supported and retained in parallel relation at the proper distance apart while they are being intertwisted with the filling-wire. This intertwisting of the wires in successive coils is effected by the alternate shifting of the shuttle-frame 31 from its coincident relation with one spindle to the other, so as to carry the filling-wire 33 alternately from one to the other across the space between the parallel wires at regular distance, so that the filling-strands will stand in diagonal relation to each other, while the intertwisting of the wires is effected by the rotation of the spindle and shuttle-frame, which are rotated together as an entirety in alternate order, each entire device in a constant direction opposite to the other, during a complete revolution of the pinion operating such spindle and the continuous forward drawing of the formed band by the eccentric relation of the wires in their respective delivery-journals. The means shown for effecting this forward drawing of the band and for holding and guiding it from the spindles I will now describe.

Immediately in front of the cylinder 40 is mounted a second cylinder or wheel 42, having near each end a circumferential row of radial blocks 43, disposed so as to stand within and between parallel and filling wires, so as to form on the surface of the cylinder a sort of depressed pattern or matrix of the band and by which the latter is drawn forward and by which it is laid and retained in shape and prevented from twisting and buckling during its passage from the first-described pin-cylinder and for delivering it smoothly to a take-up reel. This matrix-wheel has a positive continuous motion given to it by a bevel-gear 44 on its shaft engaging with a similar gear 45 on a short shaft in line with and below the cam-shaft 2, and which has a gear-wheel 46 on its inner end which engages with the pinion 4 of the cam-shaft 2, so that motion being given to said cam-shaft by a belt from the pulley 47 thereon will operate the cam-shafts, the sliding shuttle-blocks, the rotating twisting-shuttle, the spindles, and the matrix-wheel. In this operation it will be understood that the relative speed of the twisting and forming devices to that of the matrix-wheel is determined by the relative size of the gear-wheel 46 and its engaging pinion 4 on the driven cam-shaft.

A reeling device is arranged beneath the bed, the reel 48 whereof is mounted on a short shaft and driven by a band-pulley 50 thereon from the pulley 49 on the shaft of the matrix-cylinder, (see Fig. 4,) the formed band for this purpose being connected to the reel and reeled thereon as it is formed.

Referring to Fig. 2, it will be seen that the

shuttle-blocks 27 of both head-blocks are at the end of their stroke or throw and the shuttle-frame mounted therein and carrying the filling-wire 33 is coincident with the spindle 24, the wires having been previously carried through the spindle-journals and through the front journal of the shuttle-frame. The machine being now started, the spindle and the shuttle will revolve together in an outward direction and their individual wires *b'* and 33 will be intertwisted until the cogs 15 of the wheel 8 cease to mesh with those of the pinion 37, at which point the flanges of the wheels come in contact and the spindle 24 will be held idle, while the wheel 8 will continue to revolve. At this point the continuous rotation of the cam-shafts will, by the action of their cams, move the shuttle-blocks to the other end of their throw and thereby bring the journals of the shuttle-frame coincident with the journals of the other spindle 25, as in Fig. 1, and they will be rotated together in an opposite or outward direction, and their individual wires will be intertwisted until the cogs 15 of wheel 8′ cease to mesh with those of the pinion 37, at which point the flanges of these wheels come in contact and engagement, and the spindle 25 will be held idle, while the wheel 8′ will continue to revolve, and this operation goes on continuously, producing the band just in front of the front head-block and as said band is drawn therefrom over and upon the cylinder 40, during which the shuttle shifts back and forth from one spindle to the other, and each spindle is alternately rotated, together with the shuttle, in a direction constantly outward and therefore in opposite directions to each other.

It is important now to notice that in the position of the intertwisting device, as in Fig. 2, the shuttle-wire 33 will be twisted over the upper side of the spindle-wire *b* at *e* with a number of twists produced by one revolution of the pinion 37, as seen at *f* in Fig. 12, and, leaving this wire on its under side at *g*, is passed diagonally to the other spindle-wire *b'* by the lateral shifting of the shuttle-blocks and the filling-wire shuttle, which they carry, and be twisted over the upper side at *h* of said wire *b'* with a number of twists *f'* produced by one revolution of the pinion 37, and, leaving this wire *b'* on its under side at *i*, is passed diagonally to the first-mentioned spindle-wire *b* and twisted over its upper side, the diagonal strands being formed by the forward movement of the band as it is formed and the twisting of said wire being from alternate sides of the band at each alternate point of twisting, thus producing a band of three wire strands, in which the filling-wire is made to stiffen, brace, and preserve the alignment of the band. This operation is effected at the delivery ends of the journals of the spindles and of the shuttle-frame, and the band is drawn forward by hand until a sufficient length is formed to be engaged with the radial blocks 43 of the cylinder 42 and to be fastened to the reel, when the machine requires no further attention until the wire 33 in the shuttle-frame is exhausted, and the empty spool is then replaced by a filled one, its wire connected, and the machine again put in motion. The proper tension of the filling-wire is maintained by a spring 51, Fig. 8, or other means. It is important, also, to notice that it is necessary that the relation of the toothed portions of the segmentally-flanged wheels shall be such that they shall cause one or more than one revolution of the spindles, so that, starting from the position shown in Fig. 2, they shall return to that position for the next stroke of the shuttle-block, which reverses the laterally-shifting action of its shuttle-frame. It is also important to notice that the drawing of the wires by the continuous action of the matrix-wheel prevents any slack in the wires at the points of twisting, because the wires are drawn from their respective spools toward and from such points, and, being connected to each other at their point of engagement with said wheel, there can be no unequal drawing of them.

Referring to Fig. 1, the arrows show the direction in which the band is drawn and also the wires from the front journal of each spindle and from the front journal of the twisting-shuttle, and in this figure is seen how the band is formed just at the ends of these journals and between them and the roller-support 40, and that the twisting-shuttle is in position to be rotated outward with the spindle 25 to intertwist the wires 33 and *b* at the point *f*, and from which point as the band is drawn forward the cams shift the shuttle-blocks and with them the twisting-shuttle to bring the journals of the latter over and in coincident relation to the journals of the spindle 24 and thereby carry the filling-wire diagonally across the space between the line-wires, where the filling-wire is twisted with the line-wire *b'* by the outward rotation of the coincident parts, and it is this lateral shifting of the twisting-shuttle and the coacting rotation of the spindles each in a constant direction opposite to the other which cause the filling-wire to be fed off the spool and be twisted over the line-wires from opposite sides of the band, as stated.

It will be of course understood that the speed of the drawing matrix-wheel, the take-up reel, and the operation of the shuttle and twisting devices are in unison, and that the matrix-wheel serves to support the formed band in horizontal and longitudinal alignment with the band-forming devices and to deliver it at a fixed speed in smooth condition to the winding-reel. For this purpose the surface blocks of the matrix-wheel are disposed in such manner as to stand between the diagonal strands of the filling-wire and between the line-wires to lay and even the band-wires and to support them under the drawing action of the matrix-wheel in proper alignment with the wire-carrying spindles. It will also be understood that the sliding

boxes 27 may be formed with or independently of the cam-abutting pins, and that the said boxes may be retained in position on the head-blocks by any suitable means which will limit their reciprocating movement for the purpose stated.

An important feature in the organization of my machine is the provision of a pair of spindles for the two line-wires, each having a wire-delivery passage at one side of the axis of rotation, each rotated alternately in a constant direction opposite to the other and arranged in fixed relation on the frame, and a shuttle for the filling-wire, having a wire-delivery passage at one side of its axis of rotation and having an alternate lateral movement for coincident relation with and rotated by and with each separate spindle, so that in each position the said coincident parts as an entirety have a constant direction opposite to the other when the said shuttle is shifted thereto. In the operation of this coiling and intertwisting device it will be observed that the spindles are geared each to a separate mutilated gear for separate and independent rotation in directions one constantly opposite to the other, and that the shuttle is mounted for separate and independent lateral movement and for rotation by and with each spindle, whereby the filling-wire is coiled in alternately-opposite directions with each side of the band over the line-wires, and both the filling and the line-wires are intertwisted with each other in successive coils along the straight line-wires, in the way described, to make a narrow band or ribbon braced and stiffened as shown in Fig. 12.

Without limiting myself to the precise construction and arrangement of parts, I claim—

1. In a machine for forming wire-fencing bands, the combination, with a pair of spindles for the line-wires, adapted to be alternately rotated each in a constant direction opposite to the other and each having an eccentrically-disposed wire-delivery passage in one of its journals, of a twisting-shuttle for the filling-wire, adapted to have a lateral movement on its journals for alternate matching relation with the journals of said spindles and having an eccentrically-disposed wire-delivery passage in one of its journals, whereby when the said shuttle and active spindle-journal are in coincident relation and rotated together the said wires will be intertwisted or coiled together, substantially as described.

2. In a machine for forming wire-fencing bands, the combination, with a pair of spindles for the line-wires, adapted to be alternately rotated each in a constant direction opposite to the other, each having its journals flattened on one side, and an eccentrically-disposed wire-delivery passage in one of said journals, of a twisting-shuttle for the filling-wire, having corresponding flattened journals and an eccentrically-disposed wire-delivery passage in one of them, shuttle-blocks having semicircular recess-bearings for said spindle-journals, and mechanism for reciprocating the shuttle-blocks to bring the journals of the shuttle and of the spindles in coincidence and simultaneously rotate both to intertwist or coil both wires in the way described.

3. In a machine for forming wire-fencing bands, the combination, with a pair of alternately-rotating spindles for the line-wires, the rotation of each spindle being in a constant direction opposite to the other, each having a bowed form between its journals, and each having an eccentrically-disposed wire-delivery passage in one of its journals, of an open frame journaled above said spindles and having in one of its journals an eccentrically-disposed wire-delivery passage, and a spool mounted in said frame for the filling-wire, said journaled parts constituting an intertwisting device, and actuating mechanism for shifting the twisting-shuttle laterally to bring its journals in matching relations with the spindles and to rotate the said shuttle and the active spindle together in each of their matched positions alternately and in a direction constantly opposite to intertwist or coil the said wires, substantially as described.

4. In a machine for forming wire-fencing bands, the combination, with a pair of alternately-rotating spindles each having journal-bores for the line-wires, the rotation of each spindle being in a constant direction opposite to the other, of a twisting-shuttle having a journal-bore for the filling-wire, the journal-bores delivering said wires being eccentrically disposed, actuating mechanism for shifting said twisting-shuttle laterally to bring its journals in matching relation with the spindle-journals and to rotate the said shuttle and its connecting-spindle to intertwist or coil the said wires, an idle spacing-roll provided with circumferential rows of pins arranged to engage and maintain the relative distance between said wires in advance of the twisting-point, and a matrix-cylinder in advance of the idle-roll, substantially as described.

5. In a machine for forming wire-fencing bands, the combination, with a pair of oppositely-rotating spindles having journal-bores for the line-wires, the rotation of each spindle being in a constant direction opposite to the other, a twisting-shuttle having a journal-bore for the filling-wire, the journal-bores delivering said wires being eccentrically disposed to their axes, and actuating mechanism for shifting said twisting-shuttle laterally to bring its journals in matching relation with the spindle-journals and to rotate the said shuttle and its connecting-spindle to intertwist or coil the said wires, of an idle spacing-roll in advance of said journal-bores provided with circumferential rows of pins arranged to engage and maintain the relative distances between said wires, a matrix-wheel having circumferential rows of projections

disposed in alternate relation at each side thereof, and a take-up reel for operation in the way described.

6. In a machine for forming wire-fencing bands, the combination, with the spindles for carrying the line-wires and a twisting-shuttle for carrying the filling-wire, of the pinions on the spindles, having circumferential face-flanges formed with circumferential cuts, and segmentally-toothed flanged wheels engaging said pinions and their flanges, sliding boxes for the journals of said twisting-shuttle, and cams engaging said journal-boxes on the shafts of the segmentally-toothed flanged wheels for alternately shifting said twisting-shuttle from one spindle to the other for rotation therewith, substantially as described.

7. In a machine for forming wire-fencing bands, the combination, with the spindles for carrying the line-wires arranged in parallel relation, having axially-bored journals connecting bowed grooved parts, and head-blocks having semicircular bearings for said journals, of a twisting-shuttle for carrying the filling-wire, boxes having semicircular bearings for the journals of said twisting-shuttle, adapted to slide over in coincident relation to the semicircular bearings for the spindle-journals, the said journals of the spindles and of the twisting-shuttle having coincident flattened sides, means for alternately rotating said spindles, and means for alternately shifting said twisting-shuttle in coincident relation to said spindle-journals for rotation therewith, substantially as described.

8. In a machine for forming wire-fencing bands composed of three wires, a twisting device formed of a pair of spindles for the line-wires, mounted in fixed journal-bearings on the frame and adapted to be alternately rotated each in a constant direction opposite to the other and having each a wire-delivery passage at one side of its axis of rotation, and a shuttle formed of a journaled frame, having a spool for the filling-wire adapted to have a lateral movement on its journals from one spindle to the other and having a wire-delivery passage in one of its journals and rotated by and with each spindle, and means for supporting and holding the wires being twisted, whereby the filling-wire is caused to pass alternately on opposite sides of the band at the points of intertwisting, in the way and for the purpose stated.

9. In a machine for forming fencing-bands, a twisting device for carrying the line and the filling wires, consisting of a pair of spindles alternately rotative, supplemented by a shuttle alternately rotative with each spindle, a cylinder having circumferential rows of pins at the twisting-point, and mechanism for operating said spindles in opposite directions, consisting of a pinion on each spindle, having a circumferential face-flange, a wheel having gear-teeth on a portion of its circumference engaging each pinion, and a circumferential face-flange around its untoothed part for engaging a circumferential cut in said pinion, whereby each pinion is rotated a fixed portion of the revolution of said segmentally-cogged wheel and held non-rotative the remainder of such revolution, for the purpose stated.

10. In a machine for forming wire-fencing bands, a twisting mechanism composed of two line-wire-carrying spindles alternately rotated each in a constant direction opposite to the other and having a fixed relation to the frame, and a twisting-shuttle constructed to be alternately matched and rotated with said spindles to intertwist said wires, and a spacing idle-roll having circumferential rows of pins arranged to engage the inner sides of the line-wires to hold them in alignment with said spindles in advance of the twisting-point and rotated by the drawing motion of said wires, substantially as described.

11. In a machine for forming wire-fencing bands, the combination, with two line-wire-carrying spindles constructed to be alternately rotated each in a constant direction opposite to the other and having a fixed relation to the frame, and a twisting-shuttle for carrying the filling-wire, constructed and arranged to be alternately reciprocated and matched and rotated by and with said spindles, of a matrix-wheel having circumferential rows of projections disposed in alternate relation at each side of said wheel, and actuating mechanism to continuously operate said matrix-wheel, in the way and for the purpose stated.

12. In a machine for forming wire-fencing bands, the combination of a pair of spindles for the line-wires, having a fixed relation to the frame, each having an unbroken pinion on one end and a wire-delivery passage in its other end, with a twisting-shuttle for the filling-wire, reciprocating laterally in a plane above said spindles, a pair of gear-connected shafts, each having a mutilated gear separately engaging each spindle-pinion to effect the rotation of said spindles alternately each in a constant direction opposite to the other, cams on said connected shafts for shifting said shuttle, and suitable means for continuously drawing the wires, substantially as described.

13. In a machine for forming wire-fencing bands, the combination of a pair of spindles for the line-wires, having a fixed relation to the frame, each having an unbroken pinion on one end and a wire-delivery passage in its other end, a twisting-shuttle reciprocating laterally in a plane above said spindles, a mutilated gear for separately engaging each spindle-pinion to effect their rotation alternately each in a constant direction opposite to the other, cam-actuated slides for shifting said shuttle, a continuously-rotating matrix-wheel for continuously drawing the formed band, and a driving-shaft having direct connection with and simultaneously operating each separate mutilated gear, substantially as described.

14. A machine for forming wire-fencing bands of three wires, comprising a flat-top bed or table whereon are disposed the following elements, in combination, viz: two fixed parallel head-blocks 22 and 23, a pair of spindles 24 and 25 for the line-wires *b* and *b'*, arranged at right angles between and in semicircular bearings on said pillow-blocks, a block 27, arranged to slide on each of said pillow-blocks, a shuttle-frame 31, journaled in said slide-block over said spindles and having a spool 32 for the filling-wire 33, a flanged pinion 37 on one end of each spindle, the opposite ends of the latter and the corresponding journal of the shuttle-frame having wire-delivering passages at one side of their axis of rotation, two parallel shafts 2 and 11, mounted along the ends of the pillow-blocks, each having a wheel formed with a circumferentially-toothed segment 15 for engaging said pinions and each wheel having a circumferential flange 17 for engaging a curved cut 39 in the flange 38 of the pinion for rotating said spindles alternately each in a constant direction opposite to the other, cams 6 and 7 and 12 and 13, arranged in pairs on said shafts, for operating said slide-blocks to shift the shuttle from one spindle to the other and engage their journals, bevel-gear arranged to connect said shafts for continuous and simultaneous rotation toward each other, an idle-roll 40, having circumferential rows of pins 41 for spacing the line-wires, and a matrix-wheel 42, having a continuous rotation for drawing the band in the operation of forming it, and suitable gear connecting said matrix-wheel with one of said side shafts.

15. In a machine for forming wire-fencing bands, the following mechanisms, in combination: the spindles for carrying the line-wires, their pinions having flanges each having a circumferential cut, the segmentally toothed and flanged wheels engaging said pinions and their flanges, the shafts of said wheels connected for simultaneous and equal rotation in opposite directions, the twisting-shuttle supplementing said spindles, the shuttle-blocks for the journals of said twisting-shuttle, the cams on the wheel-shafts for shifting said shuttle-blocks to engage the spindle-journals with the journals of the twisting-shuttle, the cylinder having two rows of pins, the matrix-wheel, the take-up reel, and gear connecting it with one of said cam-shafts, substantially as described.

16. In a machine for forming wire-fencing bands composed of three wires, a device for coiling and intertwisting the wires, comprising a pair of spindles for the line-wires, each having a wire-delivery passage at one side of its axis of rotation, each rotated alternately, the rotation of each being in a constant direction opposite to the other and arranged in relatively fixed relations, and a shuttle for the filling-wire, having a wire-delivery passage at one side of its axis of rotation and having an alternate lateral movement and rotated by and with each separate spindle, whereby the filling-wire is coiled in opposite alternate directions—that is, on opposite sides with the line-wires—and both the filling and the line wires are intertwisted with each other at such coiling, in the way described.

17. In a machine for forming wire-fencing bands composed of three wires, the combination of a pair of spindles for the line-wires, each having a wire-delivery passage at one side of its axis of rotation arranged in fixed relative relations, gearing for separately and independently engaging and rotating them alternately in directions constantly opposite to each other, and a shuttle for the filling-wire, having a wire-delivery passage at one side of its axis of rotation, and gearing for separately and independently engaging and alternately shifting said shuttle for rotation by and with said spindles, substantially as described.

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

HERMAN EMIL SCHNABEL.

Witnesses:
C. R. WYLIE,
FRED W. RANSOM.