March 17, 1964 E. F. OBEAR 3,124,977

MULTIPLE DRILLING APPARATUS

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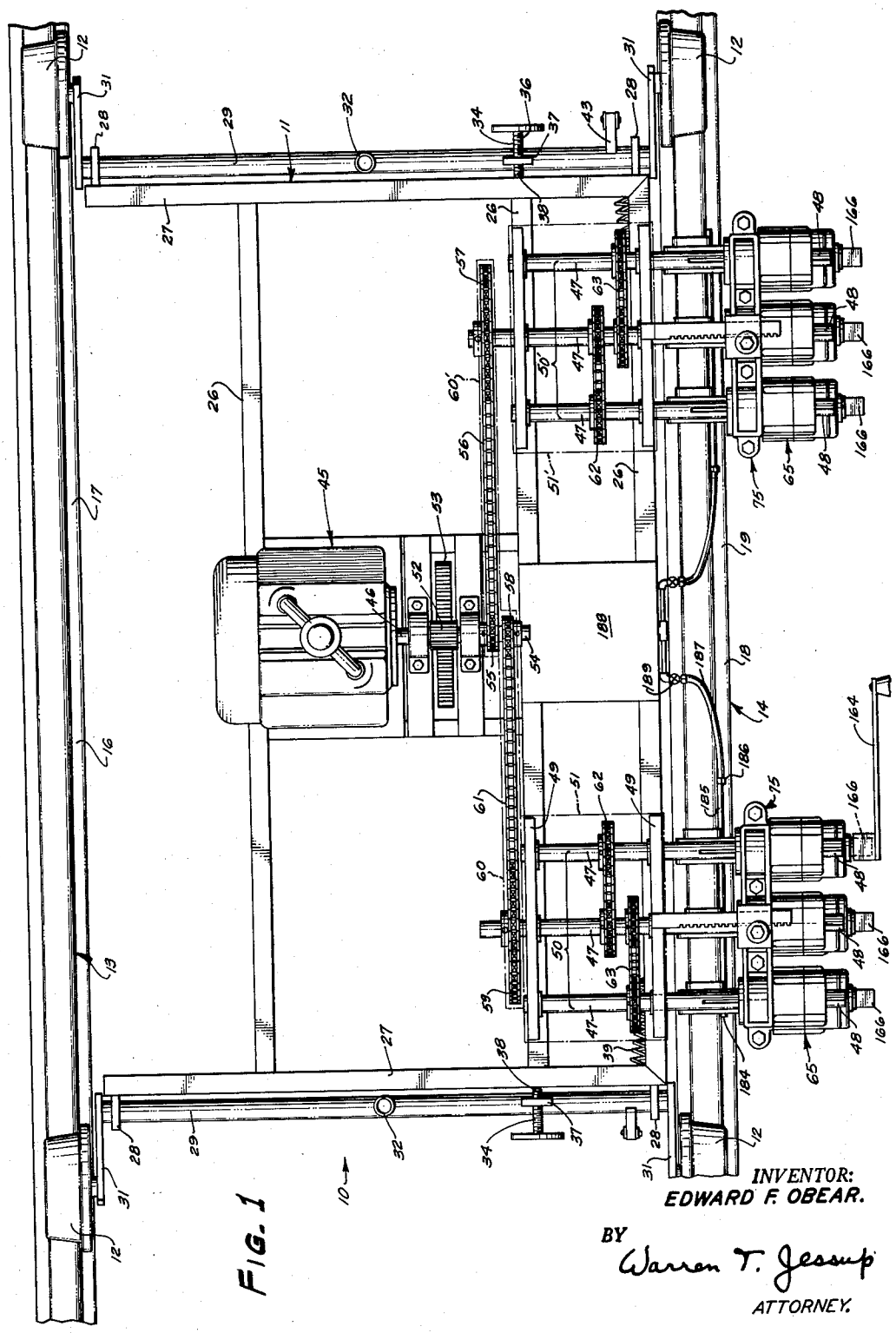


FIG. 1

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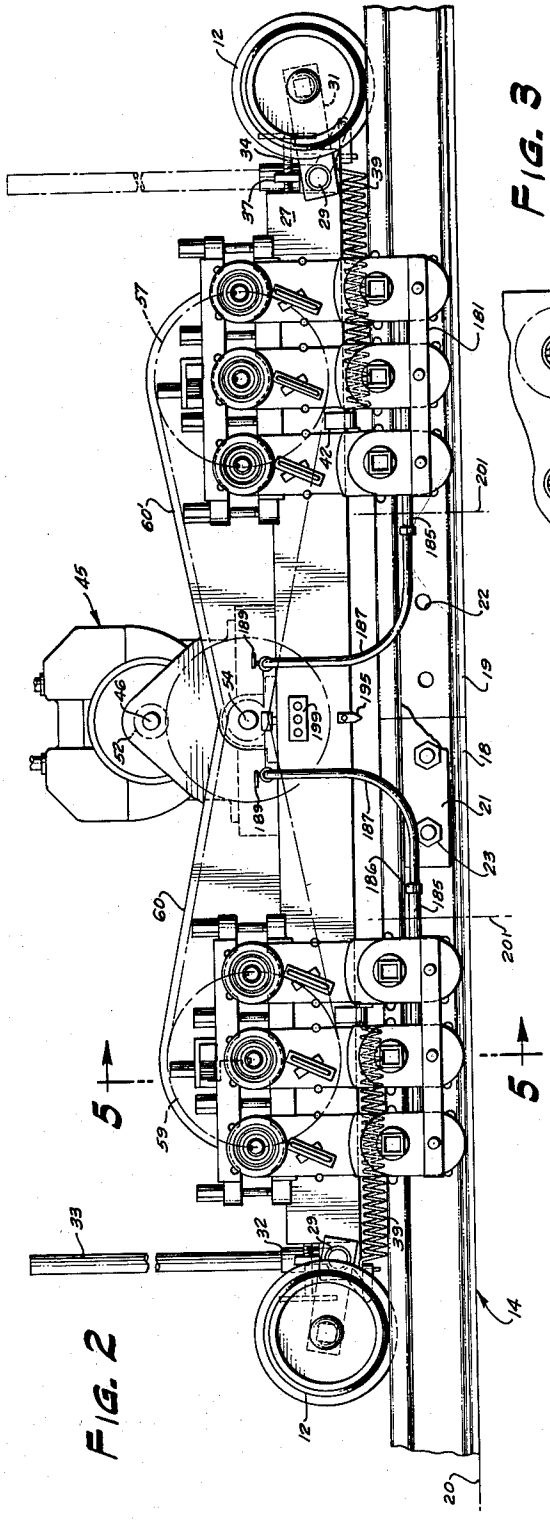


FIG. 2

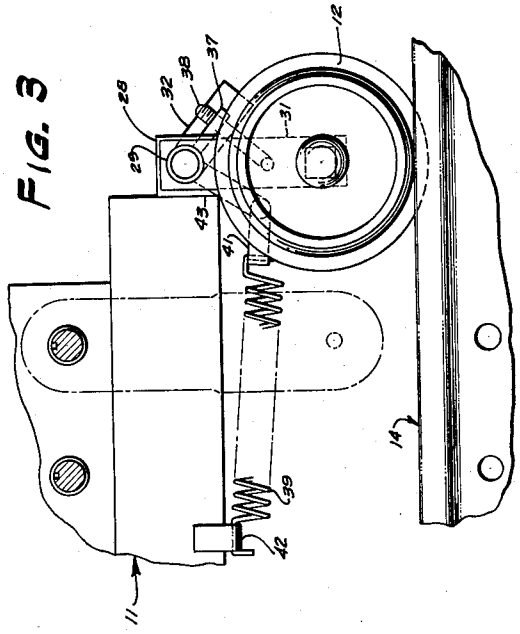


FIG. 3

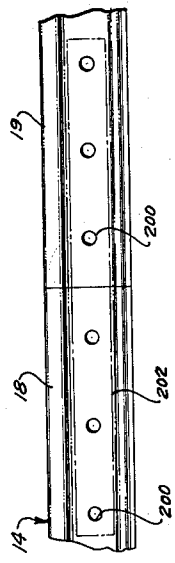


FIG. 4

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FIG. 5

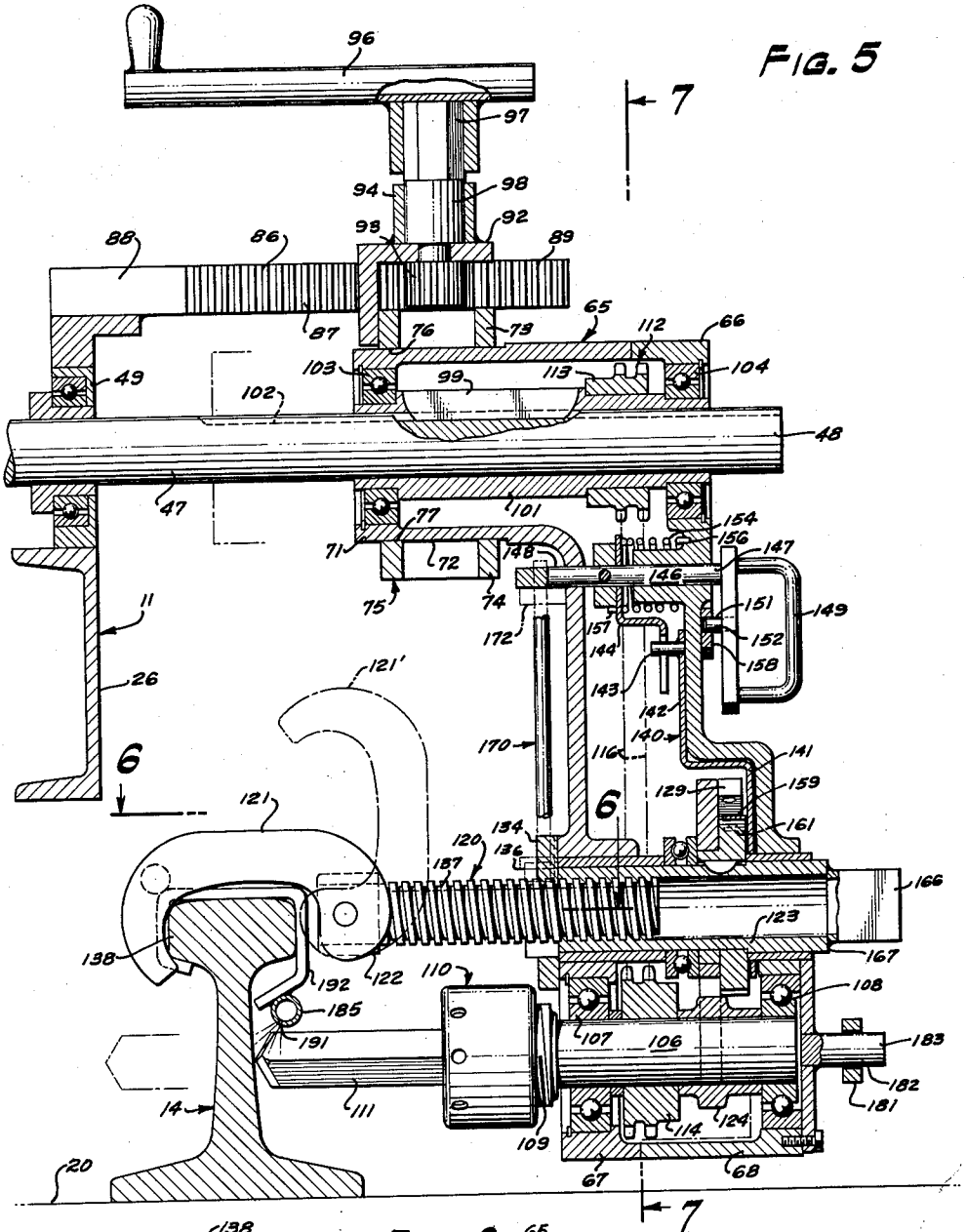
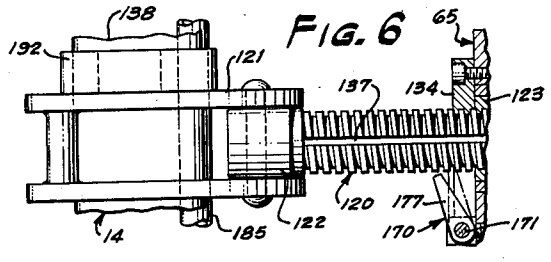


FIG. 6



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FIG. 7

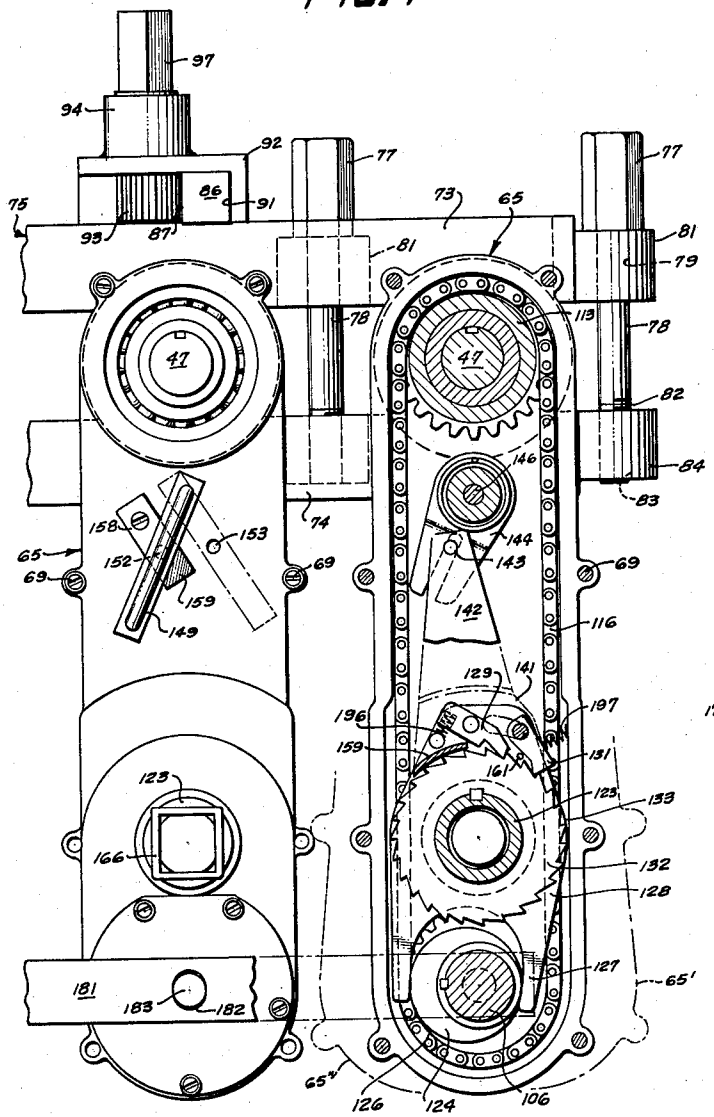
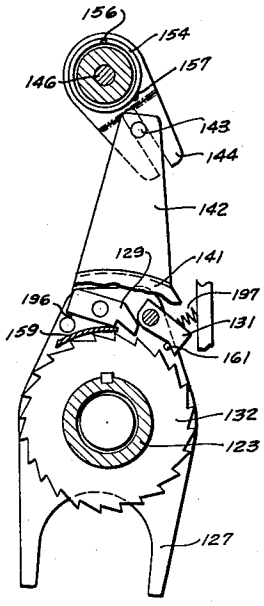


FIG. 8



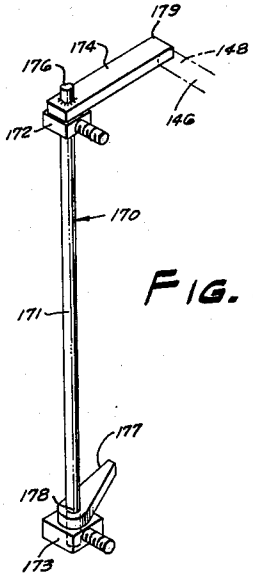
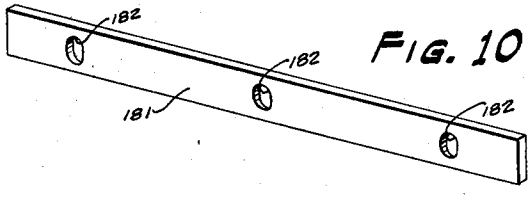


FIG. 9

FIG. 10



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3,124,977

MULTIPLE DRILLING APPARATUS

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Filed Jan. 31, 1961, Ser. No. 86,023
2 Claims. (Cl. 77—11)

This invention relates to a multiple drilling apparatus and more particularly to a portable apparatus capable of drilling a plurality of spaced aligned holes in a workpiece and is particularly adapted to simultaneously drill a group of spaced holes in each of a pair of aligned abutting rails of a railroad without necessitating removal of the rails from the railroad bed prior to the drilling.

A railroad track comprises a pair of spaced parallel rails, each rail including a plurality of elongate rail sections laid in end to end abutting relationship and secured to the ties of the railroad bed by spikes, or the like. The rail sections are usually standard in length, approximately 39 feet, and are fastened together in abutting relationship by an elongated plate overlapping the abutting ends of adjacent rails. The plates are secured to the rails by bolts or rivets extending through aligned holes in the rails and the plates.

In due time, the constant vibration imparted to the rails by heavy vehicular travel thereon causes the abutting ends of the rails to chafe and wear, forming ever-increasing gaps between the ends, and the holes within the abutting ends enlarge and form a loose fit with the fasteners extending therethrough. In the past, this condition has been corrected by removal and replacement of the entire rail sections affected; this has been a very costly and time-consuming operation.

It has been found to be less time-consuming and costly to transversely cut off the adjacent abutting ends of adjacent rails, so as to be able to remove the entire joint of abutting ends and connecting plate, redrill the newly formed ends, and progressively abut the newly formed ends so they may be secured together by new plates and new fasteners extending through the plates and the newly formed holes of the existing rails. Such a cut-out involves removing approximately 18 inches from each end of each rail or a total of approximately three feet, leaving useful the remaining 36 feet of the rail, instead of discarding the entire rail as previously described.

This invention provides a new and improved means for gang drilling a plurality of new holes in each newly formed outer end of adjacent rails while the drilling apparatus is supported on the rails. With the apparatus of this invention a frame having a plurality of drill heads is portable on the rails and positionable so as to locate the drill heads in proper position to selectively and simultaneously drill a plurality of transverse holes in accurately and properly spaced relationship to the rail so that when the damaged joint is cut out and removed, the new ends of the rails may be abutted and quickly secured together by a complementary drilled plate. The apparatus of this invention may then be moved along to another damaged joint and the operation repeated. By this method, where the rails are of customary length of 39 feet, by cut offs of three-foot increments per pair of rails, a gap is accumulatively formed between rails after 13 cut-offs which can be filled by an entire new rail of 39-foot length, thereby saving 14 lengths of rails normally discarded as waste. Aside from the tremendous saving in cost by virtue of the discontinuance of discarding the useful portions of the rails, this invention provides an appreciable saving in time by accurately and quickly, simultaneously drilling all of the required holes in the adjacent ends.

This invention further provides means by which drill bits supported within the drill heads of the apparatus may be quickly and accurately adjusted in longitudinal spacing and lateral location relative to the rail. The drill heads are also capable of being elevated by unique elevating and lowering means associated with the frame and wheels supporting the frame on the wheels for facilitating portability of the apparatus.

It is among the objects of this invention to provide a new and improved multiple drilling apparatus for simultaneously drilling a plurality of holes in a workpiece in longitudinally spaced relationship.

Another object of this invention is to provide a new and improved multiple drilling apparatus which is portable on the workpiece for transporting the apparatus to various locations on the workpiece and which is clampable to the workpiece during operation thereof for advancing the drill bits thereto.

A further object of this invention is to provide a new and improved multiple drilling apparatus which incorporates its own power drive means for driving the operating parts thereof.

A still further object of this invention is to provide a new and improved multiple drilling apparatus in which the operational parts thereof may be quickly and easily elevated to clear the workpiece during portage of the apparatus and quickly and readily lowered into operational position for operation thereof.

Yet another object of this invention is to provide a new and improved multiple drilling apparatus in which the drilling apparatus is selectively or automatically disconnected from the power drive means for respectively adjusting the drill means or halting the operation of the drill means at completion of the drilling.

An important object of this invention is to provide a new and improved multiple drilling apparatus which provides means for continually and positively transmitting the rotation of a drive shaft of the power drive means to rotation of a plurality of tool holding means supporting drill bits and means for continually, positively and simultaneously feeding the tool holding means towards the rail being drilled to effect an appreciable increase in the length of the life of the drill bits.

A general object of this invention is to provide a new and improved multiple drilling apparatus of the character described which overcomes disadvantages of prior means and methods heretofore intended to accomplish generally similar purposes.

These and other objects of this invention will be more apparent from the following drawings, detailed description and appended claims.

In the drawings:

FIGURE 1 is a plan view, in elevation, of the multiple drilling apparatus of this invention, with parts broken away and selective parts removed for greater clarity;

FIGURE 2 is a side view in elevation thereof;

FIGURE 3 is an enlarged, fragmentary side view, similar to the right end of FIGURE 2, with parts shown in a changed position;

FIGURE 4 is a fragmentary view illustrating a pair of newly formed ends in abutting relationship;

FIGURE 5 is a vertical cross-sectional view as taken substantially along the line 5—5 of FIGURE 2, with parts shown in elevation;

FIGURE 6 is a fragmentary cross-sectional view as taken substantially along the line 6—6 of FIGURE 5;

FIGURE 7 is a vertical cross-sectional view as taken substantially along the line 7—7 of FIGURE 5, with parts shown in elevation;

FIGURE 8 is a fragmentary cross-sectional view illustrating a portion of FIGURE 7 in a changed position;

FIGURE 9 is a perspective view, in elevation, of a bell crank means forming a portion of this invention; and

FIGURE 10 is a perspective view, in elevation, illustrating a means for predetermining the lateral spacing of the tool holding means of this invention.

Referring in detail to the drawings, there is shown by way of illustration, but not of limitation, a multiple drilling apparatus designed and constructed in accordance with this invention and generally referred to by the numeral 10. The apparatus 10 includes a frame generally indicated by the numeral 11 having a plurality of wheels 12 rotatably secured thereon so as to be portable on a pair of spaced, parallel rails 13 and 14 of a railroad. Each rail 13 and 14 consists of a plurality of rail sections like the sections 16 and 17 of the rail 13 and sections 18 and 19 of the rail 14, the sections being laid as on a bed or ties 20 in end to end abutting relationship, as best seen in FIGURES 1 and 2. Adjacent ends of the rail sections are secured together by connecting plates 21 having apertures extending therethrough and complementary to apertures 22 extending through the rail sections and fasteners extending through aligned apertures like the bolts 23.

The frame 11 comprises a plurality of longitudinal and lateral members 26 and 27, respectively, joined together as by welding or the like. Rotatably secured to the frame, in lugs 28 extending outwardly from the lateral members 27, are transverse shafts 29 having arms 31 to which the wheels 12 are rotatably secured, the arms 31 being pivotable in response to rotation of the shafts 29. A socket 32 is provided on each shaft 29 to facilitate manual rotation thereof to pivot the arms 31 to raise or lower the frame 11. In the position illustrated in FIGURE 3, the frame 11 is elevated relative to the rails 13 and 14. In the position illustrated in FIGURE 2, the frame is lowered and slightly spaced from the rails 13 and 14. Handles 33 may be inserted into the sockets 32 for manual rotation of the shafts 29.

The lower position of the frame 11 is limited by a stop means 34, one secured to each shaft 29 and abuttable against the outermost side of each lateral 27, as best seen in FIGURES 1 and 2. The stop means 34 comprises a manually operable screw 36 extending through a lug 37 mounted on the shaft 29 and reciprocal in the lug 37 to adjust the relative position of the end 38 of the screw 36 abuttable against the frame member 27. By retracting the screw 36, pivotal movement of the arms 36 is increased to lower the frame 11 in its lowermost position whereas by extending the screw 36 through the lug 37 the frame 11 is elevated.

A spring 39 is provided for each shaft 29 for holding the arms 31 in the substantially vertical position shown in FIGURE 3 wherein the frame 11 is in its elevated position. One end of each spring 39 is secured by linkage 41 to its associated shaft 29; the other end of each spring is secured to the frame at 42, thereby biasing the arms 31 into their uppermost position when they pass over horizontal to hold the arms 31 in their vertical position when the frame 11 is elevated. The vertical position of the arms 31 is determined by abutment of a link member 43 of the linkage 41 with its adjacent lateral frame member 27, as best seen in FIGURE 3.

A power drive means 45, herein illustrated as an internal combustion engine, is mounted on the frame 11 and includes a drive shaft 46 extending outwardly thereof, for driving a plurality of driven shafts 47.

The shafts 47 are mounted in spaced parallel relationship for rotation about axes transverse to the length of the frame 11 and the rails 13 and 14, and include outer ends 48 extending outwardly from the frame and overlying one of the rails, for example, the rail 14. For the particular adaptation of this invention herein shown, a pair of groups 50 and 50' of driven shafts 47 are mounted on the frame 11, each group consisting of three shafts 47 equally spaced from one another and each group being equally longitudinally spaced from the center of the power means 45, a distance predetermined by the spacing of the drilling means to be hereinafter described.

A pinion gear 52 is fixed to the drive shaft 46 and is meshed with a larger gear 53 fixed to a rotatable shaft 54 for translating the rotation of the drive shaft 46 into a rotation of the rotatable shaft 54 at a reduced speed. A sprocket gear 55 is fixed to the shaft 54 and is connected to an enlarged sprocket gear 57 fixed to a centermost driven shaft 47 of the group 50' of driven shafts by a sprocket chain 56, for translating the rotation of the shaft 54 into rotation of the centermost shaft 47, at a reduced speed. A sprocket gear 58, identical to the sprocket gear 55, is also fixed to the shaft 54 and is connected to a sprocket gear 59, identical to the sprocket gear 57, by a sprocket chain 61 identical to the chain 56 for translating rotation of the shaft 54 into rotation of a centermost shaft 47 of the other group 50 of shafts, to which the sprocket gear 59 is fixed. In this manner, both centermost shafts 47 of the groups 50 and 50' of driven shafts 47 are simultaneously driven at the same speed by the drive shaft 46. The rotation of each centermost driven shaft 47 is translated into rotation of equal speed of their adjacent driven shafts 47 by sprocket gear and chain means indicated at 62 and 63. Preferably, guards 60 and 60', indicated in solid lines in FIGURE 2 and in broken lines in FIGURE 1, are provided to protect the gearing 55—59, and covers 51 and 51', indicated in broken lines in FIGURE 1, guard the gearing 62 and 63.

A plurality of drill heads, generally indicated by the numeral 65, is mounted on the frame, each slidably disposed on an outer end 48 of the driven shafts 47 for linear movement relative thereto. As best seen in FIGURE 5, each drill head 65 includes a housing 66 preferably formed of a pair of housing portions 67 and 68 secured together by a plurality of fasteners such as bolts 69, or the like, (see FIGURE 7) and forming a hollow interior. The housings 66 are elongate in configuration and depend from their respective driven shafts 47. Each housing 66, at its upper end, has an inner tubular extension 71 having a circumferential exterior 72. The tubular extensions 71 of three adjacent drill heads 65 are clampable between an upper yoke 73 and a lower yoke 74 of a clamping means 75 having arcuate cut-outs 76 and 77, respectively, in the yokes. The yokes 73 and 74 are releasably clamped together by a plurality of bolts 77 having their shanks 78 extending through apertures 79 of lugs 81 formed in the yoke 73 and their threaded ends 82 threadably engaging internally threaded bores 83 of lugs 84 of the yoke 74. In this manner, by selectively rotating the bolts 77, the yokes may be loosened or tightened to release the drill heads 65 individually or collectively for rotation of the drill heads about the axes of their driven shafts 47 for a purpose, to be hereinafter described, or for clamping the drill head 65 against rotation.

An elongated rack, indicated by the numeral 86 and having a gear toothed side 87, is secured at one end 88 to the frame 11 by welding, or the like. The opposite end 89 of the rack 86 is slidably disposed within a slideway 91 of a bracket 92 secured to the upper yoke 73 of the clamping means 75. A pinion gear 93 is rotatably secured in a boss 94 extending upwardly from the bracket 92 and is meshed with the gear teeth of the rack 86. The pinion 93 is freely rotatable in response to linear movement of the drill head 65 and is manually rotatable, by a hand crank 96 removably secured to a non-round portion 97 of a shank 98 secured to the pinion gear 93, for a purpose to be hereinafter described.

The outer end 48 of each of the driven shafts 47 is keyed, as by a key 99, to a sleeve 101 slidably engaging a keyway 102 of the end 48. A sleeve 101 is rotatably mounted within each drill head 65, by a pair of spaced frictionless bearings 103 and 104, whereby the sleeve 101 may rotate relative to its housing 66 in response to rotation of the shaft 47; and the drill head 65 may move

linearly relative to the shaft 47 by virtue of the key 99 connection thereto.

Spaced downwardly from the shaft 47, a shaft 106 is rotatably mounted in each housing 66, in bearings 107 and 108, for rotation about an axis parallel to the axis of rotation of its shaft 47. The shaft 106 is provided with an enlarged end 109 extending outwardly of the housing 66 and directed towards the frame 11. The enlarged end 109 is exteriorly threaded so as to receive a tool holding means in the form of a chuck 110 which is adapted to grip a drill bit indicated by the numeral 111.

Rotation of a shaft 47 is transmitted to a shaft 106 so as to rotate the tool holding means 110 and its drill bit 111 by a gear means 112 comprising a sprocket gear 113 fixed on the shaft 47 for rotation therewith, a sprocket gear 114 fixed on the shaft 106 and sprocket chain means 116, indicated by the broken lines in FIGURE 5 and the solid lines in FIGURE 7, connecting the gears 113 and 114.

As now will be more clearly understood by the foregoing description, the rotation of a drive shaft 46 of the power drive means 45 is translated into rotation of all of the shafts 47 through the gear train 52—53, and sprocket chain drives 55—57, 58—61, and 62—63. The rotation of the shafts 47 is transmitted to the individual corresponding shafts 106 by their respective gear chain drives 112—116 to rotate the tool holding means 110 and their drill bits 111. The drill heads 65, on the other hand, are clamped together in groups of three on the respective groups 50 and 50' of shafts 47 and are linearly movable along the shafts 47 on axes transverse to the frame 11 and with drill bits 111 directed towards the rail 14.

Means are provided in each of the drill heads 65 for translating rotation of the driven shafts 47 to linear movement of the drill heads in a direction toward the frame and the rail 14 for feeding the drill bits 111 towards the rail 14 for drilling holes therethrough. The latter means comprises an externally threaded lead screw 120 having a hook member 121 pivotally secured to an outer end 122 thereof and selectively engageable with the internal surface of the rail 14 for hooking engagement therewith, the lead screw 120 being non-rotatably but reciprocably mounted in a sleeve 123 rotatably mounted in the housing 66 intermediate the shafts 106 and 47 for rotation about an axis parallel to the axes of the shafts 47 and 106.

A cam 124 (see FIGURES 5 and 7) is fixed to the shaft 106 for rotation therewith. The cam 124 has an eccentric outer surface 126 engaging a forked portion 127 of a cam follower 128 having a pawl 129 pivotally secured thereto. A similar pawl 131 is pivotally secured to the housing 66 and adjacent to the pawl 29. As the shaft 106 rotates, the cam 124 rotates with it to rock the cam follower 128 back and forth around the axis of the rotatable sleeve 123. The cam follower 128 is freely pivotable about the axis of the sleeve 123.

A ratchet wheel 132, having ratchet teeth 133 on the periphery thereof, is keyed to the sleeve 123 so that when the shaft 106 is rotated and the cam follower 128 is rocked back and forth, the pawl 129 engages the teeth 133 of the ratchet wheel 132 to rotate the wheel 132 and the sleeve 123 keyed thereto the circumferential distance of one tooth. As the cam follower 128 continues to rock and thereby rocks in an opposite direction, the pawl 131 engages a ratchet tooth to keep the wheel 132 from being rotated in a reverse direction, whereas the pawl 129 ratchets over the teeth and is positioned to engage the successive ratchet tooth for propulsion of the wheel 132 in response to subsequent rocking motion of the follower 128.

The lead screw 120 is keyed to a plate 134 secured to the housing 66, by a key 136 slidingly engaging a keyway 137 of the lead screw, so that when the sleeve 123 is intermittently rotated in one direction and the hook member 121 is in hooked engagement with a flange 138 of the rail 14, the lead screw 120 is non-rotatable by virtue of the key 136, thereby causing the sleeve 123 to be drawn onto the lead screw 120 to impart a linear movement to the entire drill head 65 relative to the shaft 47. This linear movement of the housing causes the drill bit 111 to be fed into the rail 14 and extend therethrough, while the shaft 106 is rotating to rotate the drill bit.

It will be noted that by the above described translation of rotation to linear movement, the linear movement is positive. There is no binding of the tool bits 111 as they drill holes in the rail 14, because the lead is intermittent and positive, thereby providing a constant pressure bearing against the tool bit rather than the pulsating and variant pressures used on various forms of devices heretofore intended to accomplish generally similar purposes.

It is preferable that each drill head be so adjusted relative to the rail 14 that all the drill bits 111 contact the workpiece 14 simultaneously, so as to distribute the driven linear force evenly to each drill bit.

It is well-known in the art that drill bits tend to become dull after continued use and require resharpening, in which case the drill bits become progressively shorter. It is preferable that compensation be made for the length of the tool bit by the drill head itself, rather than by advancing the drill bit within the chuck. It is for this purpose that means are provided for individually adjusting each drill head so as to align the tips of all the drill bits in a common plane wherein they may simultaneously engage the rail or workpiece when advanced. Means for disengaging the ratchet pawls 129 and 131 from the ratchet wheel 132 are provided so as to free the ratchet wheel 132 for selective rotation of the sleeve 123, independently of the shaft 106, whereby the drill heads 65 may be individually moved linearly to compensate for the variations in the lengths of tool bits 111.

As best seen in FIGURES 5, 7 and 8, the disengaging means 140 includes a member 141 freely and pivotably mounted for pivotal movement around the sleeve 123 and has an upwardly extending arm 142 having a pin 143 extending into a forked member 144 pivotally mounted on a reciprocable shaft 146 slidably mounted in the housing 66. The shaft 146 extends through the housing 66 with its outer ends 147 and 148 extending outwardly of the housing.

A handle 149 is secured to the outer end 147 for selective manual operation of the disengaging device. A pin 151, secured to the handle 149, extends inwardly towards the housing 66 and is selectively engageable in one of a pair of apertures 152 and 153 formed in the exterior of the housing portion 68 (see FIGURES 5 and 7). A spring 154 is in compression between the inner surface of the housing 68 and the forked member 144 and has one end 156 engaging an aperture of the housing 68 and another end 157 engaging an aperture of the forked member 144. The spring 154 is placed in compression when the handle 149 is drawn outwardly to draw the pin 151 out of the aperture 152, the aperture 152 being formed in a land 158 having a sloped camming end 159. The spring 154 is placed in torque when the handle 149 is drawn outwardly to remove the pin 151 from the aperture 153 and rotated to align the pin 151 with the aperture 152. The intermediate portion of the cross-section of FIGURE 5 shows a pin 151 being engaged in the aperture 152.

It will now be more clearly understood that when the shaft 146 is linearly moved relative to the housing 66 by drawing outwardly on the handle 49, or by automatic means to be hereinafter described, the spring 154 biases the forked member 144 and thereby the shaft 146 in a direction to register the pin 151 with the aperture 152.

When the pin 151 is in the position registered with the aperture 152, the members 144 and 141 are pivoted as viewed in the right-hand portion of FIGURE 7 so that

an arcuate lug 159 and a pin 161 of the member 141 are clear of the pawls 129 and 131, respectively.

In this position, the pawls 129 and 131 are engageable with the ratchet wheel 132 to intermittently rotate the sleeve 123 in response to rotation of the shaft 106 as previously described. When the shaft 146 is moved linearly as previously described, by withdrawing of the handle 149 or by other means, the pin 151 is disengaged from the aperture 152 and the shaft 146 is biased by the spring 154 to rotate the shaft 146 and the handle 149 to position the pin 151 within the aperture 152. In this latter position, the forked member 144 and the member 141 are pivoted to the position shown in FIGURE 8, wherein the arcuate lug 159 is pivoted to lift the ratchet pawl 129 and the pin 161 engages the pawl 131 to disengage the pawls 129 and 131 from engagement with the ratchet wheel 132.

With the pawls 129 and 131 disengaged, the sleeve 123 may be manually rotated by a hand crank 164 (see FIGURE 1) removably securable to a non-circular boss 166 welded or otherwise secured to the outer end 167 of the sleeve 123. Rotation of the sleeve 123, in one direction, causes the lead screw 120 to be retracted inwardly of the sleeve 123, and by virtue of the hooked engagement of the hook 121 with the rail 14, the housing 66 to be moved inwardly, relative to the clamp 75 and toward the rail 14, to align the tip of the drill bits in a common plane.

Means are provided for automatically tripping the disengaging device at the completion of the drilling operation so as to prevent undue wear of the drill bits 111 after the holes have been formed. For this purpose, a bell crank 170, shown partially in FIGURE 5 and in perspective in FIGURE 9, is rotatably mounted on the exterior of the housing 66 and actuatable in response to a predetermined linear travel of the housing 66 to apply a linear movement of the shaft 146 in a direction to disengage the pin 151 from the aperture 152, whereby the handle 149 is pivoted by the spring 154 into a position for the pin 151 to engage the aperture 152 and disengage the pawls 129, 131 from the ratchet wheel 132. The bell crank 170 includes a shaft 171 rotatably disposed in a pair of lugs 172 and 173 secured to the exterior wall of the housing portion 67. An arm 174 is fixed to an upper end 176 of the rod 71. An angularly offset arm 177 is fixed to the lower end 178 of the rod 171. The free end 179 of the arm 174 is in engagement with the outer end 148 of the shaft 146 and is biased outwardly by the spring 154 bearing against the forked member 144 so as to bias the arm 177 away from the housing. When the housing 66 moves inwardly towards the frame 11, the arm 177 is brought into contact with an edge of the hook 121 to pivot the arm 177 towards the housing 66 and thereby rotate the rod 171 to pivot the arm 174 against the shaft 146, thereby causing the shaft 146 to move linearly to displace the pin 151 from the aperture 152.

As best seen in FIGURE 10, a template means, in the form of a relatively rigid strip 181, is provided for determining the lateral distance between axes of the tool holding means 110 and thereby, the drill bits 111. The strip 181 is formed with transversely elongated apertures 182 on predetermined spaced centers and engageable with bosses 183 fixed on the housing 65 in coaxial relationship to the shafts 106. A plurality of strips 181 is preferably provided, each strip having apertures 182 on different centers in desired increments. Each strip 181 is provided with three equally spaced apertures 182, the spacing of the apertures on one strip being different than the spacing of the apertures on other strips. In this manner the spacing of a drill bit is easily and readily accomplished.

To adjust the spacing between drill bits 111 the yokes of the clamps 75 are loosened and the outermost drill heads 65 of a group of drill heads are pivoted away from, or towards the centermost drill head, as indicated by the broken lines 65′ and 65″ in FIGURE 7. A template 181 is slipped over the bosses 183 to predetermine the spacing, and the clamps 75 are retightened. To facilitate manufacture of the strips 181, the apertures 182 are preferably elongated transverse to the strip to compensate for the slight rise and fall of the outermost drill bits during pivotal movement while the shafts 47 remain coplanar. The template 181 further serves to increase the holding action provided by the clamp 75 at the upper part of the housing 65 and prevents lateral movement of the drills due to vibration.

Means are preferably provided for selectively lubricating the drill bits 111 during the drilling operation. For this purpose, a lubricant header, designated by the numeral 185, is removably secured to the rail 14 adjacent to each group of drill bits 111. The header 185 comprises an elongated tubular member having a closed end 184 and an open end 186 connected to a flexible hose 187 leading to a lubricant reservoir 188. The valve 189 is interposed in the conduit 187 and is intermittently and selectively operable for admitting lubricating fluid under pressure to the headers 185. The headers 185 are provided with a plurality of apertures 191 positioned so as to direct a spray of lubricating fluid on a drill bit 111 when a valve 189 is opened. The header 183 is supported by a plurality of hooked members 192 engageable over the top flange 138 of the rail 14.

Operation

The apparatus is properly positioned relative to the rails 13 and 14 primarily by rolling the apparatus 10 on its wheels 12 to a point where the groups of drill heads 65 are equally spaced relative to the abutment to be repaired. An indicator 195 is preferably secured to a point midway of the frame 111 and of the groups of drill heads 65 and is alignable with the abutment of the rails to be repaired so as to determine correct positioning of the apparatus 10 relative to the rail 14. The transverse shafts 29 of the frame 11 are then manually rotated by insertion of the rods 33 in the sockets 32 and rotation of the shafts 29 to pivot the arms 31 into the position of FIGURE 2 wherein the entire frame 11 is lowered to bring the shafts 106 of the drill heads 65 into proximity with the rail 14. Drill bits 111 are tightly secured within the tool holding means 110 and each group of drill heads 65 is advanced towards the rail 14 so as to bring the point of the longest tool bit into close proximity of the rail 14 or in contact therewith, by rotating the pinion 93. The pinion 93 is rotated by the hand crank 96 to move each group of drill heads 65 towards the frame 11.

In this position, the clamp members 121 are pivoted downwardly from the broken line position 121′ of FIGURE 5 to the solid line position 121 of the same figure. The handle 149 is pivoted into a position in which the pin 151 disengages aperture 153 to disengage the disengaging means 140 and free the lead screw 120 and sleeve 123 for individual operation. Each sleeve 123 is individually rotated by a hand crank 164 to draw the lead screw 120 inwardly of the sleeve 123 and bring its clamp 121 into contact with the rail 114. At this point, if all drill bits are of the same length and the points are in a common plane, the clamp 75 is retightened after a template 181 having a desired lateral spacing of apertures 182 is slipped over the bosses 183. In the event that the drill bits 111 are of uneven length, each sleeve 123 is individually rotated to reposition its housing 65 in proper relationship to the rail 14 while the clamp 75 is loose so that the tip of its tool bit 111 is coplanar with the longest tool bit, after which the clamp 75 is retightened.

The handle 149 is then drawn outwardly of the housing 65 and rotated so as to position the pin 151 in the aperture 152 to disengage the lug 159 and pin 161 from the pawls 129 and 131, respectively, to permit engagement

of the pawls with the ratchet wheel 132. The pawls 129 and 131 are biased into engagement with the ratchet wheel 132 by springs 196 and 197, respectively.

The power drive means 45 is actuated by conventional switches, indicated at 199, to rotate the drive shaft 46. Rotation of the drive shaft 46 is translated into rotation of the driven shafts 47 by the gear means previously described, and the rotation of the driven shafts 47 translated into rotation of the shafts 106 by the individual gear means previously described to rotate the drill bits 111. Rotation of each shaft 106 is translated into intermittent rotation of the sleeves 123 to draw the lead screws inwardly of their respective housings 65. This causes linear movement of the housings 65 relative to the shafts 47 in a direction toward the frame 11 thereby intermittently driving the drill bits 111 to drill through the rail 14. When the drill bits 111 have drilled entirely through the rail 14, the bell crank arms 177 contact the hooks 121 to rotate the bell crank shafts 171 and pivot the arms 174 to actuate the disengaging means and halt the linear movement of the drill heads. When the drive means 106–123 are disconnected to stop the rotation of the drill bits 111, each sleeve 123 is manually and individually rotatable by the hand crank 164 to extend the lead screws sufficiently to release the hooks 121 for pivoting into a non-engaged position 121. During the drilling operation, the valves 189 may be actuated, as needed, to lubricate the drill bits 111.

To retract the drill bits 111 from the rail 14, each group of drill heads 65 is linearly moved away from the rail 14 by actuation of the hand cranks 96 to rotate the pinion 93 engaged with the rack 86. The hooks 121, clearing the rails, and the entire housings 65 are moved transversely relative to the frame to remove the drill bits 111 from the rail 14 so that the frame may be elevated to the position of FIGURE 3 for transportation to another location.

After the holes 200 (see FIGURE 4) have been drilled by the drill bits 111 and the apparatus 10 removed from the location, the adjoining abutting ends of the rail sections 18 and 19 are transversely cut, as indicated along the broken lines 201 of FIGURE 2 and the ends secured together by the plate 21 removed, after which the rail 18 may be unfastened from its foundation 20 and slid longitudinally for its new edge to be abutted against the new edge of the rail 19. A new connecting plate indicated by the broken lines 202, having holes complementary to the holes 200 is secured on each side of the adjoining shortened rail sections 18' and 19' as by bolts or rivets not shown. The rails may be transversely cut with the improved cut-off machine disclosed in my copending application, Serial No. 21,390, filed April 11, 1960, now Patent No. 3,046,707.

While the instant invention has been shown and described herein in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom in the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be afforded the full scope of the claims.

What is claimed as new and desired to secure by Letters Patent is:

1. A multiple drilling apparatus for simultaneously drilling a plurality of transverse apertures in one of a pair of spaced parallel rails, said apparatus including: a frame; a plurality of wheels rotatably mounted on said frame in position to engage said rails and permit the apparatus to be moved along said rails; a plurality of driven shafts rotatably mounted on said frame in spaced parallel relationship and extending across said frame to project over at least one of said rails; drive means for driving said driven shafts; a plurality of drill heads pivotally mounted on respective ones of said driven shafts in side by side relationship and linearly movable with respect thereto; a plurality of bit holding members rotatably mounted in respective ones of said heads, each of said bit holding members having an axis of rotation spaced from the axis of rotation of the corresponding one of said driven shafts and each of said bit holding members being adapted to grip a drill bit and direct the same towards said one of said rails for drilling a hole therein; each drill head having a power transmission means mounted therein for coupling said respective bit holding members to the driven shafts upon which it is mounted to translate the rotation of said driven shaft to said bit holding member; releasable clamping means engaging said heads to permit pivotal movement thereof with respect to said frame; said clamping means including a plurality of bosses on respective ones of said heads, and a template having apertures at a predetermined lateral spacing positioned over said bosses; and means engaging said heads for establishing the axis of rotation of said bit holding members at a predetermined relative lateral displacement with respect to one another.

2. A multiple drilling apparatus for simultaneously drilling a plurality of transverse apertures in one of a pair of spaced parallel rails, said apparatus including: a frame; a plurality of wheels rotatably mounted on said frame in position to engage said rails and permit the apparatus to be moved along said rails; a plurality of driven shafts rotatably mounted on said frame in spaced parallel relationship and extending across said frame to project over at least one of said rails; drive means for driving said driven shafts; a plurality of drill heads pivotally mounted on respective ones of said driven shafts in side by side relationship and linearly movable with respect thereto; a plurality of bit holding members rotatably mounted in respective ones of said heads, each of said bit holding members having an axis of rotation spaced from the axis of rotation of the corresponding one of said driven shafts and each of said bit holding members being adapted to grip a drill bit and direct the same towards said one of said rails for drilling a hole therein; each drill head having a power transmission means mounted therein for coupling said respective bit holding members to the driven shafts upon which it is mounted to translate the rotation of said driven shaft to said bit holding member; releasable clamping means engaging said heads to permit pivotal movement thereof with respect to said frame; means engaging said heads for establishing the axis of rotation of said bit holding members at a predetermined relative lateral displacement with respect to one another; each of said drill heads includes a threaded sleeve rotatably mounted thereon for rotation about an axis parallel to the axis of rotation of the corresponding one of said bit holding members, a lead screw extending coaxially with said threaded sleeve in threaded relationship therewith and having an outer end protruding from the head, a hook member pivotally secured to said outer end of said lead screw and pivotable into hooking engagment with said one of said rails, and means coupled to said threaded sleeve and to said bit holding member for intermittently transmitting rotation from said bit holding member to said threaded sleeve so as to impart a linear movement to said head towards said one of said rails in response to rotation of said bit holding member when said hook member is in hooked engagement with said one of said rails.

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