(No Model.) 3 Sheets—Sheet 1.

C. WHITAKER.

FLY FRAME.

No. 554,407. Patented Feb. 11, 1896.

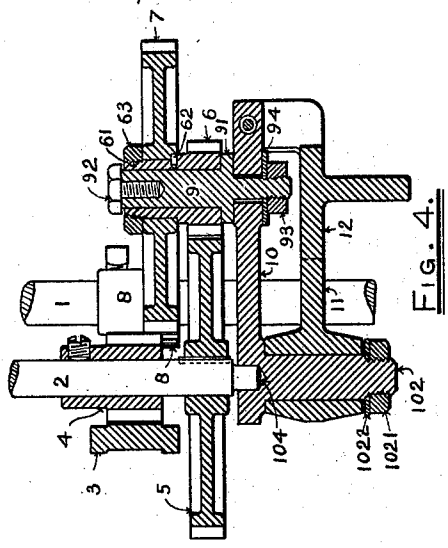


FIG. 4.

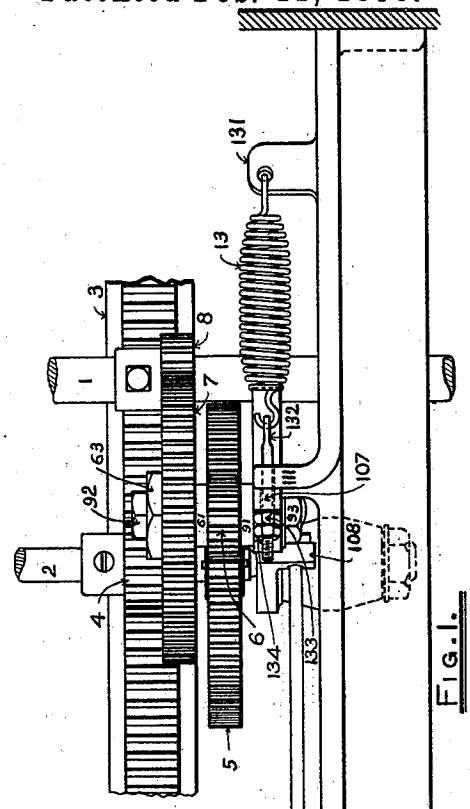


FIG. 1.

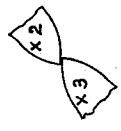


FIG. 7

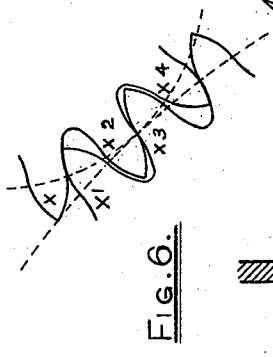
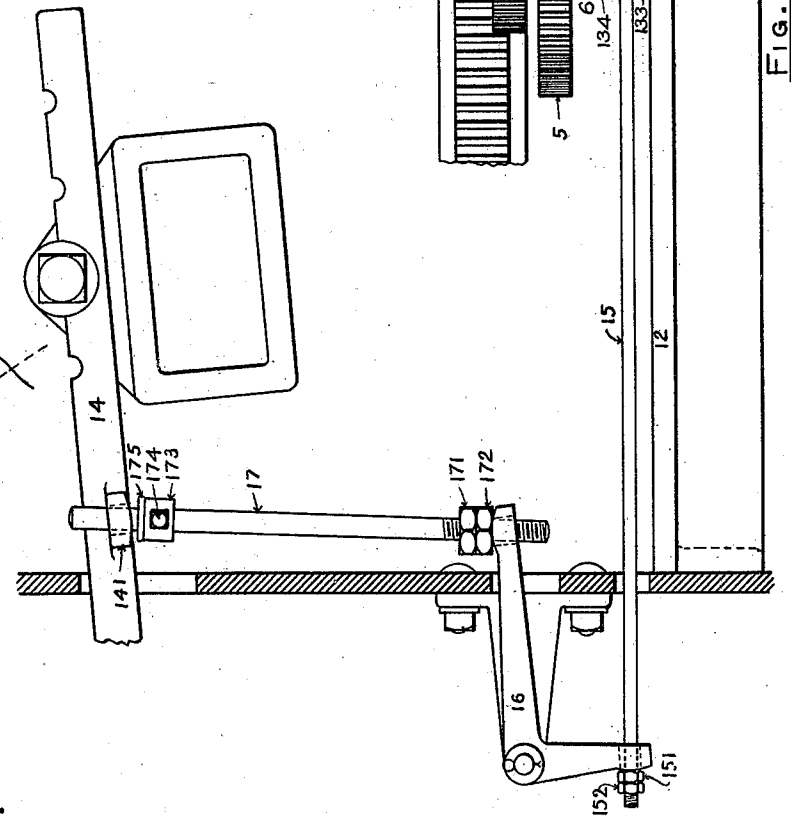


FIG. 6.



WITNESSES.

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(No Model.) 3 Sheets—Sheet 2.

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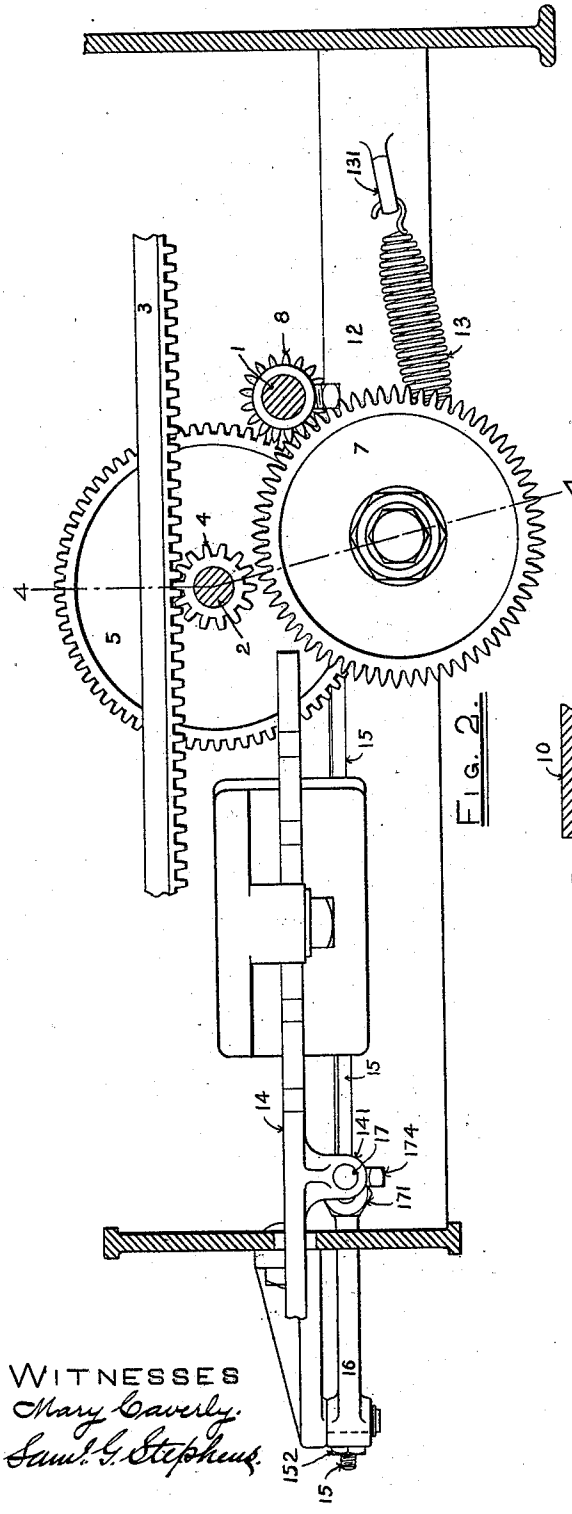

FIG. 2.

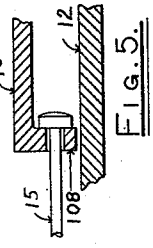

FIG. 5.

FIG. 3.

WITNESSES

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(No Model.) 3 Sheets—Sheet 3.

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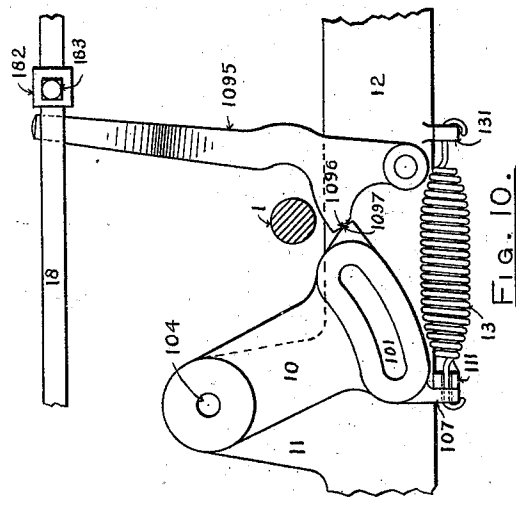

FIG. 10.

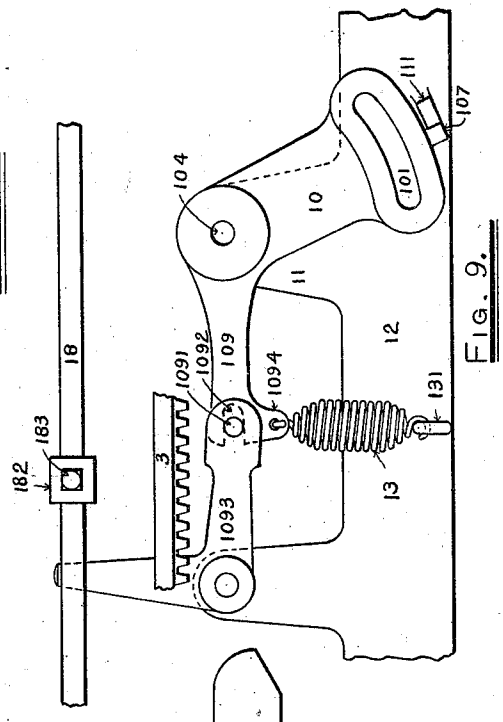

FIG. 9.

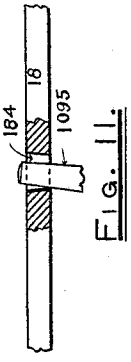

FIG. 11.

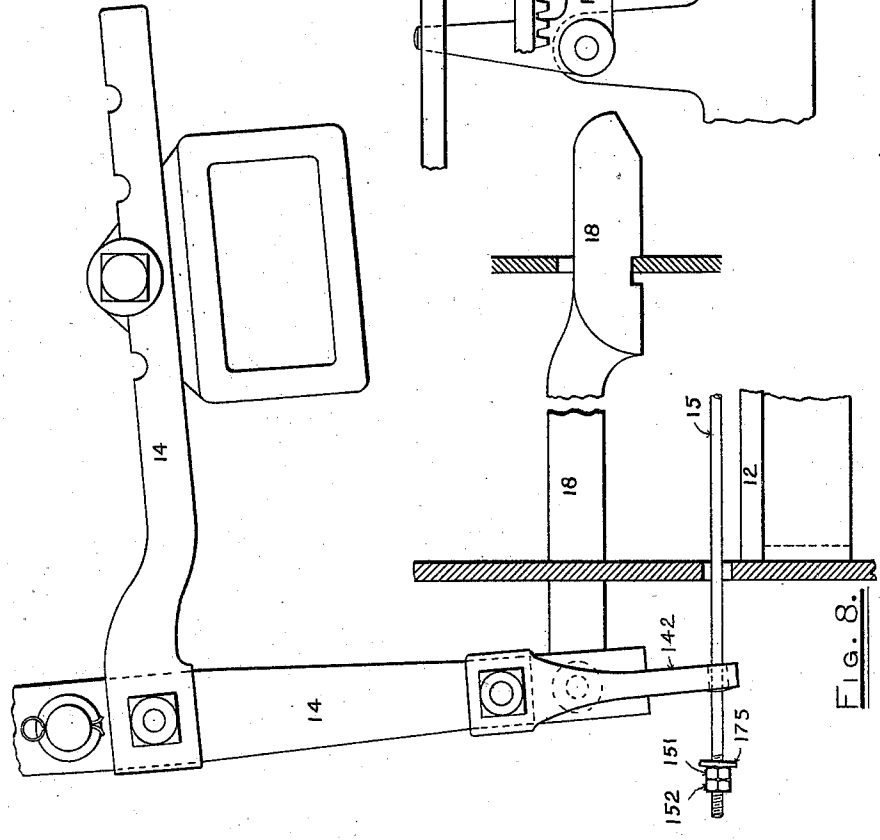

FIG. 8.

WITNESSES.

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UNITED STATES PATENT OFFICE.

CHANNING WHITAKER, OF TYNGSBOROUGH, ASSIGNOR TO THE LOWELL MACHINE SHOP, OF LOWELL, MASSACHUSETTS.

FLY-FRAME.

SPECIFICATION forming part of Letters Patent No. 554,407, dated February 11, 1896.

Application filed October 10, 1893. Serial No. 487,768. (No model.)

To all whom it may concern:

Be it known that I, CHANNING WHITAKER, a citizen of the United States, residing at Tyngsborough, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Fly-Frames, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to spinning-machines of the class known as "fly-frames," and in particular it relates to the devices which are known as "tension motions" and are employed in fly-frames for the purpose of communicating movement to the cone-rack and its connected belt-guide in order to shift the cone-belt along the cone-pulleys, as is required during the filling of the bobbins. Various arrangements of transmitting-gearing and connections have been devised for the purpose heretofore, but the greater part of those with which I have become acquainted have included an unnecessarily large number of parts, and also have contained so large a number of gears, with a correspondingly great number of gear-contacts, that considerable play or lost motion has been found to occur, with its accompanying drawbacks and disadvantages. In practice the said devices commonly are so contrived and connected that whenever the automatic shipping devices of a machine in operation are actuated to effect the transfer of the driving-belt of the machine from the fast pulley upon the driving-shaft onto the loose pulley upon the said shaft, for the purpose of stopping the machine, a break or disconnection shall be occasioned in the rack-actuating train, all as will be understood by those skilled in the art, and for well-known purposes. United States Letters Patent No. 484,776, granted October 25, 1892, may be referred to as showing and describing certain forms and arrangements of the devices and connections in question.

The present invention is intended as an improvement upon the prior forms of the said devices known to me, and the objects thereof are to provide for the actuation of the cone-rack through the simplest possible train of transmitting-gearing; also to provide for convenient and ready change in the said gearing, such as will enable the rate of advance of the cone-rack to be varied as required; to provide in a convenient manner for occasioning a break or disconnection in the said gearing through the action of the stop-motion devices; to provide for ready re-engagement of the gearing after a break or disconnection, and to guard against an unintentional or undesired change in the relative position of one gear with respect to its mate through the space occupied by one or more teeth occurring in consequence of the break or disconnection and of the recoil in the gearing, which then takes place.

In the accompanying drawings, Figure 1 is a view in rear side elevation showing part of a fly-frame having my present invention applied thereto, part of the machine-framing being in vertical section. Fig. 2 is a view showing in plan the parts which are represented in Fig. 1, with part of the machine-framing in horizontal section. Fig. 3 is a view in plan showing part of the machine-framing and the swinging arm or gear-carrier hereinafter described. Fig. 4 is a view in vertical section on line 4 4 of Fig. 2. Fig. 5 is a view in vertical section on line 5 5 of Fig. 3. Figs. 6 and 7 are views illustrating the form of gear-teeth that is hereinafter described. Figs. 8, 9, 10, and 11 are views illustrating certain modifications that are described hereinafter.

In the drawings, 1 is the tumbling-shaft of a fly-frame, the same being intermittingly operated as heretofore and as set forth in the patent aforesaid.

3 is the cone-rack.

4 is a pinion in engagement with the teeth of the cone-rack 3.

5 is a gear connected to turn with the pinion 4.

6 is a carrier-pinion meshing with the gear 5.

7 is a carrier-gear above the carrier-pinion 6 and connected with the latter so as to turn in unison therewith, and 8 is a driving-pinion fast on the tumbling-shaft and meshing with the carrier-gear 7.

The pinion 4 and gear 5 are both fixed upon the short shaft 2, which at its lower end is stepped in the bearing 104, formed in the swinging arm 10 concentric with the axis on which the said arm turns. Through the de-

scribed gearing, which, as shown, is made up of spur-gears and pinions and which it is preferred should be constituted and arranged substantially as shown, motion is transmitted automatically and intermittingly from the tumbling-shaft 1 to the cone-rack 3 during the regular working of the fly-frame, and thereby the cone-rack is gradually moved endwise to shift the cone-belt upon the cone-pulleys, as will be understood. Obviously a greater number of spur-gears and pinions may be employed in the transmitting-train, if desired, although I prefer the simplified train shown in the drawings.

The carrier-gear 7 is a change-gear, and one size of such gear may be substituted for another, as may be required, in order to transmit motion at the desired rate of speed from the tumbling-shaft 1 to the cone-rack 3.

For the purpose of enabling the carrier-gear 7 to be removably connected with the carrier-pinion 6 any suitable known form of connections may be used. I have shown (see Fig. 4) the hub 61 of the carrier-pinion 6 extended for the reception thereon of the carrier-gear 7, and provided with a pin 62, which compels the carrier-pinion and carrier-gear to turn in unison, the carrier-gear being kept on the said hub by a nut 63, which is turned onto the threaded upper end of the hub. The connected carrier-pinion and carrier-gear turn upon a stud 9, provided with a flange 91, on which the lower side of the carrier-pinion rests, and they are held from rising on the said stud 9 by means of a screw 92, the threaded stem of the said screw entering a threaded hole in the end of the stud 9 and the edge of the flat head of the screw overlying the upper end of the hub of the carrier-pinion 6.

The stud 9 is mounted on the swinging arm 10, which is arranged to swing concentrically with the gear 5 and pinion 4 in order to enable gear 7 to be moved out of engagement with pinion 8 and afterward to be restored to engagement therewith. The said arm has a curved slot 101, (see Fig. 3,) which is made so as to be concentric with the axis on which the arm swings, and in the slot 101 is placed the lower end of stud 9 at the point required to suit the diameter of the carrier-gear 7 in use, the stud being secured in place by the nut 93, placed on the threaded end of the stud below the arm 10, a washer 94 being slipped on the stud between the nut and the under side of the arm 10. Preferably the arm 10 is provided with a journal 102, that is fitted to a bearing in a bracket 11, formed or provided on the cross-piece 12, forming part of the framework of the fly-frame, the said journal receiving on its lower threaded end, which extends through said bearing, a nut 1021 and washer 1022.

The illustrated combination and arrangement of gearing is very simple. All the gears are spur-gears. There are but three points therein at which the teeth of the rack and of the different gears intermesh with each other. The change-gear is the gear in contact with the pinion on the tumbling-shaft. A difference of one tooth in a change-gear located at this point obviously will have less effect upon the movement communicated to the cone-rack than the like difference in a change-gear located at some point nearer the cone-rack. From this it follows that a finer adjustment may be secured through my devices than has been secured by the devices with which I previously have been acquainted. It follows, also, that if a tooth or teeth should be lost through recoil of the parts occurring at the time of the disengagement of the carrier-gear 7 from the driving-pinion 8 the effect will be minimized so far as concerns the extent to which the cone-rack is thereby altered in its position.

By preference I make the teeth of the carrier-gear 7 and the driving-pinion 8 sharp or pointed and of greater length than usual, as is shown in Figs. 2, 6, and 7. This form of the said teeth facilitates re-engagement of the teeth of the carrier-gear 7 with those of the driving-pinion 8 after a disconnection or disengagement, as will be apparent, inasmuch as it is practically impossible for the outer portions of the sharp or pointed teeth on one wheel so to strike against the corresponding portions of the teeth on the other wheel as to prevent the said teeth from entering at once into proper mesh when the carrier-gear 7 is moved toward the driving-pinion 8. Heretofore when gearing having teeth of ordinary character has been employed it has been deemed advisable, in view of the danger of the ends of the teeth of one wheel coming in collision with the ends of the teeth of the opposing wheel during the movement of the gear carrier or support which is made for the purpose of re-engaging the separated gears, to make provision for enabling the devices by which the gear carrier or support is moved to yield, in order to guard against breakage in the event of the occurrence of the collision just mentioned. Inasmuch as the sharp or pointed form which I prefer to give to the teeth of the wheels 7 and 8 renders it practically impossible for the outer portions of the said teeth to strike together in such manner as to prevent the teeth of carrier-gear 7 from entering at once into mesh with the teeth of the driving-pinion 8, the need for guarding against breakage of parts such as would result from the collision above referred to is very much lessened thereby. In fact, I contemplate, in some cases when the said form of teeth is employed, dispensing altogether with provisions such as aforesaid. The sharp or pointed form of teeth provides against loss of a tooth due to slight recoil or displacement of the transmitting-gearing occurring in consequence of the break or disconnection, for even if the movement due to the recoil of the carrier-gear 7 or otherwise occurring during the disconnection should be such as to carry a given tooth x^3 thereof from the position rela-

tive to adjacent teeth x^2 x^4 of the driving-pinion 8 (shown in Fig. 6) to a position which will cause the teeth x^2 x^3 to come together in the position shown in Fig. 7 when the re-engagement is occasioned the inclined sides of the teeth x^2 x^3 will slide upon each other as the movement of gear 7 toward pinion 8 continues, causing a slight rotation of carrier-gear 7 on its axis, and thus the teeth x x' x^2 x^3 x^4 will be caused to resume their original position, as in Fig. 6.

Of course, if the recoil of carrier-gear 7 is sufficient in extent to carry the point of the tooth x^3 of gear 7 to the opposite side of the point of the tooth x^2 of pinion 8, there then will be a loss of a tooth. The pointed form of the teeth permits the recoil to begin gradually as the teeth of gear 7 are drawn away from those of pinion 8, and causes a control to be exercised over the same until the separation is complete, thereby lessening the extent of the recoil.

The swinging arm or gear-carrier 10 constitutes a movable support or shifter for the movable part of the gearing intermediate the tumbling-shaft and the cone-rack. In accordance with one part of my invention the said swinging arm or gear-carrier 10 is held normally in the position which it occupies while the teeth of the gear 7 are in mesh with those of the driving-pinion 8 on the tumbling shaft 1 by the action of a spring 13, one end of which is connected to a lug 131 on the cross-piece 12 of the machine-framing, the other end thereof being connected with the screw-eye 132, the stem of which passes through the projection 107 of arm 10 and receives thereon the adjusting and lock nuts 133 134. The said spring acts upon the said swinging arm or gear-carrier with a tendency to carry the gear 7 toward the driving-pinion 8, the limit of the movement of the arm under the action of the spring being determined by a stop 111, formed on or applied to the cross-piece 12, the said stop being engaged by some part on or moving with the arm or carrier 10—such, for instance, as lug 107 on said arm or carrier—the stop arresting the movement of the arm 10 as soon as the pitch circles of the gear 7 and driving-pinion 8 have come into proper relations to each other, at which time the arm or shifter is in its normal operative position. In order to carry automatically the gear 7 away from the driving-pinion 8, when the stop-motion devices are permitted or caused to act to ship the driving-belt, I combine with the shifter, constituted by the swinging arm or gear-carrier 10, and also with the stop-motion lever 14 or some other suitable part of the automatic stop-motion devices of the machine, intermediate connections, whereby the swinging arm or gear-carrier 10 is automatically turned on its pivot or journal in consequence of the movement of the lever 14, or other part of the automatic stop-motion devices, at the time of the stopping of the machine. In the arrangement which is shown in Figs. 1, 2, 3, and 5 of the drawings the lever 14 and swinging arm or gear-carrier 10 are combined by means of a rod 15, which is moved through operative connections with the lever 14, the said rod having such engagement with the arm or gear-carrier 10 that when thus moved from and by the lever 14, at the time of the stopping of the machine, the swinging arm or gear-carrier 10 is so moved as to withdraw the teeth of the gear 7 from their engagement with the teeth of the driving-pinion 8 on the tumbling-shaft 1. The rod 15 is shown connected with the stop-motion lever 14 by the bell-crank 16 and rod 17. The vertical arm of the bell-crank has a hole therein through which passes one end of rod 15, nuts 151 152 being turned on the threaded end of rod 15 outside the said arm. The horizontal arm of the bell-crank has a hole therein through which passes the lower end of rod 17, the said end being threaded and having turned thereon the nuts 171 172, the latter of which rests on the upper surface of the said arm.

The upper end of rod 17 passes through a lug 141 on the lever 14, and has thereon below the said lug a collar 173, which is held at the desired height on the rod by a clamping-screw 174. The rod 15 is shown connected with the shifter or gear-carrier arm 10 by having its inner end passed through a hole in a lug 108 on the said arm, the said end of the rod having a head which engages with the said lug when the rod is moved toward the left in Figs. 1, 2, and 3, as shown most clearly in Fig. 5. The nuts 151 152 171 172 provide for adjustment if such be desired, or may be replaced by non-adjustable collars.

The parts are so proportioned and arranged that the spring 13 will be enabled to draw the arm or gear-carrier 10 completely into contact with stop 111. To insure this there preferably will be provided an opportunity for lost motion at some point between lever 14 and arm 10, such as will be sufficient in amount to afford freedom for the parts to move under the action of spring 13 until the arm 10 has been carried into contact with the stop 111. A convenient means of providing for this lost motion is by making suitable adjustment of collar 173 on the rod 17. In practice this collar will be set, as shown in Fig. 1, so that part of the downward movement of lever 14 will be permitted to occur before any movement is communicated to rod 17, bell-crank 16, and rod 15. The strength of spring 13 is sufficiently great to enable it to hold arm 10 normally in contact with stop 111, but when the lever 14 is permitted to turn the effect of the weight with which it is loaded, as shown, is sufficient to overcome the spring 13 and to swing the arm 10 after the lug 141 on the lever has come into contact with the rawhide washer 175 resting on top of the collar 173. After the rod 15 and connected parts have been relieved from the action of the lever 14 through the lifting

of the latter, the spring 13 returns the arm 10 to its normal position in contact with stop 111 and replaces rod 15, bell-crank 16, and rod 17 in their former positions. A simplified arrangement is shown in Fig. 8, in which the lever 14 is shown provided with a downwardly-extending arm 142, the said arm having a hole therein through which is passed the outer end of rod 15. The nuts 151 152 and the rawhide washer 175 on the said end of rod 15 are so set that the greater part of the movement of the lever 14 will be permitted to occur before the arm 142 comes in contact with the washer 175, but after the said arm engages with the said washer the action will be to move arm 10 and disengage or disconnect the gearing, as in the modification first described.

In Fig. 8 the usual holding latch for the stop-motion lever 14 is shown at 18.

Figs. 9, 10, and 11 show modifications in which the movable arm or gear-carrier is operated from the said latch 18, the idea being to utilize the endwise movement of the said latch which occurs after it has been disengaged from its hold on the machine-framing. In Fig. 9 the said arm or gear-carrier 10 is shown provided with an arm 109, which is formed with a slot 1092, that is entered by a pin, 1091, carried by one arm of a bell-crank 1093. The other arm of this bell-crank projects into the path of movement of a projection mounted on latch 18, this projection being constituted by or carried by a collar 182, that is secured on the said latch by a clamping-screw 183 with capacity for adjustment longitudinally of the latch. The space shown in Fig. 9 between the collar and the adjacent arm of the bell-crank provides for the lost motion aforesaid. In Fig. 9 one end of the spring 13 is connected to an ear 1094 on the arm 109 of the gear-carrier 10.

Fig. 10 shows a modification in which a lever 1095 is arranged to contact with a part of the movable arm or gear-carrier 10 and has its free end bent upward and disposed in position to be struck by the collar 182 on the latch 18 or a projection on said collar, similarly to the bell-crank 1093 in the modification shown in Fig. 9. The said lever 1095 is provided with a cam portion 1096, which takes bearing on the portion 1097 of the movable arm or gear-carrier 10. The same provision for lost motion is made in this modification as in that of Fig. 9.

Fig. 11 shows how a slot 184 may be provided in the latch 18, and may have placed within the same the end of the lever which actuates the movable arm or gear-carrier 10. The length and position of the slot are such as to permit lost motion, such as has been described.

It is to be understood that, although I consider it preferable and most convenient to make provision, as above indicated, for lost motion between the movable arm or gear carrier 10 and the movable member of the stop-motion devices, which serve for its actuation, I do not regard it as being without the scope of certain portions of my invention to so connect and construct the parts that such lost motion shall not occur. In this case the connections will be so disposed and arranged as not to operate to prevent the arm or gear-carrier from being drawn fully into contact with its stop by the action of the spring 13.

I claim as my invention—

1. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, carrier or transmitting spur-gearing between the latter pinion and the said driven gear, a movable support on which the carrier or transmitting spur-gearing is mounted to turn, and a movable member of the stop-motion devices having operative connection with the said support, whereby to move the same and occasion a disconnection of the gearing, substantially as described.

2. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, carrier or transmitting spur-gearing between the latter pinion and the said driven gear, a movable support on which the carrier or transmitting spur-gearing is mounted to turn, and a movable member of the stop-motion devices having operative connection with the said movable support, whereby to move the same and thereby break the engagement between the first of the carrier or transmitting gears and the driving-pinion on the tumbling-shaft, substantially as described.

3. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, a spur-gear and spur-pinion connected to turn together and meshing with the said driving-pinion and driven gear, respectively, a movable gear-carrier or supporting-arm on which said connected gear and pinion are mounted, and a movable member of the stop-motion devices having operative connection with the said gear-carrier or supporting-arm whereby to move the same and disconnect the gearing, substantially as described.

4. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, a spur-gear and spur-pinion connected to turn together and meshing with the said driving-pinion and driven gear, respectively, a gear-carrier or supporting-arm movable toward and from the tumbling-shaft and on which said connected gear and pinion are mounted, and a movable member of the stop-motion devices having operative connection with said gear-carrier or supporting-arm, whereby to move the same and thereby break the engagement between its spur-gear and the driving-

pinion on the tumbling-shaft, substantially as described.

5. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, carrier or transmitting spur-gearing between the latter pinion and the said driven gear and embracing a change-gear engaged by the said driving-pinion, a gear-carrier or supporting-arm, and a movable member of the stop-motion devices having operative connection with said gear-carrier or supporting-arm, whereby to move the same and thereby break the engagement between the said change-gear and the driving-pinion on the tumbling-shaft, substantially as described.

6. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, a change-gear in mesh with the said driving-pinion, a pinion turning in unison with the change-gear and in mesh with the said driven gear, a movable gear-carrier or supporting-arm on which said change-gear and connected pinion are mounted, and a movable member of the stop-motion devices having operative connection with the said gear-carrier or supporting-arm whereby to move the same and thereby break the engagement between the said change-gear and the driving-pinion on the tumbling-shaft, substantially as described.

7. The combination with the cone-rack, the tumbling-shaft, gearing intermediate the said tumbling-shaft and the cone-rack, the same being capable of disconnection to make a break between the cone-rack and the tumbling-shaft, a shifter for the movable part of the said gearing, and a spring operating to maintain the shifter normally in position to hold the gearing in operative connection, of a movable member of the stop-motion devices, and operative connections between the said member and the said shifter whereby to move the shifter in opposition to the action of the said spring and thereby effect the disconnection, substantially as described.

8. The combination with the cone-rack, the tumbling-shaft, gearing intermediate the said tumbling-shaft and the cone-rack, the same being capable of disconnection to make a break between the cone-rack and the tumbling-shaft, a shifter for the movable part of the said gearing, a fixed stop to determine the normal operative position of the shifter, and a spring operating to press the shifter toward the said fixed stop, of a movable member of the stop-motion devices, and operative connections between the said member and the said shifter containing provisions for lost motion to permit part of the movement of the said movable member to occur before movement is communicated thereby to the shifter, and also permit the shifter to be returned fully against the stop by the action of the spring, substantially as described.

9. The combination with the cone-rack, the tumbling-shaft, gearing intermediate the said tumbling-shaft and the cone-rack, the same being capable of disconnection to make a break between the cone-rack and the tumbling-shaft, a shifter for the movable part of the said gearing, a fixed stop to determine the normal operative position of the shifter, and a spring operating to press the shifter toward the said fixed stop, of a shifter-actuating rod whereby the shifter may be moved to occasion a break in the gearing, a movable member of the stop-motion devices, and operative connections between the said member and the said rod containing provisions for lost motion to permit part of the movement of the said member to occur before movement is communicated to the rod, the spring serving to return the shifter to the position thereof which is fixed by the stop after the rod has been relieved from the action of the said movable member, and the provisions for lost motion permitting the shifter to be returned fully against the stop by the action of the spring, substantially as described.

10. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, a tumbling-shaft and driving-pinion thereon, a spur-gear and spur-pinion connected to turn together and meshing with said driving-pinion and driven gear respectively, a movable gear-carrier or supporting-arm on which said connected gear and pinion are mounted, a fixed stop to determine the normal operative position of the said gear-carrier or supporting-arm, and a spring operating to press the said gear-carrier or supporting-arm toward the said stop, of a movable member of the stop-motion devices, and operative connections between the said member and the said gear-carrier or supporting-arm containing provisions for lost motion to permit part of the movement of the said member to occur before movement is communicated to the gear-carrier or supporting-arm, the spring acting upon the gear-carrier or supporting-arm and serving to return the latter to the position thereof which is fixed by the stop after it has been relieved from the action of the said movable member, and the provisions for lost motion permitting the gear-carrier or supporting-arm to be returned fully against the stop by the action of the spring, substantially as described.

11. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with said pinion, a tumbling-shaft and driving-pinion thereon, a spur-gear and spur-pinion connected to turn together and meshing with said driving-pinion and driven gear respectively, a movable gear-carrier or supporting-arm on which said connected gear and pinion are mounted, a fixed stop to determine the normal operative

position of the said gear-carrier or supporting-arm, and a spring operating to press the said gear-carrier or supporting-arm toward the said stop, of an actuating-rod whereby the gear-carrier or supporting-arm may be moved to occasion a break between its spur-gear and the driving-pinion on the tumbling-shaft, a movable member of the stop-motion devices, and operative connections between the said member and the said rod containing provisions for lost motion to permit part of the movement of the said member to occur before movement is communicated to the rod, the spring acting upon the gear-carrier or supporting-arm and serving to return the latter to the position thereof which is fixed by the stop after the rod has been relieved from the action of the said movable member, and the provisions for lost motion permitting the gear-carrier or supporting-arm to be returned fully against the stop by the action of the spring, substantially as described.

12. The combination with the cone-rack, of a pinion in engagement with the rack, a driven gear turning in unison with the said pinion, the tumbling-shaft, a driving-pinion thereon, a spur-gear and spur-pinion connected to turn together and meshing with the said driving-pinion and driven gear respectively, a movable gear-carrier or supporting-arm on which said connected gear and pinion are mounted, a fixed stop and a spring operating to press the shifter toward the said fixed stop, of an actuating-rod whereby the gear-carrier or supporting-arm may be moved to break the engagement between its spur-gear and the driving-pinion on the tumbling-shaft, a bell-crank acting to move the said rod, a movable member of the stop-motion devices, and a rod interposed between the said movable member and the bell-crank, the parts having provision for lost motion to permit a portion of the movement of the said member to occur before movement is communicated to the actuating-rod aforesaid, the spring serving to return the gear-carrier or supporting-arm to the position thereof which is fixed by the stop, after the devices described have been relieved from the action of the said movable member, and the provisions for lost motion permitting the shifter to be returned fully against the stop by the action of the spring, substantially as described.

13. The combination with the cone-rack, a pinion in engagement with the cone-rack, a gear rotating in unison with the said pinion, the tumbling-shaft, its pinion, and carrier-gears intermediate the pinion last mentioned and the gear aforesaid, of a movable gear-carrier for the carrier-gears, and means for shifting said gear-carrier to throw the gears into and out of mesh, substantially as described.

14. The combination with the cone-rack, a pinion, 4, in engagement with the cone-rack, a gear, 5, rotating in unison with the said pinion, the tumbling-shaft, its pinion, 8, and carrier-gears, 6 and 7, connected to turn together and meshing respectively with the pinion last mentioned and the gear aforesaid, of means connected with a part of the gearing aforesaid whereby to disconnect the same and re-establish the connection when required, substantially as described.

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

CHANNING WHITAKER.

Witnesses:
MARY CAVERLY,
SAML. G. STEPHENS.