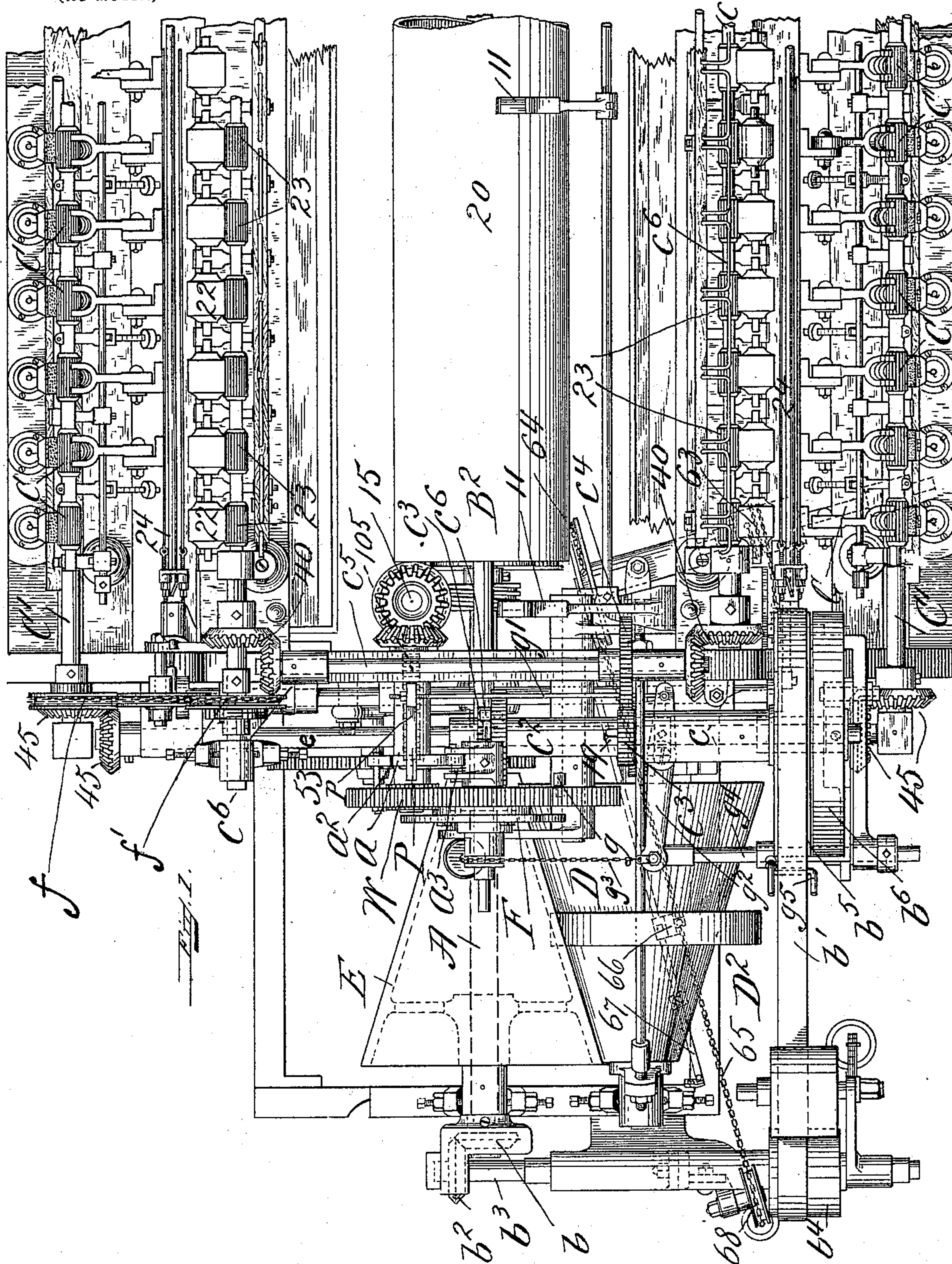


Patented Apr. 11, 1899.

(Application filed Jan. 14, 1898.)

(No Model.)

10 Sheets—Sheet 1.



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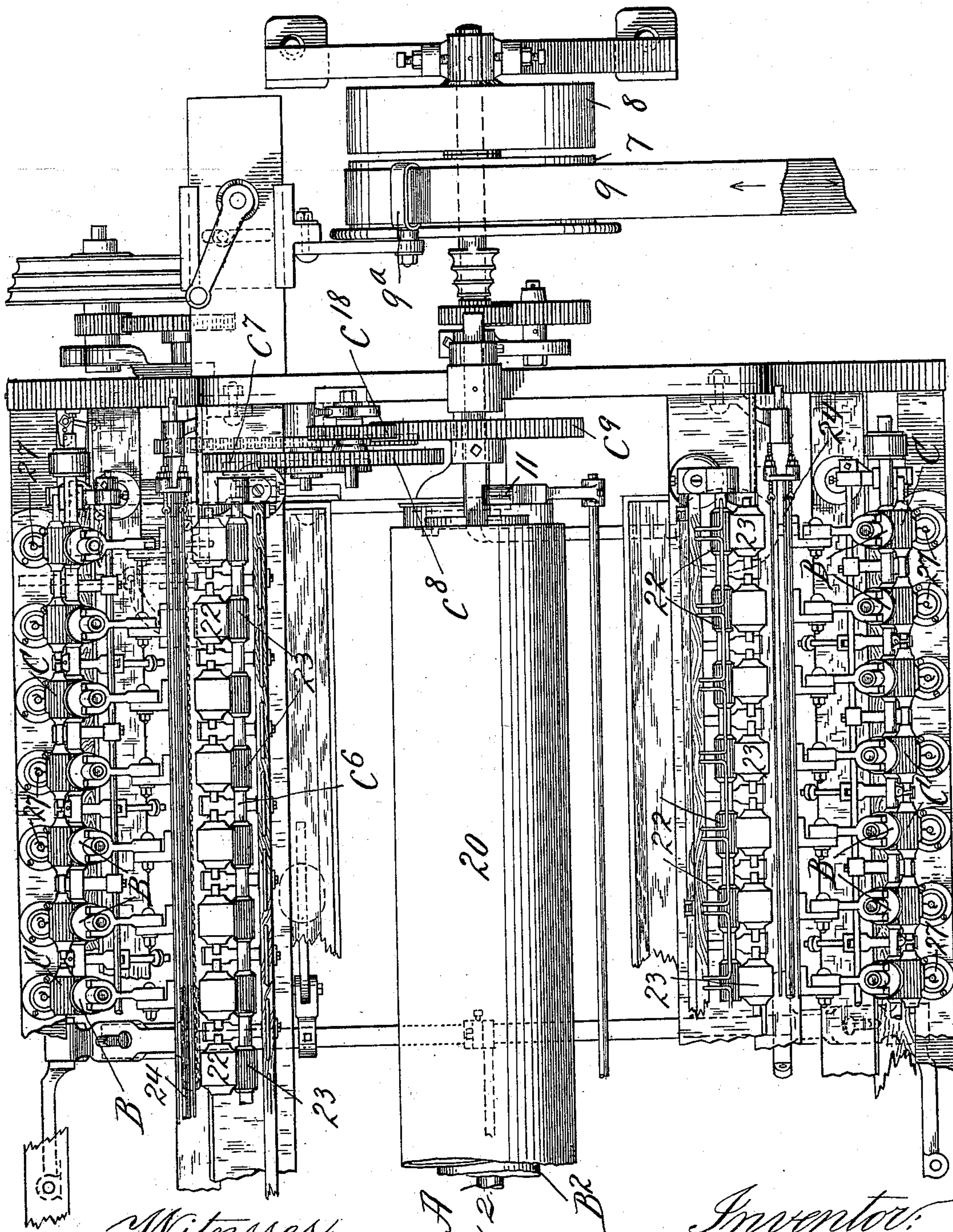
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

10 Sheets—Sheet 2.

(No Model.)



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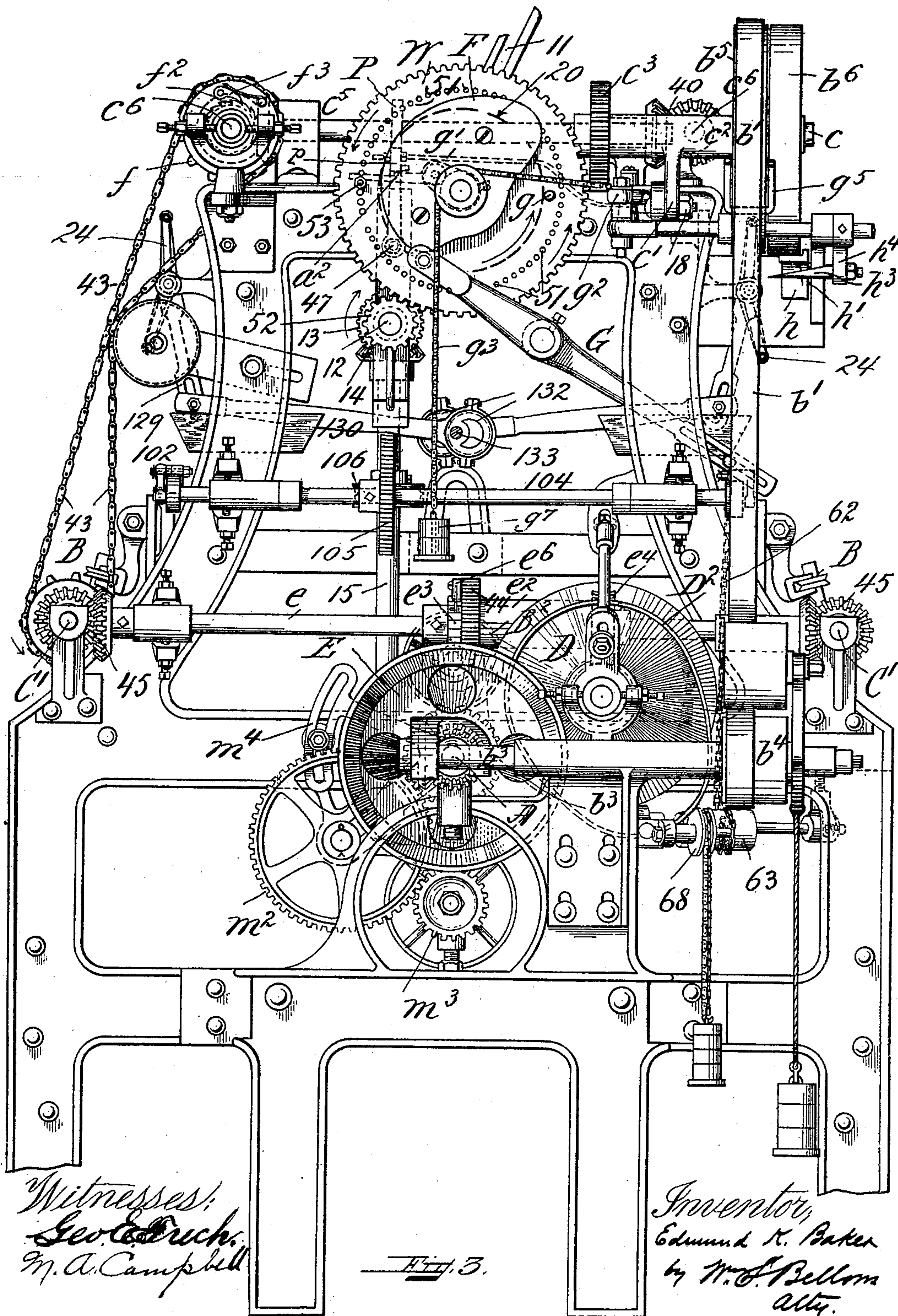
Patented Apr. 11, 1899.

E. K. BAKER.
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(Application filed Jan. 14, 1898.)

(No Model.)

10 Sheets—Sheet 3.



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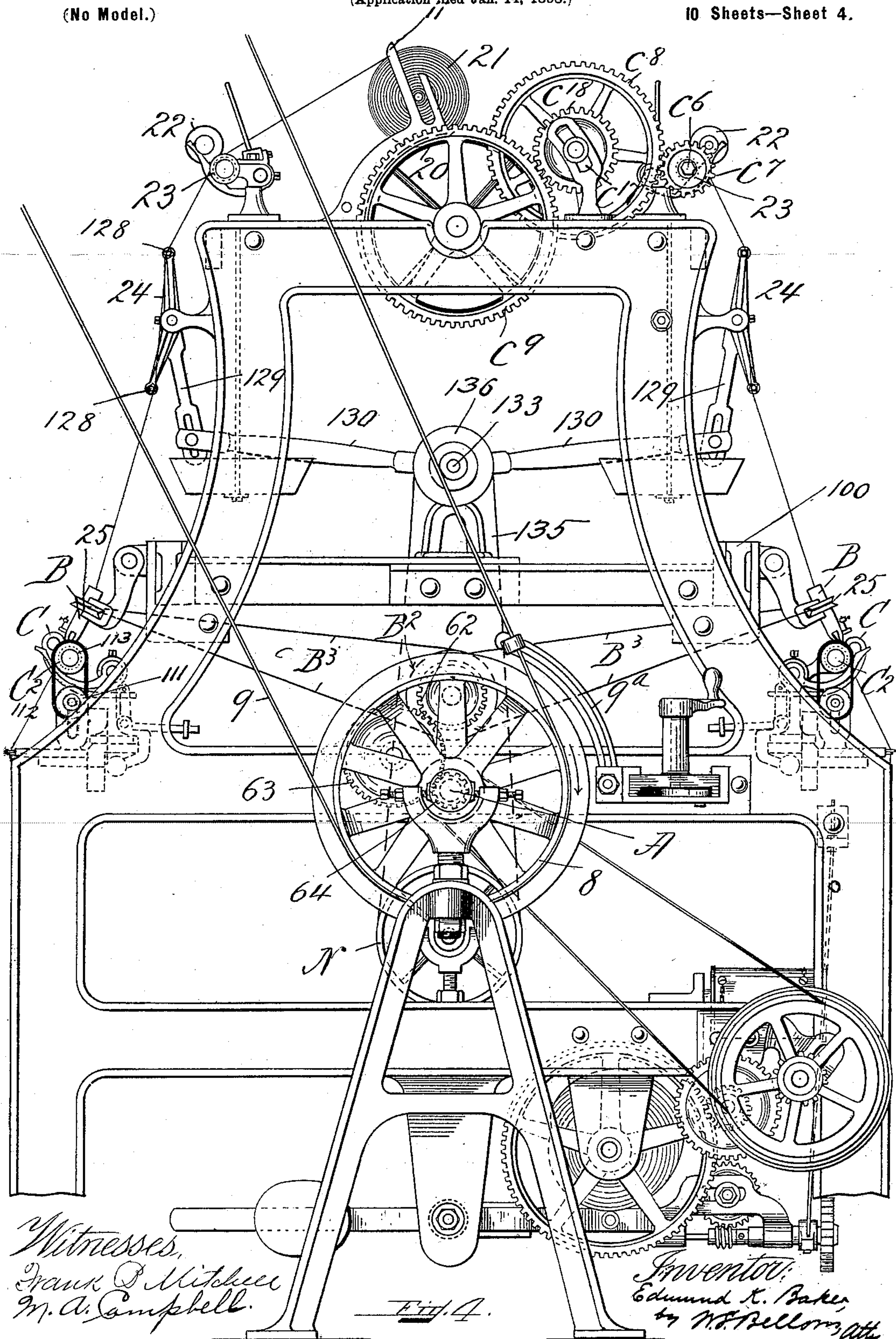
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

(No Model.)

10 Sheets—Sheet 4.



No. 622,836.

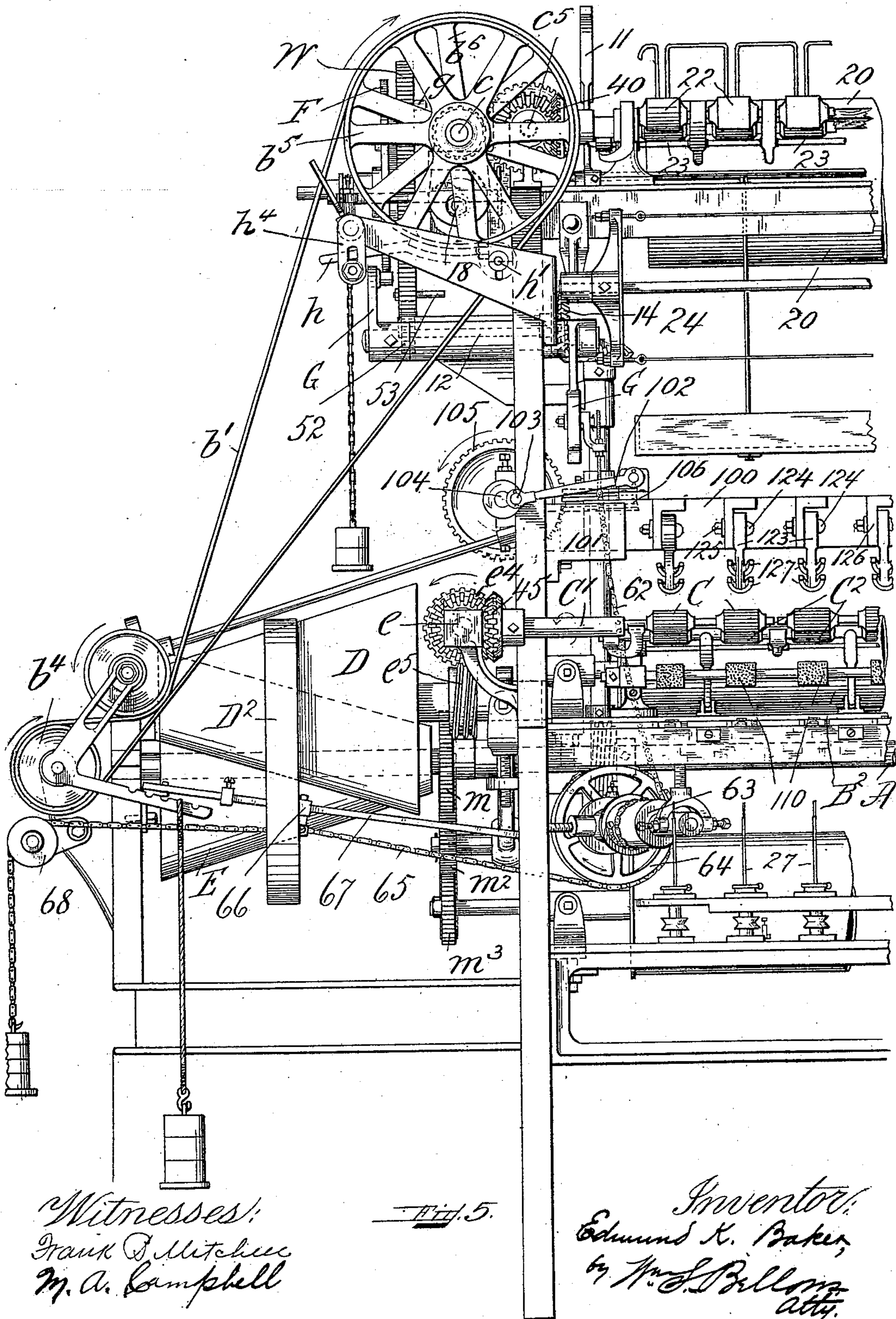
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

10 Sheets—Sheet 5.

(No Model.)



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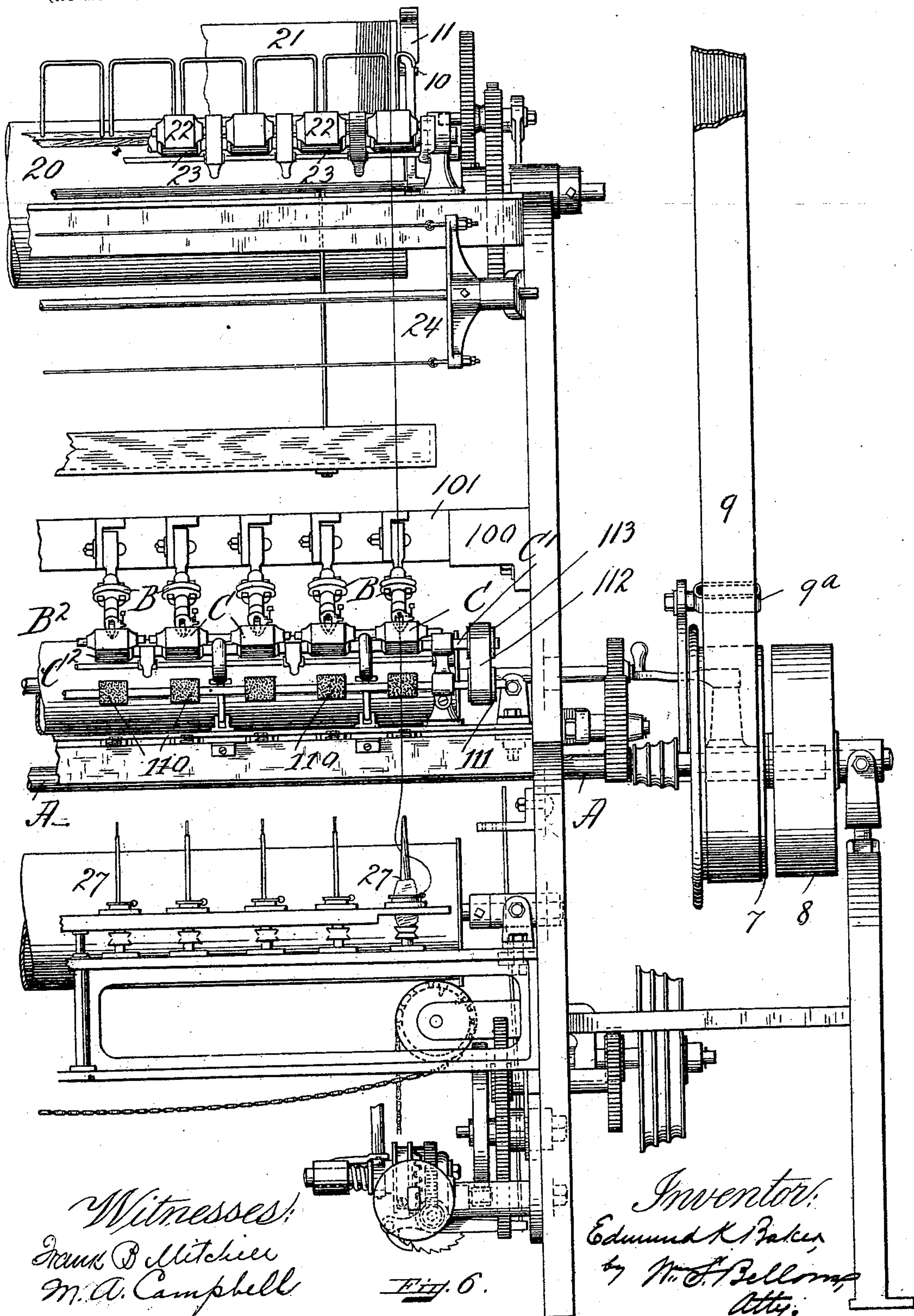
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

10 Sheets—Sheet 6.

(No Model.)



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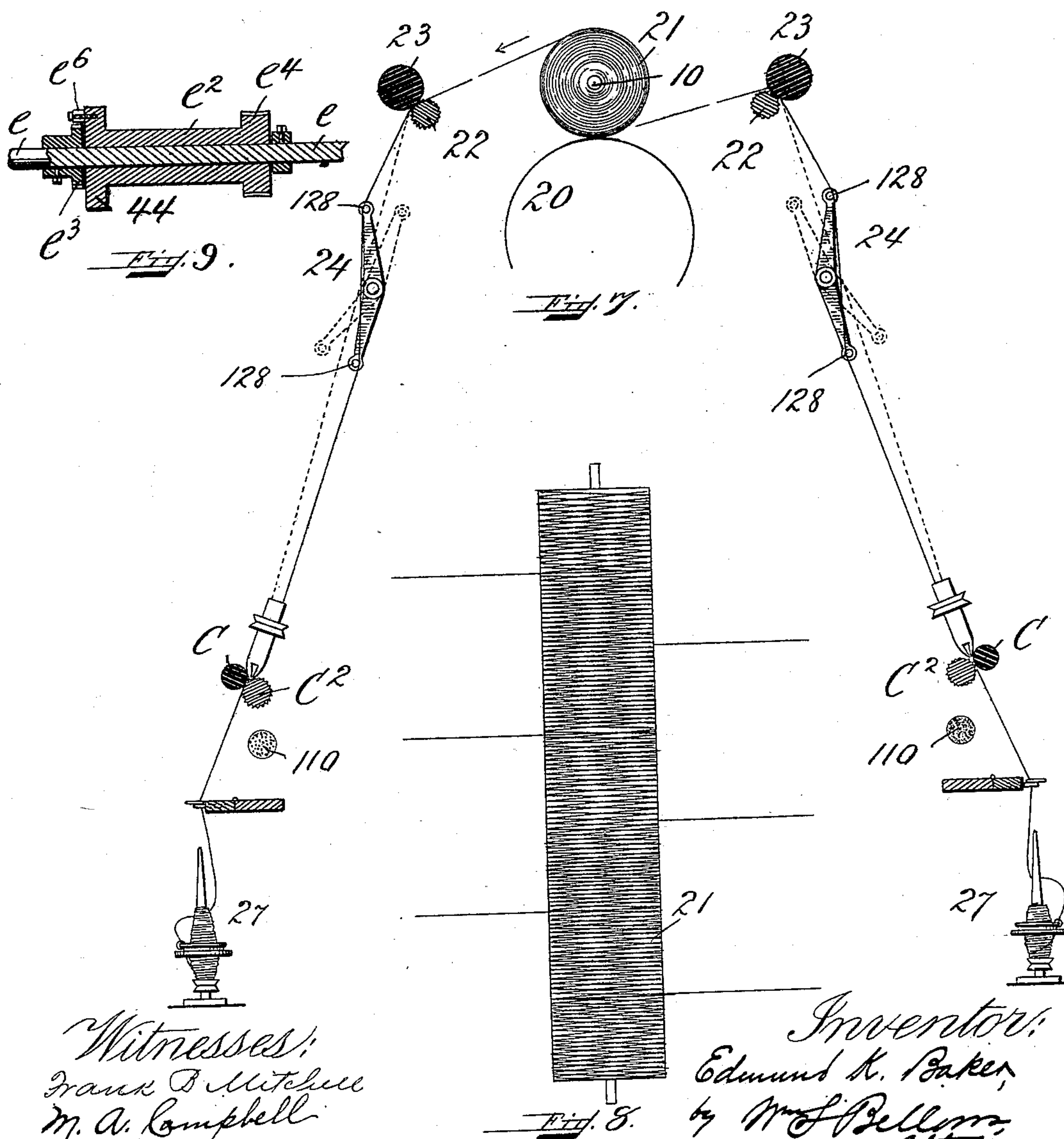
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

10 Sheets—Sheet 7.

(No Model.)



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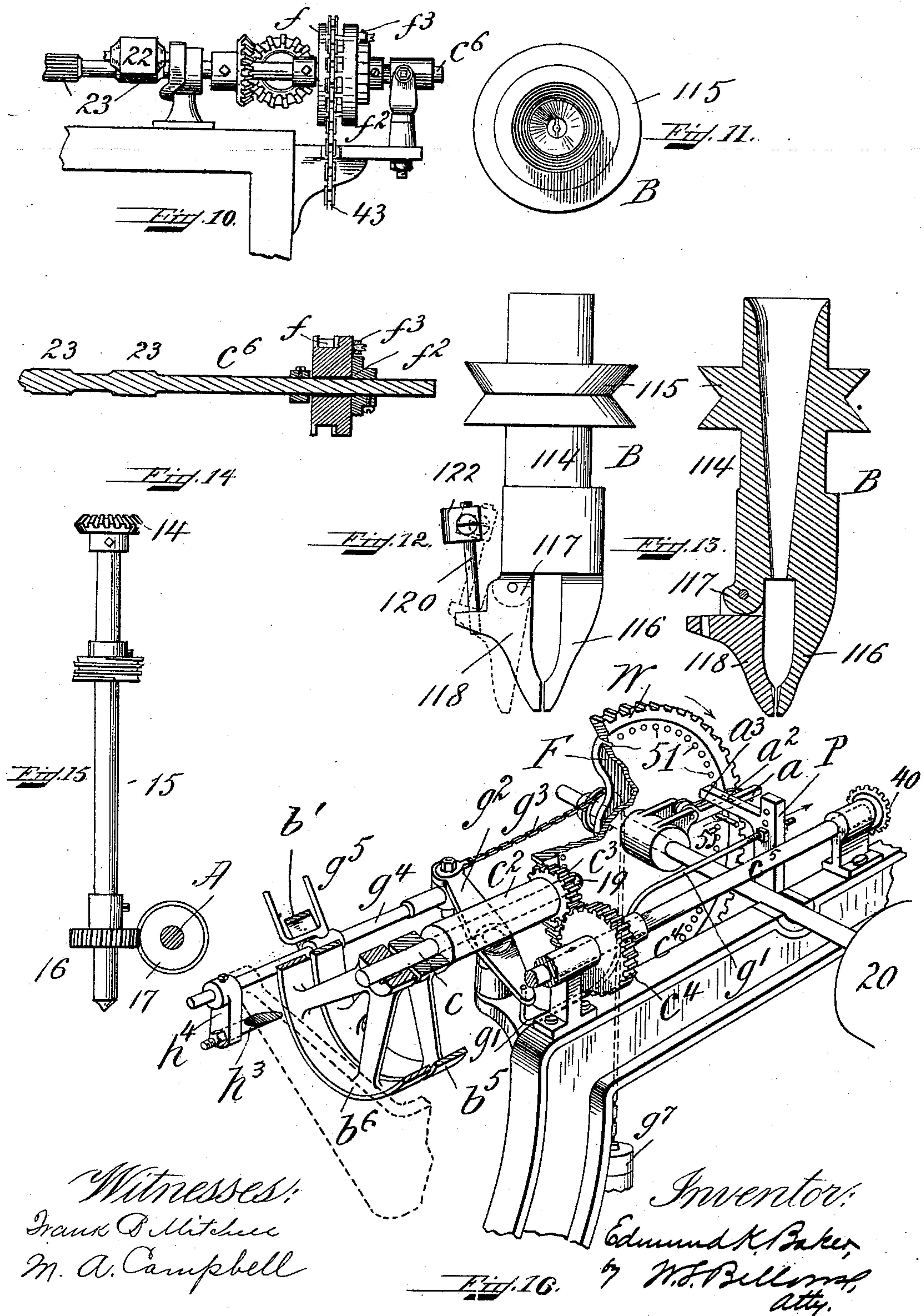
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

(No Model.)

10 Sheets—Sheet 8.



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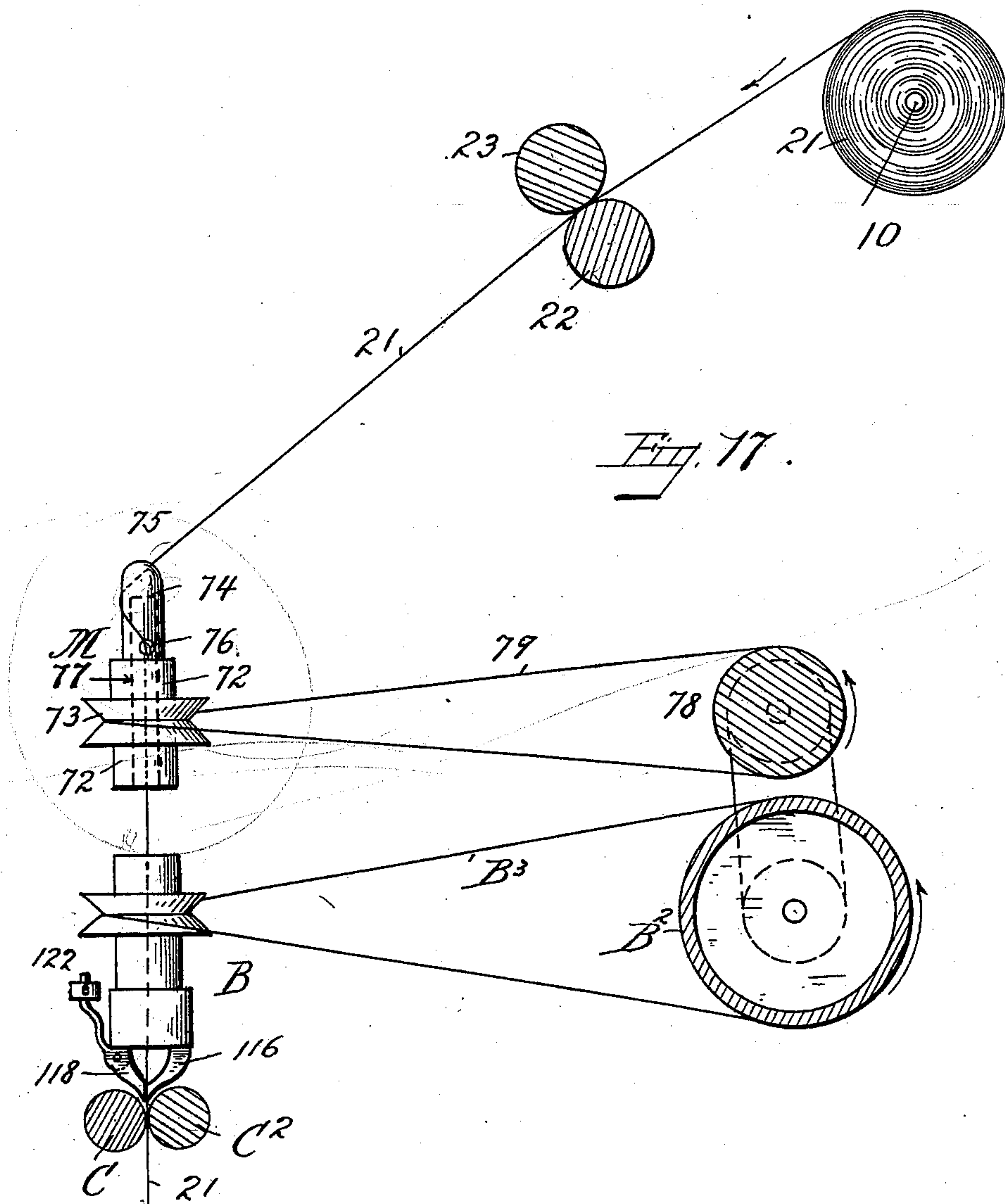
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

(No Model.)

10 Sheets—Sheet 9.



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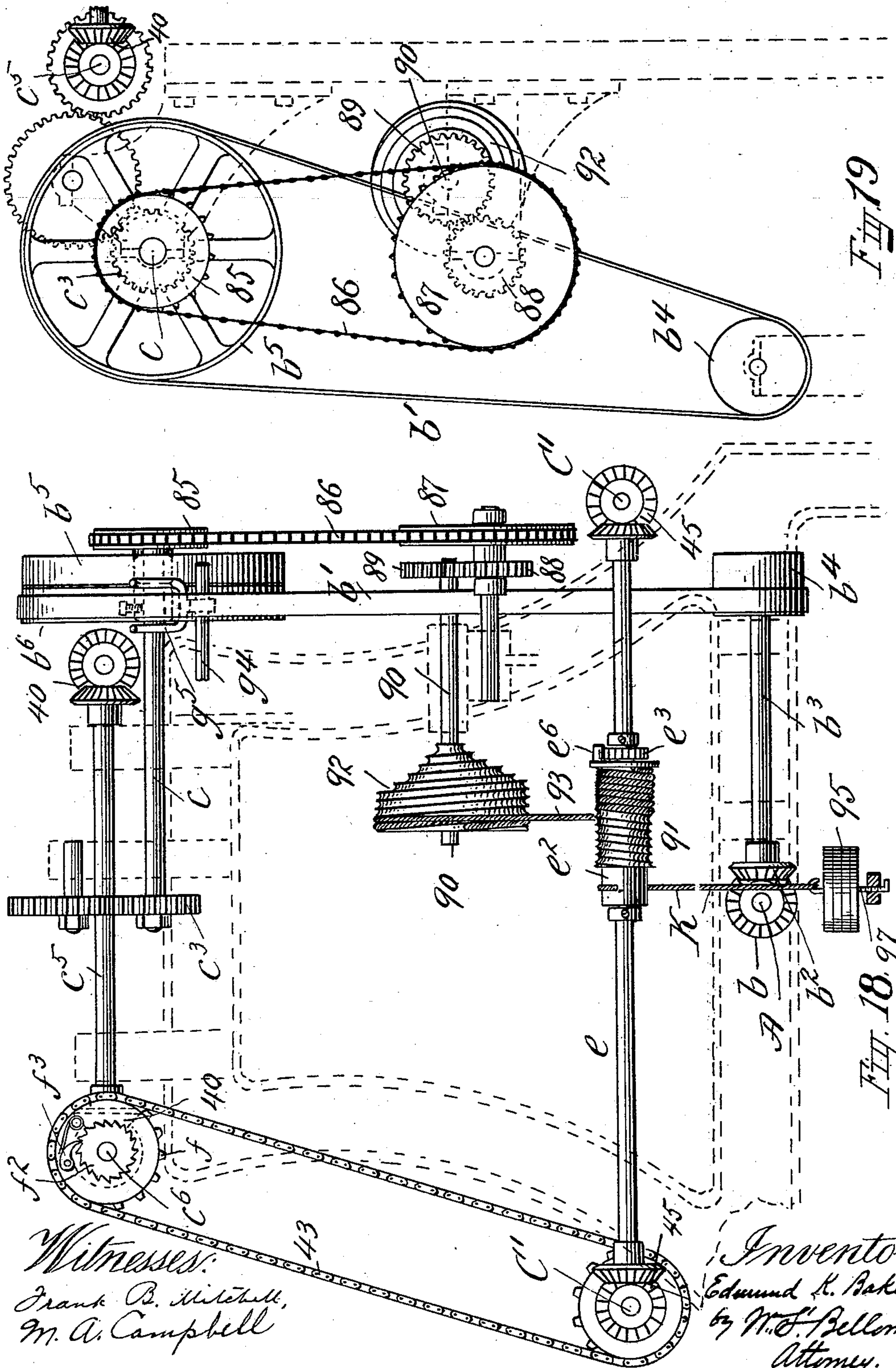
Patented Apr. 11, 1899.

E. K. BAKER.
SPINNING MACHINE.

(Application filed Jan. 14, 1898.)

10 Sheets—Sheet 10.

(No Model.)



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UNITED STATES PATENT OFFICE.

EDMUND K. BAKER, OF SPRINGFIELD, MASSACHUSETTS.

SPINNING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 622,836, dated April 11, 1899.

Application filed January 14, 1898. Serial No. 666,727. (No model.)

To all whom it may concern:

Be it known that I, EDMUND K. BAKER, a citizen of the United States, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Spinning-Machines, of which the following is a specification.

This invention relates to improvements in a spinning-machine designed to perform the work of a mule, but comprising mechanism structurally widely different and operating in a widely-different manner from the mule.

The present machine comprises mechanism for periodically delivering as required a certain amount of roving without draft, the amount delivered at each delivery period depending upon the size of the roving and the required size of fineness of the finished yarn and comprises improved means for operating and controlling the twisting and drawing mechanism, whereby the proper amount of "drawing twist" relatively to the amount that the roving is drawn or elongated may be secured in accordance with varying classes of spinning previous to the winding of the yarn onto the bobbins.

The present invention relates to a spinning-machine regarded as standing in a class by itself described in Letters Patent of the United States issued to me May 8, 1894, No. 519,491, and having in common with that machine a number of instrumentalities for the accomplishment of the ultimate object; but the reason of the present improvements is to provide more efficient and practicable mechanism for carrying out the spinning operations and to further provide mechanisms for rendering this machine available for the spinning of rovings of widely-differing sizes and qualities and for the production of yarn also of widely-differing sizes, as occasions may require.

The invention consists in the combinations of mechanisms and in the constructions and combinations of parts, substantially as will hereinafter fully appear and be set forth in the claims.

Accompanying this specification are complete drawings made substantially to uniform scale from a complete full-sized factory oper-

ating spinning-machine comprising the present improvements.

In said drawings, Figure 1 is a plan view of what I term the "head" end portion of the spinning-machine. Fig. 2 is a plan view of the opposite end portion of the machine. Fig. 3 is an elevation of the machine, taken at the head end. Fig. 4 is an elevation of the opposite end. Fig. 5 is a front or side elevation of the head end portion of the machine. Fig. 6 is a similar front elevation of the opposite end portion of the machine. Fig. 7 is a cross-sectional view in the nature of a diagram, illustrating essential components of the spinning-machine and designed to show in a simple and clear manner the course of the roving from the roving-spool to the bobbins in its relation to the instrumentalities operating thereupon. Fig. 8 is plan view of the spool of roving. Fig. 9 is a sectional view in detail to be hereinafter referred to. Fig. 10 is an elevation of a portion of the delivery-roll-driving mechanism. Figs. 11, 12, and 13 are respectively plan, side, and sectional views of the form of twister-head utilized in this machine. Fig. 14 is a sectional view of parts shown in Fig. 11. Fig. 15 shows power-transmission mechanism interposed between the main shaft and a continuously-running shaft comprised in the "head-works" for operating and controlling the intermittent let-off or delivery of the roving. Fig. 16 is a perspective view, with parts broken away and in section for clearer illustration, of the above-mentioned head-works mechanism governing the roving-delivery. Fig. 17 represents the utilization of a supplemental head, which is available for the production of the finer "numbers" of yarn. Figs. 18 and 19 are elevations at right angles to each other, showing modification in the composition and arrangement of the variably-speeded driving mechanism for the drawing-rolls.

Similar characters of reference indicate corresponding parts in all of the views.

In this machine a suitably-designed framework is understood.

A represents the main shaft, having at the rear end of the machine the fast and loose pulleys 7 and 8 with driving-belt and belt-shifter 9 and 9^a, Figs. 4 and 6.

20 represents the roving drum or cylinder, on which a spool 21 of roving bodily rests, the core-rod 10 of the spool being held against displacement by the forked arms 11, the spool deriving a rotational movement for its delivery by reason of the corresponding motion intermittently imparted to the cylinder through frictional engagement. The surface speed of the cylinder imparts a corresponding motion to the roving, so that if there is twelve inches of peripheral movement of the cylinder there will be substantially twelve inches of roving-delivery, no matter whether the spool is full or more or less depleted.

22 and 23 represent sets of delivery-rolls adjacent and axially parallel with the aforesaid cylinder.

B represents the twister-heads, and adjacent them are the paired drawing-rolls C C².

27 represents the spindles and bobbins.

24 represents a vibrator device located between the delivery-rolls and the twister-head.

W represents a comparatively large spur gear-wheel mounted loosely and concentrically on the journal for the cylinder 20, and this gear is constantly and uniformly rotated by the spur-gear 52, which is interchangeable on the horizontal shaft 12, and which shaft has the bevel-gear 13 on its opposite end, which meshes with the bevel-gear 14 on the upright shaft 15, which is driven by the worm-gearing 16 17 by the main shaft A. The said gear-wheel W has the series of small holes or sockets 51 at regular intervals in any of which to receive a stud or pin 53, extending inwardly sufficiently far to come into engagement with the latch *a*, hereinafter described and explained. (See Figs. 1, 3, and 16.)

On one end of main shaft A is mounted a bevel gear-wheel *b*, meshing into bevel gear-wheel *b*² on shaft *b*³, having on its opposite end a pulley *b*⁴. A belt *b*¹ runs around said pulley and also around the loose pulley *b*⁵, a fixed pulley *b*⁶ being alongside, said fixed and loose pulleys being on a horizontal shaft *c*, which is mounted to rotate in the journal-bearing *c*², which is adjustable by having the supporting-arm *c*¹ thereof detachably confined to a suitable lug of the framework by the clamp bolt and nut 18. (Indicated in Fig. 3.)

On the opposite end of shaft *c* from the location of the pulleys *b*⁵ *b*⁶ is placed a change-gear *c*³, detachably held in place by the nut 19, which gear meshes with the gear *c*⁴, fixed on delivery-roll driving-shaft *c*⁵, which, by the bevel-gears 40, drives the shafts *c*⁶ for and in common to one series of both sets or pairs of the delivery-rolls 23.

The roving drum or cylinder 20 is driven from one of the delivery-roll shafts *c*⁶, which has change spur-gear *c*⁷ and which meshes into the spur-gear *c*⁸, compounded with the spur-gear *c*¹⁸, which compound gear is adjustably mounted, as seen at *c*¹⁷, Fig. 4, and said gear *c*¹⁸ meshes into the spur-gear *c*⁹, which is fast to the shaft or arbor of the cylinder 20.

The aforesaid spur-gear W, provided with

a series of socket-holes, has in addition to the laterally-projected detachable stud or pin 53, also at some point around in the circular line of the holes within its face or near such circular line, the laterally-projecting shorter stud *g*.

Pivoted on the end of the framing at 47 is a frame or lever P, (seen in Figs. 1, 3, and 16,) having the engagement member *p*, with which the shoulder *a*² of the aforementioned latch has periodically an engagement and disengagement, the latch being under the stress of a spring *a*³, whereby it is maintained in its position of engagement except at such times as it is forcibly moved or depressed from such position. The lever P has engaged therewith the rod *g*¹, which connects one member of the intermediately-pivoted two-armed lever *g*², to the opposite arm of which is connected the rod *g*⁴, which carries the belt-shifting fork *g*⁵ for the aforementioned belt *b*¹.

After the drawing of a given delivered quantity of the roving has been completed and a new delivery is to be given, the small roll or stud *g*, projecting inwardly from the face of the continuously-rotating gear-wheel W, comes at the proper instant in contact with the member *p* of the swinging lever P and forces this to the left, as the parts are relatively seen in Fig. 3, sufficiently far to permit the latch *a* to spring upward and hold the lever P from returning to its normal position, as it has tendency to do by reason of the weight *g*⁷, connected to the end of the chain *g*³, which is attached to the belt-shifter mechanism with which the lever P is connected. As the said lever P is thus swung to the position to be latched it, through the said rod *g*¹, so swings the two-armed lever *g*² that the shipper-rod *g*⁴ moves to carry the belt *b*¹ onto the outer or fixed pulley *b*⁶, causing, through the mechanism heretofore described, simultaneously for a period the rotation both of the cylinder 20 and the delivery-rolls, both of these having the same surface speed, the cylinder and delivery-rolls being geared together by the gearings hereinbefore pointed out as provided at the end of the machine opposite from that at which said gear W is mounted, it being remembered that said gear W, while rotating concentrically with the arbor of the cylinder 20, is not directly connected thereto; and thus while the lever P is held in its latched-back position and the belt held running on the fixed pulley *b*⁶ the roving will be delivered by reason of the rotation of the cylinder and of the delivery-rolls, and such delivery will continue during such portion of the rotation of the wheel W as corresponds to the distance the stud 53 is from the projection *g*, for it will be manifest that so soon as the said stud 53 comes against and has a wiping bearing on and past the latch *a* to depress it and disengage it from the swinging lever P the latter will automatically return to its original position, reversely placing the belt-shifting mechanism with the belt on the loose

pulley b^5 . The shaft c now has no driving force imparted thereto, and the delivery-rolls and cylinder have their rotational movement stopped, the stoppage being immediate by reason of the action of brake mechanism operative relative to the said fixed pulley b^6 and which is pointed out in the drawings to consist as follows:

h , Figs. 3 and 5, is a brake-shoe pivoted at h' to a suitable supporting part of the machine, and operating in conjunction with this brake-shoe is the inclined bar h^3 , carried by the depending lug h^4 at the end of the belt-shifter rod g^4 , this last-mentioned part being most clearly seen in Fig. 16. The inward movement of the belt-shifter rod, whereupon the belt is carried onto the loose pulley, insures the impingement of the inclined bar h^3 against the brake-shoe to force it just as the belt is fairly off from the fixed pulley into braking engagement with said fixed pulley for the manifest result.

The relative location of the studs or projections g and 53 governs the time or duration of roving-delivery at each "draw" or complete operation of the machine represented by one complete rotation of the said gear-wheel W . Hence if the stud 53 is placed in a socket-hole farther behind the projection g , considered relative to the course of the rotation of these parts, the stud g always being considered as leading or ahead of the stud 53 , the roving will be delivered during a greater length of time than if the stud 53 were placed less far behind the stud g .

The size of the interchangeable gear c^3 determines the quantity of the roving delivered during the delivery period acquired, as just above explained.

The twistors are continually running. Each twister has a driving-band B^3 , passing around twister-head drum B^2 , driven from main shaft A by means of the changeable and adjustable gear-wheels 62 63 64 . (Shown in the end view Fig. 4.) This gearing is changeable and adjustable to vary the normal and continuous speed of the twistors by substituting the gear 62 on the drum for a larger or smaller gear and correspondingly adjusting the intermeshing gear 63 , intermediate between this and the main-shaft pinion 64 .

The roving from the spool through the delivery-rolls and through the twister-head passes from the jaws of the latter to the drawing-rolls C C^2 , which are continuously and variably driven. When the roving is being delivered, the draw-rolls are driven by the sprocket-wheel f' , fixed on the common shaft C' for the one side series of draw-rolls C^2 , through the sprocket-chain 43 from the sprocket-wheel f , which is loose on delivery-roll shaft c^6 , said shaft c^6 having fixed thereon the ratchet-wheel f^2 , the teeth of which are in engagement with the pawl f^3 , which is carried on the said sprocket-wheel f . (See Figs. 11 and 15.) When the roving-delivery stops, the drawing-rolls are driven by the

variably-rotated cone D or by the mechanism attenuated in Figs. 18 and 19, which may be employed in lieu of the cone-driving mechanism. The cone D is fast on a shaft therefor running in bearings suitably provided. On inner end of cone-shaft is fixed a worm e^5 , which engages the worm-wheel e^4 , fixed to sleeve e^2 , loose on shaft e and which by the bevel-gearing 45 is in driving engagement with the common shaft G' , on which the upper set or series of top drawing-rolls are fixed. The sleeve e^2 has on the flange 44 thereof the pawl e^6 , which engages the ratchet-wheel e^3 , fixed on shaft e .

It will be here stated that the delivery of roving will be without draft thereon, for such delivery will be faster than the rate at which the drawing is done during the time of delivery, and when the delivery begins the sprocket-wheel f' , which is fixed on drawing-roll shaft being driven, will drive the cross-shaft e faster than the rate at which the cone D has been driving the sleeve e^2 . Therefore ratchet-wheel e^3 , which is seen as provided fast to the shaft e , will run ahead of its pawl e^6 , clicking past it during part of the time that the cone is continuously though uniformly speeded. Now when the delivery of roving ceases the sleeve e^2 and pawl e^6 continuously revolving will, through the engagement of said pawl with its ratchet-wheel, drive the shaft e , and at this period in the operation the rotation of common shaft C' for the draw-rolls having the sprocket-wheel f' thereon will cause a corresponding run of the chain 43 without effect thereby, for, as may be understood on reference to Fig. 3, the sprocket-wheel f , which is loose on delivery-roll shaft c^6 , will have its pawl f^3 click past the teeth of the ratchet-wheel, which is fast on said shaft c^6 .

It is to be understood that as the roving is drawn down finer it is necessary that the speed of the drawing-rolls C C^2 should be reduced in order to insure relatively to the degree of elongation of the stock an increased twisting thereof by the continuously-rotating twister-head B , which result is accomplished by the friction-cone belt D^2 . The cone E drives cone D through said belt in the manner common in variable cone-driving mechanism. Now as the drawing progresses after the delivery the cone-belt D^2 is drawn toward the large end of the cone D , and therefore toward the small end of the cone E , reducing speed of D , and consequently, through the connected mechanism, of the drawing-rolls, all this being controlled by the action of the cam F on the same shaft as the gear-wheel W , which is the arbor for the cylinder in the present instance, although not necessarily on this particular shaft.

The cam F operates the cam-roll on lever G , to the outer end of which is attached the flexible connection 62 , having winding engagement on pulley-drum 63 , fast to which drum is a larger drum 64 , (see Fig. 5,) in wind-

ing engagement with which is the flexible connection or chain 65, connected to the sliding belt-shifter 66, mounted on slide-bar 67, said chain thence passing over sheave 68 and having a weight on its end in order to keep the cam-roll end of lever G always closely against the rim of the cam F. The said cam F is fastened adjustably to the gear-wheel W, the object of which, in a general way, is to insure that the cam will be so relatively set that when the latch has been tripped or released and the delivery stopped the cam will begin to draw up the friction-belt of and between the cones and decrease the speed of the drawing-rolls, and the decrease of the speed, both in amount of decrease and also in the suddenness or slowness thereof, is of course governed by the throw and grade of the cam.

The spinning-machine which has been constructed in accordance with the present invention as exemplified in the accompanying drawings is seen to embody a let-off cylinder or roller 20 and a driving connection for said let-off cylinder, consisting of a constantly-running wheel (instanced, the one b^4) and mechanism of driving connection between such wheel and the controller, comprising devices for rotating the cylinder for any required intervals relative to the rotation of said constantly-running wheel, (this involving the shaft c , gearing $c^3 c^4$, driving the delivery-rolls, which are geared to drive the cylinder, and the belt-shifter devices and operating means employing the wheel W with its studs or projections, and the latch a ,) and means which is capable of being changed (here the detachable and interchangeable gear-wheel c^3 just above referred to) for causing or insuring during the period of time the let-off cylinder is being rotated any required extent of rotation thereof, together with the rotatable draw-rolls and rotatable twisters and driving means therefor operative to insure such relative and timely speeds of rotation thereof that during the let-off the draw-rolls have proportionately a greater speed relative to the speed of the twisters than at the interval between the let-offs.

By the provision in the spinning-machine of the peculiar type to which this invention pertains of instrumentalities and mechanisms for imparting thereto the capabilities last above set forth it becomes possible and entirely practicable to utilize the machine for operating on roving having variety within a very wide range both as to quality and the fineness or coarseness thereof, and for the production of yarns either fine or coarse, having, as compared with the roving delivered from the spool, much or little attenuation and having intermediate between its delivery and its winding onto the bobbins comparatively little or a great degree of what in this art is known as the "drawing twist." For the production from any given roving of yarn which is excessively fine I have augmented the capability of the machine by the

provision of a series of supplemental heads which have in operation the double function of giving an added drawing twist to the roving and of also giving thereto in rapid succession a series of alternate tensionings and releases from tension, and the combination of such supplemental head in the machine is shown in Fig. 17 of the drawings, in which M represents the supplemental head, located directly above the twister-head. This head consists of a tubular body having journal-steps 72, intermediate of which is the grooved sheave 73, the upper spindle-like portion 74, having the closed rounded top 75 and considerably therebelow the sidewise-opening aperture 76, leading into the axial passage 77, continuing from the junction thereof down through the lower end of the device. This supplemental head M is driven by driving-band 79 from the drum 78, suitably rotated in the same direction as the main twister-head drum B^2 , but at a somewhat lower rate of speed than said twister-head drum. The said head M is located just above the twister B, its axis being angular to the line of the run of the roving from the delivery-rolls to its side, in which is the said aperture 76 for the entrance of the roving into the passage leading therefrom down through the head to also enter and pass to the twisting action of the twister-head B. The elongation or drawing of the roving is almost entirely performed in that portion thereof between the delivery-rolls and the head M, each rotation of the head M imparting a twist to the roving between it and the delivery-roll, which is most properly regarded as the drawing twist. The twister-head B, running faster, (for instance, twice as fast as the head M in the same direction,) imparts between its jaws and the part of the roving in tension on the cylindrical portion 74 of the said head M an additional twist, or a second twist, so that there is lessened liability of breakage of the roving between the jaws of the twister B and the draw-roll within the short distance between them, and also to prevent the roving from becoming parted anywhere between the draw-rolls and the place of tension engagement on the part 74 of head M, more especially at the time that this variable tension exists in its greater degree, which is just before it has made a complete turn around said portion 74 and has fallen off therefrom.

It will be explained that the elongation of roving results by the draft on the roving between the draw-rolls and the delivery-rolls and in that portion having the least degree of twist—that is, the portion between delivery-rolls and head M—it being understood that the excessive supporting twist between said head and the draw-rolls is so considerable that while this portion of the roving is under as great and periodically under greater tension than the roving above head M the hardness and extensiveness of its twist permit of little, if any, elongation, for that ef-

fect is produced above said head M and by a combination of draft, twist, and rapid successive tensionings and releasings, so that it is brought down entirely to the required fineness at the time it engages and passes through the head M.

In Figs. 18 and 19 of the drawings I have shown driving connections for imparting the variable speed to the drawing-rolls, which may be employed in substitution of the cone-driving mechanism illustrated in the preceding drawings and hereinbefore referred to, this driving mechanism in no way altering the action or capabilities of the machine; but it can be run with less power than the cone-drive.

It is to be understood that the delivery-rolls 23 22 are intermittently driven in the same manner as has been already described, and the drawing-rolls are driven by the sprocket-chain 43 during the delivery rotation of the delivery-rolls, and when the roving has been fully delivered the belt b' is shifted onto the loose pulley b^5 , said belt being always around the constantly-running pulley b^4 , and substantially the same devices illustrated in Fig. 16 may be utilized as the belt-shifter mechanism in the corresponding manner as described in the foregoing portions of this specification. The pulley b^6 next to the pulley b^5 is fast on the shaft C. On the hub of the loose pulley b^5 is a chain-wheel 85, around which passes the chain 86, which also passes around and drives the chain-wheel 87, on the hub of which is a pinion or gear wheel 88, which meshes into a gear-wheel 89 on the shaft 90. The scroll 92 is fast on said shaft 90, and it has through the cord 93 a flexible driving connection with the grooved drum 94 externally produced on the sleeve e^2 , which is mounted in the same way on the drawing-roll-driving shaft e , as has been already described, the sleeve having the pawl e^6 mounted thereon engaging in the ratchet-wheel e^3 , fast on shaft e . Cord K has a winding engagement with grooved sleeve e^2 , loosely mounted on shaft e , the same supporting a weight 95. When belt b' is on loose pulley b^5 , shaft 90 receives a constant and uniform speed through the action of driving connections 85 86 87, 88 and 89 therefore driving shaft e and the drawing-rolls at a gradually-decreasing speed as cord 93 is being wound on scroll 92 from drum e^2 , the grooves on parts 93 and e^2 being understood as helical and continuous. The weight-cord K has its winding connection with the sleeve and drum e^2 , so that when the belt-shifting apparatus shifts belt b' onto fixed pulley b^6 the sleeve e^2 is reversely rotated by action of weight 95 and cord 93 thereby unwound from the scroll 92 and wound up on drum 94 until the descent of the weight is arrested by the stop or stud 97, which may be adjustable as to height.

In spinning, it being supposed that the relative time of delivery of roving to time of draw has been adjusted, and also during said time

there has been delivered the requisite amount of roving, at the instant this result is attained the belt b' is shifted on loose pulley b^5 , and scroll 92 through connections 93 94, and e^6 e^3 begins to rotate shaft e and the draw-rolls C C². Therefore the speed of shaft e is comparatively fast when cord 93 is on the high part of scroll 92 and gradually decreases as it nears the smaller part thereof, and when the roving has been sufficiently drawn the belt b' is shifted back onto the fixed pulley b^6 , whereupon during the next roving delivery weight 95 is permitted to descend and unwind cord 93 from the scroll onto the drum until the descent of the weight 95 has reached its limit at just the right instant as determined by the adjustable stop 97. This reversed rotation of the sleeve e^2 is permitted by the pawl clicking over ratchet e^3 , and the loose pulley b^5 has incidentally a rotational movement in unison with the scroll, because of the described connections between said loose pulley and the scroll-shaft 90, and this is all without effect on the shaft e in geared connection with the drawing-rolls at this time being driven from the head-works of the machine—that is, the roving-delivery mechanism.

This last-described mechanism, while of lighter structure than the cone-driving mechanism, and the means for shifting the cone-belt D², hereinabove described, tend to simplify and cheapen the machine, as well as to economize power, and is believed to involve novelty and is accordingly claimed.

In the drawings are illustrated the mounting of the twister-heads on common supports or bars 100 for each side set thereof, which bars are endwise movable in suitable ways therefor, and means for imparting a bodily movement to each said bar, consisting of the connecting-rod 102, operated by the eccentric-pin 103 on the shaft 104, having the worm-wheel 105, which meshes into the worm on the vertical shaft 15. This imparts a traversing motion to the twisters, whereby the roving delivered therefrom onto the draw-rolls is not so delivered constantly at one point and whereby the wearing of grooves into the draw-rolls is prevented. It will be perceived also in the drawings that below the paired drawing-rolls are rolls 110 110, all on a common shaft, having by belt 112, running around pulleys 113 111 on the drawing-roll shaft C' and on the common shaft for said rolls 110, a rotation in unison with and in the same direction with the series of drawing-rolls C², all to the end that broken yarns which may occasionally tend to tangle the machine by coming upon said rolls 110 will be wound thereupon, so that the attendant at such time as he is able to splice the break may readily do so and remove the slight accumulation of the yarn from the take-up rolls.

The twister-head used in duplicated series in this machine consists of a hollow tubular cylindrical body 114, having sheave or whirl 115 thereon, and a narrow yarn-gripping fin-

ger 116, integrally formed and longitudinally extended. Short ear-pieces 117 are provided on the end of the body 114 opposite said finger 116, and a second yarn-gripping finger 118 is pivotally connected on said ear-piece 117 and has a capability for a vibratory movement, due to the passage of the roving between the two fingers, and it has an extension or arm 120 above its pivotal connection and laterally arranged relative thereto, on which a weight 122 is adjustably supported. Under rapid rotation of the twister-head the centrifugal force of the weight causes the finger 118 to pinch more tightly toward the finger 116, such pinching action being lessened as the speed is lessened. By adjusting the weight farther up or down the intensity of the bite of the gripping jaws or fingers of the twister-head may be regulated to suit varying kinds of yarn. This twister-head is described and claimed in an application for patent already filed by me November 21, 1896, Serial No. 612,984; but in this application I have included the twister-head supports clearly shown in Figs. 1 and 5, in which views the twistors are omitted, such twistors being shown in said supports in certain of the other views. Said support consist of the members 123, pivotally clamped by the bolts 124 and nuts 125 on the lugs 126, secured on said supporting-bar 100, said members having the approximately semicircular yokes 127 for the rest and support therewithin of the twister-head bodies, the whirls 115 thereof having space for occupancy between the upper and lower ones of said yokes. By loosening the nuts 125 the twister-head supports may have their inclination varied, so as to present the twistors axially in the proper line relative to the course of the roving and to deliver the latter directly to the nipping action of and between the drawing-rolls.

It will be perceived that the individual twister-heads may be separately and independently removed from the supports therefor just described.

The vibrator 24 is as shown in the form of a light longitudinally-ranging frame located along each side of the machine between the delivery-rolls and the twistors, the same comprising upper and lower members or rods 128, and this vibrator has the motion imparted thereto by the connection with the lever-arm 129 thereof of the connecting-rods 130, operated by the eccentrics 132, Fig. 3, on the shaft 133, having, by belt 135 and pulley 136, (shown in Fig. 4,) a connection whereby it is driven from the spindle-driving drum N. The said vibrator has its movements between limits more or less as indicated by dotted lines in Fig. 7, whereby it exerts a beating action against the delivered roving. This device, however, is not herein claimed.

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

1. In a spinning-machine, a let-off cylinder

for the roving, a driving-wheel and connections between said driving-wheel and the cylinder and a shiftable engaging and disengaging driver for said driving-wheel, a constantly-running wheel W, movable devices for shifting said driver to and from its driving connection with said driving-wheel, means on said constantly-running wheel for successively and reversely actuating the devices which shift the driver, said connections between the cylinder-driving wheel and the cylinder being changeable for varying the driving speed of the cylinder, rotatable drawing-rolls and rotatable twistors, means for rotating the twistors and means for variably rotating the drawing-rolls, substantially as and for the purposes set forth.

2. In a spinning-machine adapted to receive a roving roll or spool, a mechanism for causing intermittently the let-off of the rovings from said spool, which mechanism is changeable to cause, during the period of let-off a faster or slower speed of let-off and consequently a delivery of a greater or less quantity of the roving as required, combined with drawing-rolls and twistors and means for continuously speeding the twistors and means for variably speeding the drawing-rolls, substantially as described.

3. In a spinning-machine, adapted to receive a roving spool or roll, a let-off cylinder for the roving, and a driving mechanism for said cylinder comprising a constantly-running driver as the belt *b'* and an intermittently-rotating part as the wheel *b⁵*, and means for causing the latter to be periodically driven by said constantly-running driver, and a speed-varying medium of connection between the intermittently-running wheel and the cylinder to cause during the time of rotation of the intermittently-running wheel the faster or slower rotation of the cylinder to deliver in such time a correspondingly greater or less quantity of roving, combined with drawing-rolls and twistors, and means for variably rotating the drawing-rolls continuously but relatively faster during each let-off period than after each let-off and means for continuously rotating the twistors, for the purposes set forth.

4. In a spinning-machine, a let-off cylinder for the roving, and means for intermittently and variably actuating said let-off cylinder, consisting of a constantly-running driver and a rotary wheel or part adapted to be intermittently driven by said driver, mechanism of driving connection between such intermittently-driven wheel and the cylinder comprising means for rotating the cylinder for any required intervals, and also speed-varying connections for causing, during the period the cylinder is being rotated, correspondingly-varied extents of rotation, rotatable draw-rolls, and rotatable twistors and means for causing such relative speeds of rotation thereof that, during the let-off, the drawing-rolls have a greater speed relative to the

speed of the twist-ers, and after the let-off, a slower speed relative to the speed of the twist-ers, and supplemental rotary twisting-heads located between the let-off cylinder and the aforesaid twister-heads, and means for rotating the supplemental heads, substantially as and for the purposes set forth.

5. The combination with the let-off cylinder for controlling the delivery of the roving and delivery-rolls having driving connection therewith whereby the cylinder and said rolls are rotated in unison, of a constantly-driven rotatable part and means for constantly rotating it, and another part adapted to be intermittently rotated, and having a speed-changing driving connection with said connected cylinder and delivery-rolls, whereby during the time said part which is adapted to be intermittently rotated has its movement, the extent of rotation of said let-off cylinder and delivery-rolls and roving delivery may be quantitatively regulated, and a shiftable connection for intermittently driving, from said constantly-driven part, said second-named rotatable part, and mechanism for periodically and alternately moving said shiftable connection in opposite directions for intermittently actuating the let-off cylinder and delivery-rolls and then leaving same at rest, substantially as described.

6. In a spinning-machine of the character described, the combination with the let-off cylinder for controlling the delivery of the roving and delivery-rolls having driving connection therewith whereby the cylinder and said rolls are rotated in unison, of a constantly-driven rotatable part, and means for rotating it, and another part adapted to be intermittently rotated, a speed-changing medium of transmission between the intermittently-rotating part and said delivery-rolls for regulating the speed of rotation of said let-off cylinder and delivery-rolls and of the roving-delivery, and a shiftable connection for driving from said constantly-driven part, said second-named rotatable part, and mechanism for periodically and alternately moving said shiftable connection in opposite directions for intermittently actuating the let-off cylinder and delivery-rolls and then leaving same at rest, having regulating devices for varying the times of said shifting movements and means for driving same, constantly-running drawing-rolls and means for driving same at variable speed, substantially as and for the purposes set forth.

7. The combination with the let-off cylinder for controlling the delivery of the roving and delivery-rolls having driving connection therewith whereby the cylinder and said rolls are rotated in unison, of a constantly-driven rotatable part, and another part and means for rotating it adapted to be intermittently rotated and having driving connection with said connected cylinder and delivery-rolls, a shiftable connection for driving from said constantly-driven part, said second-named rotatable part, and mechanism for periodically

and alternately moving said shiftable connection in opposite directions for intermittently actuating the let-off cylinder and delivery-rolls and then leaving the same at rest, drawing mechanism and twisting mechanism, means for constantly and uniformly rotating the twister mechanism, and driving connection between the intermittently-operating driving mechanism for the roving let-off, and said drawing mechanism, whereby the latter is driven thereby, at the time of let-off, and other mechanism having a variable driving speed and also in driving connection with the drawing mechanism, whereby, after each let-off, said last-named mechanism drives the drawing mechanism less fast than its driving during the let-off, substantially as described.

8. The combination with the let-off cylinder for controlling the delivery of the roving and delivery-rolls having driving connection therewith whereby the cylinder and said rolls are rotated in unison, of a constantly-driven rotatable part, and means for constantly rotating it, and another part adapted to be intermittently rotated and having a speed-changing driving connection with said connected cylinder and delivery-rolls, and a shiftable connection for driving from said constantly-driven part, said second-named rotatable part, and mechanism for periodically and alternately moving said shiftable connection in opposite directions for intermittently actuating the let-off cylinder and delivery-rolls and then leaving same at rest, drawing mechanism and twisting mechanism, means for constantly and uniformly rotating the twister mechanism, a driving connection between the intermittently-operating driving mechanism for the roving let-off, and said drawing mechanism, whereby the latter is driven thereby, at the time of let-off, and other mechanism having a variable driving speed and also in driving connection with the drawing mechanism, whereby, after each let-off, said last-named mechanism drives the drawing mechanism less fast than its driving during the let-off, substantially as described.

9. In a spinning-machine, the combination with intermittently-operating roving-delivery mechanism and means for imparting thereto its intermittent motions, continuously-rotating twist-ers and means for removing them, and continuously-rotating drawing mechanism, of a driving connection between the intermittently-operating delivery mechanism and the drawing mechanism for driving the latter during the delivery operations, and an independent driving mechanism, for driving the drawing-rolls slower in the periods between successive let-offs than during the let-offs, substantially as and for the purpose set forth.

10. In a spinning-machine, the combination with let-off controlling and delivery mechanism for the roving, of intermittent driving mechanism therefor comprising a shaft in driving connection with said let-off and de-

livery mechanism, a rotary part to be intermittently driven having driving connection with said shaft, a shiftable driver for said intermittently-rotatable part and means for driving it, and a shifter for said driver, a constantly-rotating wheel W having at separated points thereon abutment members, means for constantly driving said wheel W, the lever P connected with said shifter against which one of said abutments acts, a latch or detent for detaining said lever and the connected shifter in one of its shifted positions, having a position to be engaged and released by the other abutment on said wheel W, and a break device operating to engage and disengage said intermittently-rotated part in conjunction with the reversing movements of said shifter, substantially as described.

11. In a spinning-machine, the combination with let-off controlling and delivery mechanism for the roving, of intermittent driving mechanism therefor comprising a shaft *c* in driving connection with said let-off and delivery mechanism, a rotary part having driving connection with said shaft, a shiftable driver for said intermittently-rotatable part, and a shifter therefor, and means for running said driver, a constantly-rotating wheel W having at separated points thereon, abutment members, which are adjustable so as to be much or little in advance one of the other, as required, and means for constantly rotating said wheel W, the lever P connected with said shifter against which one of said abutments acts, a latch or detent for detaining said lever and the connected shifter in one of its shifted positions, having a position to be engaged and released by the other abutment on said wheel W, substantially as described.

12. In a spinning-machine, the combination with let-off controlling and delivery mechanism for the roving, of intermittent driving mechanism therefor comprising a shaft *c*, and adjustable and interchangeable gearing between it and said let-off and delivery mechanism, a rotary part having driving connection with said shaft, a shiftable driver for said intermittently-rotatable part, and a shifter therefor, means for constantly running said driver, a constantly-rotating wheel W having at separated points thereon, abutment members, and means for constantly rotating said wheel, the lever P connected with said shifter against which one of said abutments acts, a latch or detent for detaining said lever and the connected shifter in one of its shifted positions, and having a position to be engaged and released by the other abutment on said wheel W, substantially as described.

13. In a spinning-machine, the combination with the let-off controlling-cylinder and delivery-rolls having connection therewith, whereby both are moved in unison, of the shaft *c* connected to drive said delivery-rolls and cylinder and having thereon fixed and loose pulleys, a belt shiftable to run on either

said pulley and a belt-shifter, means for constantly-driving said belt, the wheel W having a continuous rotation and provided with the projection 53 and the projection *g*, and means for constantly running said wheel W, the lever P connected with the shifter, and the latch *a*, said lever being adapted to be swung to shift in one direction, by one of said projections, whereupon it is engaged and temporarily held by the latch, and the latch having a location whereby it is engaged subsequently in each rotation of said wheel W, by its other projection, and released to permit the lever to be returned to its original position, and retracting means for returning said lever and shifter, substantially as described.

14. In a spinning-machine, the combination with the let-off controlling-cylinder 20 and the shaft *c*⁵, delivery-rolls connected to have their movements in unison with the movements of said cylinder, said delivery-rolls being intermittently driven by said shaft *c*⁵, the latter having thereon the gear-wheel *c*⁴, an adjustable journal-sleeve *c*² having supported therein the shaft *c* provided with the interchangeable gear *c*³ and having thereon fixed and loose pulleys *b*⁵ *b*⁶, the driving-belt and a shifter therefor whereby it is run on either of said pulleys, and means for alternately operating said shifter and intermittently causing the rotations of said connected shafts *c* and *c*⁵, and of the cylinder and delivery-rolls, for the purposes set forth.

15. In a spinning-machine, in let-off delivery mechanism therefor, the combination with cylinder 20 and delivery-rolls and shaft *c* having driving connection with said delivery-rolls and cylinder, and provided with the fixed and loose pulleys, of the belt-shifter *g*⁵ and a reciprocating support therefor, lever P, and lever *g*² connected to the belt-shifter support, the rod *g*¹ connecting said lever P and lever *g*², the latch *a*, and the constantly-rotating wheel W having at different points around same, the abutments *g* and 53, substantially as and for the purposes set forth.

16. In a spinning-machine, the combination with a let-off cylinder and delivery-rolls, and means for intermittently operating them, of drawing-rolls, one series thereof mounted on a common shaft provided with a sprocket-wheel, a sprocket-wheel loosely mounted on the common shaft for one series of the delivery-rolls, and having thereon a pawl, a ratchet-wheel fixed on said delivery-roll shaft in which said pawl engages, the sprocket-chain connecting said sprocket-wheels, all whereby the drawing-rolls are positively intermittently driven, concurrently with the rotations of the roving-delivery mechanism, and mechanism also having driving connection with the said drawing-rolls, whereby the latter are driven after the let-off at a different speed, substantially as described.

17. In a spinning-machine, the combination with let-off controlling and delivery mechanism for the roving and means for intermit-

tently operating it, continuously-running
twisters and means for continuously driving
them, continuously-running drawing-rolls
and means for continuously driving them,
5 driving connections between the delivery
mechanism and the drawing-rolls whereby
part of the time, the latter are driven by and
in unison with said delivery mechanism, of
a shaft also in driving connection with said
10 drawing-rolls, and means for constantly driv-
ing it, but at a diminishing speed at the in-
termediate periods between the operations
of the delivery mechanism, substantially as
and for the purposes set forth.

15 18. In a spinning-machine, the combination
with let-off controlling and delivery mech-
anism for the roving and means for intermit-
tently operating it, continuously-running
twisters and means for continuously driving
20 them, continuously-running drawing-rolls,
and means for continuously driving them,
driving connections between the delivery
mechanism and the drawing-rolls whereby
part of the time the latter are driven by and
25 in unison with said delivery mechanism, of a
shaft also in driving connection with said
drawing-rolls, having a fixed ratchet-wheel
thereon and having a sleeve loose thereon
carrying a pawl, and means for imparting va-
30 riable-speed rotations to said sleeve whereby
it, through the pawl-and-ratchet device, vari-
ably rotates the sleeve-supporting shaft, sub-
stantially as and for the purpose set forth.

19. In a spinning-machine, the combination
35 with the delivery-rolls, the common shaft of
one series thereof being provided with the
fixed ratchet-wheel and a loose wheel carry-
ing a pawl in engagement with said ratchet-
wheel, of the drawing-rolls, the common shaft
40 of one series thereof having a fixed wheel
thereon and a driving connection between
the latter and said loose wheel carrying the
pawl, a shaft *e* in driving connection with
said drawing-rolls having thereon the fixed
45 ratchet-wheel *e*³ and a sleeve *e*² carrying the
pawl *e*⁶, and means for imparting a rotary
motion to said sleeve with a variable speed,
substantially as described.

20. In a spinning-machine, the combination
50 with delivery-rolls and intermittently-operat-
ing driving mechanism therefor, and draw-
ing-rolls having driving connection with said
delivery-rolls to be intermittently driven
therefrom, of a shaft in driving connection
55 with said drawing-rolls, having thereon a

loose drum adapted by a provided pawl and
ratchet-wheel for an engagement with said
shaft when rotated in one direction, the drum
being permitted to reversely rotate independ-
ently of the shaft, a scroll-pulley having by a 60
cord a winding and unwinding connection
with said drum, a weighted cord having a
winding and unwinding engagement with the
drum, an adjustable stop for variably limit-
ing or arresting the descent of the weight, a 65
pulley or wheel and a shiftable driving con-
nection therefor whereby the same is inter-
mittently rotated, and driving connections be-
tween said wheel and said scroll-pulley, sub-
stantially as and for the purpose set forth. 70

21. In a spinning-machine, the combination
with the delivery-roll shaft *e*⁶ and shaft *e* in
driving connection therewith, having thereon
loose and fixed pulley-wheels *b*⁵ *b*⁶ and the
constantly-running belt and means for driv- 75
ing it, and an automatically-operating belt-
shifter and means for operating it, of the
scroll-pulley 92 and its shaft 90 having the
gear-wheel 89, the wheel 87 and gear-wheel 88
therewith connected, meshing into said gear 80
89, a wheel 85 mounted on the hub of said
loose pulley *b*⁵, a driving connection between
said wheels 85 and 87, the drawing-roll shaft
C', the shaft *e* having driving connection there-
with, and having thereon the fixed ratchet- 85
wheel *e*³ and loose drum *e*² having the pawl *e*⁶,
the cord 93 having winding and unwinding
engagements around the said scroll-pulley
and drum, and the weighted cord *K*, all sub-
stantially as and for the purposes set forth. 90

22. In a spinning-machine, in combination,
intermittently and successively operating let-
off mechanism for controlling the delivery of
the rovings, drawing-rolls having continuous
rotary motion to which the rovings are run 95
from the delivery mechanism, means for driv-
ing said drawing-rolls faster during the let-
off than in the period thereafter, and twisters
separate from, but adjacent the drawing-rolls,
and intervening between the latter and a de- 100
livery mechanism, to the twisting action of
which the rovings are subjected previous to
passing between the drawing-rolls, and means
for rotating the twisters, substantially as de-
scribed.

EDMUND K. BAKER.

Witnesses:

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