(No Model.)

6 Sheets—Sheet 1.

D. JONES.

DRILLING MACHINE.

No. 529,329. Patented Nov. 13, 1894.

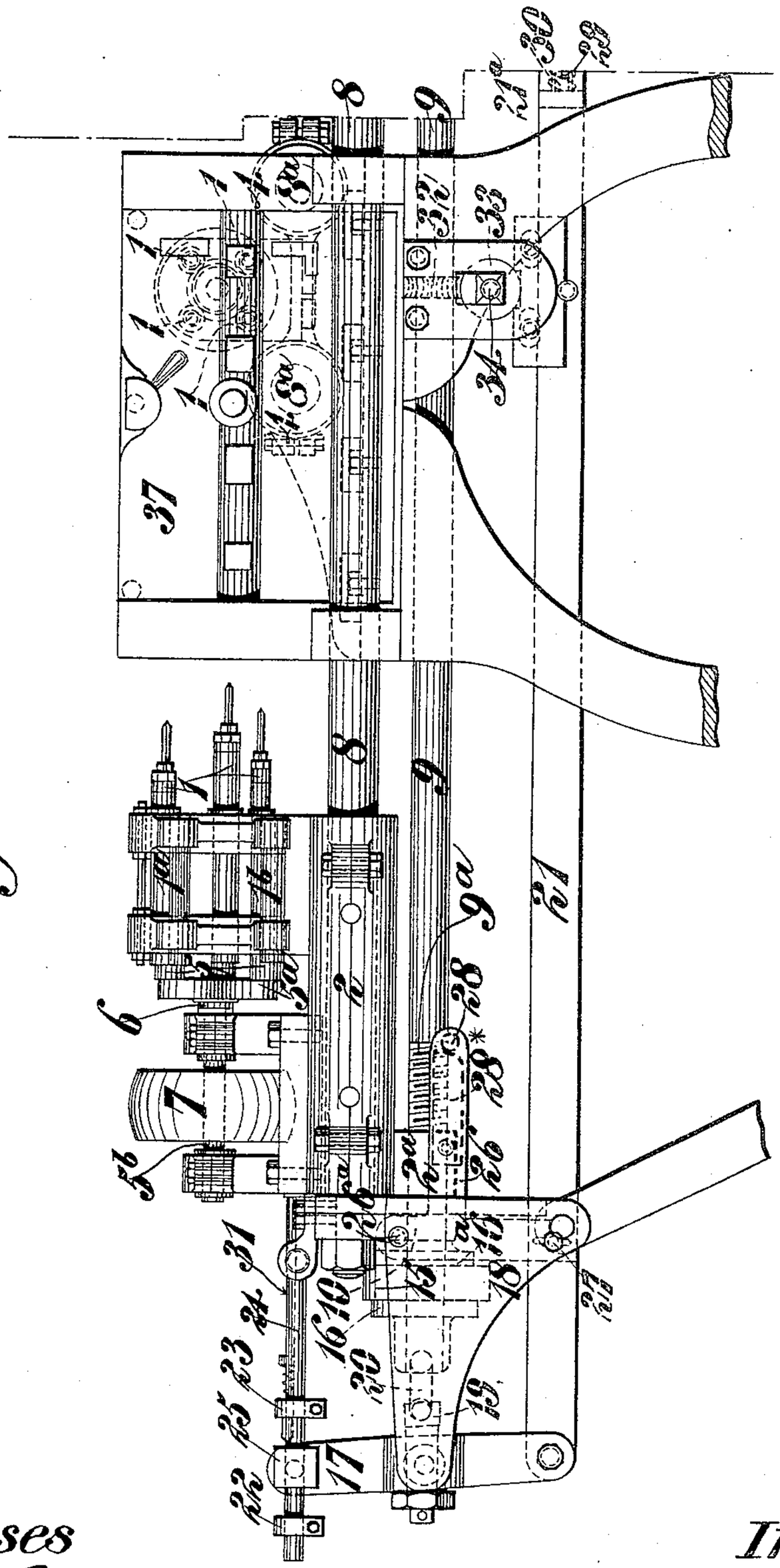

Fig. 1.

Witnesses
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(No Model.) 6 Sheets—Sheet 2.

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Fig. 1a

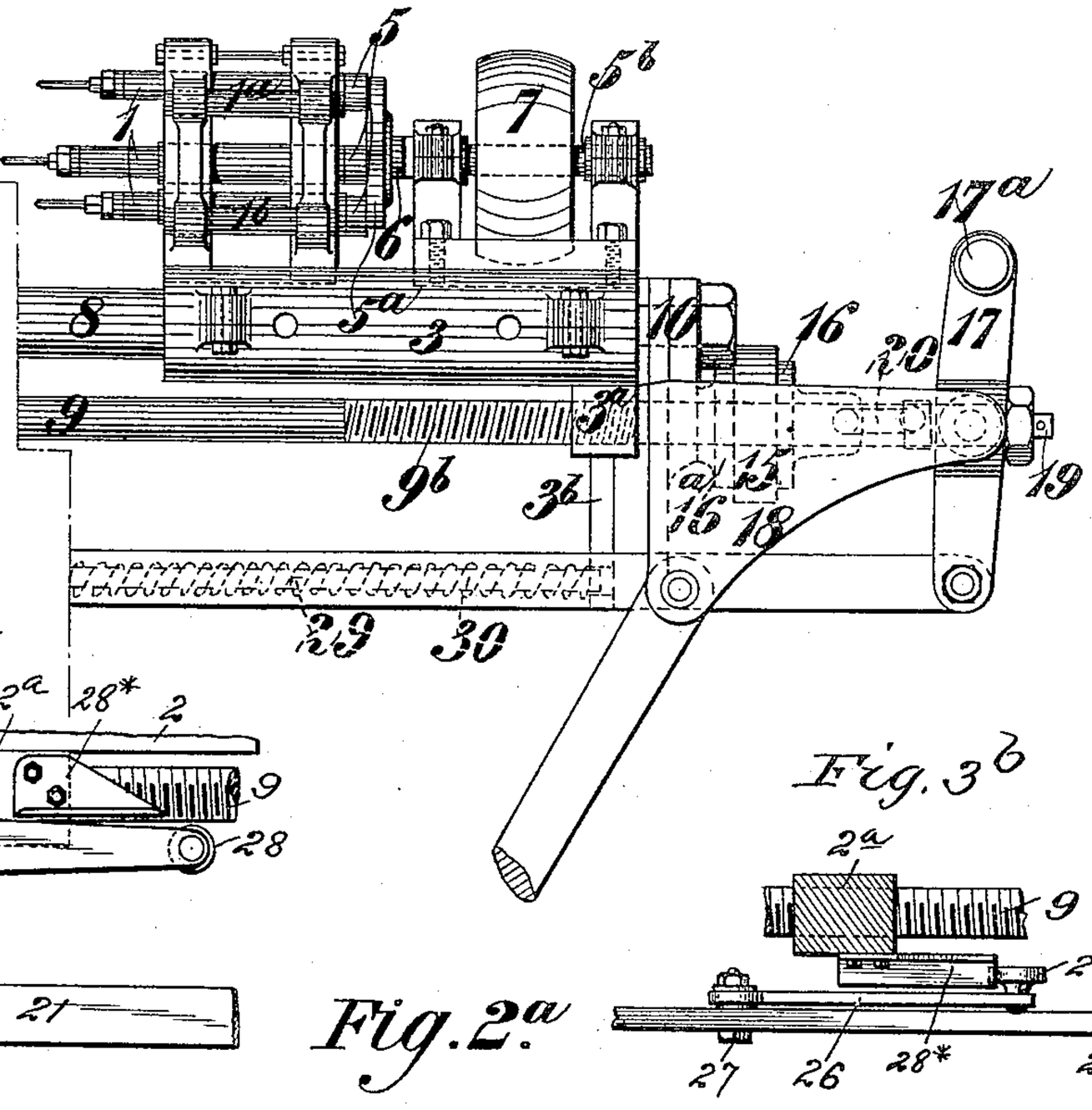


Fig. 3a

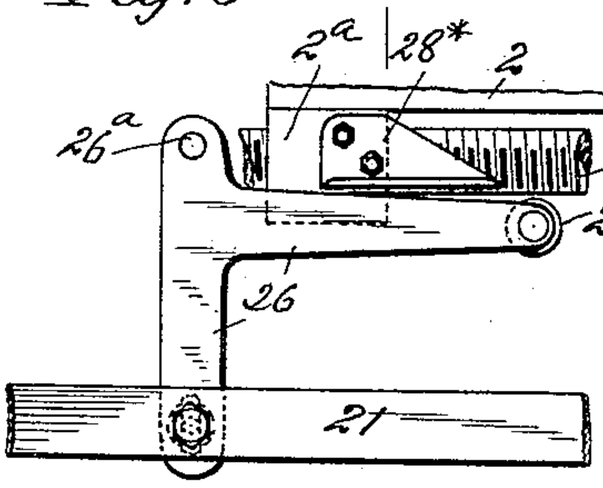
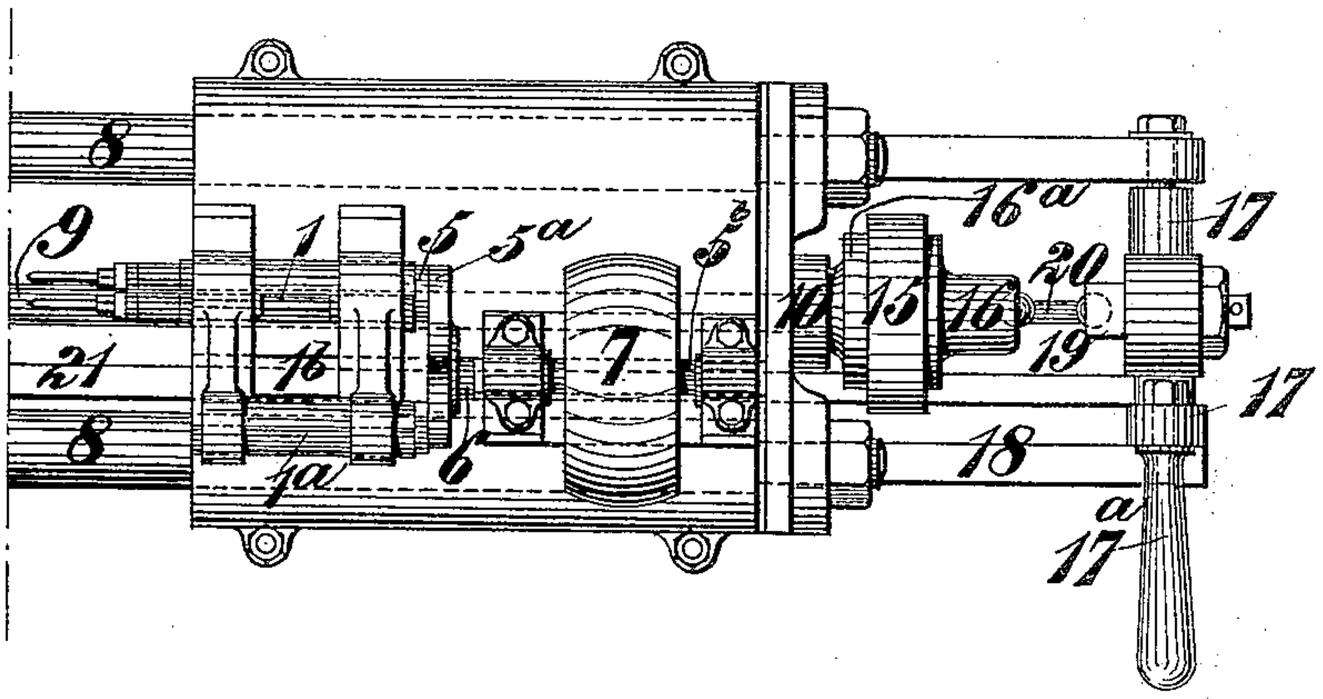


Fig. 3b

Fig. 2a



Witnesses

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(No Model.) 6 Sheets—Sheet 3.

D. JONES.

DRILLING MACHINE.

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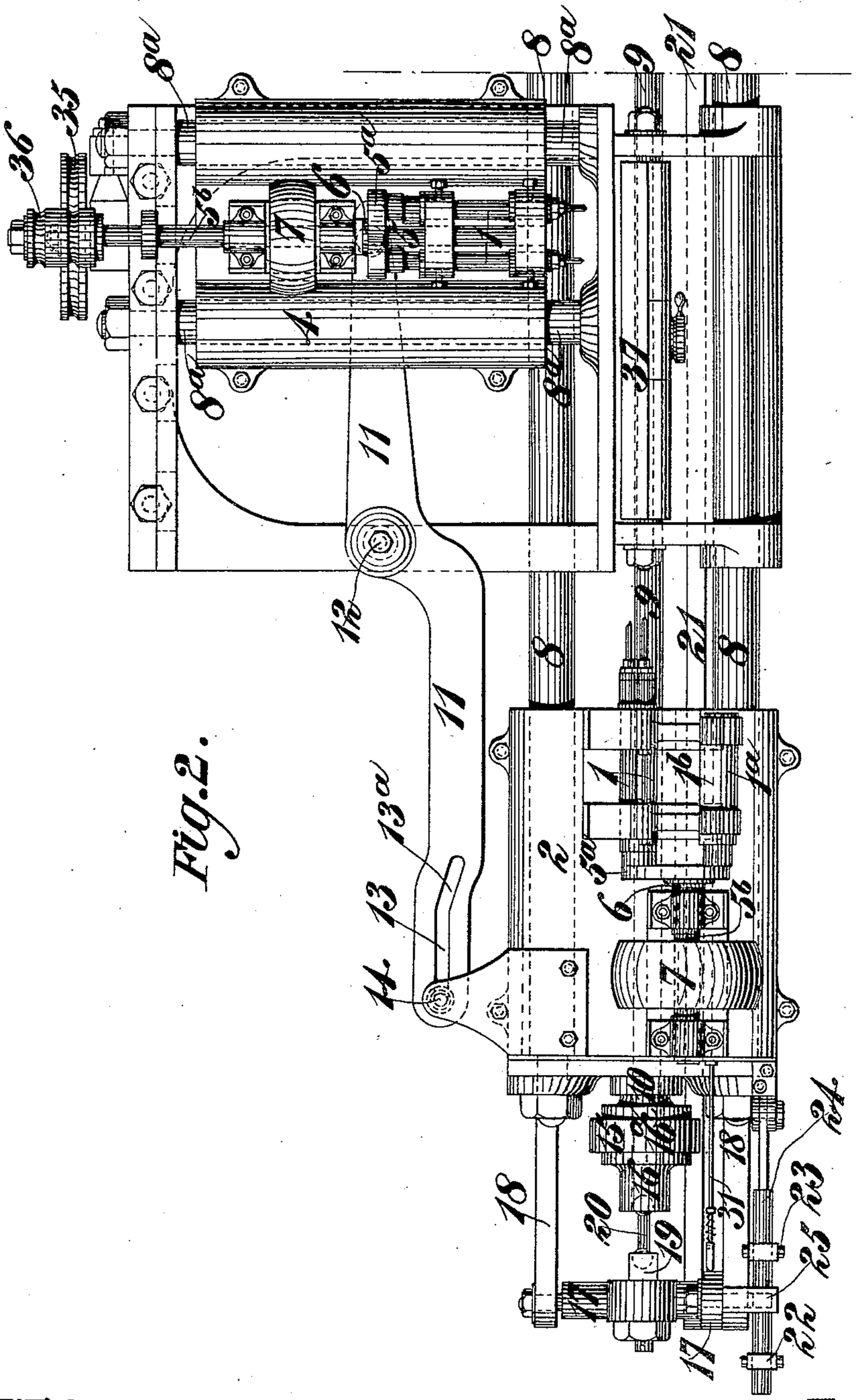

Fig. 2.

Witnesses
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(No Model.) 6 Sheets—Sheet 4.

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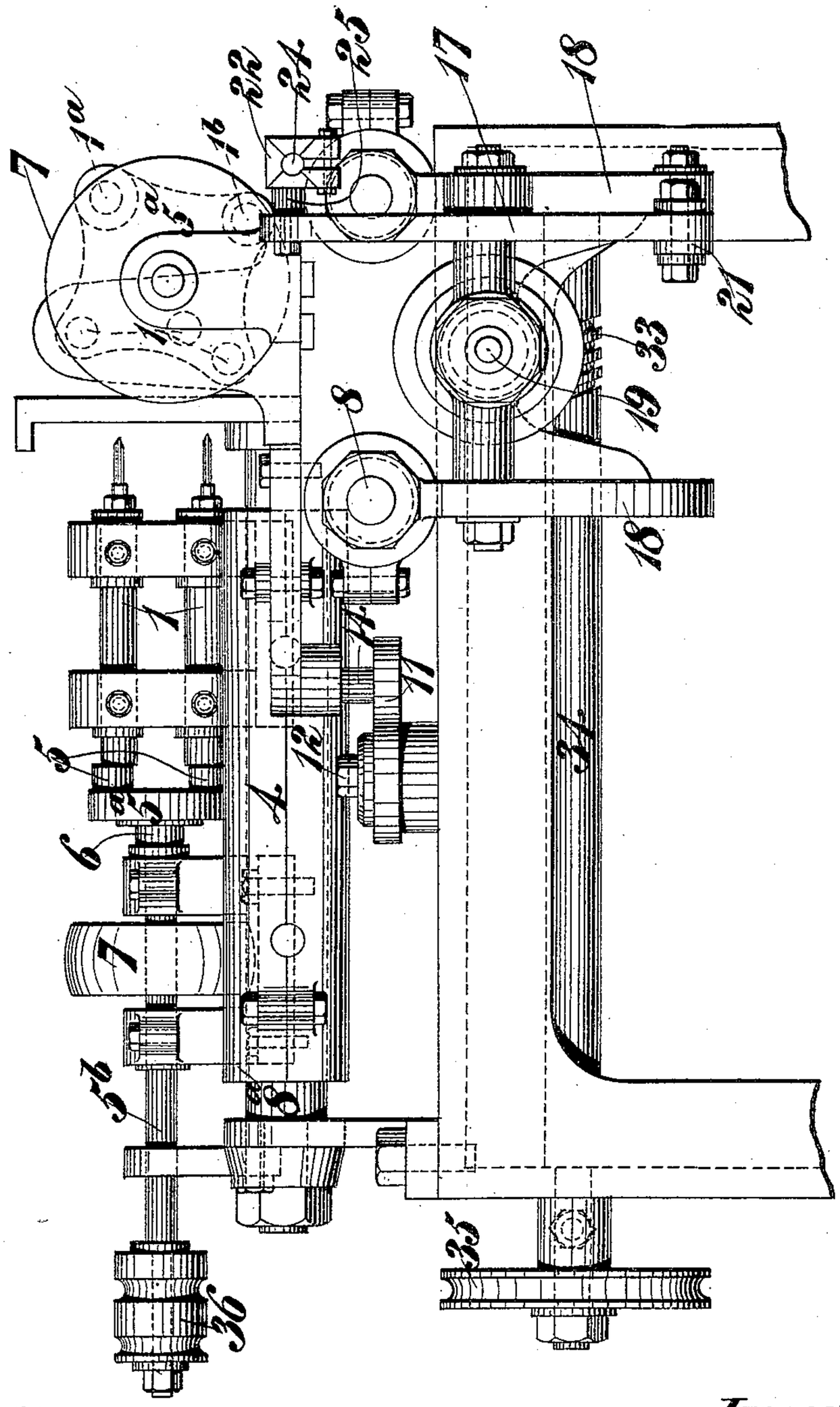
DRILLING MACHINE.

No. 529,329. Patented Nov. 13, 1894.

Fig. 3.



Witnesses
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D. JONES.

DRILLING MACHINE.

No. 529,329. Patented Nov. 13, 1894.

Fig. 3.

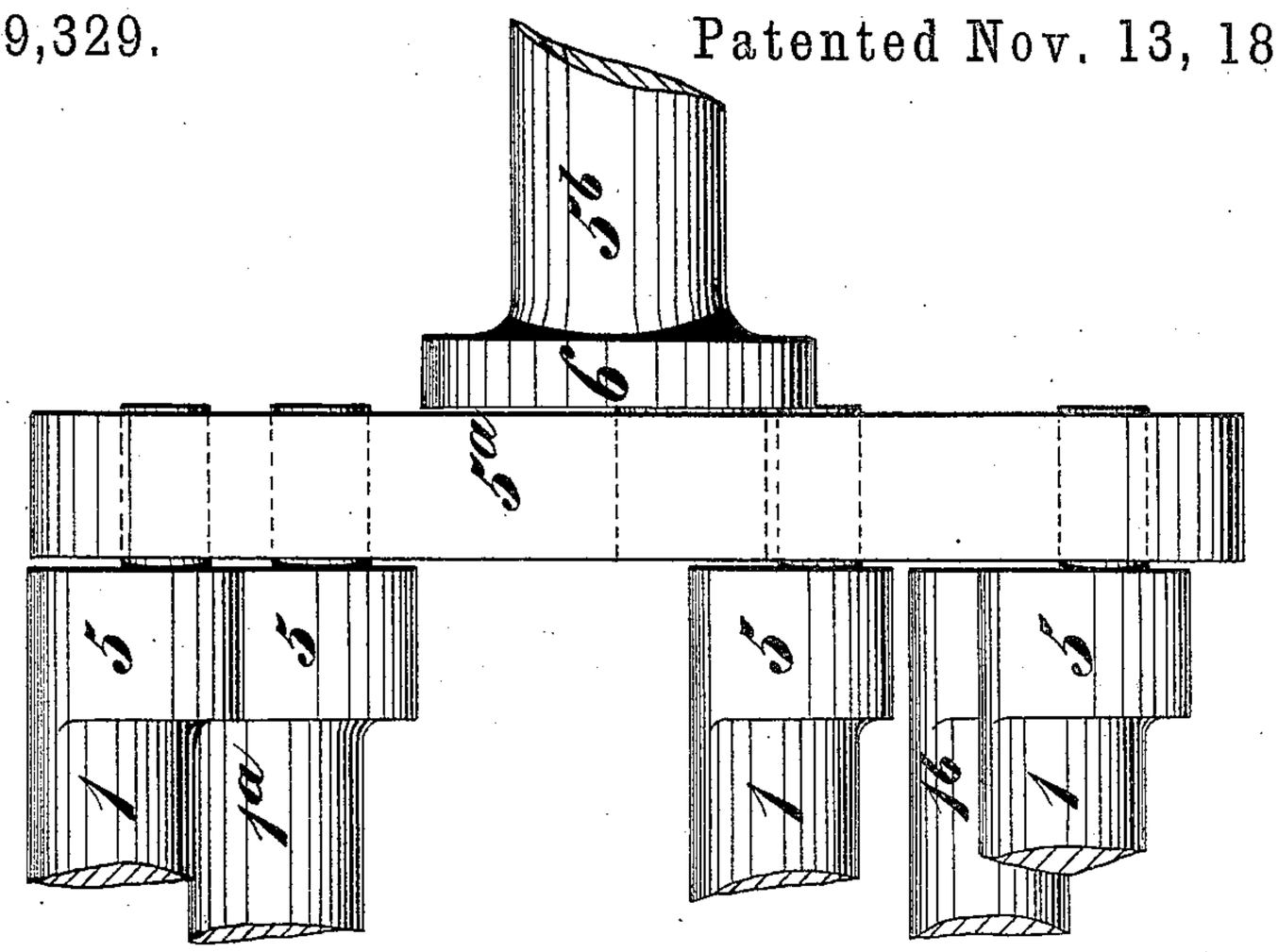
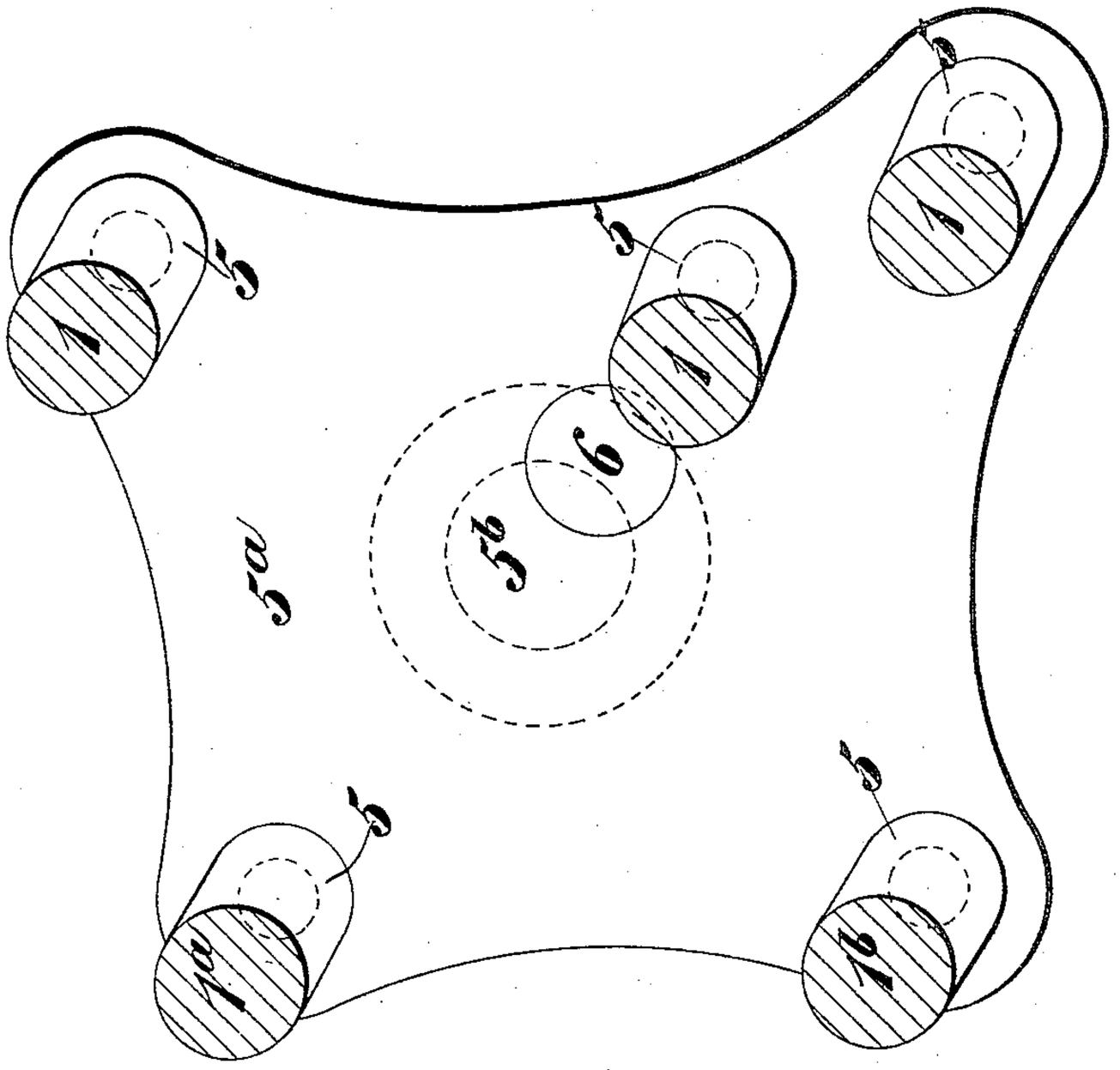


Fig. 4.



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DRILLING MACHINE.

No. 529,329. Patented Nov. 13, 1894.

Fig. 7.

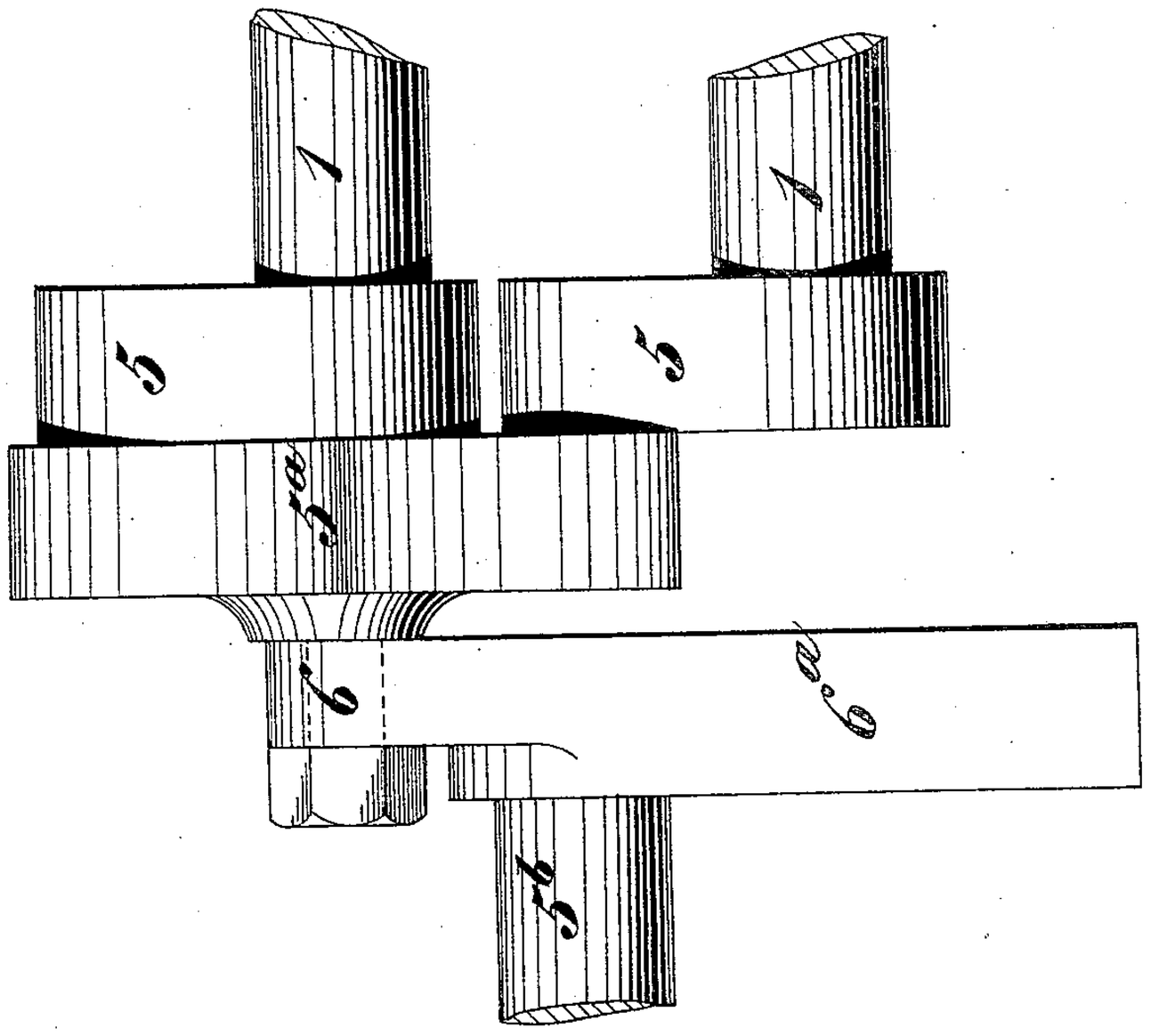
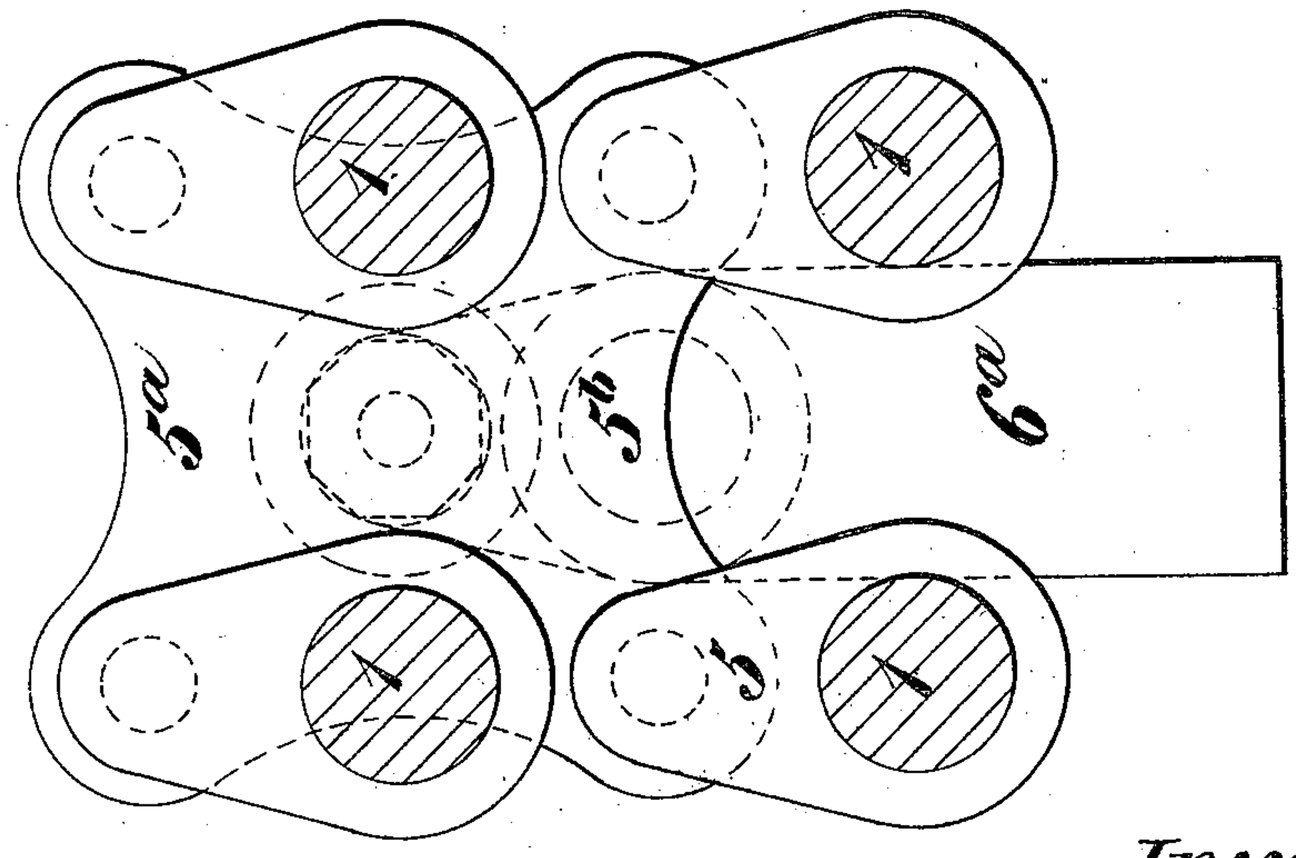


Fig. 6.



Witnesses

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Henry P. Trueman.

Inventor

Daniel Jones

UNITED STATES PATENT OFFICE.

DANIEL JONES, OF BIRMINGHAM, ENGLAND, ASSIGNOR TO THE TWO-REEL LOCK-STITCH SEWING MACHINE COMPANY, LIMITED, OF SAME PLACE.

DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 529,329, dated November 13, 1894.

Application filed May 31, 1893. Serial No. 476,156. (No model.) Patented in England April 13, 1892, No. 7,143; in Belgium March 9, 1893, No. 103,774, and in Italy March 13, 1893, XXVII, 33,696, LXVII, 352.

To all whom it may concern:

Be it known that I, DANIEL JONES, a subject of the Queen of Great Britain and Ireland, residing at No. 62 Albion Street, Birmingham, in the county of Warwick, England, have invented Improvements in Drilling-Machines, (and which were patented in Great Britain and Ireland April 13, 1892, No. 7,143; in Belgium March 9, 1893, No. 103,774, and in Italy March 13, 1893, Reg. Gen. Vol., XXVII, No. 33,696, Reg. Att., Vol. LXVII, No. 352,) of which the following is a specification.

This invention of improvements in drilling machines relates to an improved arrangement for driving a number of parallel drills from a common shaft, and for balancing the moving parts; and also to means for feeding two or more drill carrying heads toward the work to be operated upon and for afterward returning said heads to their original positions, as I will now proceed to explain by reference to the accompanying drawings, in which—

Figures 1, 1ª, 2, and 2ª are respectively front and plan views of a multiple drilling machine constructed according to this invention. Fig. 3 is an end view thereof drawn to a larger scale. Figs. 3ª and 3ᵇ are detail views. Figs. 4 and 5 are enlarged detail views showing one of the wrist plates and the corresponding set of cranks carried by the drill carrying head 2. Figs. 6 and 7 are similar views to Figs. 4 and 5 showing like parts carried by the drill carrying head 4.

1, 1 are the drill carrying spindles arranged in sets and mounted to rotate in drill carrying heads of which there are three in the example shown, viz: 2, 3 and 4. These spindles may be of different lengths and be arranged with their axes at equal or unequal distances apart to suit the nature of the work to be done. In the example shown the set of drills carried by the head 4 are arranged with their axes at equal distances apart, the sets carried by the heads 2 and 3 being arranged with their axes at unequal distances apart. Each of the drill spindles 1 is provided with a crank 5 the cranks being all of equal throw. Each set of drill spindles is provided with a wrist plate 5ª in which are formed bearings for the crank pins of the several cranks of the set. When the drill spindles are arranged at unequal distances apart, idle spindles such as 1ª and 1ᵇ may advantageously be used, each provided with a crank the pin of which is journaled in the corresponding wrist plate (Figs. 4 and 5). These idle spindles and cranks serve to balance the wrist plate.

5ᵇ is a driving spindle carrying a crank 6 of the same throw as the cranks 5 and the pin of which is also journaled in the wrist plate 5ª.

The crank 6 may, when required, be provided with a balance weight 6ª as shown in Figs. 6 and 7 to counterbalance the wrist plates.

7 is a driving pulley fast on the driving spindle 5ᵇ.

With the arrangement described it will be seen that all the drill spindles of a set can be simultaneously rotated in the same direction and at the same speed from a single driving shaft, thereby simplifying the construction of multiple drilling machines as compared with such machines as heretofore usually constructed.

The drill carrying heads 2 and 3 are mounted to slide on fixed longitudinal guide rods 8 and the drill carrying head 4 is arranged at right angles to the others and is similarly mounted to slide on fixed transverse guide rods 8ª. These heads, between which the work to be drilled is fixed in any convenient manner, are caused to advance and retreat in an automatic manner and in directions at right angles to each other by feed mechanism constructed and operating as follows:

9 is a shaft mounted in bearings 10 in the frame of the machine and arranged parallel with the guide rods 8 supporting the pair of the drill carrying heads 2 and 3. One end of this shaft is formed with a right hand screw 9ª and the other with a left hand screw 9ᵇ. On these screws work nuts 2ª and 3ª respectively that are fixed to the drill carrying heads 2 and 3. When this shaft is rotated in one direction the heads 2 and 3 connected to the nuts 2ª and 3ª will be caused to approach each other, and when the motion of the said shaft is reversed, the heads will recede from

each other. The drill carrying head 4 which in the construction shown is arranged to move on guide bars 8ª at right angles to the shaft 9 is caused to automatically advance and recede at the required times by means operated from the shaft 9. A simple and convenient means for this purpose comprises a lever 11 pivoted at 12 and formed with a slot 13 having an inclined portion 13ª and into which takes a pin 14 carried by the head 2, the arrangment being such that while the said pin is moving in the straight portion of the slot, the lever and consequently the head 4 with which it engages are stationary, but when the pin enters the inclined portion 13ª of the slot the lever will be operated in one direction or the other, according to the direction in which the head 2 and pin 14 are for the time being moving, and will cause the head to then advance or recede simultaneously with the forward or backward movement of the heads 2 and 3.

To trip and reverse the motion of the drill carrying heads, so that the drills will be caused to advance, and after completing their work to return automatically to their starting point, there is provided at each end of the screw shaft 9 a band pulley 15 free to rotate on the shaft, and to be connected therewith by means of friction disks or jaw clutches so as then to rotate the shaft. By suitable means these pulleys are driven in opposite directions. Thus one may be driven by an open belt and the other by a crossed belt.

An arrangement for causing the pulleys to alternately engage with and rotate the shaft is as follows:—At opposite sides of each pulley 15 are arranged two clutch plates 16 and 16ª that are keyed upon the shaft 9 and whereof 16 is capable of slight endwise movement on such shaft. Corresponding to each clutch 16 is a lever 17 journaled in brackets 18 carried by the framework of the machine and provided with a toggle arm 19 in the form of an adjustable screw socket. Between each toggle arm 19 and the corresponding clutch plate 16 is another toggle arm 20 the ends of which are suitably mounted in the toggle arm 19 and clutch plates respectively.

21 is a bar jointed to the lower ends of the levers 17.

22 and 23 are adjustable stops carried by a fixed bar 24 and between which a block 25 carried by the upper end of the left hand lever 17 is arranged to work. The arrangement is such that when both levers 17 are in the positions shown in Fig. 1, so that both toggle arms 20 are equally inclined to the horizontal, both pulleys 15 will be free to be rotated in opposite directions without rotating the shaft 9. If however the bar 21 be moved to the right by operating say the handle 17ª until the block 25 comes in contact with the stop 22, the toggle arms 19 and 20 at the left hand side of the machine will become more inclined to the horizontal, while the toggle arms at the right hand side will be caused to become horizontal or practically so, thereby causing the corresponding clutch plate 16 to press the right hand pulley 15 against the clutch plate 16ª with the result that the pulley will be gripped between the clutch plates and its motion will be transmitted to the shaft 9 so as to rotate it in a direction to move the heads 2 and 3 say toward each other. When the bar 21 is moved in the opposite direction so as to bring the block 25 in contact with the stop 23 the right hand toggle will be put out of action and the left hand one brought into action so that the shaft 9 will then be rotated in the opposite direction by the left hand pulley 15 and the heads 2 and 3 will be moved apart. The head 4 is during these operations actuated at the required times from the head 2 by the lever 11 in the manner hereinbefore described.

To cause the bar to be moved to the left at the required times to automatically effect the return movement of the heads, the following mechanism may be employed.

26 (Figs. 1, 3ª, and 3ᵇ) is a bell crank lever pivoted at 26ª to the left hand brackets 18. The lower depending arm of this lever is connected by a pin and slot connection 27 to the bar 21. The other arm of the lever carries a pin or roller 28 adapted to travel upon a bar or shelf 28* fixed to the nut 2ª.

29 is a spring encircling a rod 30 carried by a projecting part 21ª (Fig. 1) of the bar 21. One end of the spring acts against this projection and the other end against an extension 3ᵇ of the nut 3ª through which the rod 30 works when the extension moves endwise with the said nut.

31 (Figs. 1 and 2) is a rod fixed to the head 2 and adapted when the head moves to the left, to act against the upper end of the left hand lever 17 and move this lever as well as the right hand lever into the inoperative position shown in Fig. 1. As will be seen the arrangement is such that when the bar 21 is moved to the right by the handle 17ª to cause the heads 2 and 3 to approach each other in the manner hereinbefore described, the pin or roller 28 will be raised above the bar or shelf 28* which will then prevent the bell crank lever and the bar 21 being moved in the opposite direction by the spring 29 which will be compressed by the extension 3ᵇ while the heads 2 and 3 are approaching each other. When these heads have completed their forward movement the pin or roller 28 will slip off the outer end of the bar or shelf 28* thereby leaving the spring 29 free to move the bar 21 to the left and cause the heads to make their outward or return movement as hereinbefore described. When this movement has been nearly completed, the rod 31 will act against the upper end of the left hand lever 17 and upon continued movement of the heads will move both levers 17 in the positions shown in Fig. 1 in which both clutches are rendered inoperative and the heads will be automatically brought to rest.

To enable the shaft 9 to be driven when necessary at a slower rate than can be obtained by the pulleys 15 it is or may be provided with a worm wheel 32, (Figs. 1 and 3) gearing with a worm 33 on a shaft 34 journaled in the frame work of the machine and provided with a pulley 35 by means of which it can be driven by a band from a corresponding pulley 36 fixed on the driving shaft 5 carried by the head 4. 37 is a hinged work plate to which the article to be drilled is secured.

As will be evident apparatus according to my invention may be variously modified. In practice the various parts would be arranged to suit the requirements of the special work intended to be done. The multiple drilling machine shown, is adapted for drilling holes in the bed and fixed parts of a sewing machine, but it can obviously be adapted for drilling other articles.

In explaining the nature of my invention I have described it as it would be applied in the construction of a machine having three heads one of which is adapted to move at right angles to the other which constitutes a pair, but it might be desirable to arrange the heads to work at other angles to each other and to construct machines with two or more pairs of heads.

What I claim is—

1. In a multiple drilling machine, the combination with separate drill carrying heads arranged to move to and from each other and each carrying a screw threaded nut, of a rotary shaft with right and left handed screw threads directly engaging said screw threaded nuts, separate sets of driving mechanism adapted to rotate said shaft in opposite directions, and means for bringing said sets of driving mechanism alternately into action substantially as herein described.

2. In a multiple drilling machine, the combination of drill carrying heads arranged to move relatively to each other and each carrying a screw threaded nut, a rotary shaft with right and left handed screw threads engaging the correspondingly screw threaded nuts on said heads and driving mechanism for rotating said shaft alternately in opposite directions, a spring adapted to reverse the action of said driving mechanism when the said drill carrying heads have been moved to a predetermined extent, and tripping mechanism adapted to release said spring at the required times, substantially as herein described for the purpose specified.

3. In a multiple drilling machine, the combination of drill carrying heads arranged to move relatively to each other and each carrying a screw threaded nut, a rotary shaft with right and left handed screw threads engaging the correspondingly screw threaded nuts on said heads and driving mechanism for rotating said shaft alternately in opposite directions, a spring adapted to reverse the action of said driving mechanism when the said drill carrying heads have been moved to a predetermined extent, tripping mechanism adapted to release said spring at the required times, and a stopping device operated by one of said drill carrying heads and arranged to automatically throw said driving mechanism out of action when the said heads have returned to a predetermined extent substantially as herein described.

4. In a multiple drilling machine, the combination of drill carrying heads arranged to move relatively to each other, a shaft for reciprocating said heads, driving wheels loosely mounted on said shaft and arranged to be driven in opposite directions the one to the other, clutches for connecting said driving wheels to said shaft, toggle mechanism for fixing said clutches, and means for operating said toggle mechanism to bring said driving wheels alternately into action substantially as described.

5. In a multiple drilling machine the combination of parallel drill spindles, cranks with crank pins on said spindles and a wrist plate in which said crank pins are journaled, movable heads for carrying said drill spindles, a rotary shaft with right and left handed screw threads engaging correspondingly screw threaded parts carried by said movable heads, driving wheels mounted loosely on said shaft, and means for causing them to engage alternately therewith substantially as described.

6. In a multiple drilling machine, the combination of drill carrying heads arranged to move relatively to each other, driving mechanism for operating the same alternately in opposite directions, toggle and clutch mechanism for throwing said mechanism in and out of action, a spring adapted to actuate said toggle and clutch mechanism so as to reverse the direction of movement of said drill carrying heads, said spring being arranged to have energy stored therein by a moving part of the machine during the advancing movement of said drill carrying heads, and a retaining device carried by one of said drill carrying heads and acting to restrain the action of said spring until the said heads have completed their forward movement and to then release said toggle and clutch mechanism and permit it to be acted upon by said spring substantially as herein described for the purpose specified.

7. In a multiple drilling machine, the combination of two drill carrying heads arranged to reciprocate to and from each other, a shaft for reciprocating said heads, means for driving said shaft alternately in opposite directions, a drill carrying head arranged to move at an angle to the other two heads and means for reciprocating it from one of said other heads substantially as herein described.

8. In a multiple drilling machine the combination of drill spindles 1, drill carrying heads 2, 3 and 4, right and left handed screw threaded nuts carried by the heads 2 and 3 respectively a screw threaded shaft 9 engaging said nuts, a slotted lever 11 adapted to

transmit motion from one of the heads 2, 3, to the other head 4 arranged to move at an angle to them, pulleys 15 loosely mounted on the said shaft 9 and driven in opposite directions, clutch plates 16, 16ª keyed on said shaft and arranged one on each side of each of said pulleys, toggle arms 19 and 20, for operating one of the clutch plates of each pair, levers 17 for operating said toggles and means for simultaneously operating said levers substantially as herein described.

9. In a multiple drilling machine the combination of drill carrying heads 2, 3, a right and left handed screw threaded shaft 9, for operating said heads, pulleys 15 loosely mounted on said shaft and driven in opposite directions, clutches 16, 16ª and toggles 19 and 20, for locking each of said pulleys in turn to said shaft, levers 17 to which said toggles are connected, a bar 21 connecting said levers, and stops 22 23 between which an end of one of said levers is arranged to work, substantially as herein described for the purpose specified.

10. In a multiple drilling machine the combination of drill carrying heads 2, 3, a right and left handed screw threaded shaft 9, for operating said heads, pulleys 15 loosely mounted on said shaft and driven in opposite directions, clutches 16, 16ª and toggles 19 and 20, for locking each of said pulleys in turn to said shaft, levers 17 to which said toggles are connected, a bar 21 connecting said levers, a spring 29 arranged to act against said bar and effect the return movement thereof, a projection carried by one of said heads and arranged to compress said spring when said head is moved in one direction and trip mechanism for preventing said bar returning until the drill carrying heads have completed their operative movement substantially as described.

11. In a multiple drilling machine the combination of drill carrying heads 2, 3, a right and left handed screw threaded shaft 9, for operating said heads, pulleys 15 loosely mounted on said shaft and driven in opposite directions, clutches 16, 16ª and toggles 19 and 20, for locking each of said pulleys in turn to said shaft, levers 17 to which said toggles are connected, a bar 21 connecting said levers, a spring 29 arranged to act against said bar and effect the return movement thereof, a projection carried by one of said heads and arranged to compress said spring when said head is moved in one direction, a tripping device comprising a bell crank lever 26 connected at one end to said lever 21 and provided at the other with a pin or roller 28, and a ledge or support 28* carried by one of said heads and wherein said pin or roller is supported during the forward movement of the heads, and a rod 31 carried by one of said heads and arranged to act against one of said levers and move the driving mechanism into its inoperative position when said heads have returned to a predetermined extent, substantially as herein described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

DANIEL JONES.

Witnesses:
W. H. HARRIS,
Notary Public, Birmingham, England.
REGINALD TREW MORGAN,
His Clerk, Birmingham.