No. 685,713. Patented Oct. 29, 1901.

G. W. CILLEY.

AUTOMATIC DRILLING MACHINE.

(Application filed July 6, 1899. Renewed June 30, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

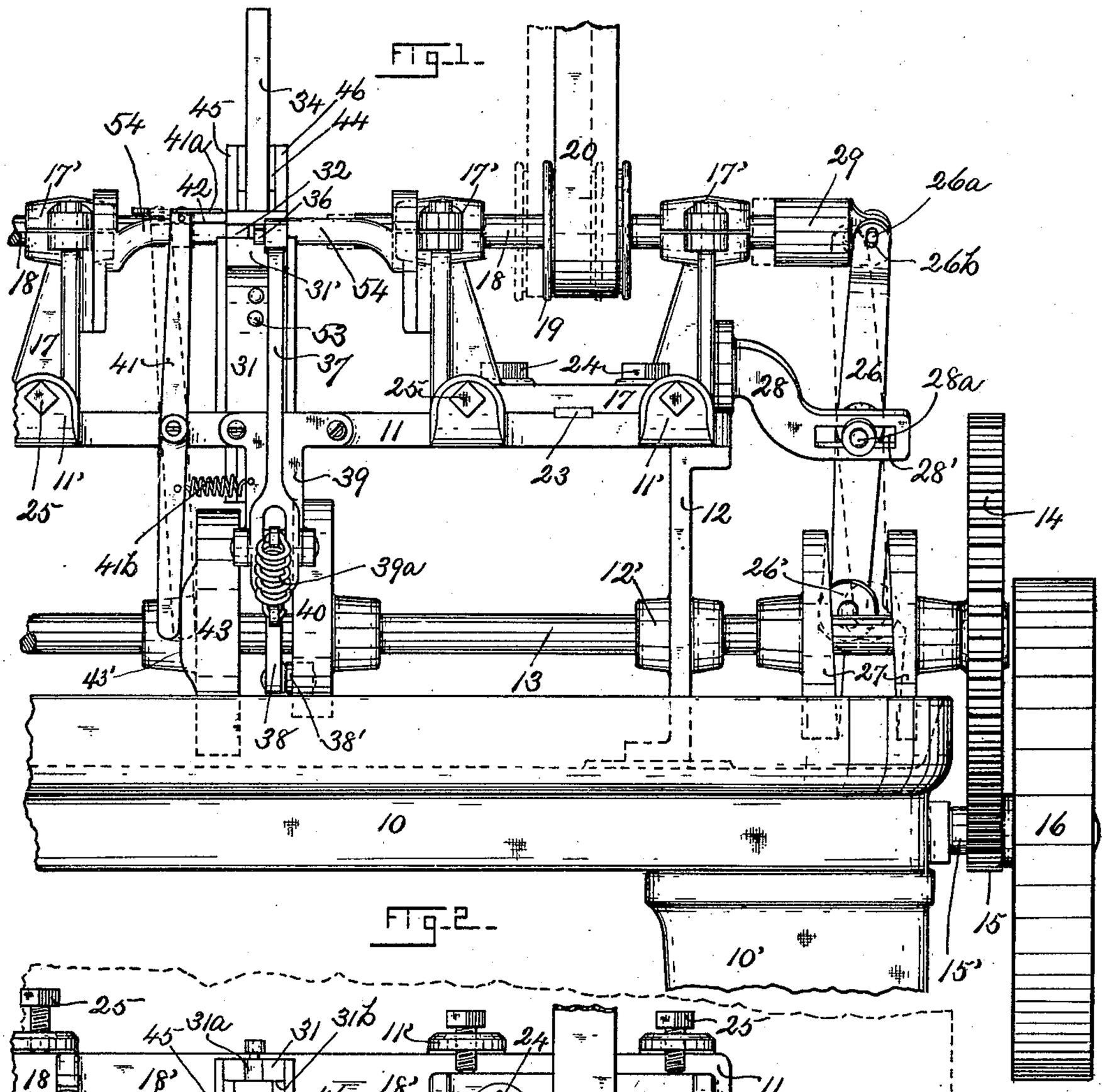
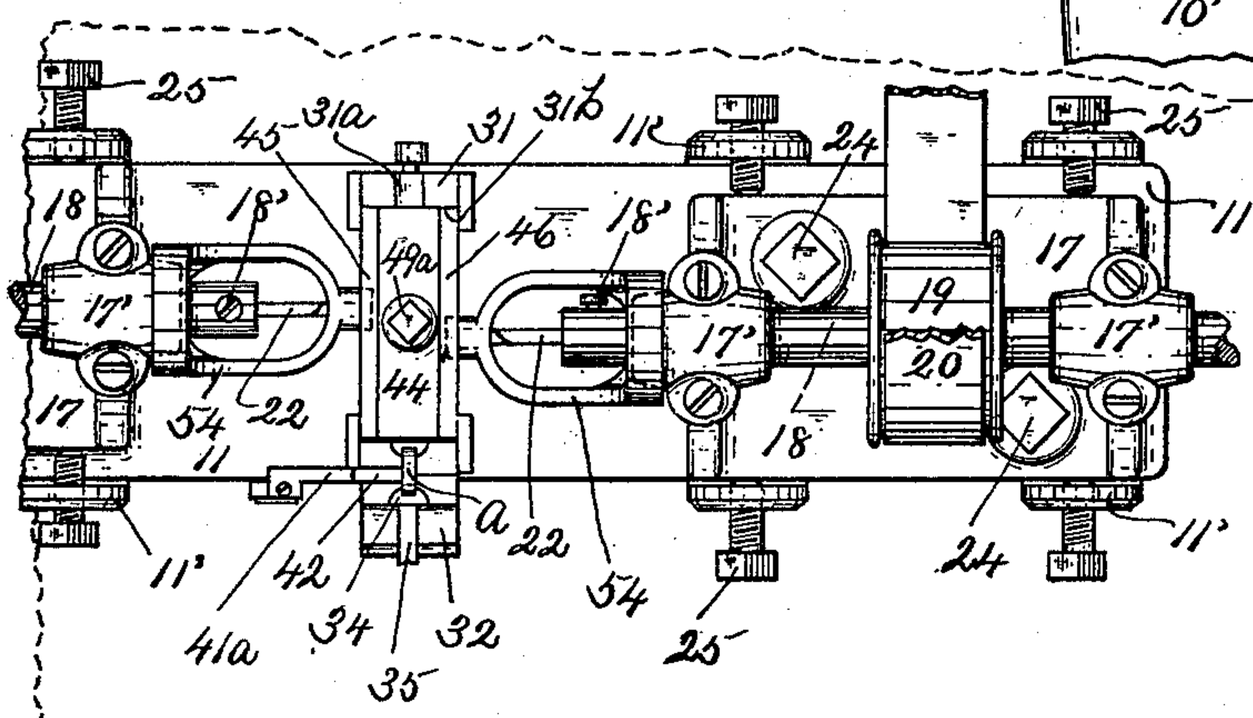


Fig. 2.



WITNESSES

Alonzo H. Luther.

May F. Ritchie.

INVENTOR

George W. Cilley.

BY

Frank H. Allen

ATTORNEY.

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Fig. 3.

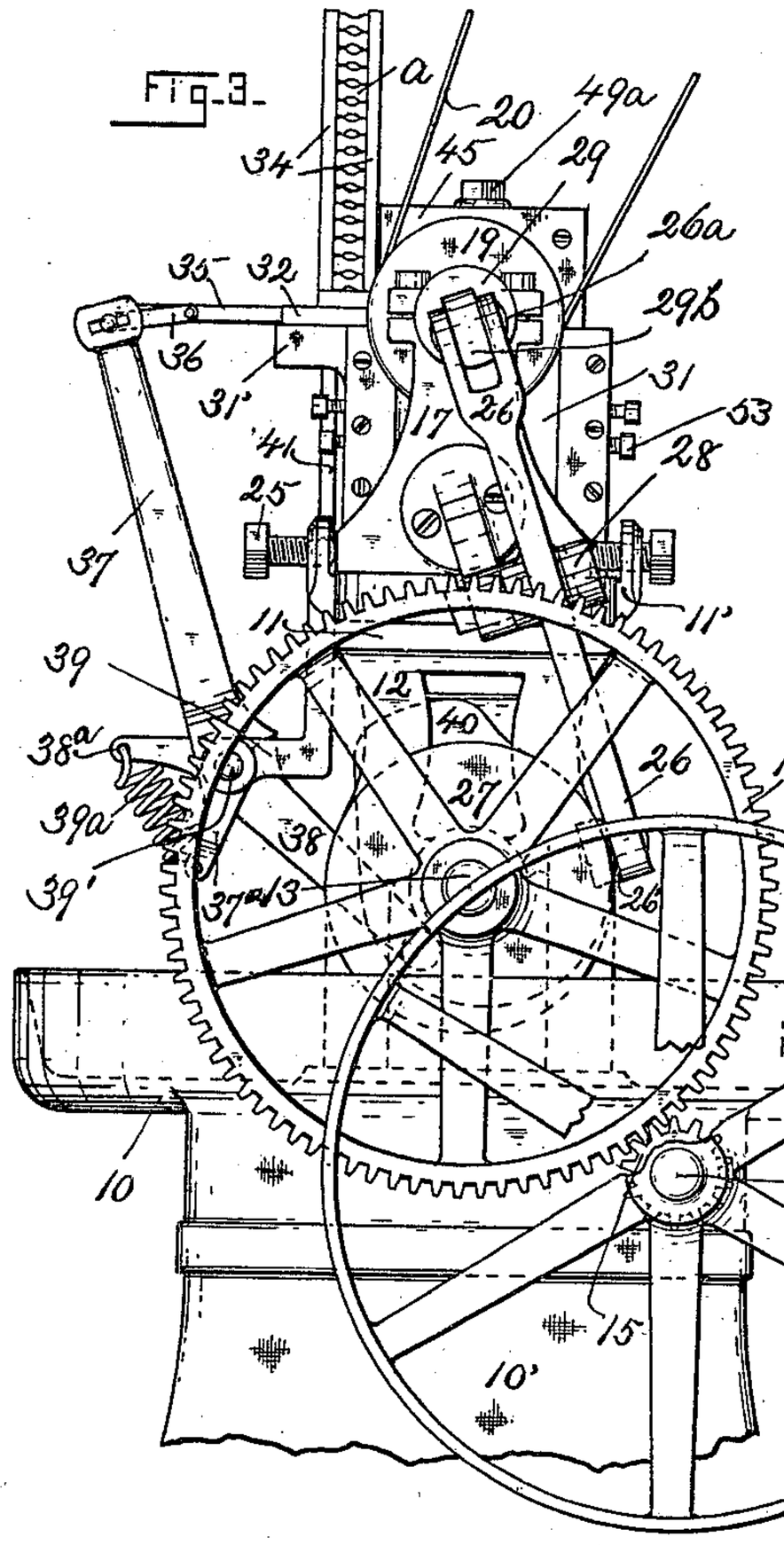


Fig. 4.

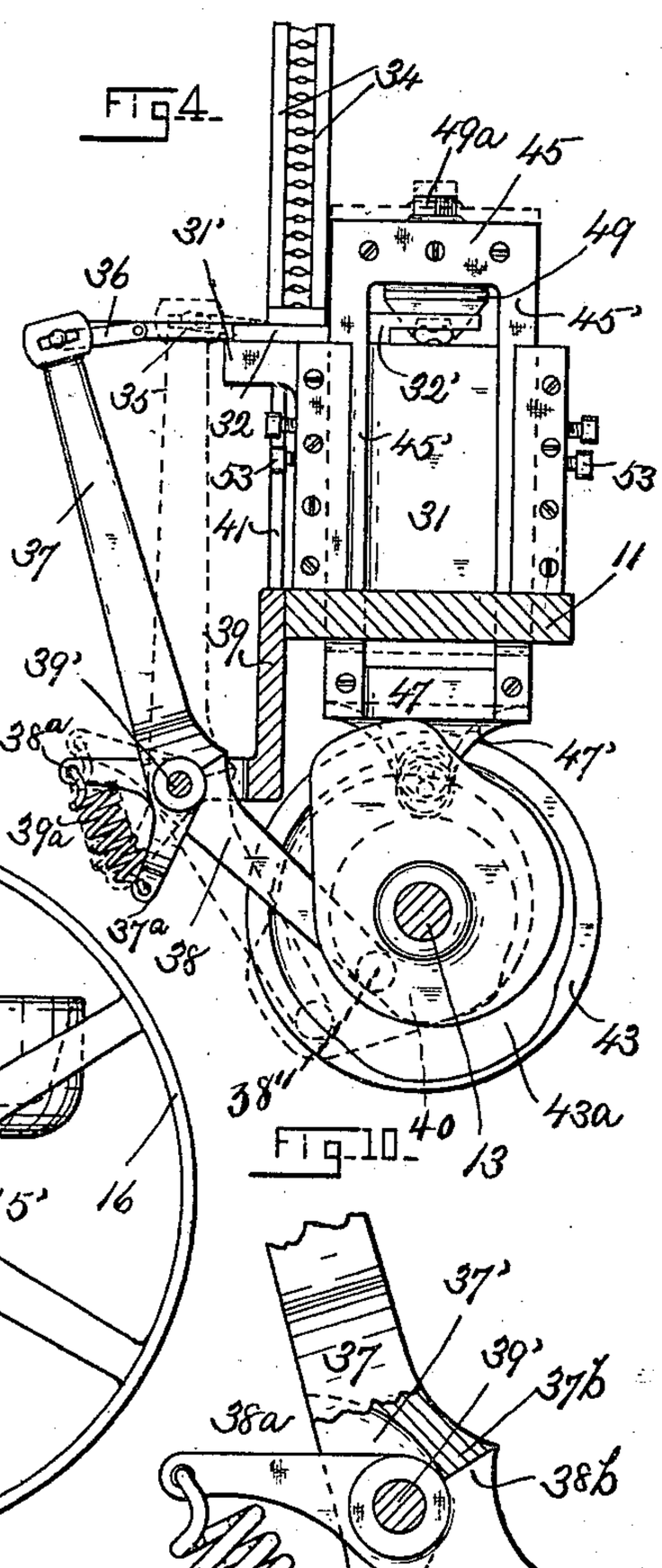


Fig. 10.

Fig. 9.

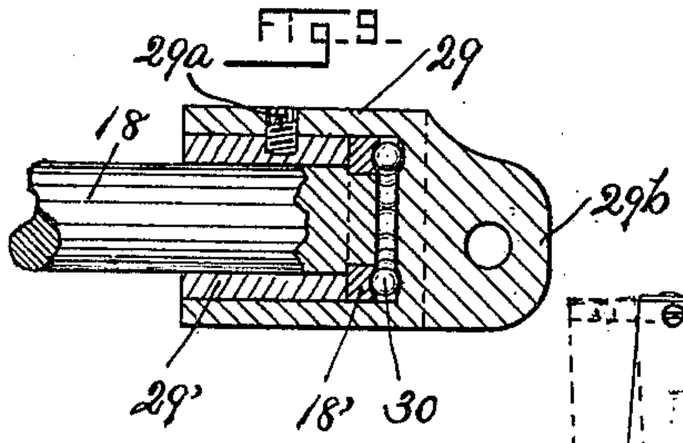


Fig. 8.

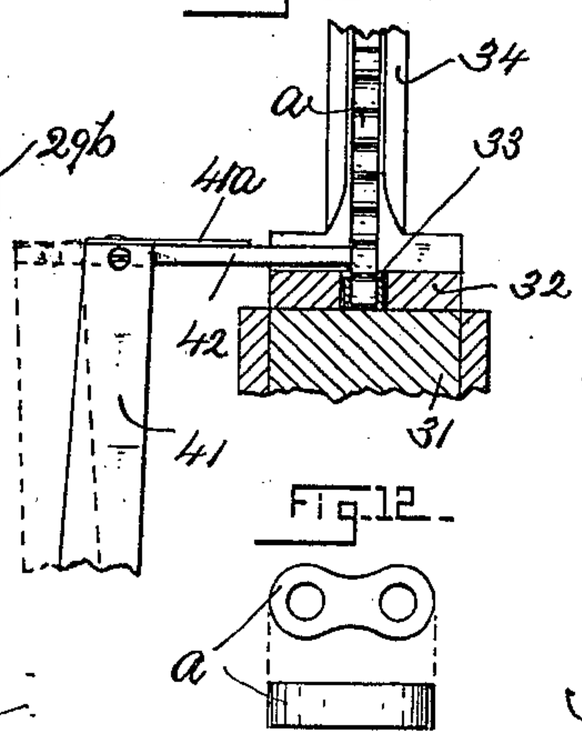
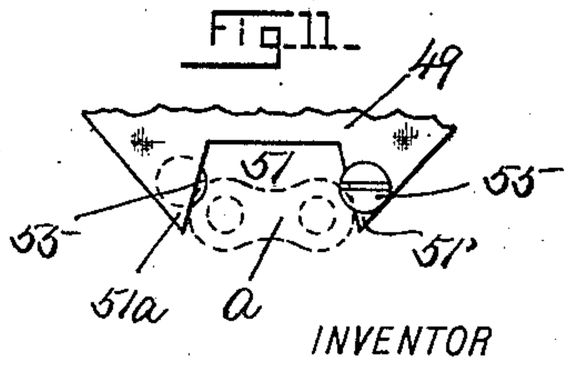


Fig. 12.

Fig. 11.



WITNESSES

Lawrence L. Luther.

May F. Ritchie.

INVENTOR

George W. Cilley,

BY

Frank H. Allen

ATTORNEY.

No. 685,713. Patented Oct. 29, 1901.

G. W. CILLEY.

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Fig. 5.

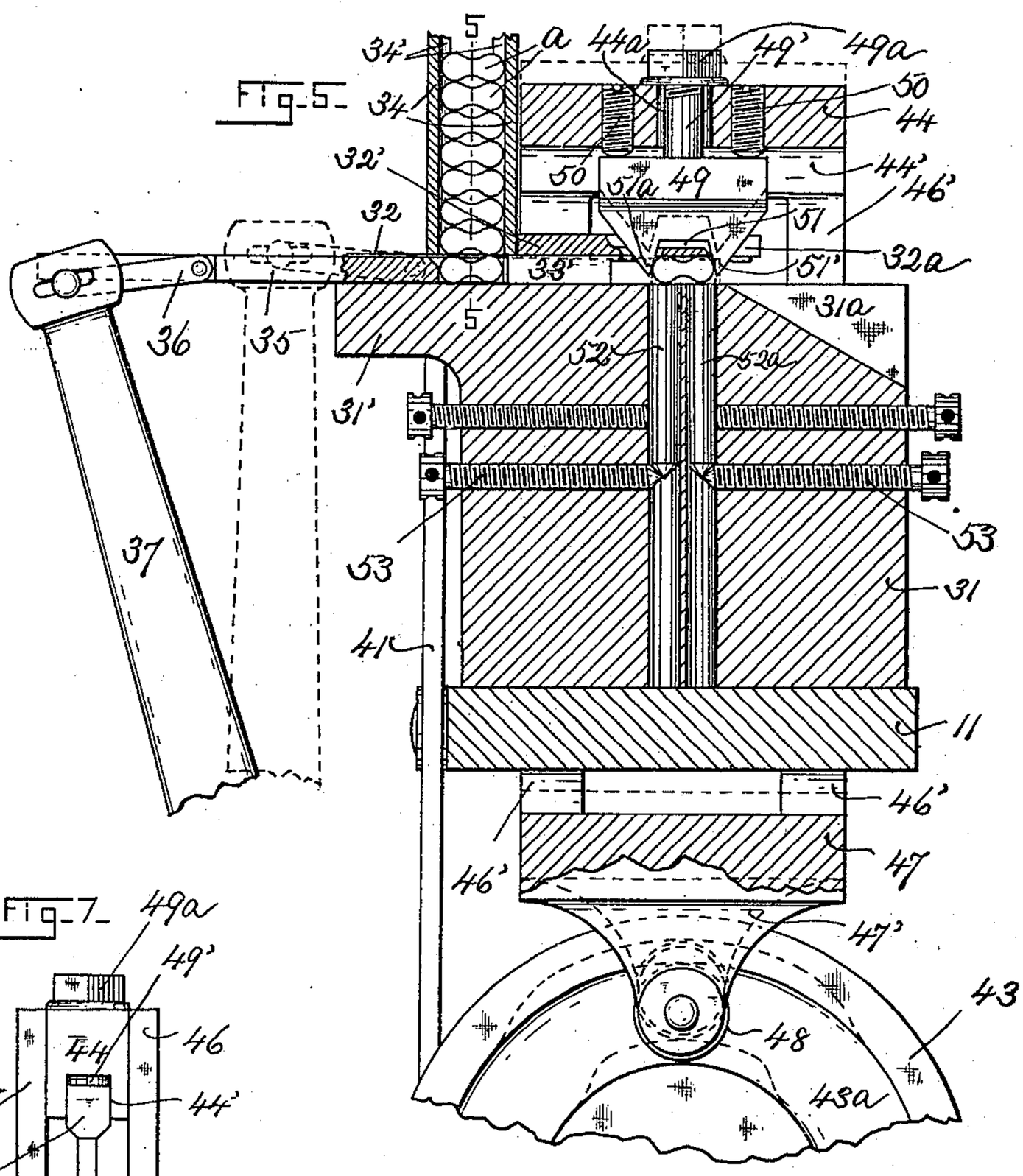

Fig. 7.

Fig. 6.

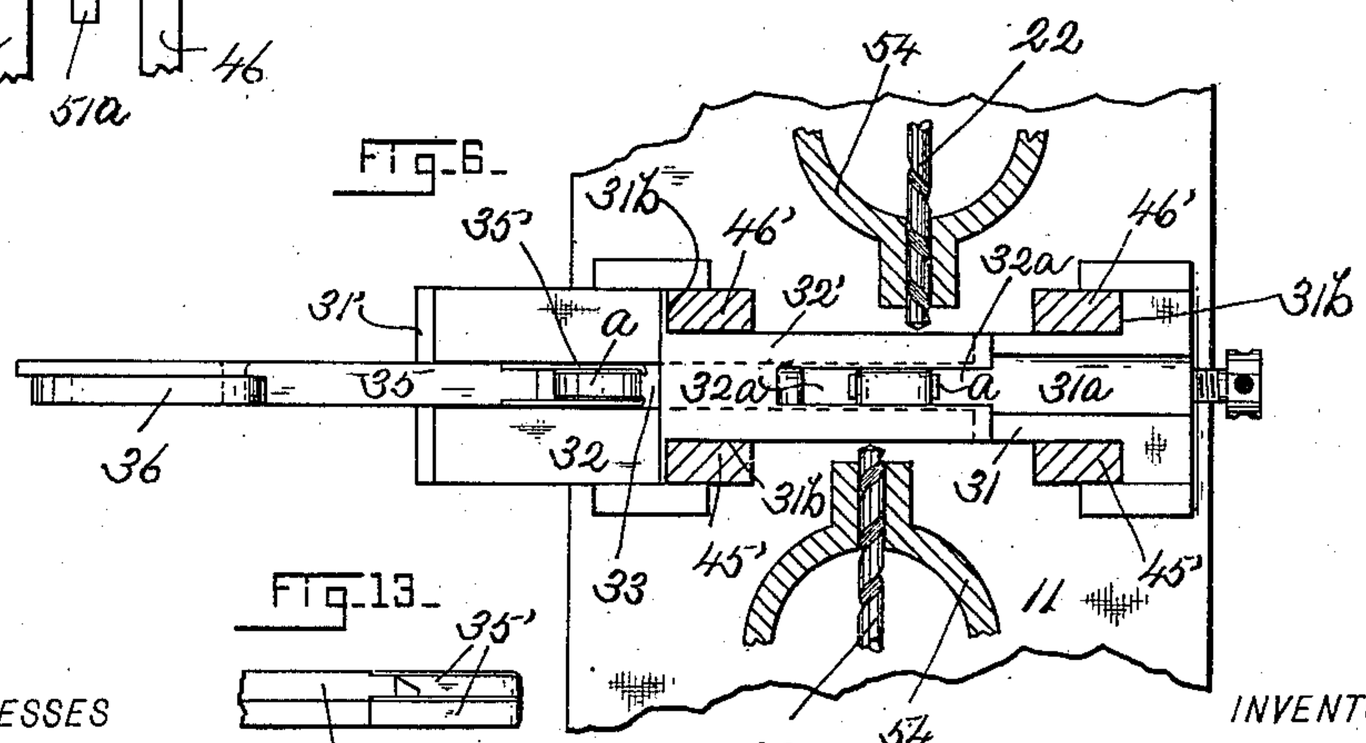

Fig. 13.

WITNESSES

Alonzo W. Luther.

May F. Ritchie.

INVENTOR

George W. Cilley,

BY

Frank H. Allen

ATTORNEY

UNITED STATES PATENT OFFICE.

GEORGE W. CILLEY, OF NORWICH, CONNECTICUT, ASSIGNOR TO EDWARD P. ARMSTRONG, OF BAY SHORE, NEW YORK.

AUTOMATIC DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 685,713, dated October 29, 1901.

Application filed July 6, 1899. Renewed June 30, 1900. Serial No. 22,181. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. CILLEY, a citizen of the United States, residing at Norwich, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Automatic Drilling-Machines, of which the following is a full, clear, and exact description.

The object of this invention is to provide a simple form of machine for automatically drilling or reaming block-links of the class commonly used in the manufacture of sprocket-chains. Said machine comprises mechanisms for feeding, clamping, and discharging the links, for drilling the same, and incidentally includes various means for adjusting the several mechanisms.

Briefly described, my machine consists of two drilling mechanisms located, respectively, at opposite ends of the machine-bed, said mechanisms being somewhat offset from each other and adapted to drill the link simultaneously from opposite directions, the link being suitably supported midway said drilling mechanisms. Mechanism is also provided for causing the drilling mechanisms to operate in unison, also for automatically feeding the blocks from a stack or reservoir into the position occupied during the drilling operation, and for clamping and holding said blocks during said operation.

To assist in explaining my invention, the accompanying drawings have been provided, illustrating the same, as follows:

Figure 1 shows in elevation somewhat more than one-half of my machine, the portion of that end thereof which is omitted being substantially the same as the end shown. Fig. 2 is a plan view of that portion of the machine shown in Fig. 1. Fig. 3 is an end elevation of my machine looking at the right end of Fig. 1. Fig. 4 shows in elevation that portion of the mechanism located substantially centrally of the machine—viz., the block feeding and clamping mechanism. Fig. 5 shows, on a somewhat-enlarged scale and principally in section, certain of the elements of Fig. 4. Fig. 6 shows, partly in section and partly in plan, a portion of the mechanism of Figs. 4 and 5. Fig. 7 shows in front elevation the upper portion of the block-clamping device. Fig. 8 illustrates certain mechanism pertaining to the feeding of the blocks, said view being taken principally on the line 5 5. Figs. 9 and 10 illustrate certain details of construction of the spindle-moving and block-feeding mechanisms. Fig. 11 shows in elevation a portion of the clamp for holding the block in position while being drilled. Fig. 12 embraces side and plan views of a block-link after having been drilled. Fig. 13 illustrates in perspective a certain element 35′ of the block-feeding mechanism.

Referring to the drawings, the number 10 denotes a table upon which the various parts of the machine are mounted, said table being formed as a pan to receive oil and chips and provided with the usual legs 10′.

The reference-number 11 denotes the machine-bed, extending parallel with the pan and supported above the latter by means of stands 12, located, as here shown, beneath each end of said bed. If desired, other similar stands may be provided intermediate said end stands. The stands 12 are provided with bearings 12′ for the supporting of the main shaft 13 of the machine, which shaft extends parallel with the said machine-pan 10 and bears thereon various cams by means of which the movements of the several mechanisms of my machine are controlled, as will be hereinafter described. Shaft 13 bears upon one end a gear 14, which meshes with a pinion 15, located upon a stud 15′, projecting from the pan 10, said stud also bearing a pulley 16, to which the pinion 15 is fixedly secured. The pulley 16 is the main driving-pulley of the machine, and it will be readily seen that when the latter is in motion the pinion 15, revolving therewith and meshing with the gear 14, drives the latter, as well as the main shaft 13, upon which said gear 14 is mounted, thus imparting motion to the cams located on the said main shaft 13.

The drilling mechanism proper of my machine is mounted upon the bed-plate 11, and this mechanism I will now proceed to describe. Located upon the upper face of said plate, near each end thereof, is a frame 17, having two bearings 17′ for the reception and horizontal support of a drill-spindle 18, the latter having mounted thereon between the bearings 17′ a flanged pulley 19, which receives and is driven by a belt 20, that serves

to drive the drill-spindle 18, upon which said pulley is mounted. The confronting ends of the drill-spindles 18 are each adapted to receive a drill 22, which may be inserted in a socket in the spindle end and secured therein by a set-screw 18′, or any other suitable means may be employed for mounting the drills in position.

In addition to the rotary motion of the drills 22 (attained by driving the spindles 18, as just explained) it is also necessary to provide for the requisite feeding of the drills, and this is attained through certain mechanism which imparts to the spindles 18 a longitudinal reciprocating motion, operating to cause the said drills 22 to approach toward or recede from each other in unison, and such mechanism I have hereinafter fully described.

As before explained, the block to be drilled is supported between the confronting ends of the drill-spindles 18, and it will be apparent that to make possible the feeding of the drills 22 to and through said work it will be necessary that the drills be offset from each other, so that they may not come in contact. The distance to which said drills are offset, it will be apparent, should be equal to the distance between the centers of the holes to be drilled, and that such adjustment may be very readily accomplished and very accurately controlled the following construction is provided.

Describing now the manner of mounting the frames 17 upon the plate 11, the reference-number 23 denotes a key extending at right angles to the length of the plate and located one-half in a keyway cut in said plate and one-half in a keyway cut in the under side of the base portion of the frame 17. Clamping-bolts or set-screws 24 are provided in plate 11, which pass through elongated holes (not seen) in the said base portions of the frame 17. It will now be readily seen that when screwed home the screws 24 will serve to hold the frame 17 in position; but when loosened slightly the frame 17 may be moved upon said plate, the key 23 serving to retain the frame and its spindle 18 at all times parallel with the main shaft 13.

In order that the above adjustment of the frames 17 may be very accurately controlled, I have provided a pair of ears 11′ on each side the said plate, between which pairs of ears the frame 17 is located. Each ear 11′ is provided with an adjusting-screw 25, whose inner end is adapted to engage the edge of the base portion of the frame 17. When it is desired to slightly adjust the frame 17, it may be accomplished by easing up the screws 25, engaging the side of the frame 17 toward which said frame is to be moved, after which the turning home of the screws engaging the opposite edge of said base portion serves to force the frame into the desired position.

The horizontally-reciprocating movement of each drill-spindle 18 is attained by means of a lever 26, pivotally supported midway its length, having connection at its upper end with the said spindle and bearing at its lower end a roll 26′, adapted to be received between a pair of confronting cams 27, mounted upon the shaft 13. To support the lever 26, a bracket 28 is secured to the outer end of the frame 17, having an elongated slot 28′ therein, within which is a stud 28^a, upon which the lever 26 rocks. It will now be readily understood that when the shaft 13 is revolving the cams 27, engaging the roll 26′ of the lever 26, will rock said lever, and thus cause the spindle 18 to reciprocate horizontally, as above mentioned.

The cams 27 are of such shape that they serve to force the spindles 18 toward each other (at which time the drilling is being accomplished) at a slow rate of speed as compared with their return movement—that is to say, when carrying the spindles away from each other to return them to their normal or starting positions.

The upper end of the lever 26, which actuates the drill-spindle 18, is not connected directly to said spindle; but such connection is secured in the following-described manner: Referring particularly to Fig. 9, the number 29 denotes a box having a circular opening extending almost throughout its length, which opening is of sufficient diameter to receive a collar 18′, mounted upon the end of the spindle 18. The confronting faces of the collar 18′ and the bottom of the box 29 are provided with raceways, within which a ring of balls 30 is located. A sleeve 29′ is provided whose external diameter is such that it may be driven into the box behind the collar 18′, and when in such position it is held by a screw 29^a, the internal diameter of said sleeve being such that the spindle 18 may revolve freely therein. An ear 29^b projects from the closed end of the box 29 and is received and pivotally secured between the bifurcated upper end of the lever 26 by means of a pin 26^a, whose ends are located in slots 26^b, provided in the said bifurcated end of the lever.

With the construction described it will be seen that when the lever 26 is serving to carry the spindle 18 inward to perform its work the thrust of the spindle will be received upon the balls 30, located between the collar and the bottom of the box 29, in which case said balls will greatly reduce the friction that would otherwise result. When the lever 26 is serving to carry the spindles 18 backward, the sleeve 29′ engages the collar 18′ and forces the latter and its spindle 18 also backward.

Inasmuch as the lever 26 is mounted upon a bracket secured directly to the frame 17, it will be seen that any adjustment of said frame in the manner first above explained will not affect in the least the operation of said lever, and it will also be seen that the slot 28′ in the bracket-arm 28 provides means whereby the fulcrum or point of support of the lever 26 relative to said frame may be varied, and the inner end of the drill thus moved toward or away from the central portion of the machine.

I will describe now that portion of the machine pertaining to the supporting and feeding of the links *a* and the clamping of the same in position during the drilling operation.

The reference-number 31 denotes a block located upon the upper face of the plate 11 midway the frames 17. The block 31 is in length about the same as the width of the plate 11, and when said block is in position the top thereof lies slightly below the line of the centers of the drills. The block 31 is shown in the drawings with a portion 31′ projecting toward the front side of the machine, such portion being provided to increase the length of the top surface of said block, so that there may be mounted thereon certain portions of the blank-feeding mechanism. The block 31 has secured to its upper face a plate 32, which conforms in outline with the said upper face, while a portion of said plate 32 reaches inward to a point somewhat beyond the center of the block and is of equal width with said central portion. The main portion of the plate 32 is slotted, as at 33, parallel with its length to receive a certain carrier, hereinafter described, for conveying the links to be drilled from a point within said slot to the central portion of the block 31, and in order to permit such motion of the carrier the slot 33 is continued as a groove 33′ in the lower face of the thickened portion 32′ of the plate 32. When a link is in position to be drilled, it is approximately centrally located on the top of the block 31, and when in such position said link still lies within the groove 33′, although near the end thereof, and in order to permit said link to be reached and operated upon by the drills 22 the side walls of the groove are cut away in part, as best shown in Fig. 5.

Secured to the upper face of the plate 32, immediately over the slot 33, are two vertically-extending rods 34, whose confronting faces have cut therein shallow grooves 34′, in which the undrilled blanks or links *a* are piled by the machine attendant, said blocks being adapted to drop by gravity at proper times from the bottom of the pile into the slot 33, after which they are carried forward into position to be drilled.

The reference-number 35 denotes a carrier-block adapted to travel with a horizontal reciprocating motion in the slot 33 and groove 33′ to feed the links *a* from the bottom of the pile to the point where they are to be drilled. When the carrier 35 is in its forward position, the rear end thereof has passed from beneath the pile of undrilled links *a*, and the bottom link is permitted to drop between spring extensions 35′ of said carrier, which with said rear end provide a box inclosing the link on three sides, as will be understood from Figs. 5, 6, and 13. When the carrier 35 is actuated to travel forward in the slot 33 and groove 33′, said carrier moves with it, the link *a* lying within its box-like end until that point of the block 31 is reached where the drilling of the link is performed. In this last-named position the carrier 35 remains until the clamping of the block is accomplished, after which it returns to its starting position and again receives the bottom link of the pile, repeating the operation just described so long as the supply of links lasts. When the carrier recedes to leave the block, the arms 35′ yield laterally until they are drawn beyond the block, when they spring back to their normal positions. After the drilling of a link is completed the clamping mechanism moves to release the same, and when the next link is pushed forward into position to be drilled the one previously drilled is forced outward by it and enters a downwardly-inclined groove 31ª, leading from the point near where the said drilling operation occurred. The drilled link then travels downward by gravity and drops into a box or other suitable receptacle.

To give to the carrier 35 the reciprocating movement just explained, its forward end is connected by a link 36 to the upper arm 37 of a lever, the companion arm of which is denoted by the reference-number 38. This lever (which might be termed the "link-feeding" lever of the machine) is hinged in a bracket 39, secured to the front edge of the plate 11, and the arm 38 of said lever bears at its free end a roll 38′, which lies in a cam-groove 40, located on the shaft 13, the cam being of such shape that when in revolution it serves to rock the link-feeding lever, and thus move the carrier 35 in the manner already described.

The link-feeding lever is practically a rigid lever and ordinarily operates as such; but to guard against the breaking of any portion of the link-feeding mechanism which might occur should the links become clogged when dropping downward from the pile or when being fed forward to be drilled the said lever is constructed in the following-described manner, (see particularly Fig. 10:) The arms 37 and 38 instead of being formed of a single piece are formed of separate pieces, each of which is hinged upon a pin 39′ of the bracket 39. The hinged end of the arm 37 has a recess 37′ cut therethrough, in which the hinged end of the lever-arm 38 is received. The arms 37 38 have projecting from their respective hinged ends short arms 37ª 38ª, whose free ends are connected by a stiff spring 39ª. The said arms 37 38 are also provided at their hinged ends with shoulders 37ᵇ 38ᵇ, which are held normally in close contact by the spring 39ª, which seeks always to draw the arms 37ª 38ª together, and thus force the shoulders 38ᵇ 37ᵇ in close contact, as mentioned. The spring 39ª is sufficiently stiff to hold the shoulders in such close contact that the arms 37 38 form practically a rigid lever; but it will be seen that should the longer arm fail to respond when the shorter arm 38 is actuated by the cam 40 the spring 39ª will yield sufficiently to permit the movement of said latter arm while the former remains stationary, thus doing away with any

liability of breakage to the link-feeding mechanism should the links become clogged or in any way prevent the free working of the carrier 35. To still further control the feeding of the links, I have provided means whereby the links in the pile from which delivery is made are held, with the exception of the lowest link, in an elevated position, while the said lowest link is being pushed forward by the box-like end of the carrier 35 into position to be drilled. To perform this work, I have provided a lever 41, hinged to the front edge of the plate 11 and having pivotally secured to its upper end a short strip 42 of slightly-flexible material, the free end of which rests upon the upper face of the plate 32 and is held in contact with the latter by means of a flat spring 41^a, secured to the upper end of said lever 41 and bearing upon the said strip 42. The lower end of the lever 41 engages the rear side of a cam 43, whose chief work is to operate the link-clamping mechanism, as hereinafter fully explained. The lower end of the lever 41 is held in contact with the cam 43 by a spring 41^b, connecting said lever end and the bracket 39. When the said lower end of the lever 41 is in contact with the back side of the cam 43, the upper end is rocked to carry the strip 42 out of contact with the pile of links *a*, as shown in dotted lines in the drawings; but just previous to the dropping of the lower link into position to be fed forward for drilling the free end of the lever 41 engages a projection 43′ on the cam 43, which results in rocking said lever to carry the strip 42 into engagement with the said pile of links. When the strip 42 is thus carried into contact with the pile of links, it engages the link next above the lowest, (the link to be dropped,) and such engagement is of sufficient frictional strength to hold the engaged link and all the links above it in suspense. As soon, however, as the carrier 35 returns to its normal position the clamp 42 is released and the pile of blanks drops until the bottom one enters the carrier-box.

To effect the clamping of the links in position while they are being drilled, a vertically-reciprocating carriage is provided, actuated by the cam 43, which carriage serves to carry the clamping-plate proper into and out of engagement with a link when the latter is in the position to be drilled. Describing now the said carriage, the reference-number 44 denotes a block located above the block 31 and extending parallel therewith. The said block 44 is bolted between two plates 45 46, each provided at its opposite ends with downwardly-extending portions 45′ 46′, which latter are received and adapted to travel vertically in ways 31^b in the block 31, the two rods 45′ being located in ways 31^b on one side the block 31 and the rods 46′ being located in similar ways on the opposite side of the said block. The rods 45′ 46′ pass through suitable openings in the plate 11 and near their lower ends have bolted between themselves a block 47, which has a downwardly-extending portion 47′, bearing a roll 48, adapted to enter and travel in the groove 43^a of the cam 43. The said cam 43 when in motion serves to actuate the carriage with a vertically-reciprocating motion, such movement being of course governed by the cam-groove 43^a, in which the roll 48 travels. The reference-number 49 denotes what is termed the "clamping-plate" proper, said plate being located in a groove 44′, provided in the under side of the block 44 and extending parallel therewith. A slight adjustment of the clamping-plate 49 is made possible by supporting said plate by means of a centrally-located stem 49′, which passes upward through an elongated hole 44^a in the block 44, leading from the bottom of the slot 44^a to the upper face of the said block 44. The upper end of the stem 49 is threaded to receive a nut 49′, which latter when screwed home engages the upper face of the said block 44 and serves to draw the upper edge of the plate 49 into close contact with the lower ends of two set-screws 50, located in the block 44, one on each side the elongated hole 44^a, and extending through said block parallel with said hole. By adjusting the position of the stem 49′ in the elongated hole 44^a a slight additional adjustment may be attained by properly manipulating the screws 50, so as to slightly spring the stem 49′ and correspondingly rock the plate 49.

The portion of the clamping-plate 49 that engages the links *a* is approximately of equal thickness with said links and has cut in its lower edge a recess 51, within which the said links are adapted to be received, the end walls of which recess are at an angle to each other, and thus serve to center a link when the plate is carried into engagement therewith by the downward travel of the clamping-carriage. The opposite corners of the said lower edge of the plate 49 are beveled off from the said end walls of the plate 49, thus leaving the two points 51′ 51^a.

In order that the portion 32′ of the plate 32 may not interfere with the downward travel of the plate 49, and thus prevent the latter from engaging and clamping a link when the latter is in its drilling position, the said plate portion 32′ has openings 32^a cut therethrough to permit the passage of the points 51^a 51′ and so that the end walls of the recess 51 may receive said link between them, as shown in Fig. 5. When the carriage carrying the clamping-plate 49 is in its lower position, the link to be clamped is received and wedged between the end walls of the recess 51 and held by such contact during the drilling of the link, the carriage remaining in its lower position during the said operation. Upon the upward travel of the carriage and its plate 49 the drilled link is prevented from being also carried upward by its contact with the portion 32′ of the plate 32.

It has already been explained that a slight

endwise movement of the plate 49 is possible, and thus corresponding endwise adjustment of the link with reference to the drills is provided. In addition to the above endwise adjustment of the link means are also provided whereby a slight vertical adjustment thereof is made possible. The last-named adjustment is attained by means of two vertical rods 52 52ª, located in holes 52ᵇ, provided in the block 31. The upper ends of the rods 52 52ª are approximately flush with the upper face of the block 31, and the links while being drilled are adapted to rest on the upper ends of the said rods, as shown in Fig. 5. The lower ends of the rods 52 52ª are provided with miter-points, which are engaged by the miter-pointed ends of horizontally-extending adjusting-screws 53, located in the said block 31. By the proper manipulation of the said adjusting-screws the rods 52 52ª may be slightly raised or lowered to correspondingly vary the position of the link to be drilled.

To guide the drills 22 and insure their proper introduction to the work, each drill is provided with a bushing 54, through which it is adapted to travel, said bushing being secured to the stand 17, the end of the bushing lying close to the work to be drilled.

To guard against any possibility of the turning of the link while being drilled, the plate 49 is provided with screws 55, whose heads project slightly over the opening 51 to engage the link upon the side opposite that engaged by the drills, and thus prevent such turning, this feature being readily understood by reference to Fig. 11.

Assuming that a machine constructed as above explained is provided and that the various mechanisms thereof are properly timed and adjusted and that the pulleys 16 and 19 are belted to power, the operation of said machine is as follows: It being assumed that a supply of blank links is piled between the vertical guides 34 and that the machine is set in operation, the first result is to cause the link-feeding mechanism operated by the cam 40 to feed a link from the bottom of the pile to the point where the drilling occurs, such feeding being of course controlled by the lever 41 engaging the back side of the cam 43, as above explained. Upon the link reaching its drilling position the feeding mechanism remains stationary until the clamping mechanism controlled by the cam 43 effects, through the plate 49, the engagement and clamping of the link in position, after which the link-feeding mechanism recedes, preparatory to feeding another link into position to be drilled. The clamping mechanism holds the link during the drilling operation, which is accomplished by the forward and rotary travel of the drills 22, the said forward movement being attained by means of the levers 26, whose opposite ends engage, respectively, the drill-spindles and the pair of cams 27, which serve to rock the said levers 26. Upon the drilling of the link the drills 22 recede and the clamping mechanism moves upward, thus leaving said link in its drilled position, where it remains until forced therefrom by the introduction of the next link. It will of course be understood that the guides 34 are kept constantly full of links, or practically so, and it might be also mentioned that when my machine is in operation streams of oil or soda-water or the like are playing constantly upon the points drilled, as is common in drilling machinery; but this last-named feature is not thought to demand illustration or detailed explanation.

Having thus described my invention, I claim—

1. In a machine for drilling the holes at opposite sides of the center of a block-link, the combination of oppositely-disposed drill-spindles relatively positioned to accord with those of the holes in the link; means for feeding the blanks one at a time into position to be acted on by both drills; work-clamping mechanism, intermediate the drill-spindles, operated to hold the blank immovably presented to the action of both drills; and means for conveying the work from the machine as soon as it is drilled.

2. A machine for automatically drilling the holes at opposite sides of the center of a block-link, embodying the following instrumentalities, namely, a blank-containing receptacle; oppositely-disposed drill-spindles set off from each other in relative positions to accord with the positions of the holes in the link; work clamping and releasing mechanism intermediate the drill-spindles, operated to hold the blank immovably presented to the action of both drills and to release the work when the holes are drilled therein; means for feeding the blanks one at a time from said receptacle to the work-clamping mechanism; and means for conveying the work from the machine as soon as it is drilled.

3. In combination, in a drilling-machine, oppositely-disposed drill-spindles, offset from each other as set forth, and work-clamping mechanism intermediate the drill-supporting ends of said spindles; said clamping mechanism consisting of a fixed bed-plate, a movable clamping-frame, and means consisting of screws 55 for meeting the thrust of the drills.

4. In a machine for simultaneously drilling the holes at opposite sides of the center of a block-link, the combination of oppositely-disposed drill-spindles set off from each other to accord with the positions of the holes in the link, means for simultaneously advancing and retracting the spindles, a work-clamping mechanism intermediate the spindles, operated to hold the link-blank immovably presented to the action of both drills at once, and a reciprocating carrier operated to convey the blanks one at a time to said clamping mechanism and to release the blank and

return to its starting-place for another blank as soon as the conveyed blank has been clamped, as specified.

5. In a machine for simultaneously drilling the holes at opposite sides of the center of a block-link, the combination of oppositely-disposed drill-spindles set off from each other to accord with the positions of the holes in the link, means for simultaneously advancing and retracting the spindles, a work-clamping mechanism intermediate the spindles, operated to hold the link-blank immovably presented to the action of both drills at once, a reciprocating carrier operated to convey the blanks one at a time to said clamping mechanism and to return to its starting-place for another blank as soon as the conveyed blank has been clamped, and a conveyer to which the drilled work is delivered by the action of said carrier.

6. In a drilling-machine of the class referred to, in combination, work-clamping mechanism consisting of a fixed bed and movable section, mechanism for operating said movable section with a reciprocating movement, and means, embodying an adjustable stem attachment to said section and adjustable screws to bear upon said section, for adjusting the said movable section to vary the grip of the clamping mechanism upon the work to be drilled.

7. A work-clamping mechanism for drilling-machines, embodying a fixed bed to support the work, a fixed part opposed to said bed and having openings leading to the space between it and said bed, and a movable section having projections to extend through said openings and engage the work.

8. In a machine for drilling the holes at opposite sides of the center of a block-link, the combination with oppositely-disposed drill-spindles set off from each other in positions to accord with the positions of the holes in the link, of work-clamping mechanism between the confronting ends of said spindles, embodying a fixed bed to support the blank, a fixed part opposed to said bed and a movable part operating to engage the ends of the blank and secure the same between said bed and fixed part, and means for feeding the blanks one at a time into position between said bed and fixed part.

9. In a machine for drilling the holes of block-links, the combination with oppositely-disposed drill-spindles set off from each other; of work-clamping mechanism between said spindles, embodying a supporting-block, a plate having a slot and openings leading to its slot; and a reciprocating section having a recess in its under side; and a reciprocating device for feeding the blanks one at a time into position to be clamped.

10. A work-clamping mechanism for a drilling-machine, said mechanism including a supporting-block, means adjustable in said block upon which the work is supported, a fixed part opposed to said block, and a movable part operated to engage the ends of the work and fix the same in position between said adjustable means and fixed part.

11. In a machine for drilling the holes of block-links, the combination with oppositely-disposed drill-spindles set off from each other, of work-clamping mechanism between said spindles, said mechanism embodying a fixed bed having adjustable rods for supporting the blanks, and a reciprocating clamping-section.

12. In a machine for drilling the holes of block-links, the combination with oppositely-disposed drill-spindles set off from each other, of work-clamping mechanism between the confronting ends of said spindles, said mechanism embodying a fixed bed having adjustable rods for supporting the blanks, a fixed part above said rods and a movable section to engage the ends of the blanks and fix the same in position between said rods and fixed part, and means for feeding the blanks one at a time into position between said rods and fixed part.

13. In a machine for drilling the holes of block-links, the combination with oppositely-disposed drill-spindles set off from each other; of work-clamping mechanism between said spindles, embodying a supporting-block, a plate having a slot and openings leading to its slot, and a reciprocating section having a recess in its under side and operated to clamp a blank between the block and plate; a blank-receptacle at one end of said plate, open to the slot in the latter; and a reciprocating feeding device operating in said slot.

14. The combination with a blank-receptacle, a clamping device, and a reciprocating carrier for forcing blanks one at a time from said receptacle to said clamping device, of a reciprocating means for holding the blanks in the receptacle in suspense while one is being fed to the clamp and until the carrier has returned to its starting-place, said means embodying a pivoted lever, a pivoted device attached to one end of said lever and reciprocated thereby at the delivery end of said receptacle, and means for actuating said lever to cause said device to engage the lowest blank in the receptacle and hold it therein until the reciprocating carrier has returned to its starting-place.

15. The combination with a blank-receptacle, a plate having a slot leading from the delivery end of said receptacle, a clamping device to which said slot leads, and a means for forcing blanks through said slot, of a reciprocating means for holding the blank in the receptacle in suspense while one is being fed through said slot, said means embodying a pivoted lever, a pivoted device attached to one end of said lever and reciprocated at the delivery end of the receptacle, and means for actuating said lever.

16. A machine for drilling the holes at opposite sides of the center of a block-link, embodying the following instrumentalities, namely: oppositely-disposed drill-spindles

set off from each other in positions to accord with the positions of the holes in the link; a work-clamping mechanism arranged between the confronting ends of said spindles; a longitudinally-slotted plate leading to said mechanism; a blank-receptacle at the end of said plate remote from said clamping mechanism; a reciprocating carrier operated to force the blanks one at a time through said slot and to said clamping mechanism; and a device reciprocated at the delivery end of the blank-receptacle to hold the blanks therein in suspense while one is being fed to the clamping means and until the carrier has returned to its starting-place.

17. A machine for drilling the holes at opposite sides of the center of a block-link, embodying the following instrumentalities namely: oppositely-disposed drill-spindles set off from each other in positions to accord with the positions of the holes in the link; a work-support; a plate above said support, having a longitudinal slot terminating at one end in a groove located between the confronting ends of said spindles; a blank-receptacle at the end of said slot remote from said groove; a reciprocatory carrier for feeding blanks one at a time through said slot and into said groove; a movable device for holding the blank in the groove until it has been drilled; and a reciprocating device for holding the blanks in the receptacle in suspense until the carrier is in position to feed one forward.

18. The combination of a work-clamp, having a reciprocating section, a blank-receptacle, a carrier for feeding blanks one at a time from said receptacle to said clamp, a plate reciprocated at the delivery end of said receptacle for holding the blanks therein in suspense, a pivoted lever pivotally connected with said plate, and a cam operating the movable section of the clamp and said pivoted lever, substantially as described and for the purposes set forth.

19. The combination of a work-clamp, having a reciprocating section, a blank-receptacle, a carrier for feeding the blanks one at a time from said receptacle to said clamp, a pivoted lever actuated to reciprocate said carrier, a plate reciprocated at the delivery end of said receptacle for holding the blanks therein in suspense, a pivoted lever pivotally connected with said plate and means for actuating said movable section and levers at predetermined relative times, substantially as described and for the purposes specified.

20. The combination with work-clamping mechanism, of a reciprocating device for feeding the work thereto, said device having a feed-lever constructed in two sections hinged together and normally rigid each with the other and provided with a connection at their junction which yields to prevent breakage in event of clogging, as specified.

21. In a drilling-machine, the combination with a drill-spindle, and a work-clamping mechanism, of a plate having a passage leading to said clamping mechanism, a reciprocating carrier for feeding the blanks through said passage, and a lever for actuating said carrier, said lever being constructed in two sections hinged together and provided with a connection at their junction which normally holds them rigid with each other and yields to prevent breakage in event of clogging, substantially as described.

22. In a drilling-machine of the class referred to, the combination with work-clamping mechanism, of a reciprocating device for feeding the work thereto, and an actuating means for said device embodying a cam and a pivoted lever interposed between the cam and device, said lever being constructed in two sections having engaged shoulders at their junction and each formed with a short projecting arm, and a spring connecting said short arms together.

23. In a drilling-machine, a drill-spindle, combined with a collar mounted on the end thereof, a box encircling said collar, a line of balls interposed between the collar and bottom of the box, a sleeve encircling said spindle and engaged with said collar, and a pivoted lever connected with said box and actuated to reciprocate said spindle.

Signed at Norwich, Connecticut, this 27th day of June, 1899.

GEORGE W. CILLEY.

Witnesses:
FRANK H. ALLEN,
ALONZO M. LUTHER.