(No Model.)

3 Sheets—Sheet 1.

G. L. BROWNELL.

TWISTING MACHINE.

No. 560,680. Patented May 26, 1896.

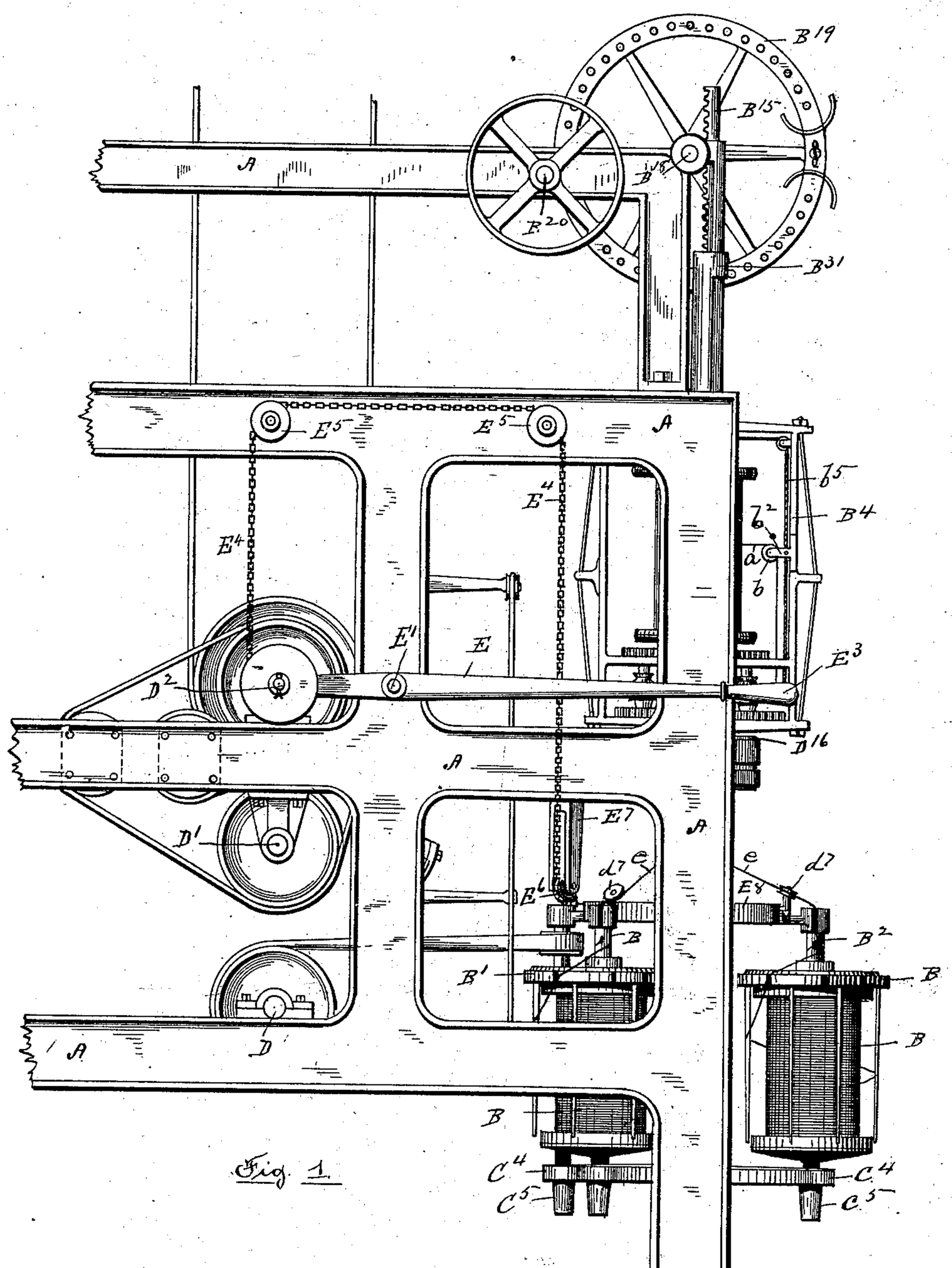

Fig. 1.

Witnesses
Walter S. Bowen.
Clara A. Blake.

Inventor
George Loomis Brownell

By his Attorney
Rufus B. Fowler.

(No Model.) 3 Sheets—Sheet 2.

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TWISTING MACHINE.

No. 560,680. Patented May 26, 1896.

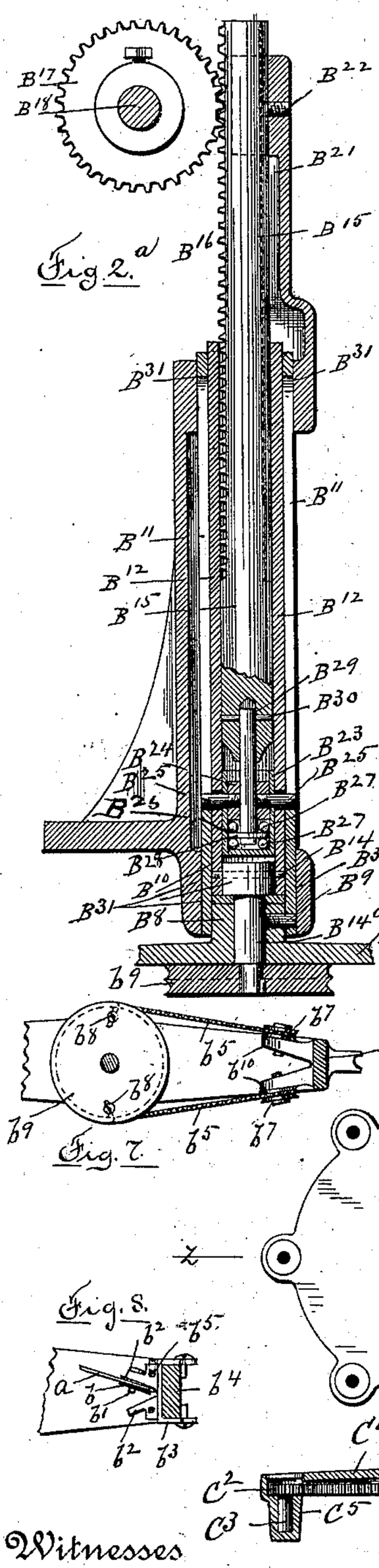

Fig. 2a

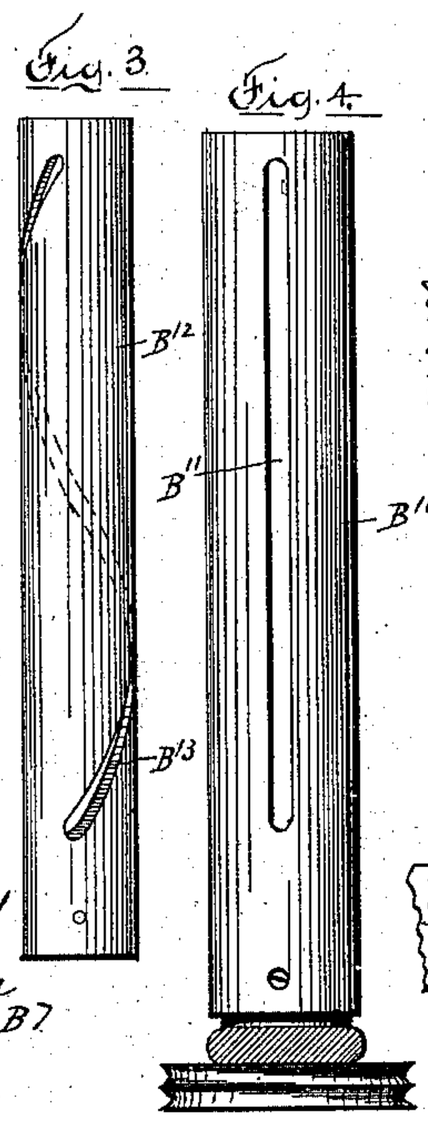

Fig. 3

Fig. 4.

Fig. 7.

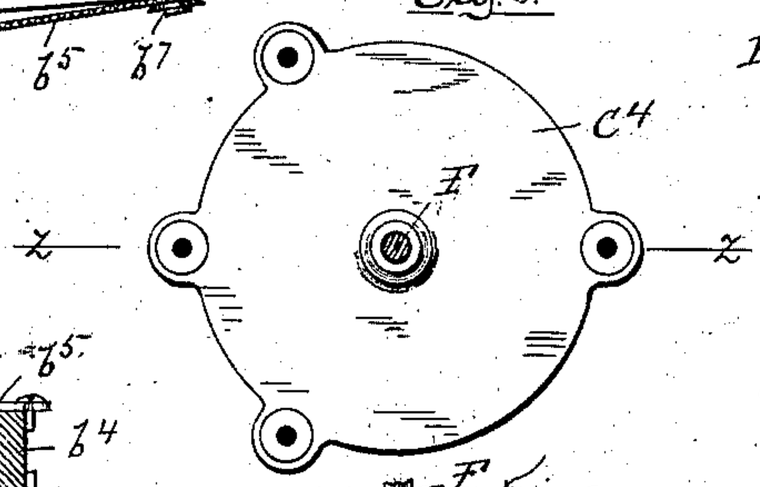

Fig. 5.

Fig. 8.

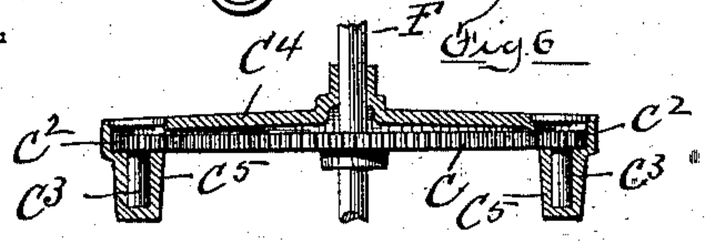

Fig. 6

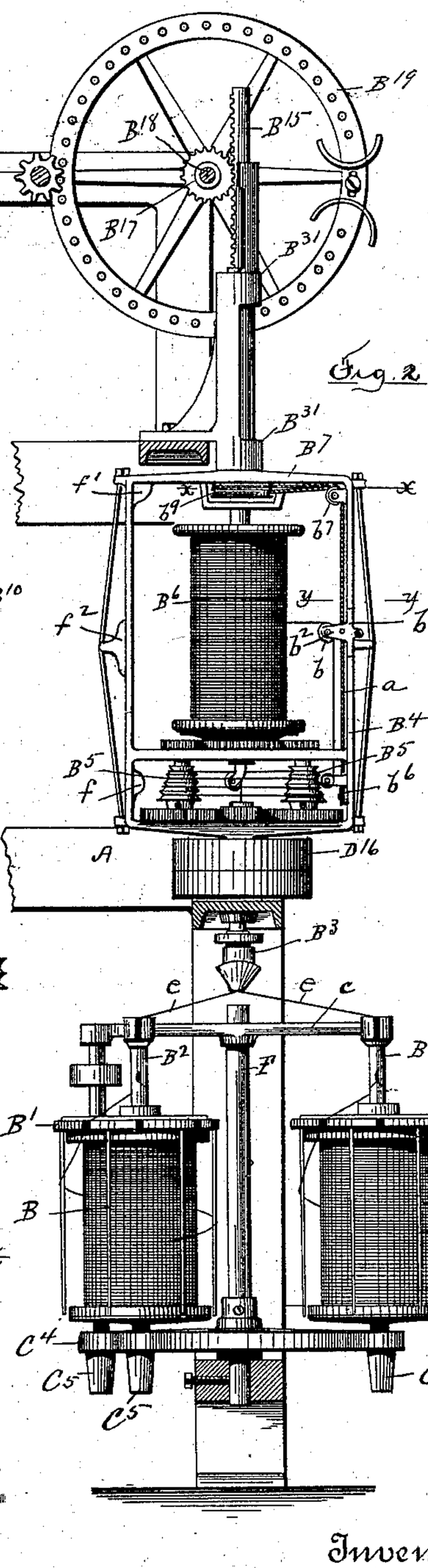

Fig. 2

Witnesses
Walter S. Bowen
Clara A. Blake.

Inventor
George Loomis Brownell
By his Attorney
Rufus B. Fowler

(No Model.)

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G. L. BROWNELL.

TWISTING MACHINE.

No. 560,680. Patented May 26, 1896.

Fig. 9.

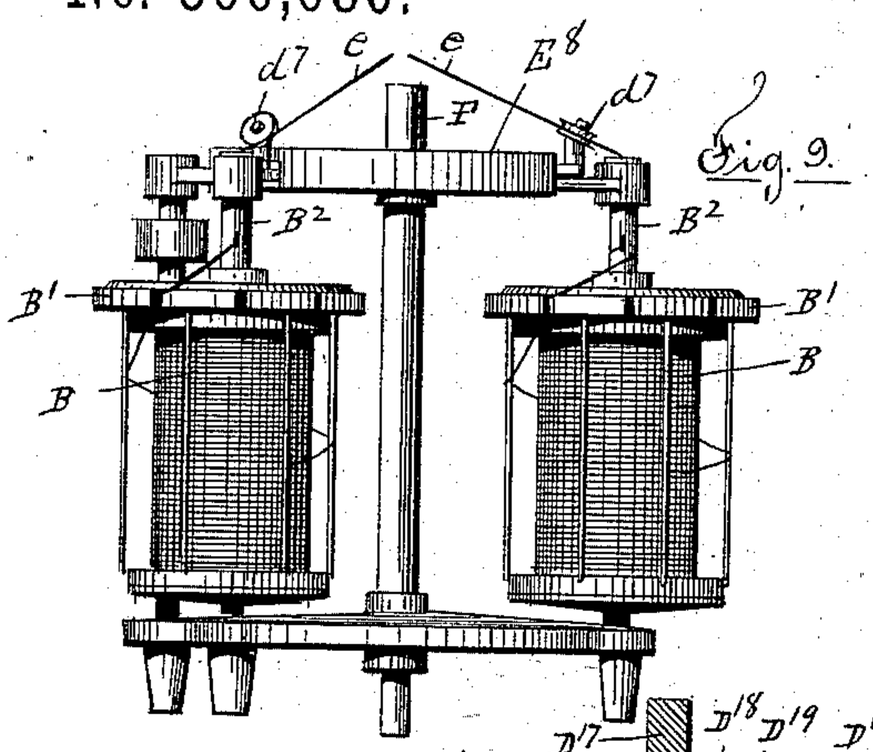


Fig. 12.

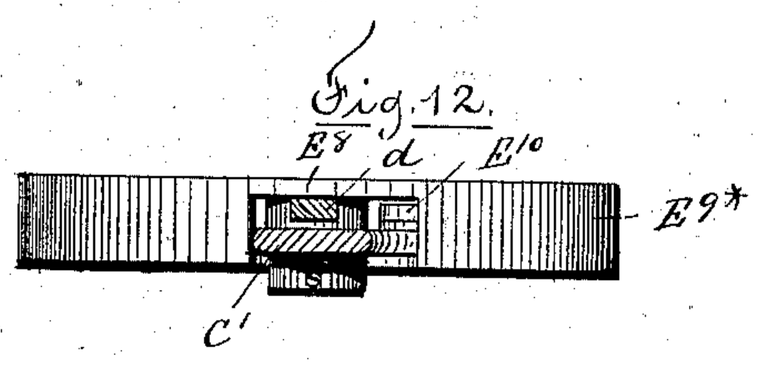


Fig. 13.

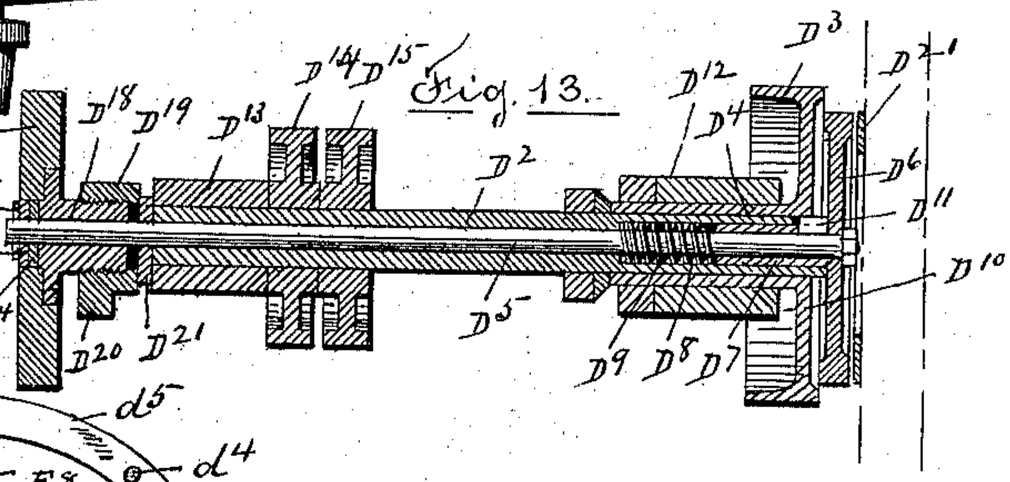
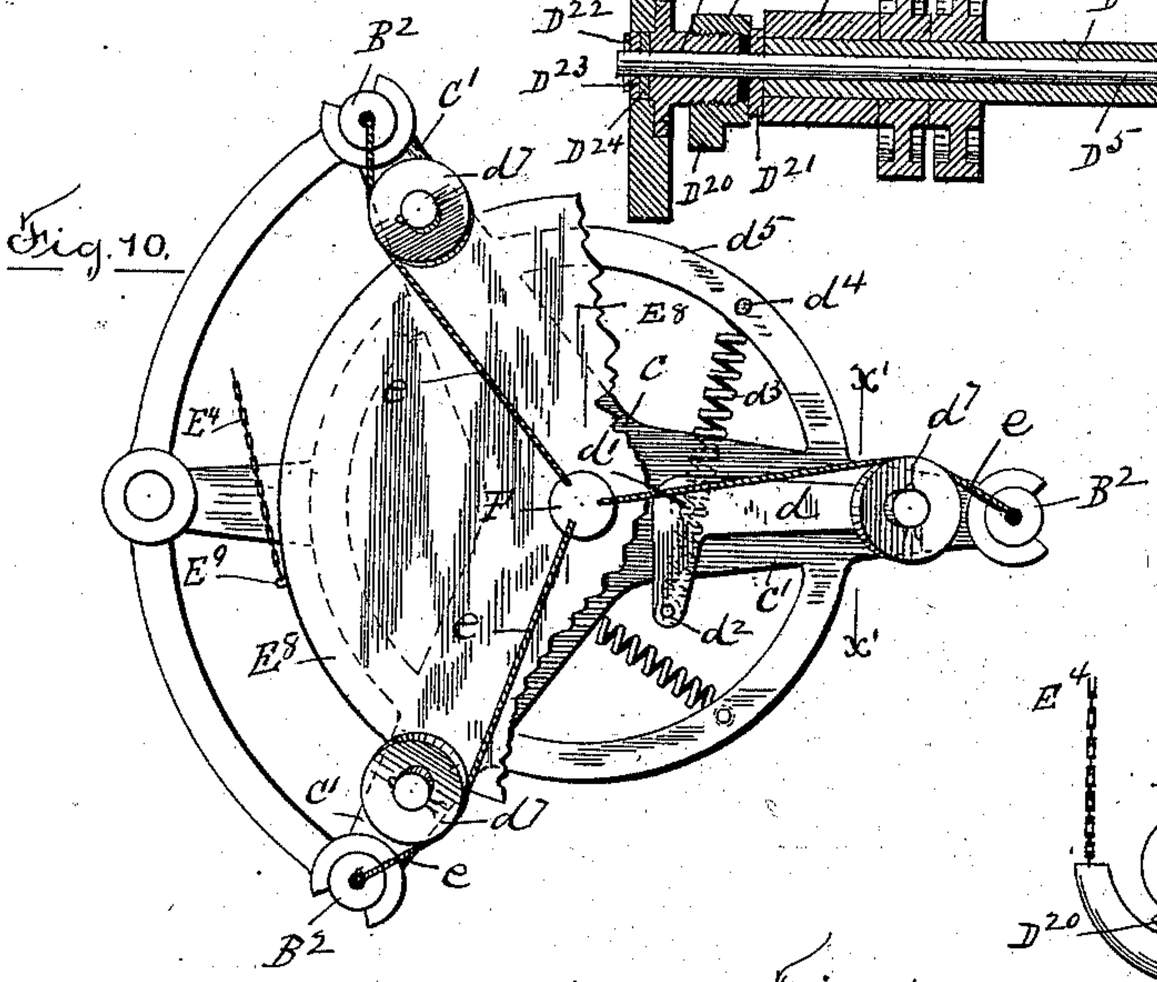


Fig. 10.



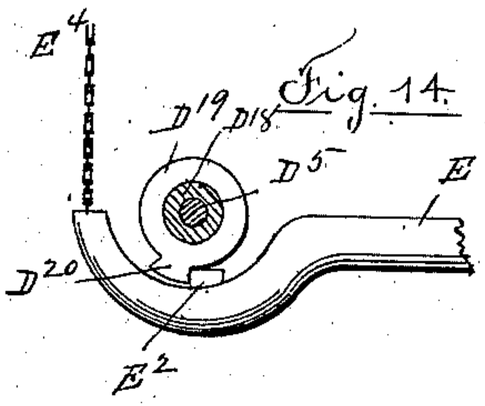
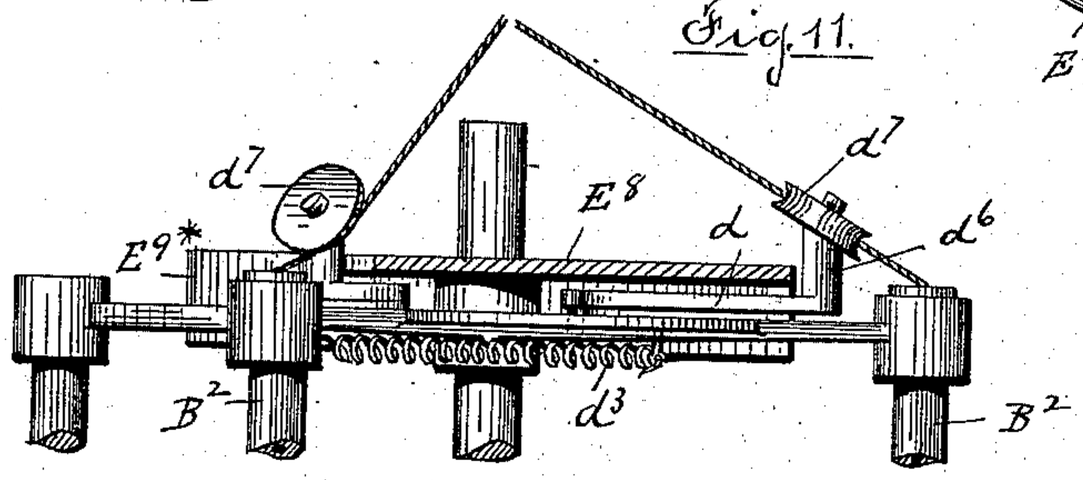


Fig. 14.

Fig. 11.



Witnesses
Walter S. Bowen.
Clara A. Blake.

Inventor
George Loomis Brownell.

By his Attorney
Rufus B. Fowler

UNITED STATES PATENT OFFICE.

GEORGE LOOMIS BROWNELL, OF WORCESTER, MASSACHUSETTS.

TWISTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 560,680, dated May 26, 1896.

Application filed May 22, 1891. Serial No. 393,784. (No model.)

To all whom it may concern:

Be it known that I, GEORGE LOOMIS BROWNELL, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Twisting-Machines, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 represents a side view of a portion of a twisting-machine embodying my invention. Fig. 2 represents a side elevation of the head or mechanism by which the individual strands are twisted into a cord and wound upon a winding-spool, the larger portion of the supporting-framework having been removed. Fig. 2ª represents a central vertical sectional view of a part of the mechanism by which a traversing motion is imparted to the cord as it is wound upon the winding-spool. Fig. 3 represents a detached view of the tubular sleeve having a spiral slot and by which the reciprocating movement of a rack-bar inclosed within said sleeve is made to impart a rotary motion to the sleeve itself. Fig. 4 represents a detached view of the outer sleeve inclosing the sleeve shown in Fig. 3 and attached to the rotating flier-frame. Fig. 5 denotes a top view of the circular plate or shell which is placed over and forms a housing for the gearing by which the fliers are rotated in twisting the individual strands. Fig. 6 represents a sectional view of the plate or housing shown in Fig. 5, the section being taken upon line Z Z, Fig. 5. Fig. 7 represents a top view of the reciprocating drum by which the cord-guiding pulley is traversed, the flier-frame within which said drum is supported being taken on line X X, Fig. 2. Fig. 8 represents a sectional view of one side of the flier-frame on line *y y*, Fig. 2, showing in top view the traversing carriage and the cord-guiding pulley supported thereon. Fig. 9 shows a side elevation of the individual-strand spools having a connected stop-motion mechanism. Fig. 10 represents a top view of that portion of the stop-motion mechanism directly acted upon by the individual strands. Fig. 11 shows a side view of that portion of the stop-motion mechanism represented in top view in Fig. 10. Fig. 12 represents a side view of the flanged disk, which is partly shown in top view in Fig. 10 and which is moved by the spring-actuated bell-cranks, one of which is shown in sectional view in Fig. 12, the section having been taken upon line X′ X′, Fig. 10. Fig. 13 shows a longitudinal central sectional view of that portion of the stop-motion mechanism which is placed concentrically to the driving-shaft; and Fig. 14 shows a detached view of the inner end of the hand-lever, showing the main driving-shaft in section and an end view of the actuating-nut shown in sectional view in Fig. 13.

Similar letters refer to similar parts in the different figures.

My present invention relates to that portion of a twisting-machine by which the twisted twine or cord is traversed or laid upon a winding-spool, and also to the stop-motion by which the twisting and winding mechanism is stopped upon the breakage of one of the individual strands; and it consists in the construction and arrangement of parts as hereinafter described, and specifically set forth in the subjoined claims.

Referring to the accompanying drawings, A, Fig. 1, denotes a portion of the supporting-framework, said figure showing in side elevation so much of the operating mechanism as pertains to one "head" or twisting mechanism by which several component strands are twisted into a single twine or cord.

In Fig. 2 a portion of the framework has been removed, disclosing more clearly that portion of the mechanism forming what is known as the "head" and comprising the individual-strand spools B, held concentrically with the fliers B′, attached to the rotating spindles B². Each individual strand as it is drawn from its strand-spool is twisted by the rotation of the fliers in the usual and well-known manner, and the several strands of which the twisted cord is formed are carried together through a condensing-tube B³ of any known form of construction, and through the hollow hub of a rotating flier-frame B⁴, over the conical and scored stretching-drums B⁵ to a rotating winding-spool B⁶. These several parts in their general construction and arrangement form no part of my present invention, having already been shown and described in prior patents of the United States granted to

me. The mechanism by which the twisted cord (represented at *a* in Figs. 1 and 2) is traversed or laid upon the winding-spool B^6, as hereinafter described, I believe to be new. The twisted cord *a*, after leaving the stretching-drums B^5 B^5, is carried over a guide-pulley *b*, turning upon a stud *b'*, Fig. 8, held in one of the prongs b^2 of the traversing carriage b^3, which is capable of a sliding motion along the side b^4, forming one of the sides of the flier-frame B^4.

The carriage b^3 is attached to a cord b^5, which passes around the guide-pulley b^6 and over the two guide-pulleys b^7 and having its ends carried around and attached at b^8 b^8 to the reciprocating drum b^9. By imparting a reciprocating motion to the drum b^9 the traversing carriage b^3 will be made to move along the side b^4 of the rectangular frame B^4. A reciprocating motion is imparted to the drum b^9 by means of the mechanism shown in elevation in Fig. 2 and in sectional and detailed views in Figs. 2^a, 3, and 4. The upper rail B^7 of the flier-frame B^4 is provided with a boss or hub B^8, to which is attached by means of a screw B^9 the sleeve B^{10}, provided upon diametrically opposite sides with the longitudinal slots B^{11}.

Inclosed within the sleeve B^{10} is a sleeve B^{12}, having a spiral slot B^{13}. The sleeve B^{12} is attached by a pin B^{14} to the short spindle B^{14a}, journaled within the hub B^8 and having the scored drum b^9 attached to its lower end. Inclosed within the sleeve B^{12} is a sliding rack-bar B^{15}, having teeth B^{16}, engaged by a pinion B^{17} upon a shaft B^{18}, which has a reciprocating motion as actuated by the mangle-wheel B^{19} and driving-pinion B^{20} in the usual manner.

The sliding rack-bar B^{15} is provided with a groove (shown by the broken lines B^{21}, Fig. 2^a) and receiving the end of the screw B^{22}, held in the fixed framework of the machine and by which the rack-bar B^{15} is held from rotating. Within the sleeve B^{12} and below the reciprocating rack-bar B^{15} is placed a cylindrical shell B^{23}, containing a block B^{24} and carrying projecting pins B^{25} B^{25}, which pass through the spiral slots B^{13} in the sleeve B^{12} and enter the straight longitudinal slots B^{11} in the sleeve B^{10}. The shell B^{23} incloses a chamber B^{26}, within which is contained the two rows of friction-balls B^{27} B^{27}, separated by the flange B^{28}, upon the spindle B^{29}, which is journaled in the block B^{24} and attached by a pin B^{30} to the lower end of the reciprocating rack-bar B^{15}. A swiveled connection is thereby made between the reciprocating rack-bar B^{15} and the shell B^{23}, in which are carried the pins B^{25} B^{25}, allowing the shell and pins to be rotated as they are moved up and down within the rotating shells B^{10} B^{12}.

The shell B^{12} is attached to the upper end of the spindle B^{14a}, and as the pins B^{25} are moved up and down by the rack-bar B^{15} a rotating reciprocating motion will be imparted by means of the spiral slots B^{13} to the shell B^{12}, spindle B^{14a}, and attached scored drum b^9, causing and up-and-down traversing motion of the cord-guiding carriage b^3 and cord-guide pulley *b* and laying the twisted cord evenly upon the winding-spool B^6.

The friction-rolls B^{27} B^{27}, interposed between the block B^{24}, flange B^{28}, and the end wall of the shell B^{23}, serve to reduce the friction between the moving surfaces with which they are in contact.

The upper portion of a side b^4 of the rotating frame B^4 is provided with the projecting lugs b^{10} b^{10}, forming such an angle with each other as will bring them into planes tangential with the opposite sides of the scored reciprocating drum b^9. The traversing yarn-guiding carriage b^3 is likewise provided with the projecting lugs b^2, placed at a similar angle, allowing the cord-guiding pulley *b* to be supported upon either one or the other of the lugs b^2, as it may be desired to guide the yarn upon either the right or left hand side of the winding-spool B^6. A rapid rotative movement is imparted to the flier-frame B^4 as the individual strands are being twisted into the cord or twine in the usual manner, the shell B^{10}, attached to the hub B^8 of the upper rail B^7 of the flier-frame, forming the upper journal of the flier-frame and held in and rotating within the bearings B^{31} B^{31}. The inclosed shell B^{12}, with its attached spindle B^{14} and scored winding-drum b^9, together with the pins B^{25}, have a common rotating motion with the flier-frame B^4 and shell B^{10}. If, however, a reciprocating movement be imparted to the toothed rack-bar B^{15}, causing the pins B^{25} to move up and down along the longitudinal slots B^{11} in the shell B^{10}, a reciprocating rotative movement will be imparted to the shell B^{12} by the action of the pins B^{25} within the spiral slots B^{13}, producing a corresponding reciprocating motion of the scored winding-drum b^9, alternately winding the cord *a* in opposite directions and imparting a traversing motion to the cord-guiding carriage b^3, moving it along the sides b^4 with a positive motion a distance equal to the length of the winding-spool B^6.

The spindles B^2, carrying the fliers B', are driven by a rotating driving-gear C, turning loosely about the post F and engaging pinions C^2, attached to the short rotating spindles C^3, which form the steps for the flier-spindles B^2. The gearing mechanism by which the flier-spindles B^2 are driven is covered by a plate or shell C^4, having the dependent hollow lugs C^5 containing the spindles C^3, the plate C^4 and lugs C^5 forming a housing for the driving-gears, by which they are completely protected from dirt and lint.

The arrangement of the driving-gear C, pinions C^2, step-spindles C^3, and flier-spindles B^2 form no part of my present invention, it being fully shown in the Letters Patent of the United States, No. 499,204, dated June 13, 1893, my present invention relating only to the employment of the shell or plate C^4, forming a cover or housing for the driving-gears.

The flier-spindles B^2 are supported at their lower ends upon the step-spindles C^3 in the manner described in my application above referred to, and the upper ends of the flier-spindles are supported by the arms of a spider *c*, Fig. 2, in the same manner as the flier-spindles are supported in the twisting-machine described in said application.

In Figs. 1 and 9 I have added to the mechanism by which the individual strands are twisted the stop-motion mechanism by which the machine is stopped upon the breakage of one of the individual strands of which the twisted cord is composed, and in Figs. 10 to 14, inclusive, I have shown in detail the several parts of the stop-motion mechanism.

D, D′, and D^2 denote three parallel driving-shafts journaled in the framework of the machine. The shaft D^2 receives rotary motion from a counter-shaft or main line of shafting through a belt connection in the ordinary manner, and the shafts D and D′ are driven by a belt or other connection from the shaft D^2. The stoppage, therefore, of the shaft D^2 will cause the simultaneous stoppage of the shafts D and D′. The strand-twisting mechanism is driven by a belt from the shaft D. The winding-spool receives rotary motion from the shaft D′ and the flier-frame is driven through a belt connection from the shaft D^2, as shown in my application aforesaid, Serial No. 383,726.

The stoppage of the main driving-shaft D^2, as determined by the breakage of either of the individual strands from which the cord is twisted, is effected by means of the mechanism shown in Figs. 9 to 14, inclusive.

In Fig. 13 the driving-shaft D^2 is represented with the mechanism carried thereon shown in central sectional view.

D^3 denotes the main driving-pulley provided with an elongated hub D^4, forming a sleeve inclosing the shaft D^2, upon which the pulley D^3 revolves loosely. The shaft D^2 is hollow and incloses the concentric spindle D^5, having attached thereto a friction-disk D^6, provided with an elongated hub D^7, entering the end of the hollow spindle D^2. Surrounding the spindle D^5 is an annular chamber D^8, containing a spiral spring acting against the end wall of the annular chamber and the end of the hub D^7 to push the hub D^7 out of the hollow shaft and carry the friction-surface of the disk D^6 out of contact with the web D^{10} of the driving-pulley D^3. A spline D^{11} serves to connect the hub D^7 with the hollow spindle D^2, causing the rotation of the disk D^6 as it is driven by frictional contact with the web D^{10} of the driving-pulley D^3 to be imparted to the driving-shaft D^2. The driving-shaft D^2 is journaled in bearings D^{12} D^{13} and carries the driving-pulleys D^{14} D^{15}, by which rotary motion is communicated to the pulley D^{16} upon the flier-frame, Figs. 1 and 2, and also to a belt-pulley upon the shaft D′.

Carried upon the end of the spindle D^5 is a hand-wheel D^{17}, having a screw-threaded hub D^{18}, carrying a nut D^{19}, provided with a spur D^{20}, the inner end of the nut resting against a washer D^{21}, which bears against the end of the shaft D^2. The twisting mechanism is put in operation by rotating the hand-wheel D^{17}, withdrawing its screw-threaded hub D^{18} from the nut D^{19}, and sliding the spindle D^5 within the hollow shaft D^2, causing a compression of the spiral spring D^9 and bringing the side of the disk D^6 into frictional contact with the web D^{10} of the driving-pulley D^3, causing the rotation of the driving-shaft D^2. Upon the side of the frame A, Fig. 1, is a hand-lever E, pivoted upon a stud E′ and having a projecting spur E^2 arranged to be brought in the path of the spur D^{20} upon the nut D^{19}.

By depressing the handle E^3 the inner end of the lever E is raised, bringing the spur E^2 into the path of the spur D^{20}, as shown in Fig. 14, thereby stopping the rotation of the nut D^{19} and causing the screw-threaded hub D^{18} to enter the nut, allowing the spiral spring D^9 to slide the spindle D^5 along the hollow shaft D^2 and carry the disk D^6 out of frictional contact with the web D^{10} of the driving-pulley D^3 and also to bring the opposite side of the disk D^6 into contact with a fixed plate D^{21}, Fig. 13, causing the disk D^6 to act as a brake to check the momentum of the rotating shaft D^2. The hand-wheel D^{17} is held upon the spindle D^5 by means of the cotter-pin D^{22}, the thrust of the spiral spring D^9 drawing the cotter-pin D^{22} against the metallic washer D^{23}, which rests upon a washer D^{24}, made of rawhide or vulcanized fiber. The frictional contact between the cotter-pin D^{22} and the washers D^{23} D^{24}, and also between the inner end of the nut D^{19}, washer D^{21}, and the end of the rotating shaft D^2, will cause the hand-wheel D^{17}, with its screw-threaded hub D^{18} and nut D^{19}, to rotate with the shaft.

As already described, the stoppage of the driving-shaft D^2 is effected by bringing the spur E^2 upon the pivoted lever E into the path of the spur D^{20} upon the rotating nut D^{19}, and this motion of the pivoted lever E is determined by means of the stop-motion mechanism controlled by the individual strands. To the inner end of the lever E, I attach a chain E^4, Fig. 14, which is carried over the guide-pulleys E^5 E^5, turning upon studs held in the frame A and around the guiding-segment E^6, held upon the arm E^7, to the flanged disk E^8, to which the opposite end of the chain E^4 is attached at E^9.

The flanged disk E^8 is capable of rotating about the central post F and is placed just above the spider *c*, in whose arms are placed the upper bearings for the flier-spindles B^2. Upon the lower side of the disk E^8 is a flange E^9, provided with notches E^{10} to receive the spokes *c′ c′* of the spider *c*. Pivoted upon each of the arms *c′* of the spider *c* are the bell-crank levers, one of which is shown in

top view in Fig. 10, a portion of the disk E^8 having been removed for that purpose.

The bell-crank d is pivoted to the spider-arms c' at d', and to the end d^2 of the shorter arm of the bell-crank I connect the spiral spring d^3, attached at its opposite end at d^4 to the rim d^5, forming a part of the spider, the line of draft of the spring E^8 passing between the pivotal pin d' and the end of the longer arm of the bell-crank, which is turned upward at d^6, forming a support for the guide-pulley d^7. As the individual strands e are carried from the flier-spindles B^2 to the condensing-tube B^3 they are carried around the rolls d^7 and thereby deflected from a right line, the tension of the strands e tending to rotate the bell-crank d upon its pivot d' and against the tension of the spiral spring d^3.

Whenever either of the strands e is broken and its tension removed from its guiding-pulley d^7, the corresponding bell-crank d is rotated upon its pivot by the action of its spring d^3, bringing the longer arm of the bell-crank into contact with the edge of the flange E^9, inclosing the notch E^{10}, and causing a slight rotating movement of the flanged disk E^8, winding up the chain E^4 and lifting the inner end of the pivoted lever E, bringing the spur E^2 into the path of the spur D^{20}, projecting radially from the rotating nut D^{19} and causing the immediate stoppage of the driving-shaft E^2, as already described.

The shorter arms D^2 of the bell-crank levers D carry studs which extend below the spider-arms c', to which the spiral springs d^3 are attached, thus bringing the springs below the spider-arms c', as shown by the broken lines in Fig. 10. When the bell-crank levers are held by the tension of the strands e against the tension of the springs d^3, the line of strain of the springs between the points d^2 and d^4 is made to pass near the center of the pivot d', so that the force of the spring d^3 is resisted by a slight pressure applied by the individual strand e to the guide-pulley d^7.

Whenever the individual strand e breaks, allowing the lever d^3 to rotate about its pivot d', the line of strain exerted by the spring d^3 between the point d^4 and the end of the shorter arm of the bell-crank moves farther from the center of the pivot d', causing an increasing force to be applied through the longer arm of the bell-crank to rotate the flanged disk E^8 and wind up the chain E^4.

I am aware that the intermediate mechanism between the individual strands e and the driving-pulley D^3 can be modified in many particulars by the substitution of other and well-known devices by which the tension of each of the individual strands of which the twisted cord is to be formed can be made to determine the action of the stop-motion mechanism. I do not therefore confine myself to the specific construction and arrangement of parts as herein shown and described, the employment of a spring-actuated vibrating lever restrained by the tension of the individual strands being, so far as I am aware, new in machines of this class.

The rotating flier-frame carries a stud upon which is journaled the guide-pulley b^6, and it is also provided with the prongs b^{10}, carrying studs upon which are placed the guide-pulleys b^7, and the weight of the guide-pulley b^6 with its stud is counterbalanced by the enlargement of the flier-frame upon the opposite side at f, the enlargement f being placed in the same plane of rotation as the guide-pulley b^6, and in like manner the weight of the prongs b^{10} and guide-pulleys b^7 are counterbalanced upon the opposite side of the flier-frame by the enlargement f', placed in the same plane of rotation, and the traversing carriage b^3 is counterbalanced upon the opposite side of the flier-frame by the enlargement of the frame f^2.

I do not herein claim, broadly, the counterbalancing of the flier-frame, but the enlargements of the flier-frame are placed in the same plane of rotation as the weight to be counterbalanced.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a twisting-machine, the combination with a rotating flier-frame having a hollow journal and a spool-support carried in said frame, of a cord-guiding carriage having a traversing motion by which the twisted cord is laid upon the winding-spool, a reciprocating drum, a connection between said drum and said carriage, a spindle carrying said drum and journaled concentrically within the hollow journal of said flier-frame, and connected actuating mechanism by which a reciprocating rotary motion is imparted to said spindle and through the intermediate connecting mechanism a traversing motion is given to the cord-guiding carriage, substantially as described.

2. In a twisting-machine, the combination with a flier-frame provided with a hollow journal, of a reciprocating rotating spindle journaled within said hollow journal and carrying a drum or pulley within said flier-frame, a sleeve attached to said spindle and provided with spiral slots, a block having a reciprocating sliding movement within said sleeve, pins carried by said block and entering the spiral slots in said sleeve, connected actuating mechanism, substantially as described, by which a sliding reciprocating motion is imparted to said block, a cord-guiding carriage capable of a traversing motion and operatively connected with said drum or pulley and a spool-support adapted to carry a winding-spool upon which the twisted cord is laid, substantially as described.

3. In a twisting-machine, the combination with a rotating flier-frame provided with a hollow journal, a spool-support carried in said flier-frame, a traversing cord-guiding carriage, a drum or pulley having a reciprocating

rotary motion and operatively connected with said traversing carriage, a spindle journaled concentrically in the hollow journal of said flier-frame and carrying said drum or pulley, a sleeve attached to said spindle and provided with spiral slots, a block carrying pins which pass through said slots and enter grooves in the hollow journal of the flier-frame and having a reciprocating motion within said sleeve, a rack-bar inclosed in said sleeve and having a swivel connection with said block and a pinion having a reciprocating rotary motion and engaging said rack-bar, substantially as described.

4. In a twisting-machine, the combination with a flier-frame provided with a hollow journal having longitudinal grooves or slots, of a sleeve inclosed within said journal and provided with spiral slots, a rack-bar having a reciprocating sliding motion, connected actuating mechanism for reciprocating said rack-bar and inclosed within said sleeve, a block having a swivel connection with said rack-bar, pins carried by said block and passing through said spiral slots into the longitudinal grooves in said hollow journal, a spindle attached to said sleeve, a traversing cord-guiding carriage operatively connected with said spindle and a spool-support upon which the twisted cord is carried, substantially as described.

5. In a twisting-machine, the combination with a rotating flier-frame, of a spool-support carried in said frame, a traversing cord-guiding carriage, prongs projecting from said traversing carriage toward opposite sides of said winding-spool and forming an angle with each other and a guide-pulley adapted to be held alternately on said prongs as the direction of the winding-spool is changed, substantially as described.

6. In a twisting-machine, the combination of a flier-frame having a hollow journal, a rack-bar having a longitudinal sliding motion within said hollow journal, means for actuating said rack-bar a pin held in said rack-bar and having an annular flange, a sliding block provided with a chamber inclosing said flange, a series of friction-rolls between said flange and the walls of said chamber, a spool-support, a traversing carriage by which the twisted cord is laid upon the spool and intermediate connecting mechanism, substantially as described, between said traversing carriage and said sliding block, substantially as described.

7. In a twisting-machine, the combination of a driving-shaft D^2 hollow throughout its entire extent, a sliding spindle D^5 extending through said hollow shaft and having a spline connection therewith, a driving-pulley D^3 turning loosely on said hollow shaft, a friction-disk D^6 attached to one end of said sliding spindle and arranged to be brought into contact with said driving-pulley, a screw-threaded sleeve D^{18} held on the end of said spindle opposite said friction-disk and having a frictional connection with said spindle, a nut D^{19} held on said sleeve and held from longitudinal movement, whereby said sleeve and spindle are moved endwise and the friction-disk brought into engagement with said driving-pulley, substantially as described.

8. In a twisting-machine, the combination of a hollow driving-shaft, a driving-pulley turning loosely on said shaft a spindle sliding in said shaft and having a spline connection therewith, a friction-disk carried on said spindle and arranged to be brought into frictional contact with said driving-pulley, a screw-threaded sleeve held on said spindle and having a frictional connection therewith, a nut carried on said sleeve and held from longitudinal movement, a radially-projecting spur extending from said nut and a pivoted lever provided with a spur, which is arranged to be brought into the path of the spur on said nut, whereby the rotation of said nut is checked, causing the spindle to be moved longitudinally and its friction-disk thrown out of engagement with said driving-pulley, substantially as described.

9. In a twisting-machine, the combination of a driving-shaft, a driving-pulley running loosely on said shaft, clutching mechanism, substantially as described, whereby said pulley is connected and disconnected with said driving-shaft at will, embracing a sliding spindle held in said driving-shaft and carrying a screw-threaded sleeve, a nut carried on said sleeve and held from longitudinal movement a spur projecting radially from said nut a lever pivoted upon the framework and provided with a projecting spur arranged to be brought into the path of the spur upon said nut by the angular movement of said lever by which said nut is checked from rotation, substantially as described.

10. In a twisting-machine, the combination with spool-supports adapted to support spools for carrying the strands to be twisted into a cord, of a series of pivoted bell-cranks provided with guide-rolls over which the strands are carried and by which they are deflected from a straight line, springs applied to said bell-cranks and against the tension of said strands, a disk having a flange provided with notches, which are adapted to be engaged by said bell-cranks as their springs are released by the breakage of the strands and clutching mechanism by which the operative portions of the twisting-machine are connected with the driving-power, and intermediate mechanism, substantially as described, between said clutching mechanism and said disk, whereby the clutching mechanism is released by the breakage of the strand, substantially as described.

11. In a twisting-machine, the combination with clutching mechanism, by which the driving-power is connected with the machine, of a series of bell-crank levers, guide-rolls carried upon one arm of each of said levers, a spring applied to the other arm of each of said levers with its tension exerted in a line pass-

ing near the axis of said bell-crank levers, a disk arranged to be rotated by the angular motion of either of said bell-cranks as their springs are released by the breakage of a strand, and intermediate connecting mechanism between said disk and said clutching mechanism, substantially as described.

Dated at Worcester, in the county of Worcester and State of Massachusetts, this 16th day of May, 1891.

GEORGE LOOMIS BROWNELL.

Witnesses:

RUFUS B. FOWLER,

CLARA A. BLAKE.