(No Model.) 7 Sheets—Sheet 1.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

No. 276,315. Patented Apr. 24, 1883.

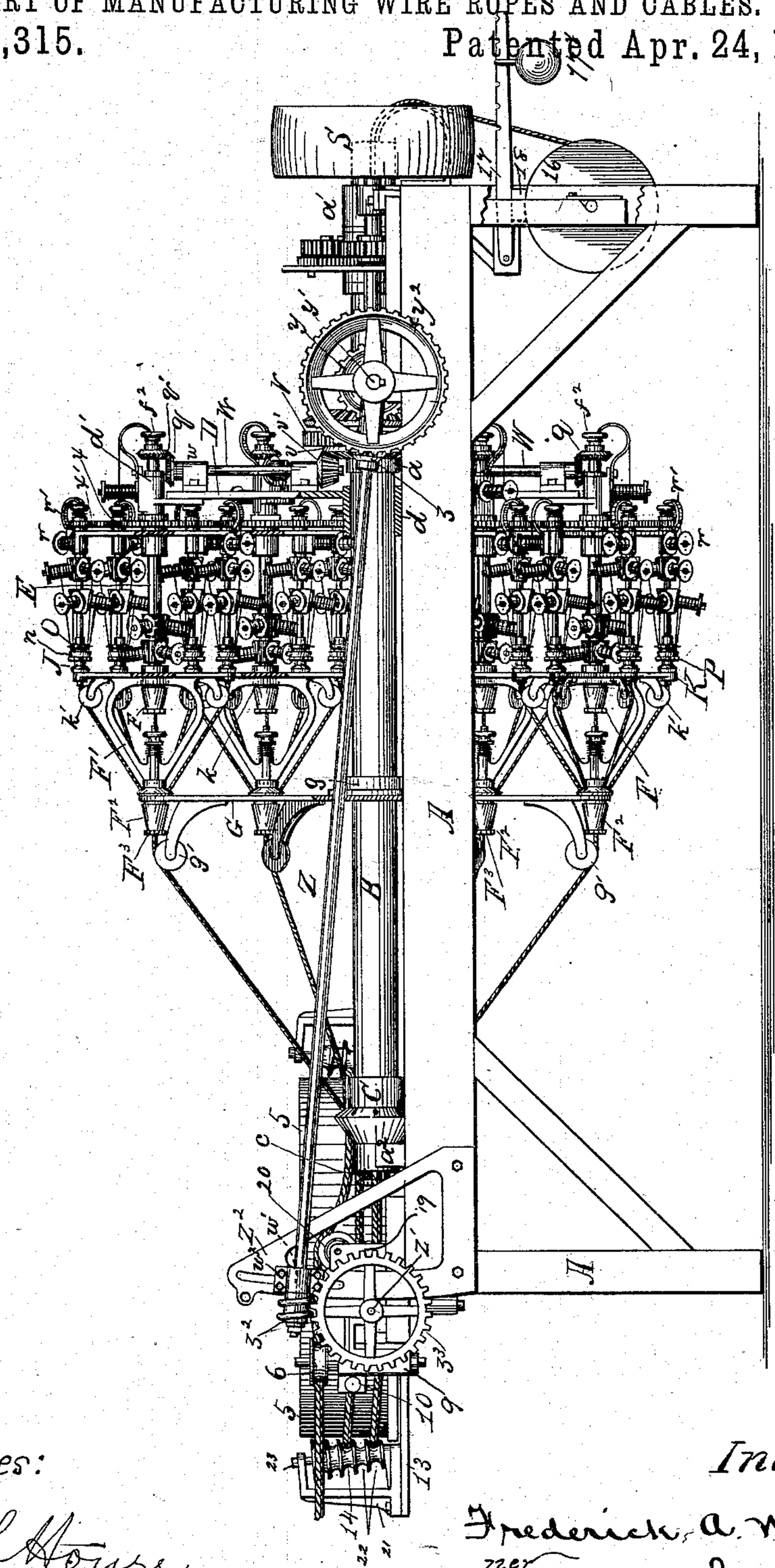

Fig. 1.

Witnesses:

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Inventor:

Frederick A. Wiswell.

per Wiswell & Lange

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(No Model.) 7 Sheets—Sheet 2.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

No. 276,315. Patented Apr. 24, 1883.

Fig. 2.

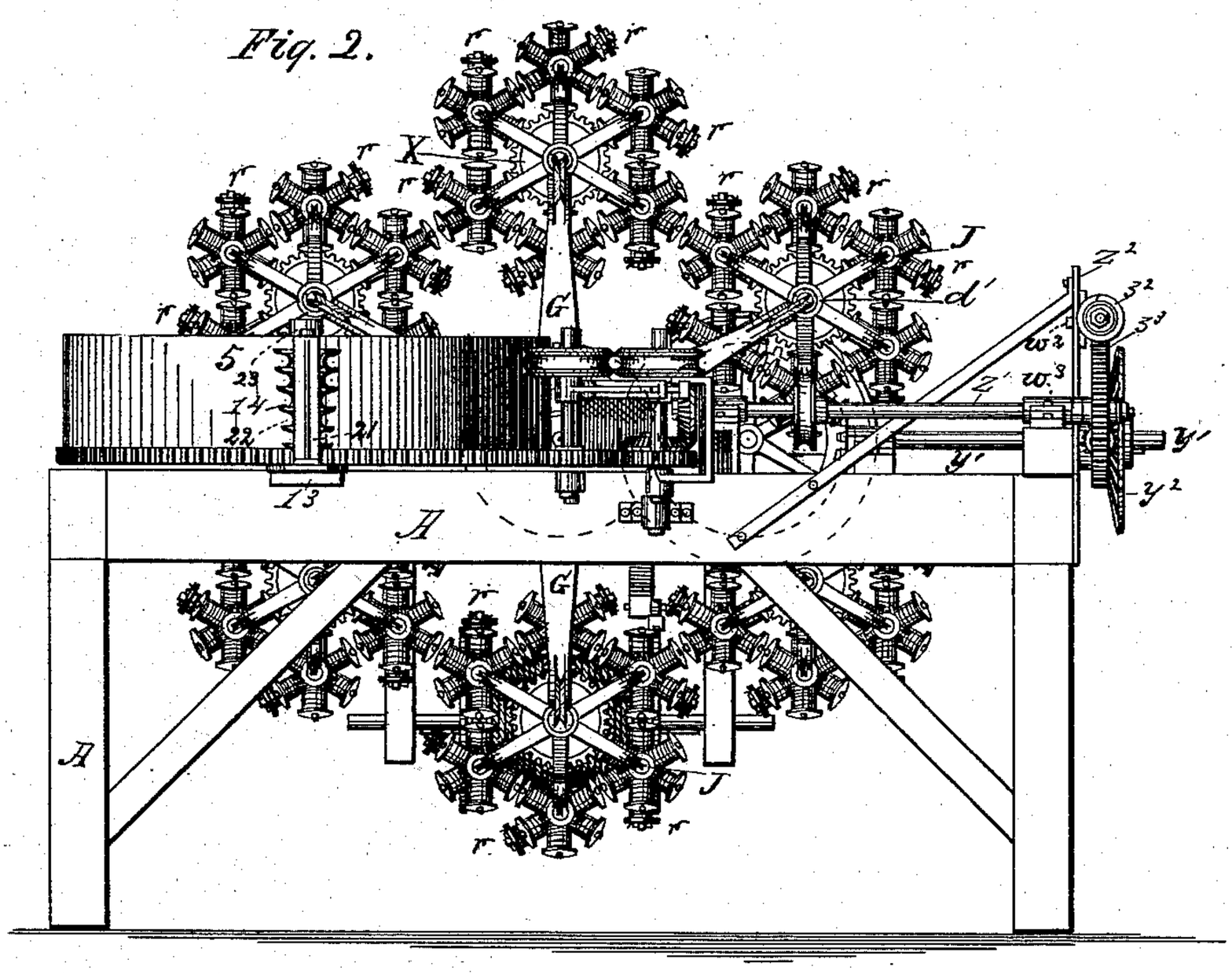
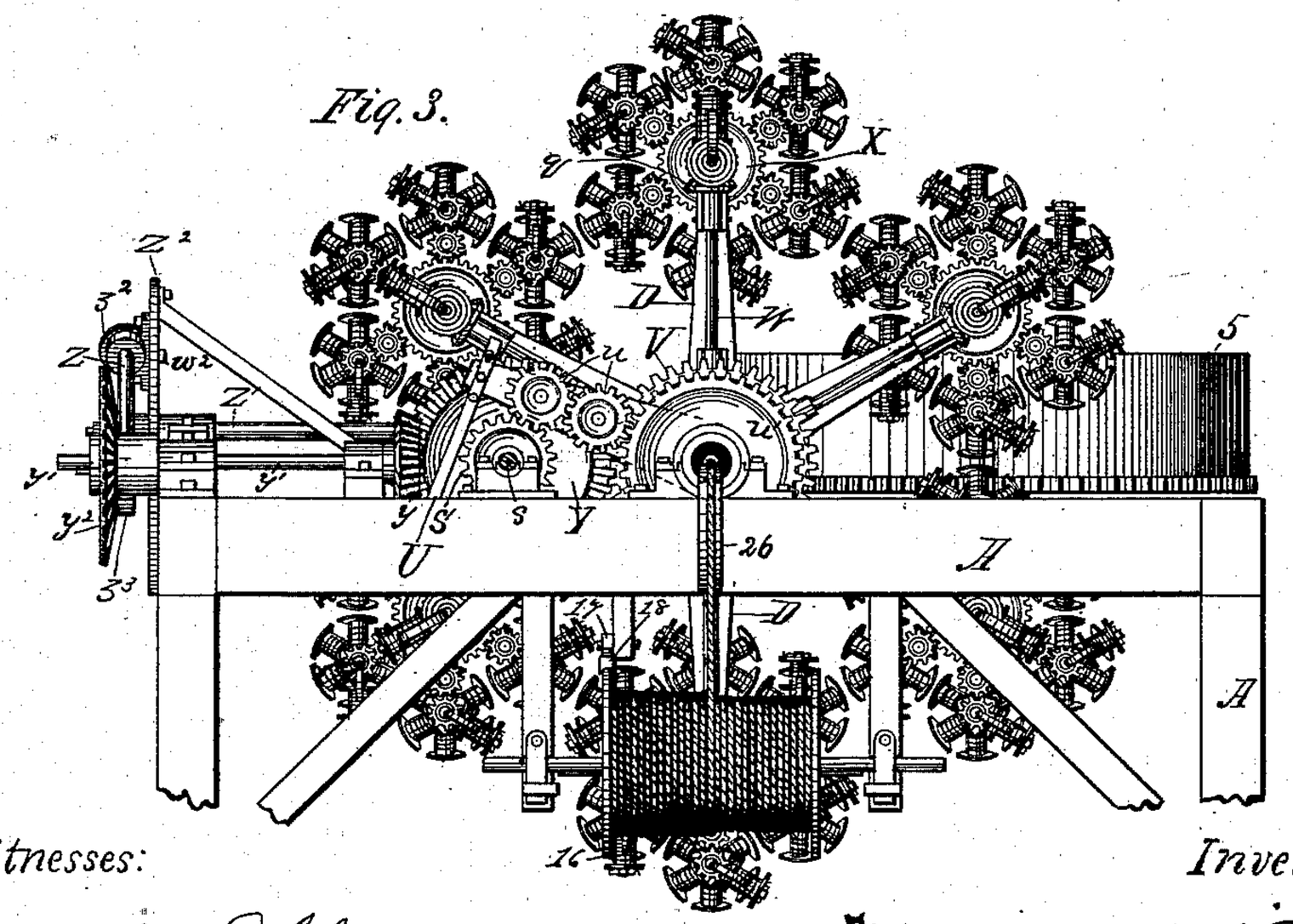


Fig. 3.



Witnesses:

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(No Model.) 7 Sheets—Sheet 3.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

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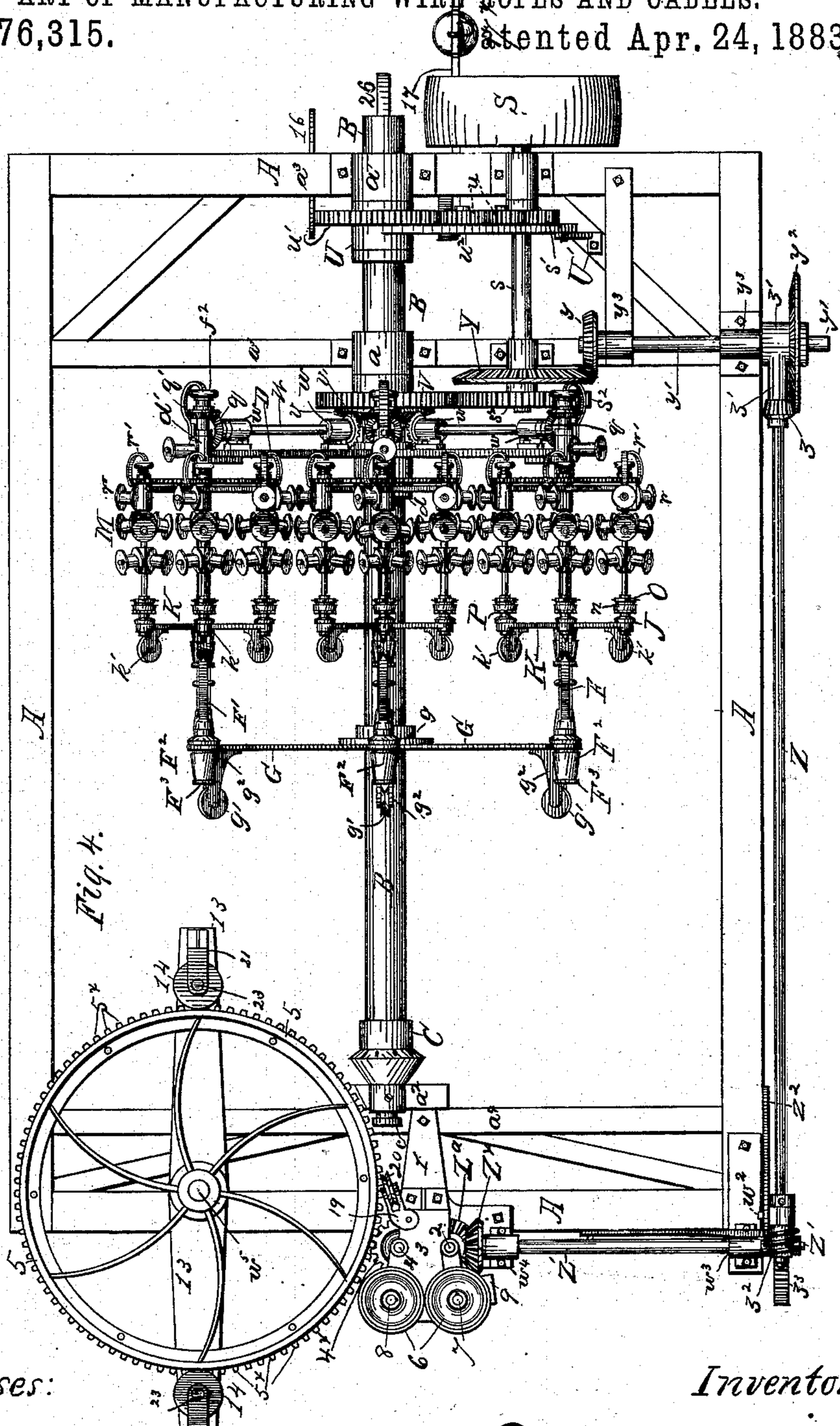

Fig. 4.

Witnesses:

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(No Model.) 7 Sheets—Sheet 4.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

No. 276,315. Patented Apr. 24, 1883.

Fig. 5.

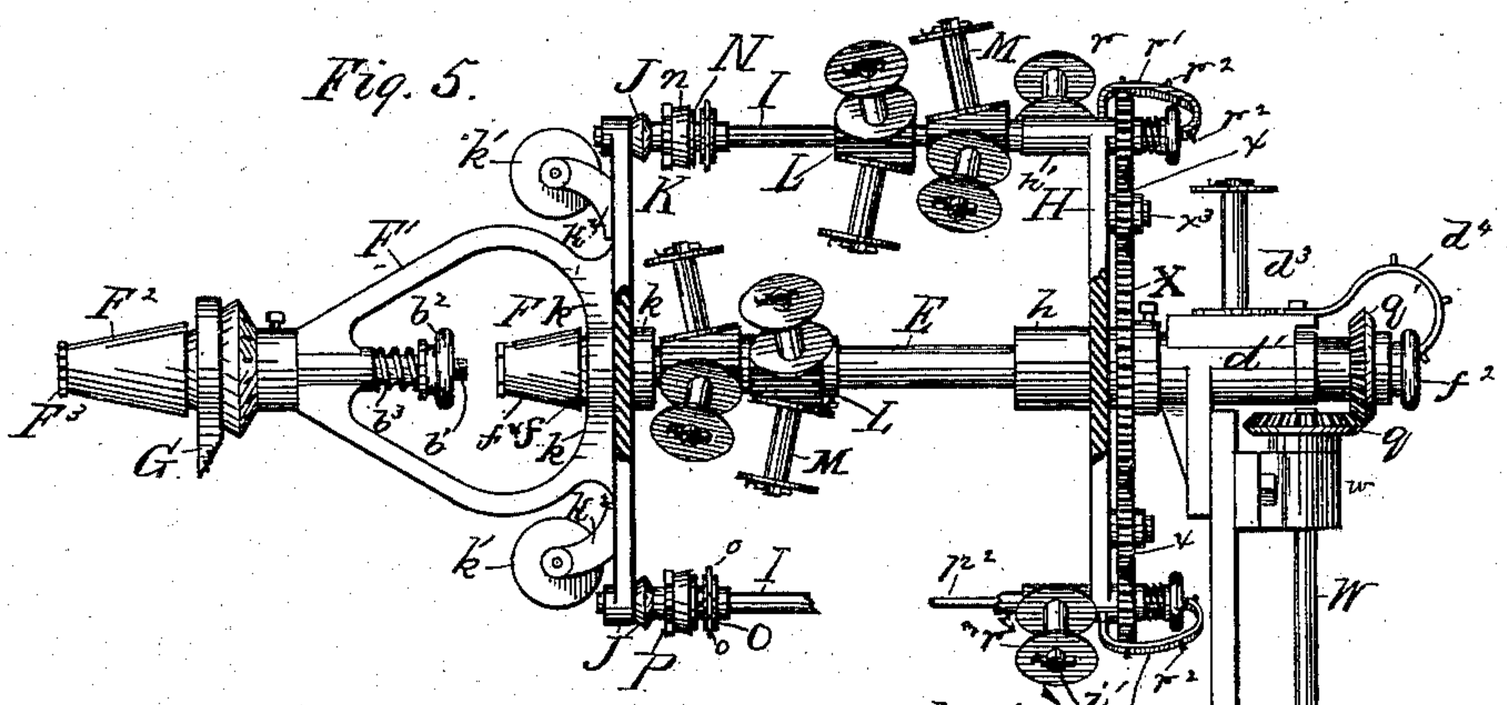


Fig. 6.

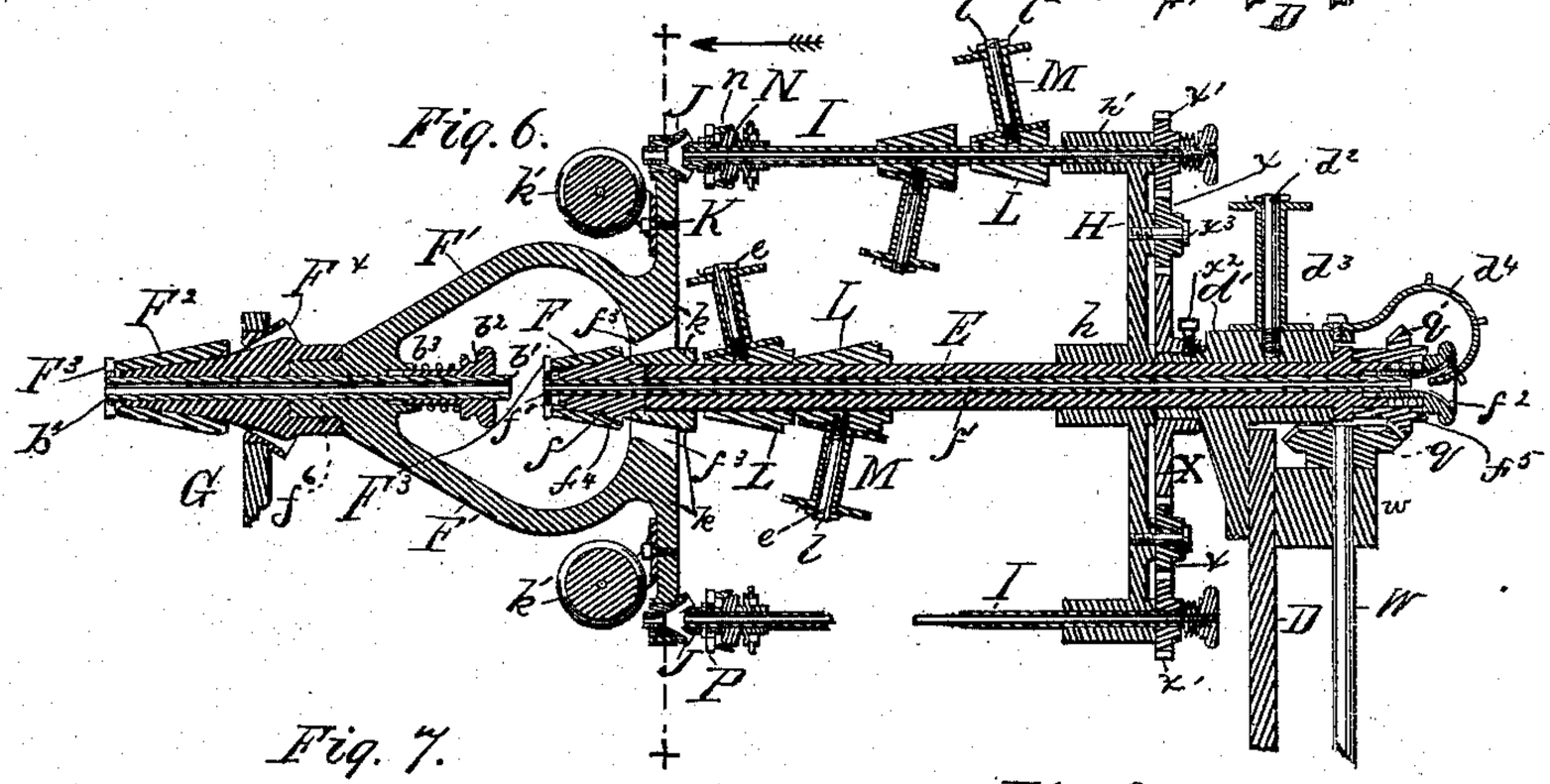


Fig. 7.

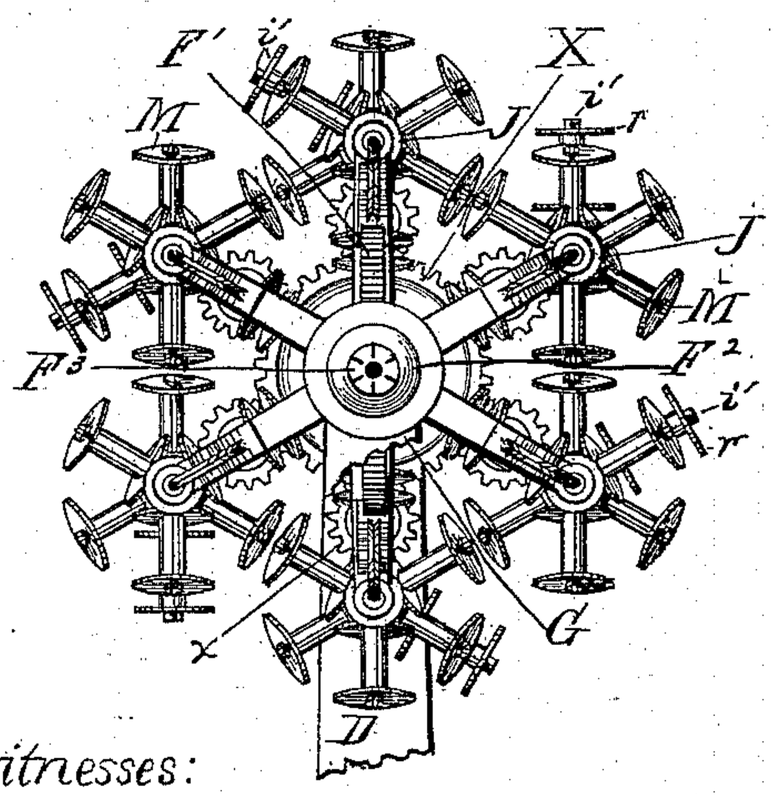
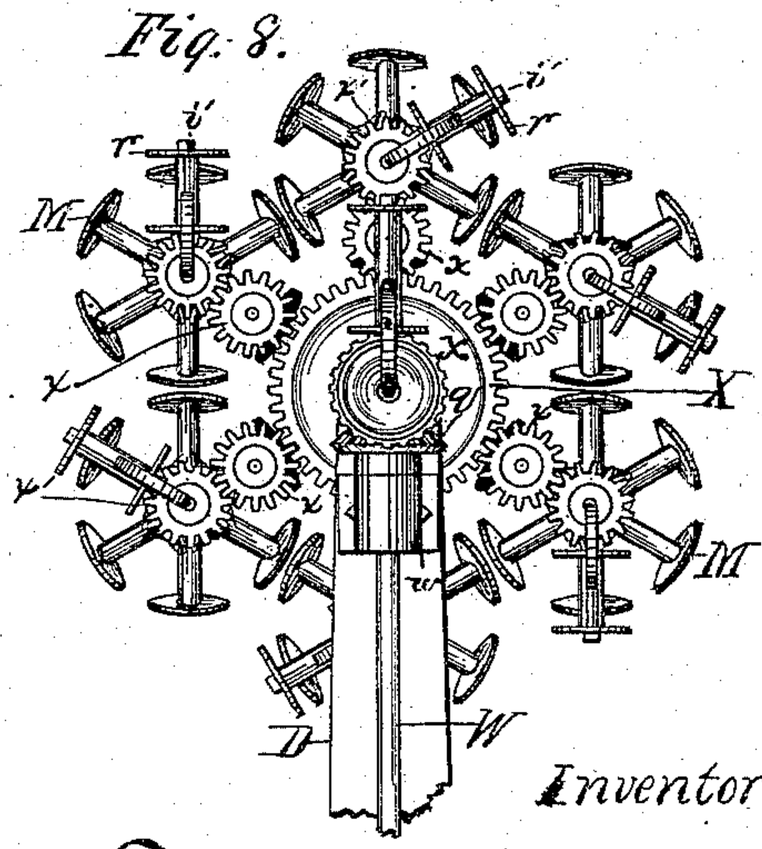


Fig. 8.



Witnesses:

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(No Model.) 7 Sheets—Sheet 5.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

No. 276,315. Patented Apr. 24, 1883.

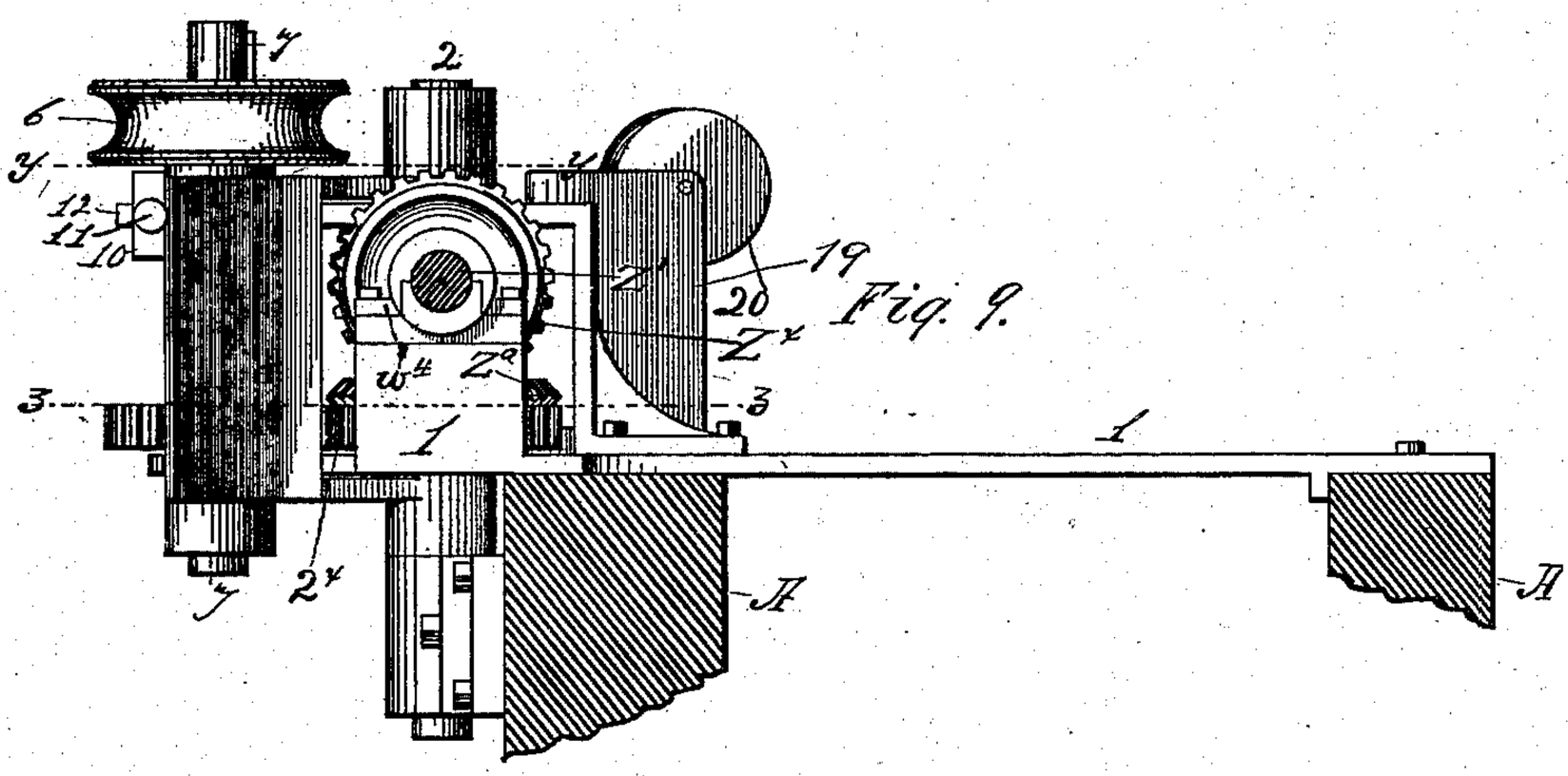

Fig. 9.

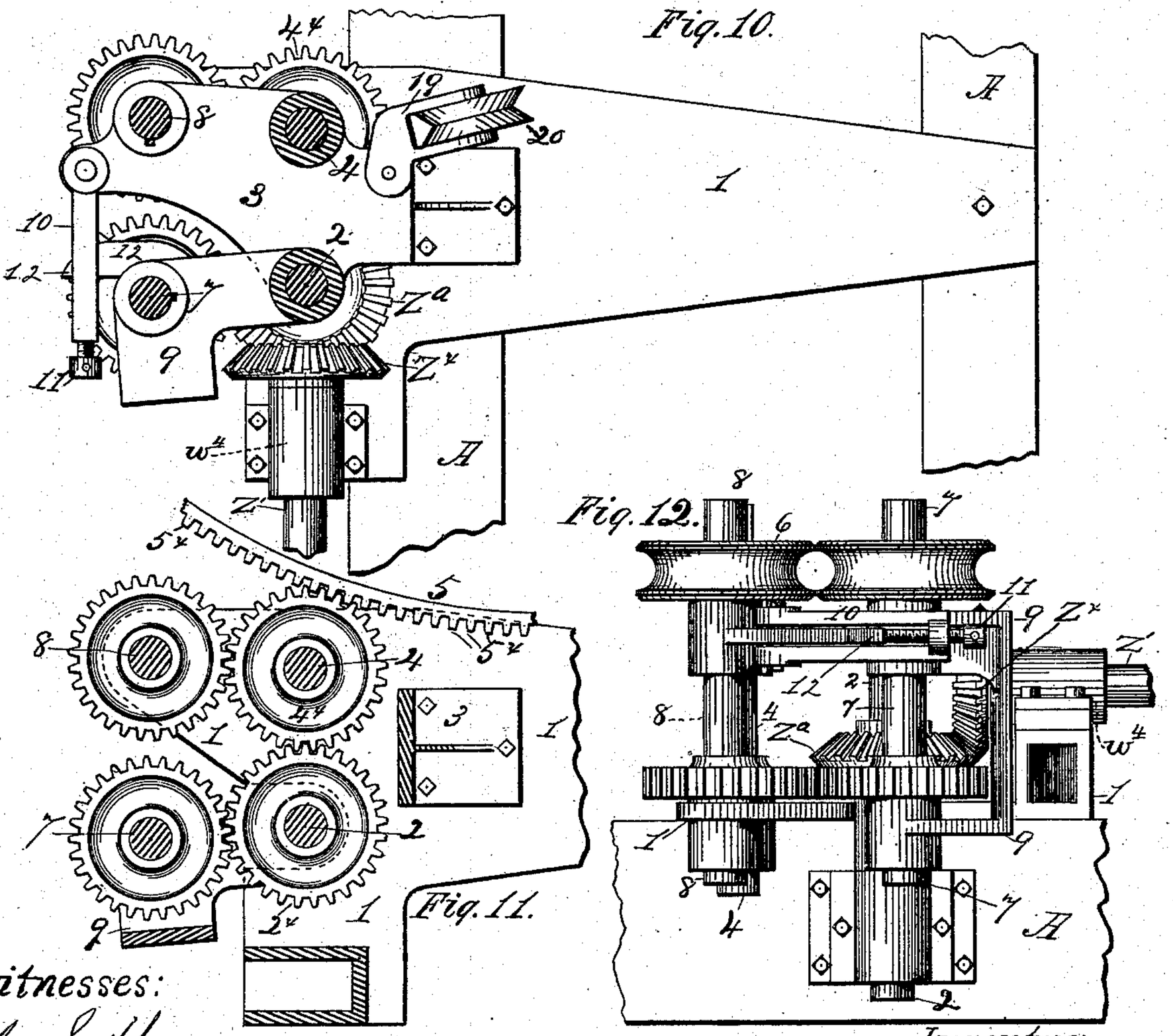

Fig. 10.

Fig. 11.

Fig. 12.

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(No Model.) 7 Sheets—Sheet 6.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

No. 276,315. Patented Apr. 24, 1883.

Fig. 13.

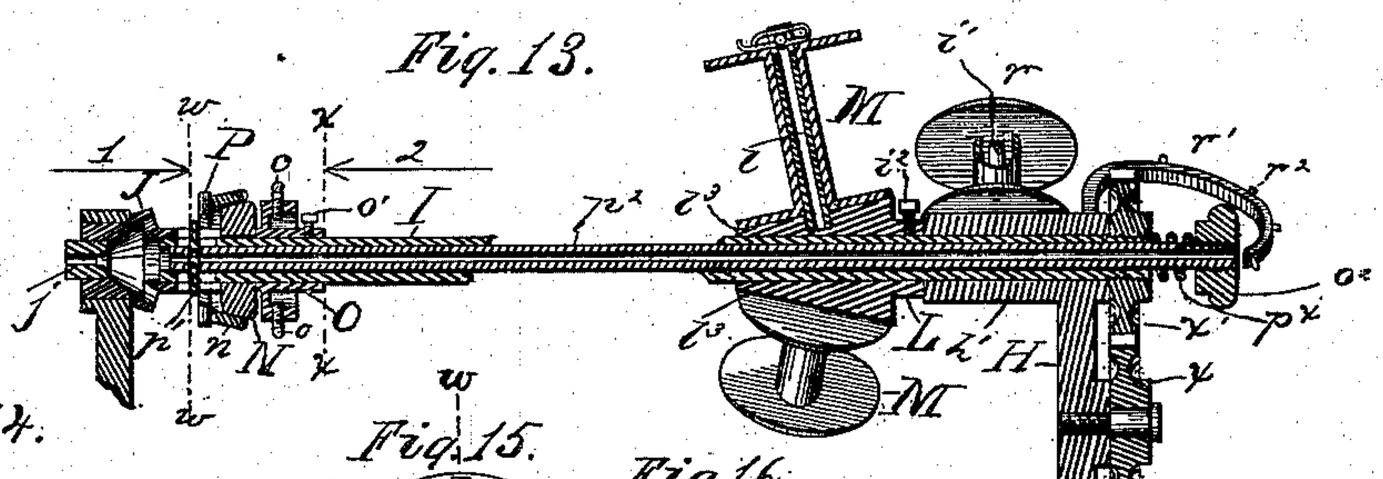


Fig. 14.

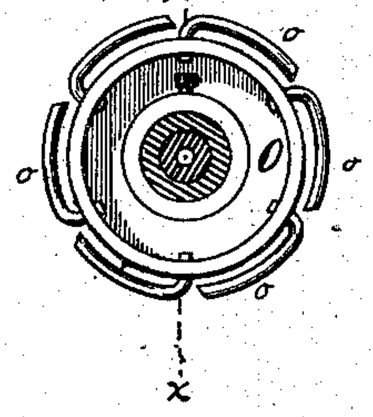


Fig. 15.

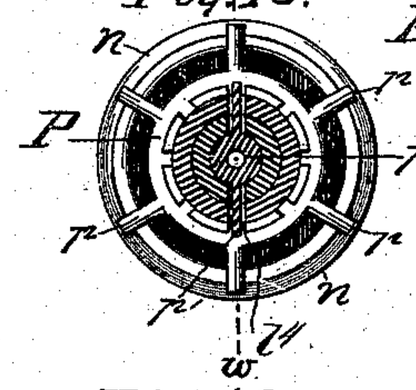


Fig. 16.

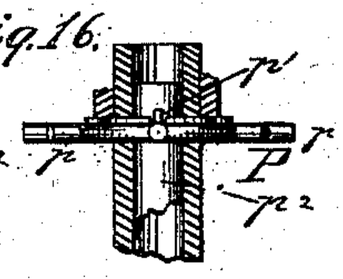


Fig. 17.

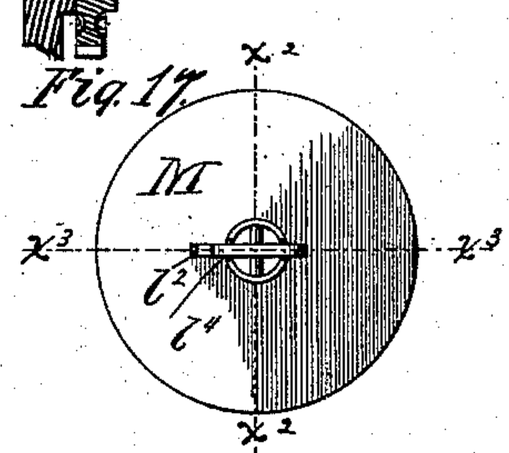


Fig. 18.

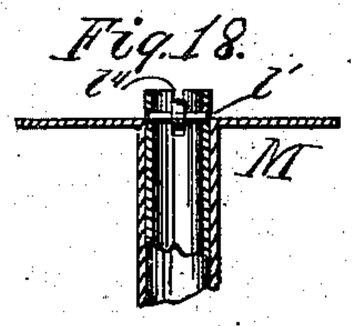


Fig. 19.

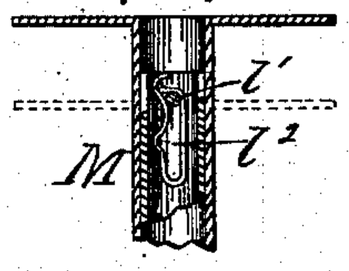


Fig. 20.

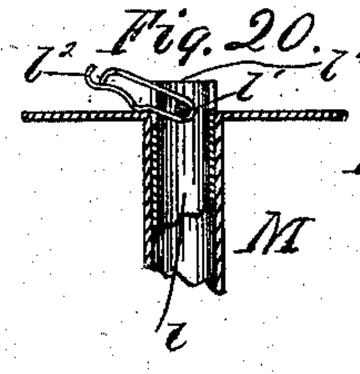


Fig. 21.

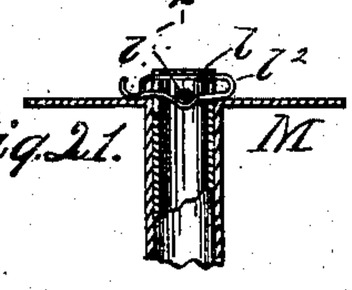


Fig. 22.

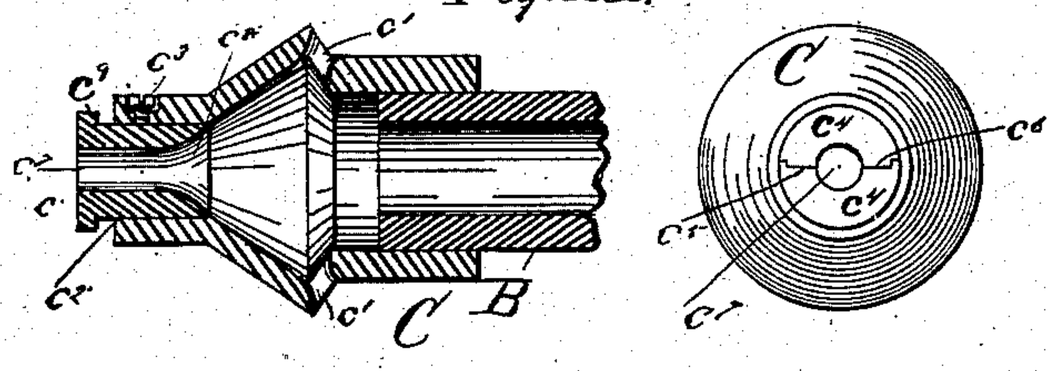


Fig. 23.

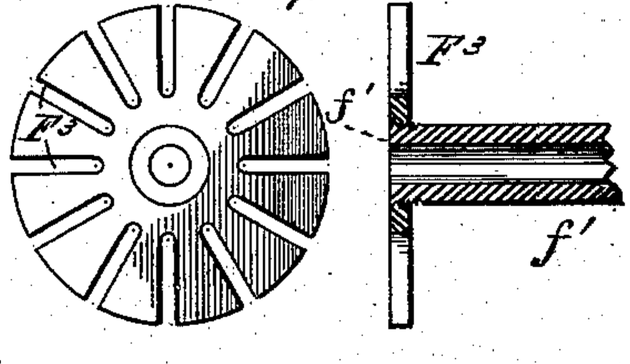


Fig. 24.

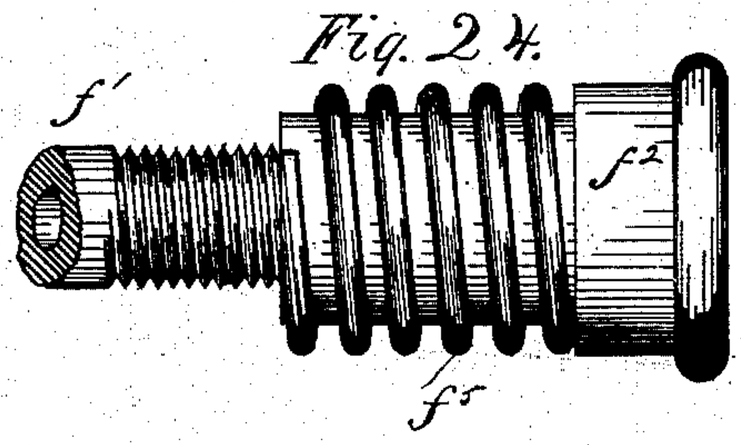
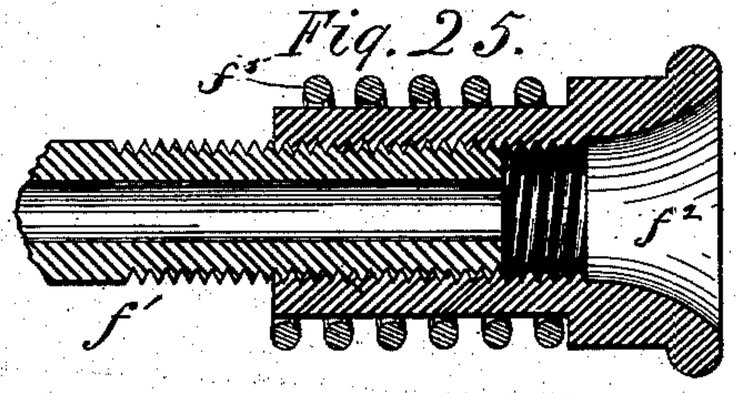


Fig. 25.



Witnesses:

J. L. House

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(No Model.)

7 Sheets—Sheet 7.

F. A. WISWELL.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

No. 276,315. Patented Apr. 24, 1883.

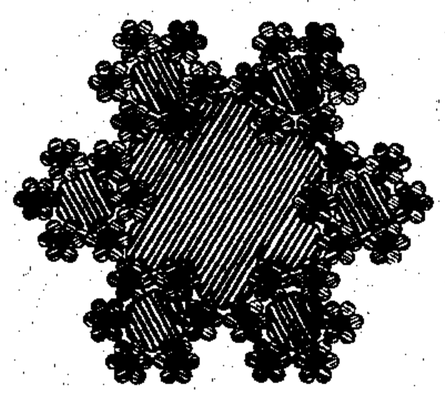
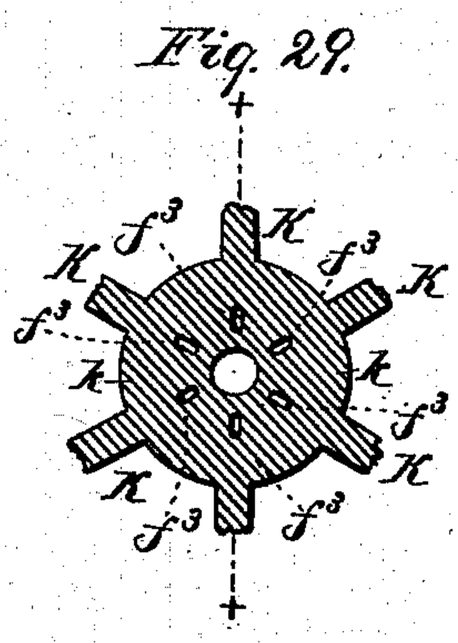


Fig. 26.

Fig. 29.



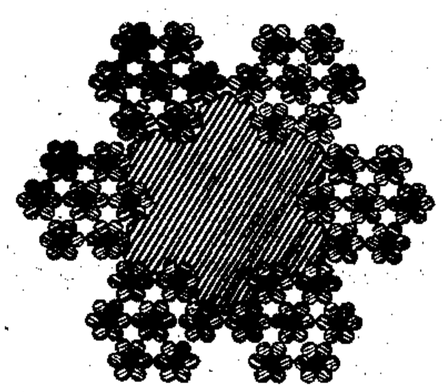
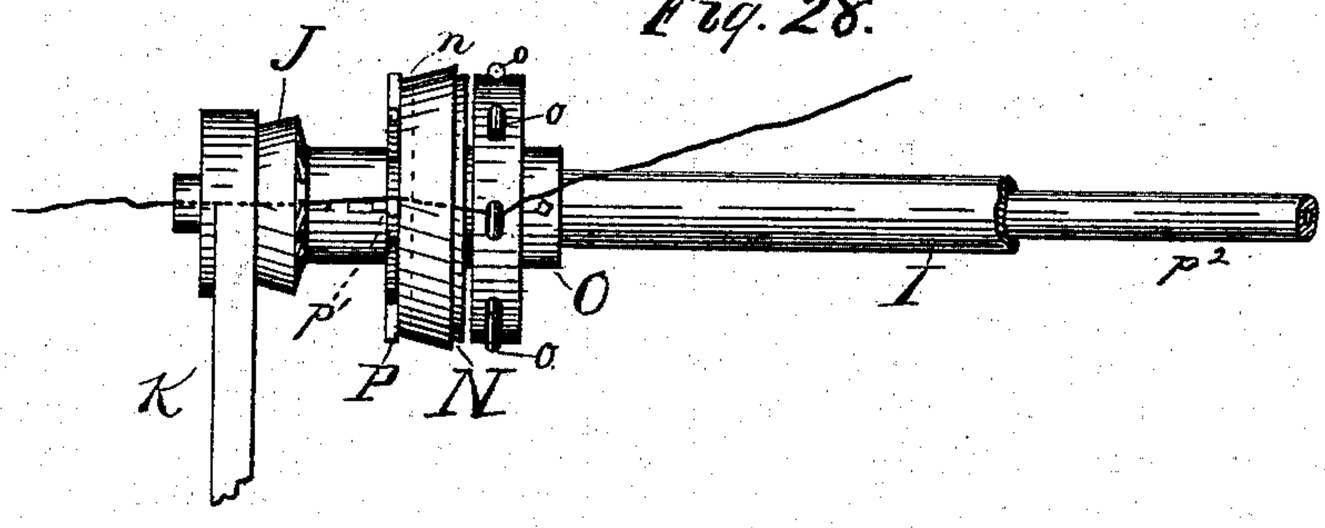


Fig. 27.

Fig. 28.



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UNITED STATES PATENT OFFICE.

FREDERICK A. WISWELL, OF BEEBE PLAIN, ASSIGNOR TO CHARLES C. COLBY, OF STANSTEAD, QUEBEC, CANADA.

ART OF MANUFACTURING WIRE ROPES AND CABLES.

SPECIFICATION forming part of Letters Patent No. 276,315, dated April 24, 1883.

Application filed September 24, 1881. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK A. WISWELL, a citizen of the Dominion of Canada, residing at Beebe Plain, in the county of Stanstead and Province of Quebec, Canada, have invented certain new and useful Improvements in the Art of Manufacturing Wire Ropes and Cables; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in the art of manufacturing wire ropes and cables, the purpose being to obtain a rope or cable in which the strain applied thereto will be borne by all the wires, and to obtain a superior working-rope and materially lessen the cost of same. To effect these results I lay individual wires around a core to form a cord, next lay individual wires around a core to form a strand-core, next lay the cords around the strand-core to form a strand, and lastly lay a number of the strands around a main or rope core to form the rope, all in one continuous operation; secondly, I lay individual wires around cores to form cords, next lay the cords around strand-cores to form strands, and lastly lay the strands around a main or rope core to form the rope, all in one continuous operation.

The following description, together with the drawings, describes and shows a machine for practically carrying out my improvement, and the claims indicate the nature thereof.

Referring to the drawings, Figure 1, Sheet 1, is a side elevation of a machine adapted for carrying out my invention, some of the parts being broken away to more clearly illustrate the principal working portion of the same. Fig. 2, Sheet 2, is a front elevation of the machine. Fig. 3, Sheet 2, is a rear elevation thereof, the band-wheel and the weight to be placed on the friction-lever being removed. Fig. 4, Sheet 3, is a plan view of the machine. Fig. 5, Sheet 4, is a detail view of one of the general heads, with four of the cord-shafts removed and another broken away to show the tube passing through the same. Fig. 6 is a longitudinal vertical section of Fig. 5. Fig. 7 is a front elevation of one of the general heads. Fig. 8 is a rear elevation of the same. Fig. 9, Sheet 5, is a detail view of part of the drawing-off mechanism as seen from the side thereof farthest removed from the drawing-off wheel. Fig. 10 is a sectional view of the same on line *y y* of Fig. 9. Fig. 11 is a similar view on line *z z*, Fig. 9. Fig. 12 is a front elevation of the parts shown in Fig. 9. Fig. 13, Sheet 6, is a longitudinal vertical section of one of the cord-shafts with accompanying mechanism. Fig. 14 is an enlarged transverse vertical section on line *x x* of Fig. 13, looking in the direction of the arrow 2. Fig. 15 is a similar view on line *w w*, Fig. 13, looking in the direction of the arrow 1. Fig. 16 is a sectional detail view of a part of one of the cord-shafts, showing the slotted tube with the key *p'* projecting through the slot. Fig. 17 is a plan view of one of the spools on a spool-arm, showing the disposition of the holding spring-button. Figs. 18, 19, 20, and 21 are sectional details of Fig. 17, showing the various positions of the parts in the act of securing the spool on the spool-arm and after the same is held thereon. Fig. 22 shows detail views in section and elevation of the main or rope laying head and die. Fig. 23 shows details in elevation and section of one of the spiders which act in connection with the strand-laying heads. Figs. 24 and 25 are enlarged details of the rear end of the strand-shaft, showing the arrangement of the thumb-nut and its coil-spring thereon, the latter figure being in section. Fig. 26 is a transverse section of the "tiller-rope," showing the arrangement of the wires and cores. Fig. 27 is a similar view of the "transmission-rope;" and Fig. 28 is an enlarged detail view of one of the cord-shafts I, showing the inclined path of a wire. Fig. 29 is a transverse vertical section on line *x x* of Fig. 6, showing the extent of the hub *k* with its arms K broken away and the arrangement of the openings f^3.

Corresponding parts in the several figures are denoted by similar characters of reference.

In the accompanying drawings, A marks a frame of suitable strength and dimensions to support the operating machinery.

B is a central hollow shaft, having its rear end supported in bearings *a a'*, secured upon

cross-pieces a^3 of the frame A, and its forward end held into the rope-laying head C, which in turn rests upon bearings a^2, attached to a cross-piece, a^4, forming part of the frame A. This rope-laying head C is made solid or in the form of a shell, as convenience may dictate, and is provided with a number of oblique openings or passages, c', and a central opening or bore, c^2, at its forward end, in line with the opening through the hollow shaft B. A die, c, is held in this bore c^2 by means of a set-screw, c^3, passing through the rope-laying head and into said die c. The die c is formed of longitudinal sections, in the present instance of two pieces or halves, c^4, one of which is provided with a depression, c^5, in its face, extending its length, to receive the other half, having a corresponding projection, c^6, so that the parts will register to form a cylinder when placed in the rope-laying head. The die c has a central opening, c^7, throughout its length, of a diameter equal to that of the rope which is to pass through it. Further, the opening c^7 of the die c is flared at the rear end, as at c^8, as particularly shown in Fig. 22, so that the strands passing from the strand-laying head F^2 through the oblique openings c' in the rope-laying head will impinge against and be guided by such flared surface c^8 to the rope-core in said die c, and thus be laid evenly around said rope-core to form the rope. When different-sized ropes are made, dies c, having correspondingly-sized openings c^7, are used. The purpose of forming the dies c in longitudinal sections c^4 is to permit said sections to be inserted into the rope-laying head C without cutting the rope-core or the rope itself, which passes through said rope-laying head to the drawing-off mechanism. One object for providing the depressions c^5 and corresponding projection, c^6, in the sections c^4 of the die c is to prevent sidewise play of the sections, should they not fit snugly in the bore c^2 of the rope-laying head C; also, to cause the circumferential surface of the central opening, c^7, of the die c to be always preserved, and thus prevent damage to the rope that might otherwise occur from abrasion against the sharp edges of the sections of said die. The die c may be provided with a collar, c^9, integral therewith, at its outer end, to limit its insertion into the bore of the rope-laying head C.

A hub, d, secured to the shaft B, has a number of radial arms, D, each provided at its extremity with a sleeve, d', to receive a hollow shaft, E, known in this connection as the "strand-shaft," the forward end of which is secured in the hub k.

The strand core-laying-head F is composed, first, of a piece, f, (see Figs. 5 and 6,) shaped somewhat similar to a truncated cone, with a reduced portion to fit in the hub k, and having a central bore; and, secondly, of a sleeve, f^4, conforming to the outer surface of said piece f, and free to rotate thereon. The sleeve f^4 is held to the piece f, and the latter in the hub k and against the shaft E by means of the tube f' screwing into the spider F^3, which presses against said sleeve f^4. (See Fig. 6.) Said tube f' extends rearwardly through said hollow shaft E, and receives an interiorly-screw-threaded thumb-nut, f^2. (See Figs. 24 and 25.) A coil-spring, f^5, encircles the nut f^2 between the shoulder of said thumb-nut f^2 and the end of shaft E, so that when said thumb-nut is screwed up the pressure exerted on the wires between the sleeve f^4 and the piece f composing the strand-core-laying head F will be yielding, to permit any irregular surfaces on the wires to pass through said strand-core-laying head F, and thus prevent breakage of the wires.

The hub k is provided with openings f^3, as shown in Fig. 6, to direct the wires from the spools to the laying-head F. The spider F^3, having the slots, as shown in Fig. 23, is designed, in connection with the guideways or grooves in the laying-head, to keep the wires out of contact with each other and insure their proper laying around the core. The hollow shaft E is provided with spool-carriers L, having spools M, the latter being held to the arms l of the former by means of spring-buttons e, the said spool-carriers L, spools M, arms l, and spring-buttons e being in every respect similar to the like recited parts on the cord-shafts I, to be presently described.

The sleeves d' of the arms D, in which the shafts E freely revolve, are provided with arms or pins d^2, screwed therein, and carry core-spools d^3 and shields d^4, of like construction and arrangement as those on the sleeves of the arms H, arranged in connection with the cord-shafts I, as hereinafter described.

Considered alone, the laid strand-core is produced in the following manner, viz: Upon imparting motion to the strand-shaft E from the shaft W, arranged back of the arms D, as described hereinafter, the wires contained on the spools M of said strand-shaft will pass through the strand-core-laying head F and be laid around the core, which extends from the core-spool d^3 to and through the hollow strand-shaft E. Of course in this operation of the machine, as well as in others, the wires must be drawn from the spools at a desired speed through the operation of the drawing-off mechanism.

Two arms, F', extend in a curved manner forwardly from the hub, k, and joining at their forward ends, the reduced portion f^6 thereof enters the strand-laying head F^2 to support the latter in the manner shown in Fig. 6. In the present instance the arms F' are cast in one piece with the hub k and its vertical arms K, and, as stated hereinbefore, the openings f^3 are made through said hub. The strand-laying head F^2 is further supported and firmly braced as against lateral pressure in the end of the arm G, radiating from the hub g, secured to the hollow shaft B. With the exception that the strand-laying head itself contains openings $F^\times$, as shown in Figs. 5 and 6, to direct the cords from the cord-laying heads, to be set forth presently, it is similar to the strand-

core-laying head F, described hereinbefore, and is provided also with a spider, F^3, tube b', thumb-nut b^2, and coil-spring b^3, corresponding with the spider F^3, tube f', thumb-nut f^2, and spring f^5, connected with the strand-core-laying head F. By this construction a space is provided between the strand-core-laying head F and the rear end of the strand-laying-head mechanism, whereby adjustment of the latter can be made.

Journaled in a bracket, g^2, attached to the end of each of the radial arms G, is a grooved pulley, g', the grooved surface of which is in line with the bore of the strand-laying head F^2, in order that the strands coming from the strand-laying heads will pass over said pulleys on their way to the rope-laying head C, and thus cause the strands to converge at the proper angle from the contact-surface of said grooved pulleys to the rope-laying head, instead of from the mouths of the strand-laying heads to the said rope-laying head, whereby the working of the strand-laying heads will not be interfered with, nor such heads F^2 be subjected to lateral strain.

Firmly attached to each of the strand-shafts E, immediately in front of the sleeve d' on the end of each of the radial arms D, is a hub, h, having a number of radial arms, H, the extremities of which are provided with sleeves h', to receive hollow shafts I, termed the "cord-shafts," the outer end of each of which is firmly secured in any suitable manner in a cord-laying head, J, which has its forward end bearing in the end of one of the series of radial arms K proceeding from hub k. The cord-laying head J is provided with a die, j, similar to the die c, employed in the rope-laying head C, and is constructed in general in manner similar to said rope-laying head C, (see Fig. 13,) attached to a bracket, k^2. In each of the extremities of the arms K is a grooved pulley, k', of the same construction, and to serve the same purpose with relation to the cords as the grooved pulleys g' do to the strands.

Held to the hollow cord-shafts I by means of set-screws i^2, or otherwise, are the spool-carriers L, formed each of a hub, l^3, having three radiating hollow arms, l, inclining forwardly or at an acute angle with relation to the longitudinal axis of the hub l^3. Each arm is provided with a pin, l', passing transversely through it near the outer end thereof, and is further provided with two slots, l^4, in its end opposite each other, as clearly seen in Figs. 17 and 18.

Loosely hung on the pin l' of the spool-arms l is a spring-button, l^2, formed of one piece of spring metal bent to form two parallel arms of different lengths, the end of the shorter of which is bent at right angles thereto to meet the surface of the other arm, which latter extends beyond said bent portion, and is itself bent downward and then upward, so as to present a semicircular appearance. The longer arm is provided with a curved depression at about midway of its length, in which rests the pin l' of the spool-arm l when the spring-button is in position to hold a spool, M, on the spool-arm, as shown in Fig. 21. Further, the reversely-curved end of the longer arm of the spring-button presses on the disk of the spool to an extent to overcome the "spring" in the wire coiled thereon, and prevent the too rapid uncoiling of the wire when the machine is in operation. The object of inclining the spool-arms l, as described, is to permit the wires to be evenly fed from the spools to the hereinafter-described tension mechanism at about the proper angle, and prevent side-play of the uncoiling wire against the coils on the spool, by which entanglement of the wire or its wedging or jamming with its coils on the spool is avoided.

By retaining the spool-holders L on the hollow cord-shafts with set-screws i^2, I am enabled to so arrange the said holders that the spool-carrying arms will be radiated from the hollow cord-shafts in different lines, by which the wires will be fed to the cord-laying head J without danger of entanglement with one another.

Free to turn on the cord-shaft I, at a point between the spools and the cord-laying head J, is a disk, N, having an oblique or forwardly-inclined periphery, which receives a loose ring, n, constructed to conform to the inclined surface of the disk, as particularly described in Patent No. 244,974, dated August 2, 1881, as granted to Edward M. Ball and Frederick A. Wiswell.

Fastened with a set-screw, o', to the cord-shaft I, immediately in rear of the loose disk N, is a collar, O, against which the disk abuts, and which is provided with a number of bent fingers, o, on its periphery, the purpose of which will be presently set forth.

P marks a follower arranged in front of the disk N, and having a number of radiating fingers, p, which serve, in connection with the bent fingers o, to lead the wires across the periphery of the disk and below the ring at an angle to the line of draft from the spools to the cord-laying head J, as shown in Fig. 28, to cause the disk N and ring n to rotate slowly at different speeds, by which new surfaces of the parts will constantly be presented for wear, as clearly set forth in the patent hereinbefore mentioned. The follower P is held to the disk by means of a key, p', passing transversely through the hollow cord-shaft I, which is slotted, and through the tube p^2, which passes backwardly through the said cord-shaft and projects a short distance beyond, where it is exteriorally screw-threaded to receive a thumb-nut, o^2. A coil-spring, $p^\times$, encircles the tube between the thumb-nut o^2 and the end of the cord-shaft. By screwing up the nut the tube carrying the key will be partially drawn through the cord-shaft to press the ring n against the disk N, to exert greater pressure on the wires passing between said ring and disk, by which the tensile strain is increased. The coil-spring $p^\times$ allows the parts to yield to irregu-

lar surfaces in the wire; also, the threading of the wires between the disk and its ring is readily accomplished by unscrewing the nut to loosen the parts. A stud or spool carrying arm, i', is screwed into the sleeve h' on the end of the arm H to receive a spool, r, filled with the wire or textile core for the cord, said arm i' having the slots l^4, a pin, l', and spring-button l^2, as in the case of the arms in the spool-holders L of the cord-shaft. The sleeve h' of the arm H is also provided with a shield, r', curved rearwardly and outwardly to pass around the gear x' and thumb-nut o^2, at that point and then reversely curved to bring its free end at the mouth of the tube p^2, so that the cord-core may pass from the cord-core spool r, along the surface of the shield r', between the retaining-studs r^2 thereon, to and into the tube p^2, and thence pass by the key p' at its forward end and through a small opening in the tube at that end, to and through the cord-laying head, to be incorporated into the cord. In the present instance the hub d has six radiating arms D, each carrying at its end a hollow shaft, E, known herein as the "strand-shaft," which in turn carries a hub, h, having six radiating arms H, which support each one end of the hollow cord-shafts that carry the spool-holders, as described.

Referring now to the driving mechanism, S marks a band-wheel to carry a belt from a suitable motor, whose shaft s has a small spur-gear, s', conveying motion through the pair of idle-gears u to the gear-wheel w', which is keyed to the hollow rope-shaft B to give motion to said shaft. The idle-gears u are journaled to an arm, w^2, forming part of the sleeve U, encircling the main shaft, and free to turn thereon, carrying with it the arm w^2 and idle-gears u to throw the shaft out of motion when desired. When in use the arm w^2, carrying the idle-gears u, is held to the standard U' by means of a bolt, as shown in Fig. 3, so as to insure the operation of the parts. A spur-gear, s^2, is keyed to the forward end of the shaft s to mesh with the spur-gear V, loose on the main shaft B, immediately in front of the bearing a.

Firmly secured to the spur-gear V, and in front thereof, is a bevel-gear, u, into which mesh the pinions v', attached to the inner ends of the shafts W, which latter are held in bearings w, secured to the back of the radiating arms D, as clearly shown in the drawings. The outer end of each of these shafts W is provided with a miter-gear, q, meshing with a second miter-gear, q', on the rear end of each of the strand-shafts E to give motion to said shafts in a reverse direction to that of the main shaft.

Held by a set-screw, x^2, to the sleeve d', which supports the rear end of the strand-shafts E, is a spur-gear, X, with which meshes an idle-gear, x, secured with a journal-bolt, x^3, on the arm H, there being one of said idle-gears, x, to each of the radiating arms H, and each gear x in turn meshes with a pinion, x', secured one to each of the cord-shafts I. From the fact that the gear-wheel X is held by the set-screw x^2 to the sleeve d' of the arm D, that the idle-gears x are held to the radiating arms H, and that the strand-shaft E in rotating carries the arms H around its axis, the gear X, fixed stationary with relation to the rotating strand-shaft E, will, when motion is imparted to strand-shaft E from shaft W, rotate the idle-gears x on their axes, and cause the pinions x' to rotate the cord-shafts in an opposite direction to that of the strand-shaft. When the gear-wheel X is not held firmly to the sleeve, as set forth, it is free to rotate thereon, in which event the cord-shafts do not revolve on their own axes, but merely around the common axis of the strand-shaft. The object of causing the cord-shafts to revolve in an opposite direction to that of the strand-shafts and the strand-shafts oppositely to that of the main shaft will be presently shown.

A bevel-gear, Y, is keyed to the shaft s, and meshes with the bevel-pinion y, secured to one end of the shaft y', journaled in bearings y^3, attached to the frame A, which receives at its other end a bevel-gear, y^2, meshing into a bevel-pinion, z, on the shaft Z, disposed at right angles to the shaft y', and having its rear end held in one arm of a double sleeve, z', whose other arm encircles the shaft y'. This construction permits play of that end of the shaft Z when the other end is raised or lowered, for purposes to be presently set forth. The forward end of the shaft Z receives a worm, z^2, meshing with a worm-gear wheel, z^3, secured to a shaft, Z', disposed at right angles to the shaft Z. The shaft Z is supported at its forward end in a bearing, w', adjustably secured by bolts w^2 in a slotted standard, Z^2, attached to the frame A at that point, to enable the vertical adjustment of said shaft when worm-gear wheels of different sizes are used. The shaft Z' has one of its bearings, w^3, secured to the frame A and the other, w^4, to a plate, 1, itself fastened to the frame A. A miter-gear, $Z^\times$, is attached to the inner end of the shaft Z', that meshes with a second miter-gear, Z^a, keyed to the vertical shaft 2, having bearings in the plate 1 and the bracket 3, secured to the plate 1. Keyed to the said shaft 2, below the miter-gear, is a spur-gear, $2^\times$, meshing with a similar spur gear, $4^\times$, arranged on a second vertical shaft, 4, held in bearings in the bracket 3 and plate 1, said spur-gear $4^\times$ working in the teeth $5^\times$, arranged on the bottom portion of the periphery of a large wheel, 5, horizontally arranged on the vertical shaft w^5, secured to the plate 13, which in turn is held to the frame A. This large wheel, which I term the "drawing-off wheel," is so arranged with relation to the bore in the main shaft B and the meeting edges of the drawing-off rolls 6 (to be presently set forth) that its periphery will be about on a line with said parts, so that as the rope comes from the rope-laying head C it may be coiled one or more times around the drawing-off wheel 5, and thence pass through the drawing-off rolls 6 to a reeling device. By passing the rope

issuing from the rope-laying head one or more times around the drawing-off wheel 5, which is caused to rotate by the mechanism just described, and by keeping it taut thereon by means of the drawing-rolls 6, there will be sufficient friction between the rope and the drawing-off wheel 5 to prevent the former from slipping on the latter, and cause the wheel 5 to exert the necessary pulling or drawing strain on the rope to overcome the tension on the individual wires, and draw the rope from the rope-laying head C at the required rate of speed.

The drawing-rolls 6 are removably held to the splined vertical shafts 7 and 8, one of said shafts having its bearings in the plate 1 and bracket 3 and the other being held in bearings forming part of a swinging frame, 9, hinged on the vertical shaft 2, as clearly shown in Fig. 10. The drawing-rolls 6 are intended not only to keep the rope taut on the drawing-off wheel, but also to compress the rope more or less as is deemed advisable to render it more compact and even and to straighten out or remove any possible irregularities therein. When compressed by the rolls the rope is slightly increased in length, owing to such compression, and therefore I cause the said rolls to draw the rope from the drawing-off wheel 5 slightly faster than the wheel 5 draws it from the rope-laying head. This slightly-increased speed of the drawing-rolls is obtained by having the diameter of said rolls slightly greater than the diameter of the pitch-line of the gears on shafts 7 and 8, which carry said rolls. Were not this done—that is, increasing the surface speed of the rolls 6 over that of the wheel 5—the rope would soon become slackened on the drawing-wheel 5, thereby rendering the latter quite useless for the purpose designed. After leaving the drawing-off wheel 5, and before reaching the drawing-rolls 6, the rope passes over a roll, 20, pivoted in an arm, 19, attached to the bracket 3, to guide said rope to the drawing-rolls, as shown.

Since the drawing-off wheel 5 and drawing-rolls 6 are geared to and receive motion from a common shaft, Z′, and thus have a fixed relative motion, the diameter of the rolls must be increased or diminished according to the different sizes of rope to be made, so that the relative surface motion of the wheel 5 and rolls 6 will be preserved. The swinging frame 9, carrying one of the drawing-rolls, is provided to permit drawing-rolls of different sizes having grooves of varying dimensions to be placed on their respective shafts as required for the various kinds of rope made.

I provide a swinging dog, 10, pivoted to the bracket 3, and having an adjusting-screw, 11, to engage with a stud, 12, projecting from the swinging frame 9. The swinging dog, with its adjusting-screw, is also intended to regulate the degree of compression of the drawing-rolls on the rope.

Pivoted in a bracket, 21, secured one to each end of the plate 13, projecting on opposite sides of the drawing-off wheel 5, is an inverted truncated cone, 14, having one or more grooves, 22, in its periphery, the bottom or working surface of each of which is cut at right angles to the longitudinal axis of said cone. The cones are arranged each upon an inclined axis, 23, in close relation to the periphery of the drawing-off wheel 5, so that as the rope is coiled one or more time, around the said wheel it is passed through a groove in each of the cones 14 at relatively increased heights in the direction of the rotation of the wheel 5, in order that the rope passing onto the wheel 5 at its lower part will by the action of the grooved cones 14 be lifted at points around the periphery of said wheel, so as to leave it at a higher point to pass between the drawing-rolls 6, and to prevent the rope winding on itself or becoming twisted or scraped on the surface of the drawing-off wheel 5. The immediate object of providing an inverted truncated cone, 14, with the lower or working surface of its groove or grooves 22 at right angles to the axis 23 of said cone is to cause the rope to be lifted upward and outward from the drawing-off wheel 5. Were the rope lifted or forced directly upward on the periphery of the drawing-off wheel 5, the wires would rub against one another and against the surface of the wheel and be damaged more or less, especially so with reference to galvanized wire used in the manufacture of rope for ship's rigging. Besides, the rope itself, owing to its pressure on the wheel, will be twisted more or less. The number of cones 14 or the grooves 22 in the cones may be varied as deemed necessary or advisable. After the rope leaves the drawing-rolls 6 it may be wound on a suitable reel attached to an extension of the frame A or to a separate frame.

Secured to the rear end of the frame A is a reel, 16, arranged below and about in line with the bore of the main shaft B, said reel containing the rope-core which is passed through the hollow shaft B and incorporated into the rope at the rope-laying head C. A lever, 17, pivoted to the frame A, has a friction-block, 18, which rests on one of the disks of the reel. Said lever is provided at its free end with a weight, 17×, capable of adjustment on the lever to regulate the amount of friction between the lever 17 and reel 16, so as to prevent a too rapid unwinding of the rope-core and give it more or less tensile strain, to provide for its proper incorporation into the rope. The rope-core may be guided from the reel 16 to the bore of the main shaft B by a shield, 26, as shown in dotted lines in Fig. 1 and in full lines in Figs. 3 and 4.

As now constructed and described, the machine is capable of making a rope for use as a bridge-cable, and also as a transmission-rope, said rope being composed of six individual wires laid around a core to form what I term in this connection a "cord," six wires laid around a core to form a strand-core, six of the cords mentioned above laid around a strand-cord to form a strand, and six strands laid

around a bunch of straight wires or a textile rope to form the rope proper, as shown in Fig. 27.

The machine is also capable of making what is known in the trade as "tiller" or steering rope. This rope requires to be very flexible, and is made of six individual wires laid around a wire or textile core to form a cord. Six cords are then laid around a textile core to form a strand, and six strands are laid around a textile core to form the rope, as shown in Fig. 26. If it is found necessary or desirable, a less number of wires, cords, or strands may be used, though I am of the belief that six is the proper number throughout for making tiller-rope.

Assuming that the spools M are filled with wire of proper size, the core-spools r d^3 filled with the required cores, the reel 16 contains the proper rope-core, and the wires are drawn forward around the drawing-wheel 5 and through the drawing-rolls 6, the operation of the parts to effect laying individual wires around cores to form cords, next laying individual wires around cores to form strand-cores, next laying the cords around the strand-cores to form strands, and lastly laying the strands around a main or rope-core to form the rope in a continuous operation will be as follows: Upon giving motion to the described driving mechanism the hollow cord-shafts I will be rotated around their axes, the individual wires will be drawn from the spools M on the spool-carriers L on said shafts, and, after passing through the described tension mechanism, enter the cord-laying heads J and be laid around the cord-cores, passing from the cord-core spools r through the tubes p^2 in said hollow cord-shafts I to form the cords. While revolving around their own axes the cord-shafts I are also carried or caused to revolve in an opposite direction around the axes of the strand-shafts E. The rotation of the strand-shafts E on their own axes causes the cords passing from the cord-laying heads J over the rolls k' and into the strand-laying heads F^2 to be laid around the strand-cores, which latter are laid simultaneously with the laying of the cords and pass from the strand-core-laying heads F to the strand-laying heads F^2 to form the strand. Simultaneously with the revolution of the cord-shafts I around their own axes, their revolution around the axis of the strand-shaft E, and the revolution of the strand-shafts E around their axes, the main shaft B is rotated on its axis, which, carrying the radiating-arms G D, supporting the strand-shafts E, causes the latter to rotate around the common axis of said main shaft B. Thus rotating, the strands, issuing from the strand-laying heads F^2 and passing over the rollers g contiguous thereto, to and into the rope-laying head C, are laid around the main or rope core to form rope, which, issuing from the die c at the end of the main shaft B, passes around the drawing-off wheel 5, one or more times, as is found necessary, thence over the roller 20, through the drawing-rolls 6, and onto a suitable reel, in the meantime the inverted peripheral grooved truncated cones 14 acting to lift the rope on the drawing-off wheel 5, as described.

Instead of extending the wires from the main shaft B to and around the drawing-wheel 5 and through the drawing-rolls 6, which amount of wire would become so much waste material, the said wires could be attached to a hook or eye in the end of a rope, which latter would be passed around the drawing-wheel 5 and through the drawing-rolls 6, so as to effect the proper operation of the drawing mechanism in connection with the other parts of the machine. When the hook or eye in the rope reached the cones 14 the latter should be removed by withdrawing their axial pins 23 from their supporting-frames 21, and be replaced as soon as the hook was drawn past. The drawing-rolls 6 can also be adjusted to effect this object by means of the swinging dog 10, with its adjusting-screw 11.

The rotation of the cord-shafts I with relation to the strand-shafts E, and of the latter with relation to the main shaft B, is about two to one. However, since the cord-shafts I revolve in a reverse direction to the strand-shafts E, and the latter in a reverse direction to the main shaft B, the gearing of said shafts is as three to one, to compensate for the lost revolution in each of the cord and strand shafts, caused by their reverse rotation relative to their preceding shafts.

The speed at which the rope is drawn off may be varied by placing a larger or smaller worm-gear wheel, z^3, on the shaft Z' to mesh with the worm z^2, the shaft Z being vertically adjustable to permit this change of gears, as stated hereinbefore.

The speed of the drawing-off mechanism regulates the amount of twist in the rope, its strands, and cords, since by increasing the speed of the drawing-off mechanism and not changing the speed of the laying mechanism the rope is drawn off faster, and the twist is more in line with the longitudinal axis of the rope. The speed of the drawing-off mechanism can still further be varied by a change of the gears at the rear end of the shaft Z. If it is desired to lay the strands around the rope-core closer or more in line with the transverse axis of the rope while the twist or lay in the strands and cords remains unchanged, the spur-gear s', which meshes with one of the pair of idle-gears u, is replaced by a larger gear to get an increased revolution of the main shaft, which will cause the rope-laying head C to lay the strands around the rope-core faster to get the increased twist or lay, as stated. This will be more apparant when it is remembered that the strand and cord shafts do not receive motion directly from the main shaft, but from the double gear-wheel V v, loose on the main shaft, as described.

The operation of the machine to effect the laying of individual wires around cores to from cords, next laying the cords around cores to

form strands, and lastly laying the strands around a main or rope core to form the rope in one continuous operation is the same as that hereinbefore described, with the exception that the spools M on the strand-shaft F and the strand-core-laying head are not used, as a textile core running from the core-spool d^3 on each of the strand-shafts through said hollow strand-shaft is designed to be used as the strand-core. (See Fig. 26.)

It will be seen from the foregoing that the machine must be properly "threaded," as it is termed, and the wires carried to and around the drawing-off wheel 5 and through the drawing-rolls 6, so that upon giving motion to the machine the laying operations at the cord-shafts, strand-shafts, and main shaft will begin simultaneously.

I use the terms designated herein as "cords," "strands," and "rope" to mark the products of their respective shafts in preference to the nomenclature used in the manufacture of hempen rope—viz., "strands," "hawsers" or "ropes," and "cables," respectively—for the reason that the final products made by the machine herein set forth as carrying out my improvement are known generally and commercially as "tiller" or "steering" rope and "transmission-rope."

The machinery illustrated in the drawings and described in the foregoing specification is intended simply to show in this connection means for practically carrying out my improvements in the art of manufacturing wire rope and cables; but I do not seek to claim in this application any part of such machinery, as the same is fully described and claimed in an application filed by me on the 11th day of July, 1882, No. 66,359, for an improvement in wire-rope machines.

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

1. The improvement in the art of manufacturing rope which consists in first laying individual wires around a core to form a cord, next laying individual wires around a core to form a strand-core, next laying a number of the cords around the strand-core to form a strand, and lastly laying a number of the strands around a main core to form finally a rope, the whole simultaneously performed substantially in the manner set forth.

2. The improvement in the art of manufacturing rope which consists in first laying individual wires around a core to form a cord, next laying a number of the cords around a core to form a strand, and lastly laying a number of the strands around a main or rope core to form finally the rope, the whole simultaneously performed, but at progressively forward points in the process of manufacture, substantially as set forth.

3. The improvement in the art of manufacturing rope which consists in first laying individual wires, subjected to tension applied directly thereto, around cores to form cords, next laying wires around cores to form strand-cores, next laying the cords around the strand-cores to form strands, and finally laying a number of the strands around a main core to form the rope, the whole simultaneously performed substantially in the manner set forth.

4. The improvement in the art of manufacturing rope which consists in first laying individual wires, subjected to the tension applied directly thereto, around cores to form cords, next laying the cords around cores to form strands, and lastly laying the strands around a main core to form the rope, the whole simultaneously performed at progressively forward points in the process of manufacture, substantially as set forth.

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

FREDERICK A. WISWELL.

Witnesses:
GEO. H. HOUSE,
C. C. BEEBE.