Apr. 24, 1923.

1,452,921

J. McLELLAN

MULTIPLE DRILL MACHINE

Filed May 9, 1922

6 Sheets-Sheet 1

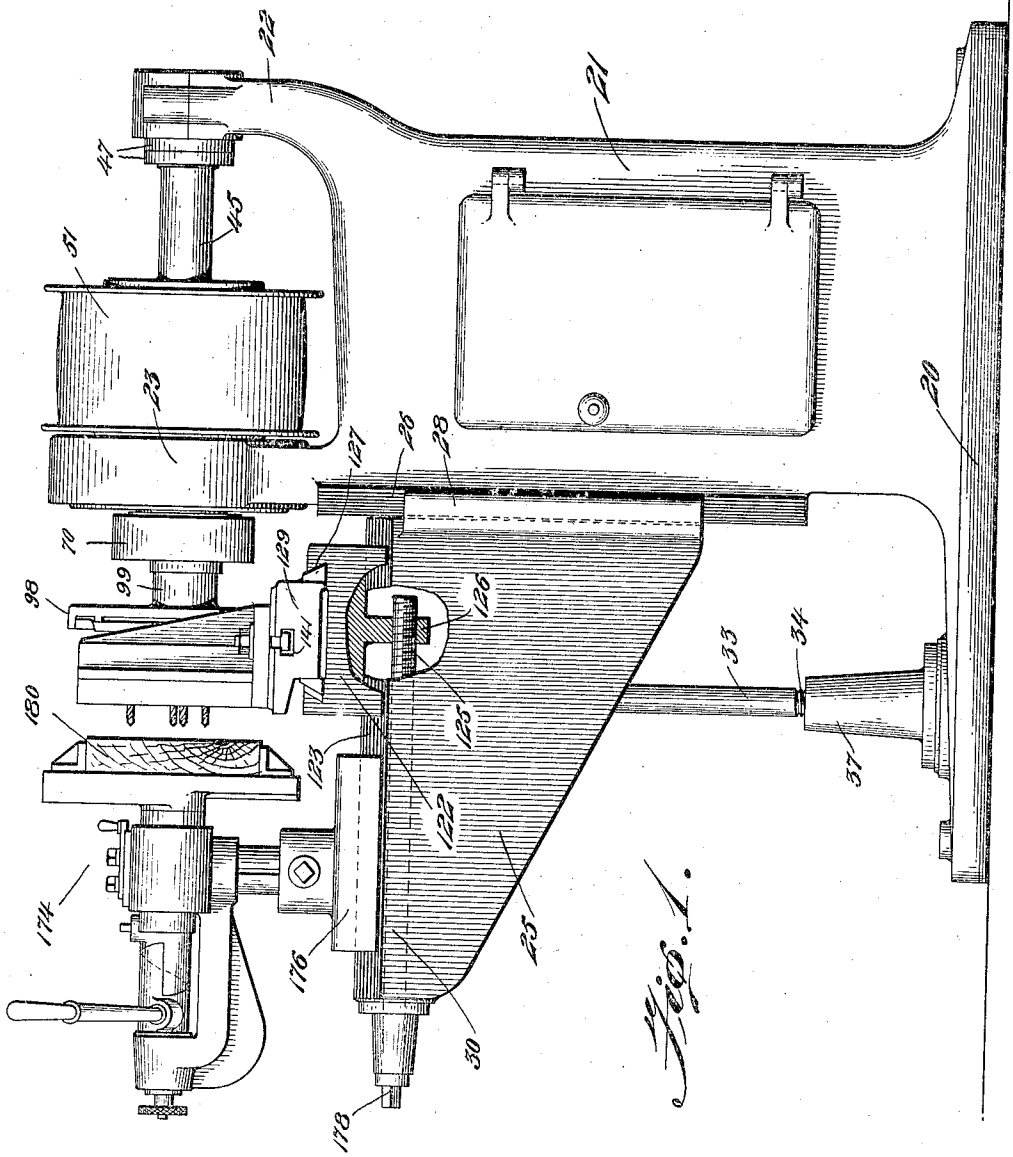


Fig. 1.

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Apr. 24, 1923.

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6 Sheets-Sheet 2

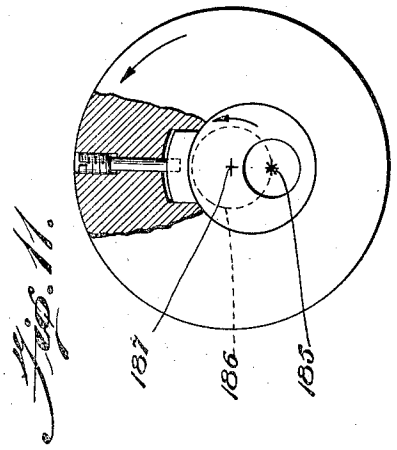


Fig. 11.

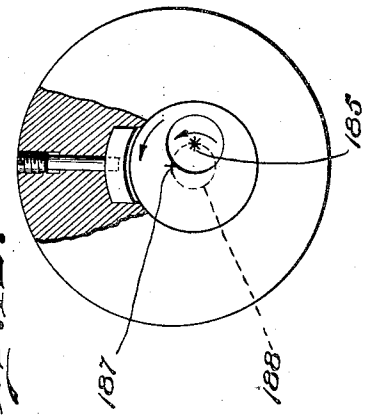


Fig. 12.

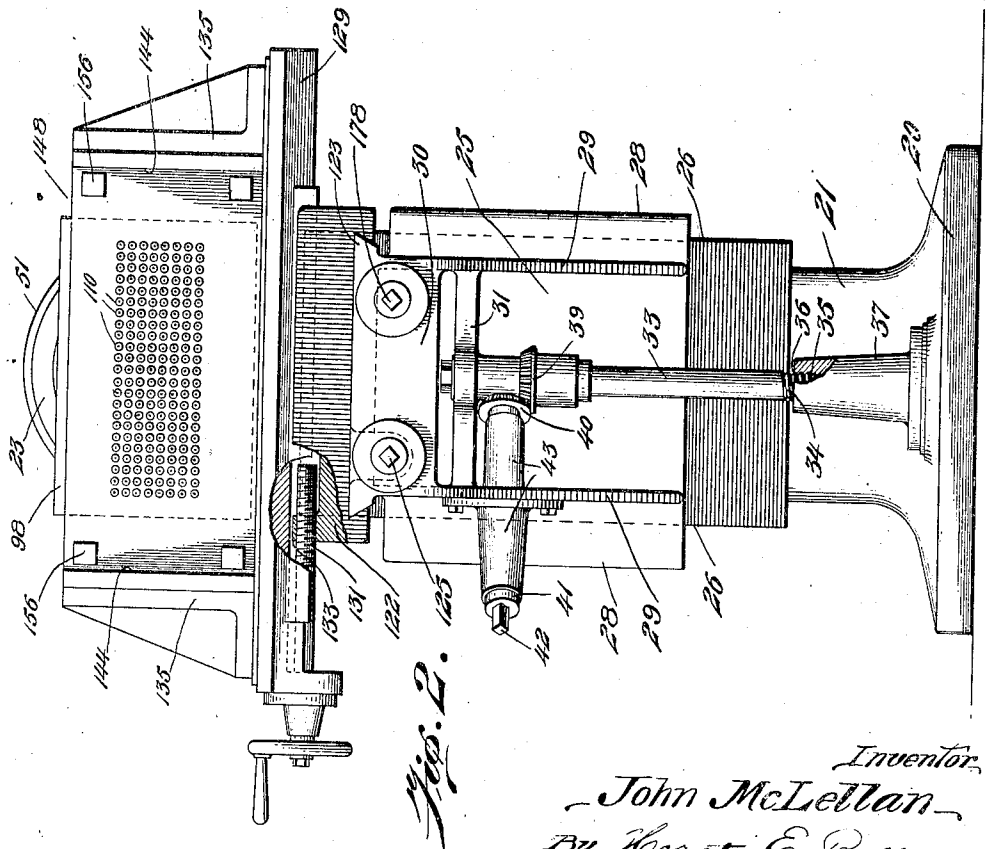


Fig. 2.

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1,452,921

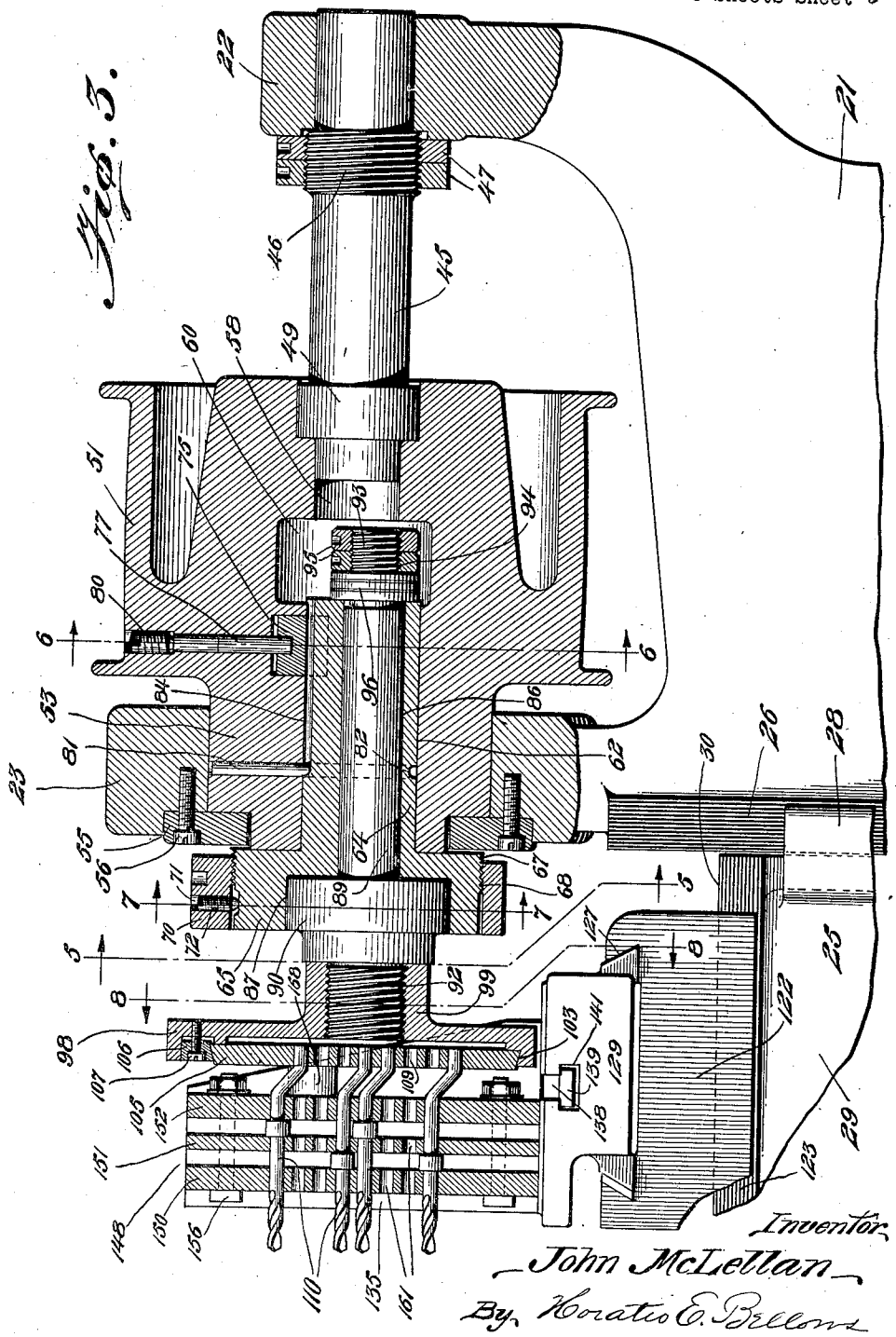
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MULTIPLE DRILL MACHINE

Filed May 9, 1922

6 Sheets-Sheet 3

Fig. 3.



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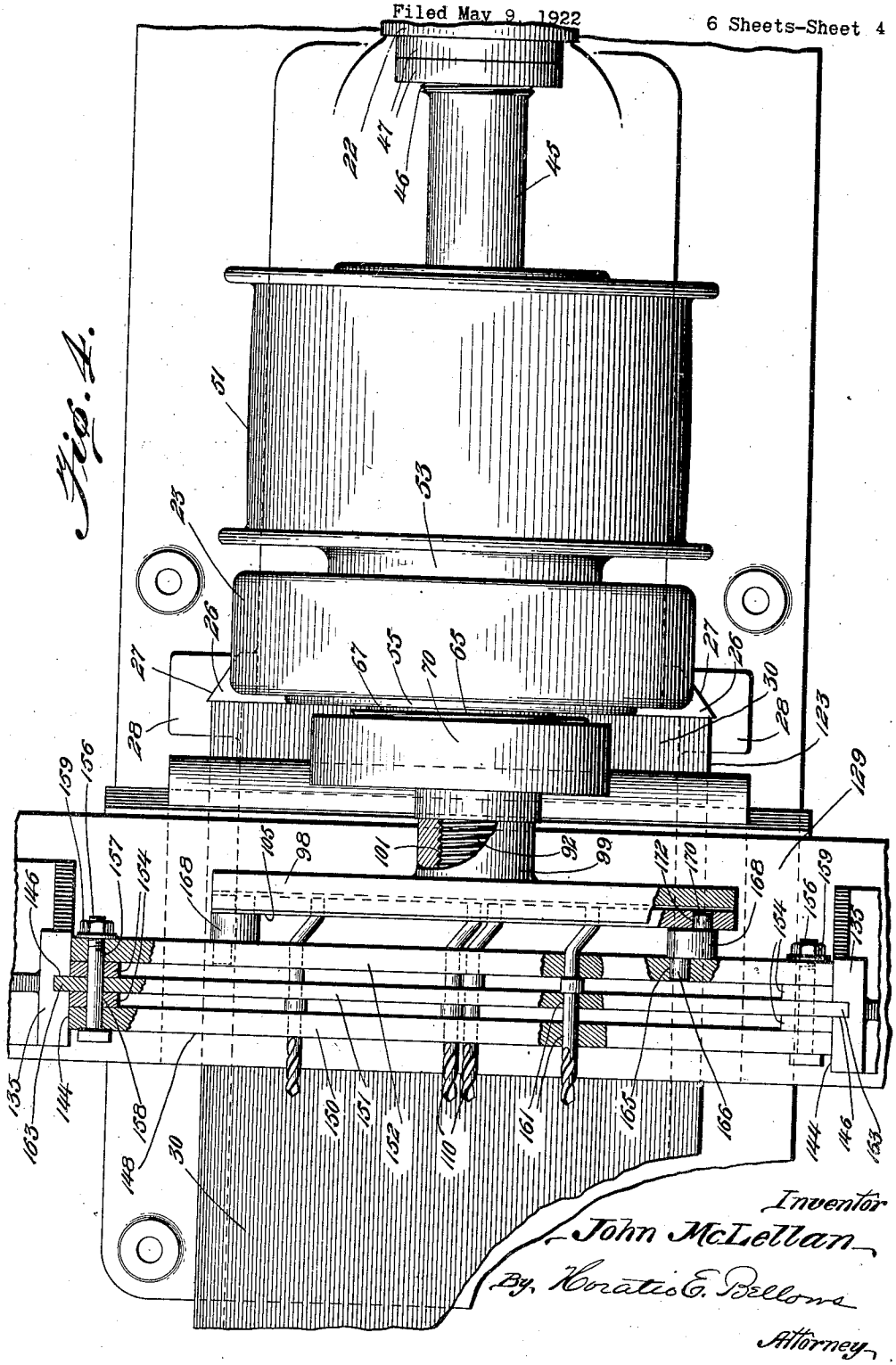
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6 Sheets-Sheet 4



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MULTIPLE DRILL MACHINE

Filed May 9, 1922 6 Sheets-Sheet 5

Fig. 6.

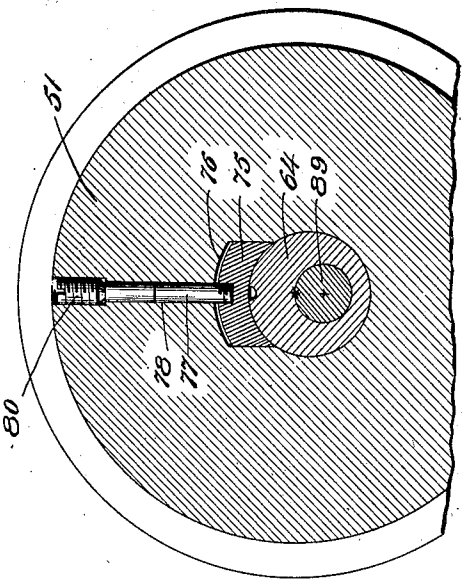
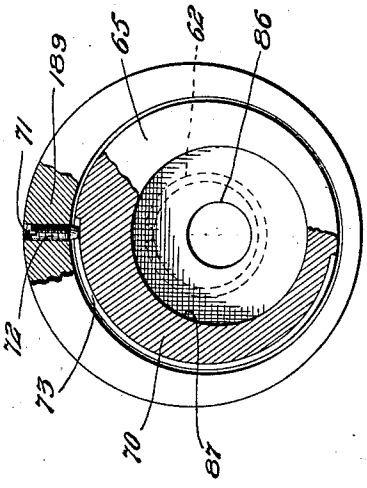


Fig. 7.



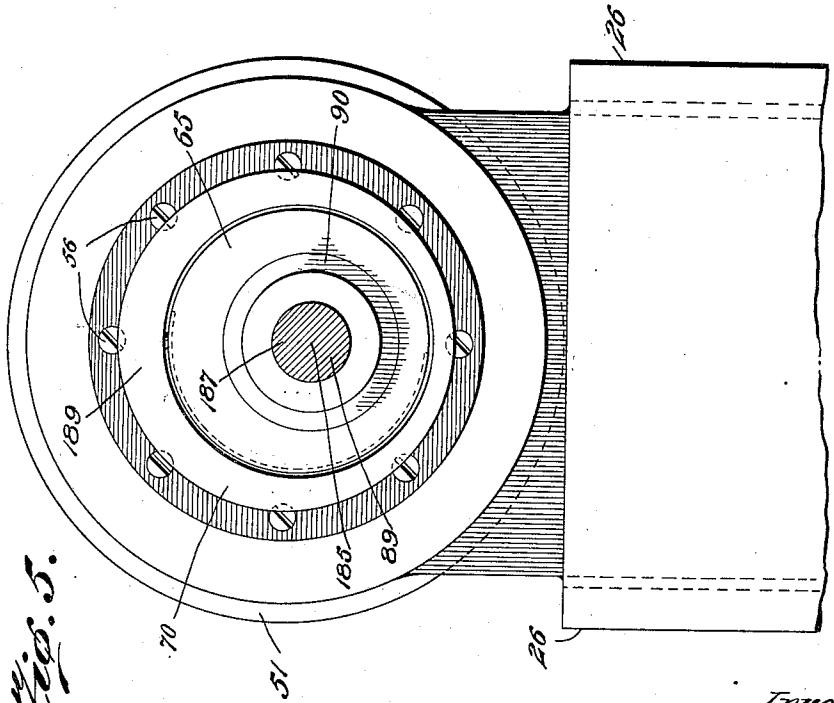


Fig. 5.

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MULTIPLE DRILL MACHINE

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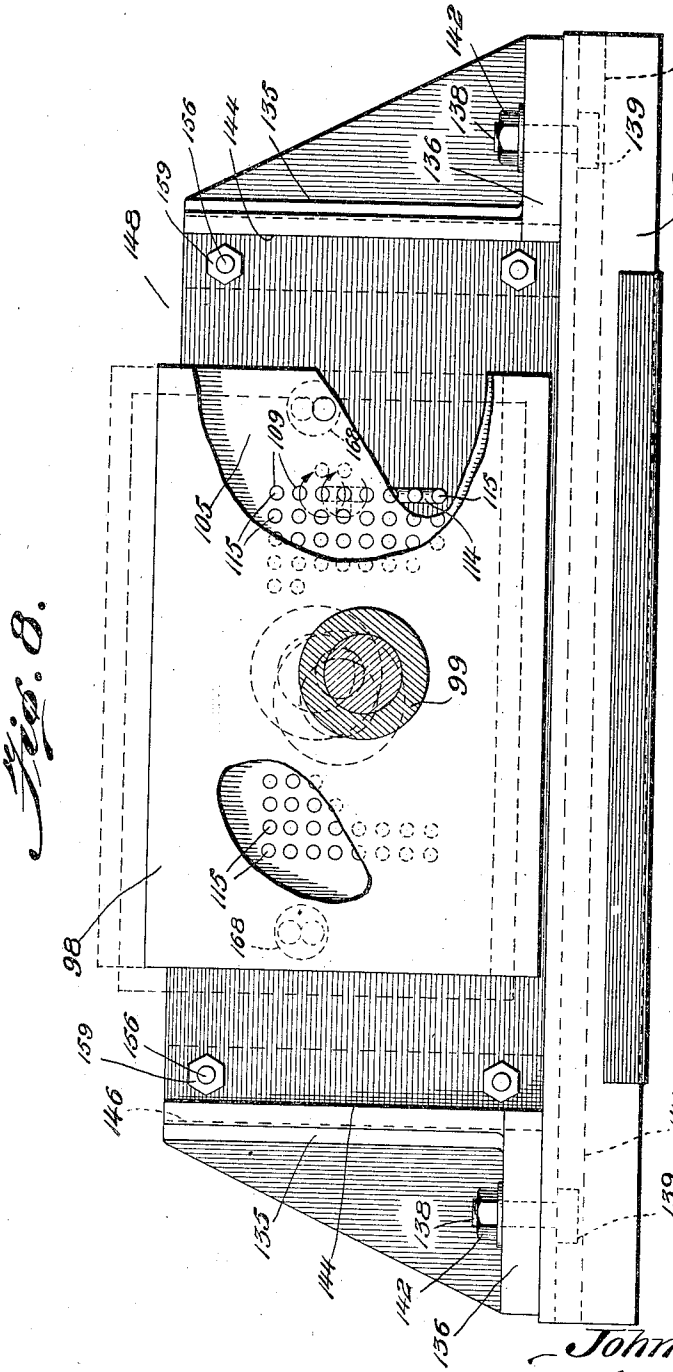


Fig. 8.

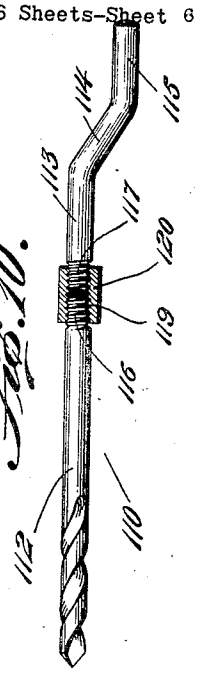


Fig. 10.

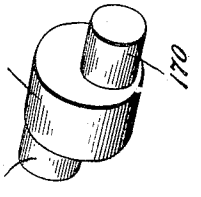


Fig. 9.

Inventor
John McLellan
By Horatio E. Bellows
Attorney

Patented Apr. 24, 1923. 1,452,921

UNITED STATES PATENT OFFICE.

JOHN McLELLAN, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MULTIPLE DRILLING MACHINE COMPANY, A CORPORATION OF RHODE ISLAND.

MULTIPLE-DRILL MACHINE.

Application filed May 9, 1922. Serial No. 559,575.

To all whom it may concern:

Be it known that I, JOHN MCLELLAN, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Multiple-Drill Machines, of which the following is a specification.

My invention relates to multiple drilling machines of the oscillatory type, and is an improvement of that disclosed in United States Patent No. 1,075,588 issued to me Oct. 14, 1913.

The essential objects of my invention are to eliminate vibration of the drills and driving mechanism; to enable a regulation of the oscillatory travel of the driving element to correspond with the degree of eccentricity or offset of the drill shanks; and to prevent cramping of the drills in the tool holder or driving element.

Other objects and advantages will be apparent to those skilled in the art by an examination of this specification.

To the enumerated ends primarily invention resides in construction and combinations which fall within the scope of the appended claims.

In the accompanying drawings,

Figure 1 is a side elevation of my machine,

Figure 2, a front elevation of the same omitting the work holder,

Figures 3 and 4, a central vertical longitudinal section, and a partial plan view respectively of the same,

Figures 5 and 6, sections on lines 5—5 and 6—6 respectively of Figure 3,

Figure 7, a fragmentary section on line 7—7 of Figure 3,

Figure 8, a section on line 8—8 of Figure 3 showing parts of the driving chuck broken away,

Figures 9 and 10, detail views of a spacer member and a drill respectively, and

Figures 11 and 12, diagrammatic views of the oscillator controlling means in various degrees of adjustment.

Like reference characters indicate like parts throughout the views.

The framework of my machine in the form thereof herein illustrated comprises a base 20 on which is a standard or bed 21 having a rear support 22 and a front bearing 23. The frame also includes a table or extension 25 connected to the standard in this instance by vertical guides 26 on the front end of the latter on which are movable in dovetailed guideways 27 laterally projecting extensions 28 an the former. The table includes walls 29 integral with said extensions and with a top or bed 30. A cross piece 31 is located below the bed in which is rotatable the upper end of an elevating rod 33 whose lower end has a thread 34 engaging a thread 35 in the orifice 36 of a socket 37 fast to the base 20. A bevel gear 39 fast to the rod 33 is engaged by a gear 40 on a shaft 41 with a squared end 42 and rotatable in a bearing 43 secured in one of the walls 29 transversely thereof. By the described means the table 25 is vertically adjustable.

Fast in the bearing 22 is a shaft 45 in this case provided with a thread 46 to accommodate lock nuts 47, and having an external shouldered journal 49 near its front end. On this shaft is revolubly mounted a pulley 51. A hub portion 53 upon the body of the pulley is journaled in the front bearing 23, and is held therein by a retaining ring 55 attached to the bearing by screws 56, and through which a portion of the hub extends. The bore 58 of the rear end of the pulley accommodates the shaft 45 and shouldered journal 49. This bore terminates in a forward direction in an enlarged concentric portion 60. Extending longitudinally of the pulley through its hub portion 53 is a bore 62 whose center is slightly eccentric to the center of the pulley, and which extends to the enlarged portion 60 of the bore 58. In the bore 62 is a spindle bushing 64 provided with an end portion 65 of increased diameter whose inner face abuts against the forward end of the pulley hub 53. Said end portion or head is provided with a peripheral thread 67 engaging an internal thread 68 on an eccentric counterbalance ring 70. The ring is provided with a radially disposed threaded hole 71 to receive a screw 72 which registers in a semicircular peripheral groove

73 in the enlargement 65. The spindle bushing 64 is retained within the bore 62 by means of a clamping shoe 75 slidable in a cavity 76 in the pulley and opening into the bore. Fast to the shoe is a pin 77 slidable in a radial hole 78 extending to the periphery of the pulley 51. In the outer portion of the hole is threaded a set screw 80 adapted to engage the pin 77 by means of which clamping pressure is applied to the shoe 75. A radial pin 81 in the pulley hub 53 projects into an annular groove 82 in the bushing to which it has access through a longitudinal groove 84 on the periphery of the bushing.

The bushing 64 is provided with a longitudinal bore 86 eccentric to its center and adjustably eccentric in a greater degree to the center of the pulley. The bore 86 at its forward end is enlarged as at 87. Loosely mounted in the bore 86 of the bushing is a spindle member 89 having a cylindrical shoulder 90 in the enlargement 87 and provided with a thread 92 upon its end. In order to retain the spindle in the bushing the rear end 93 of the former is of reduced diameter and has a thread 94 to engage lock nuts which bear against a thrust bearing 96 upon the spindle, which in turn abuts against the end of the bushing.

A driving plate chuck 98 has a hub 99 provided with an internal thread 101 engaging the thread 92 of the spindle 89. In the present instance the chuck is rectangular and has a dove-tailed recess 103 in its face to receive a driving plate 105 which is retained in its seat by a beveled clamping strip 106 engaging its upper margin and which is adjustably secured to the chuck by screws 107. The plate has a plurality of transversely disposed holes 109 throughout its area adapted to loosely receive the butt ends of drills 110. Each drill in this case consists, as shown in Figure 10, of a sectional or divided shank comprising a drilling section 112 and an operating section 113; the latter being provided with an inclined intermediate portion 114 terminating in an offset butt portion 115. The degree of offset corresponds to the maximum eccentricity of the center of the spindle 89 relative to the center of the pulley 51. The adjacent ends of the drill sections have threads 116 and 117 respectively. These threads are engaged with an internal thread 119 in a sleeve 120 adapted to join the sections.

A block 122 is longitudinally slidable on dovetailed guides 123 upon the top 30 of the table 25, and is adjustable thereon by means of a feed screw 125 engaging a lug 126 on the block 122. The top of the block 122 is provided with a guideway 127 extending transversely of the machine, in which is slidably mounted a bed plate 129 adjustable longitudinally by a feed screw 131 swiveled in one end thereof and engaging the lug 133 on the block 122. Upon the upper face of the bed plate 129 near its end are clamping brackets 135 through the base portion 136 of which pass bolts 138 whose heads 139 are slidable in a longitudinal T groove 141 in the bed plate 129, and whose nuts 142 operate upon the base portions 136. The brackets may be adjusted to and from each other and can be maintained in adjusted position by the bolts and nuts. The opposed vertical clamping faces 144 of the brackets are broad and are provided with vertical grooves or slots 146.

Mounted on the bed plate 129 between the brackets 135 is a removable drill holder 148. This comprises three parallel rectangular plates 150, 151, 152 spaced from each other at their ends by vertical spacing strips 154 and maintained in engagement relatively to each other by bolts 156 passing through openings 157 and 158 in the plates and strip respectively, and having nuts 159. These three plates are provided with transversely disposed holes 161, the holes in one plate being in alignment with the corresponding holes in the other two plates. The arrangement of the holes in these plates corresponds with the arrangement of the holes 109 of the driving plate 105. The plate 151 extends at each end beyond its companion plates and forms vertical lateral shoulders 163 on the drill holder 148. These shoulders are slidable in the grooves 146. In mounting the drills the drill holder is bodily withdrawn from between the brackets, and the parts disassembled by withdrawing the bolts 156. To assemble the drills and drill holder the drilling sections 112 of all the drills 110 are first inserted in the holes 161 of the drill plate 150. The sections are alternately of different lengths. Upon the ends of the shorter sections are now threaded the sleeves 120. The plate 150 is now applied so that the ends of the longer drill sections pass through alternate holes thereof and are now equipped with their sleeves 120. The plate 152 is now attached together with the spacing strips to the plates 150 and 151. The operation sections 113 of the drills, which sections are of different lengths are now passed through the holes of the plate 152 and alternately through the plate 151 and are threaded into their respective sleeves. This method of assemblage is not exclusive. The drill holder is now returned to place.

The plate 152 is provided near each end with a marginal opening 165 in each of which is journaled a stud 166 upon one face of a guide disk 168 which has upon its opposite face a diametrically oppositely disposed stud 170. The drill holder is fed towards the driving plate by the rotation of the feed

screw 125, and the butt ends 115 of the drills are during this movement directed to their respective holes 109 of the driving plate. The studs 170 are also carried into holes 172 in the margins of the driving plate 105 wherein they are journaled. The guide disks act not only as spacers but insure accurate parallelism between the drill holder and driving plate thus preventing clamping of the drill shanks. These guide disks have a circular movement corresponding with the movement of the drive plate and drill butts.

A work holder 174 is provided mounted on a base 176 slidable on the top 30 of the table 25 and adjustable longitudinally of the table by means of a feed screw 178. A piece of work 180, as shown in Figure 1, may be carried in the work holder 174 for presentation to the drills.

In operation the pulley 51, to which the bushing 64 is eccentric, is driven by a belt, and being fast to the bushing moves the bushing in an eccentric path around the axis of the pulley. The pulley and the bushing carry the spindle 89 which is eccentric to the center of the bushing, and also eccentric in a greater degree to the axis of the pulley than it is to the axis of the bushing in a circular path concentric with the travel of the pulley. The spindle does not rotate on its own axis. The bushing has during the operation of the machine no rotation upon its own axis but the radius of its travel is somewhat shorter than that of the spindle. It will be observed that there are present in this construction two eccentric members rather than one whereby it is possible to vary the degree of eccentricity of the spindle. The driving plate 105 is driven by the spindle and therefore is moved in a path corresponding with that of the spindle. Therefore the variation of the spindle movement imparts a corresponding movement to the driving plate. It is evident, therefore, that drills of varying degrees of offset may be employed in this machine. The method of varying the degree of eccentricity of the driving parts is as follows.

The screw 80 is loosened relieving pressure upon the clamping shoe 75, thus releasing the bushing 64 and permitting the latter to be rotated in its bore 86. During said rotation the radial pin 81 moves in the annular groove 82, but retains the bushing against longitudinal movement. This rotation of the bushing 64 causes the center of the spindle 89 to travel in a path concentric to the bushing. In Figure 11 is diagrammatically shown the maximum eccentric position of the parts, wherein the center 185 of the spindle during the ordinary operation of the machine has its path of movement shown by a broken line circle 186 in the direction of the arrows as shown and around the center of the pulley. When adjusting from the initial position above described the bushing 89 rotates on its own center causing the center 185 of the spindle to approach the center 187 of the pulley in the direction of the arrows along the broken line circle 188, as shown in Figure 12, thus decreasing the radius or extent of eccentricity from the pulley center.

When the spindle 89 is adjusted to any desired position as described the counterbalance ring 70 must be adjusted to correspond. That is, the weighted portion 189 of the ring and the center 185 of the spindle 89 are diametrically opposite each other relatively to the center of the pulley. To adjust the ring 70, the screw 72 is loosened and the ring turned to the desired point, and the screw retightened. Thus any vibration which might occur due to centrifugal impulse will be neutralized.

I claim:—

1. In a multiple spindle drilling machine, a bearing, a pulley provided with an eccentric bore journaled in the bearing, a bushing in the bore having an eccentric bore, a spindle free to rotate in the bushing, a driving plate carried by the spindle provided with drill sockets, a tool holder adjacent the plate, and drills comprising bodies rotatably mounted in the holder and offset ends free to rotate in the sockets.

2. In a multiple spindle drilling machine, a base, a bearing on the base, a support on the base, a shaft fixed in the support, a pulley journaled in the bearing and provided with an eccentric bore receiving the shaft, a bushing in the bore having an eccentric bore, a spindle free to rotate in the bushing, a driving plate supported by the spindle provided with drill sockets, a tool holder adjacent the plate, and drills comprising bodies rotatably mounted in the holder and free to rotate in the sockets.

3. In a multiple spindle drilling machine, a bearing, a pulley provided with an eccentric bore journaled in the bearing, a bushing in the bore having an eccentric bore, means in the pulley for circularly adjusting the bushing in the bore, a driving plate carried by the spindle provided with drill sockets, a tool holder adjacent the plate, and drills comprising bodies rotatably mounted in the holder and offset ends free to rotate in the sockets.

4. In a multiple spindle drilling machine, a bearing, a pulley journaled in the bearing provided with an eccentric bore, a cavity opening into the bore, a radial hole extending to the cavity, and provided with a thread, a bushing mounted in the bore having an eccentric bore, a clamping shoe in the cavity engaging the bushing, a pin in the hole pro-

vided with a thread engaging the first thread, a driving plate carried by the spindle provided with drill sockets, a tool holder and drills comprising bodies in the holder and offset ends in the sockets.

5. In a multiple spindle drilling machine, a bearing, a pulley journaled in the bearing provided with an eccentric bore and with an enlarged cavity concentric with the bore, a bushing having an eccentric bore comprising a shank in the bore and a head exterior of the pulley, a spindle free to rotate in the shank of the bushing and extending into the cavity, a shoulder on the spindle loose in the head, a thrust bearing on the extended portion of the spindle adapted to cooperate with the end of the bushing shank, a driving plate carried by the spindle provided with drill sockets, a tool holder adjacent the plate, and drills comprising bodies rotatably mounted in the holder and offset ends free to rotate in the sockets.

6. In a multiple spindle drilling machine, a bearing, a pulley provided with an eccentric bore journaled in the bearing, a bushing having an eccentric bore comprising a shank in the bore, and a head exterior of the pulley, a spindle free to rotate in the shank, a shoulder on the spindle loose in the head, a circularly adjustable counterbalance ring on the head, a driving plate carried by the spindle provided with drill sockets, a tool holder adjacent the plate, and drills comprising bodies rotatably mounted in the holder and offset ends free to rotate in the sockets.

7. In a multiple spindle drilling machine, a bearing, a pulley provided with an eccentric bore journaled in the bearing, a bushing having an eccentric bore comprising a shank in the bore, and a head exterior of the pulley provided with a peripheral thread and with an arcuate peripheral groove, an eccentric ring on the head provided with a thread engaging the first thread, a clamping screw in the ring registering in the groove, a spindle free to rotate in the shank, a shoulder on the spindle free to rotate in the head, and a driving plate carried by the spindle provided with drill sockets.

8. In a multiple spindle drilling machine, a bearing, a pulley mounted in the bearing, a spindle free to rotate in the pulley disposed eccentrically of the pulley, a driving plate carried by the spindle provided with drill sockets, and with spaced holes, a drill holder adjacent the driving plate provided with spaced openings, disks intermediate the plate and holder, studs on the disks free to rotate in the holes, studs on the disks loose in the openings, and offset drills mounted in the holder extending into the sockets.

9. In a multiple spindle drilling machine, a bearing, a pulley mounted in the bearing, a spindle free to rotate in the pulley disposed eccentrically to the pulley, a chuck fast to the spindle provided with a dovetailed recess, a driving plate seated in the recess, a beveled clamping strip in the recess engaging the driving plate, adjusting screws in the strip engaging the chuck, said driving plate being provided with drill sockets, a drill adjacent the driving plate, and drills in the holder free to rotate in the sockets.

10. In a multiple spindle drilling machine, a standard, a support on the standard, a bearing on the standard, a shaft in the support, a pulley mounted in the bearing and on the shaft, a spindle loosely supported in the pulley eccentrically thereto, a driving plate fast to the spindle provided with drill sockets, vertical guides on the standard, a table slidably engaging the guides, means for vertically feeding the table, longitudinal guides on the table, a block slidably mounted on the guides and provided with a guideway transversely of the machine, means for feeding the block, a bed plate slidably mounted in the guideway, means for feeding the bed plate, a drill holder carried by the bed plate, and drills in the holder adapted to register in the drill sockets.

11. In a multiple spindle drilling machine, a frame, a bearing on the frame, a pulley journaled in the bearing provided with an eccentric bore, a spindle in the bore, a driving plate carried by the spindle provided with drill sockets, a bed plate supported by the frame provided with a longitudinal T slot, spaced brackets resting on the bed plate, bolts in the brackets registering in the slots, a drill holder on the bed plate embraced by the brackets, and drills in the holder loosely seated in the sockets.

12. In a multiple spindle drilling machine, a frame, a bearing on the frame, a pulley journaled in the bearing provided with an eccentric bore, a spindle in the bore, a driving plate carried by the spindle provided with drill sockets, a bed plate supported by the frame, spaced brackets carried by the bed plate provided with vertical grooves, a drill holder comprising a plurality of plates, marginal spacing strips between the plates, bolts connecting the plates and spacing strips, one of said plates registering in the grooves and all of said plates resting on the bed plate, and all of said plates being provided with transverse drill holes, and drills in said holes loosely seated in the drill sockets.

13. In a multiple spindle drilling machine, a frame, a bearing on the frame, a pulley journaled in the bearing provided with an eccentric bore, a spindle in the bore, a driving plate supported by the spindle provided

with drill sockets, a drill holder supported by the frame comprising a plurality of parallel vertical plates spaced from each other provided with series of drill holes, drills mounted in the holes comprising drill sections provided with threaded ends and operating sections provided with threads at one end and offset portions at the other end seated in the drill sockets, and threaded sleeves engaging the threaded ends of the drill sections and operating sections.

In testimony whereof I have affixed my signature.

JOHN McLELLAN.