Aug. 23, 1932. H. H. McCLINTIC 1,873,547

APPARATUS FOR POSITIONING STRUCTURAL MEMBERS FOR DRILLING AND LIKE OPERATIONS

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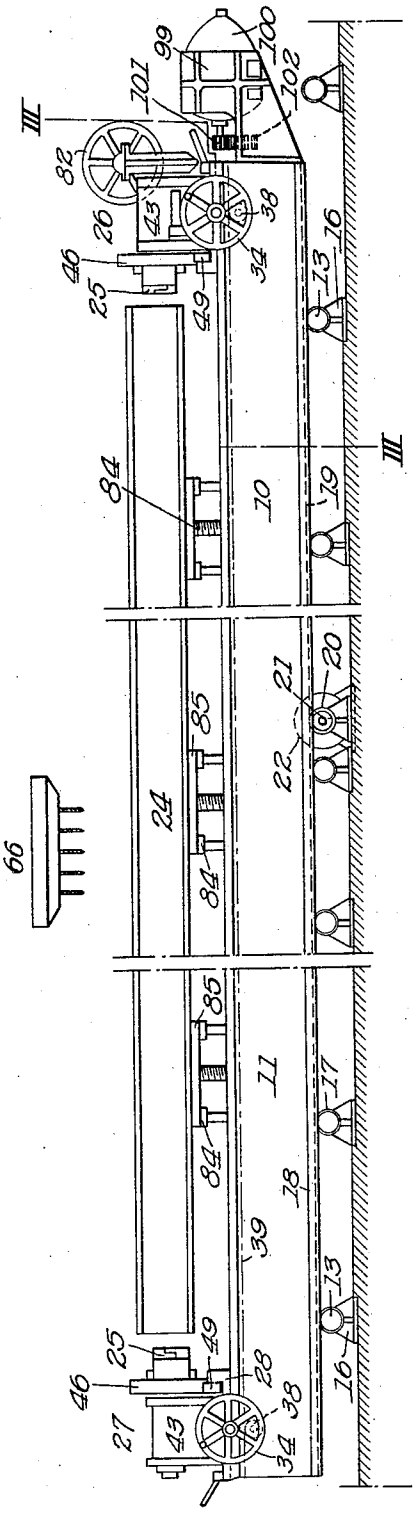


Fig. 1.

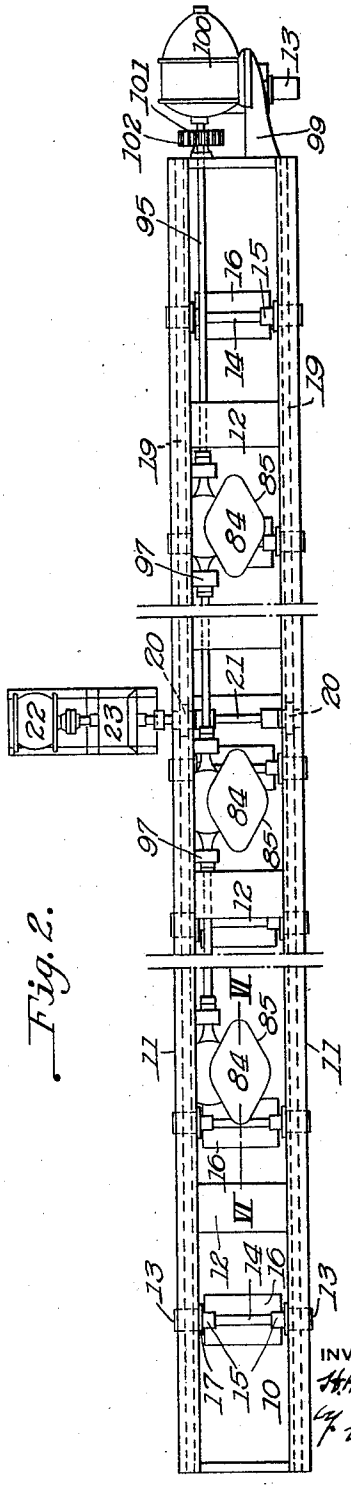


Fig. 2.

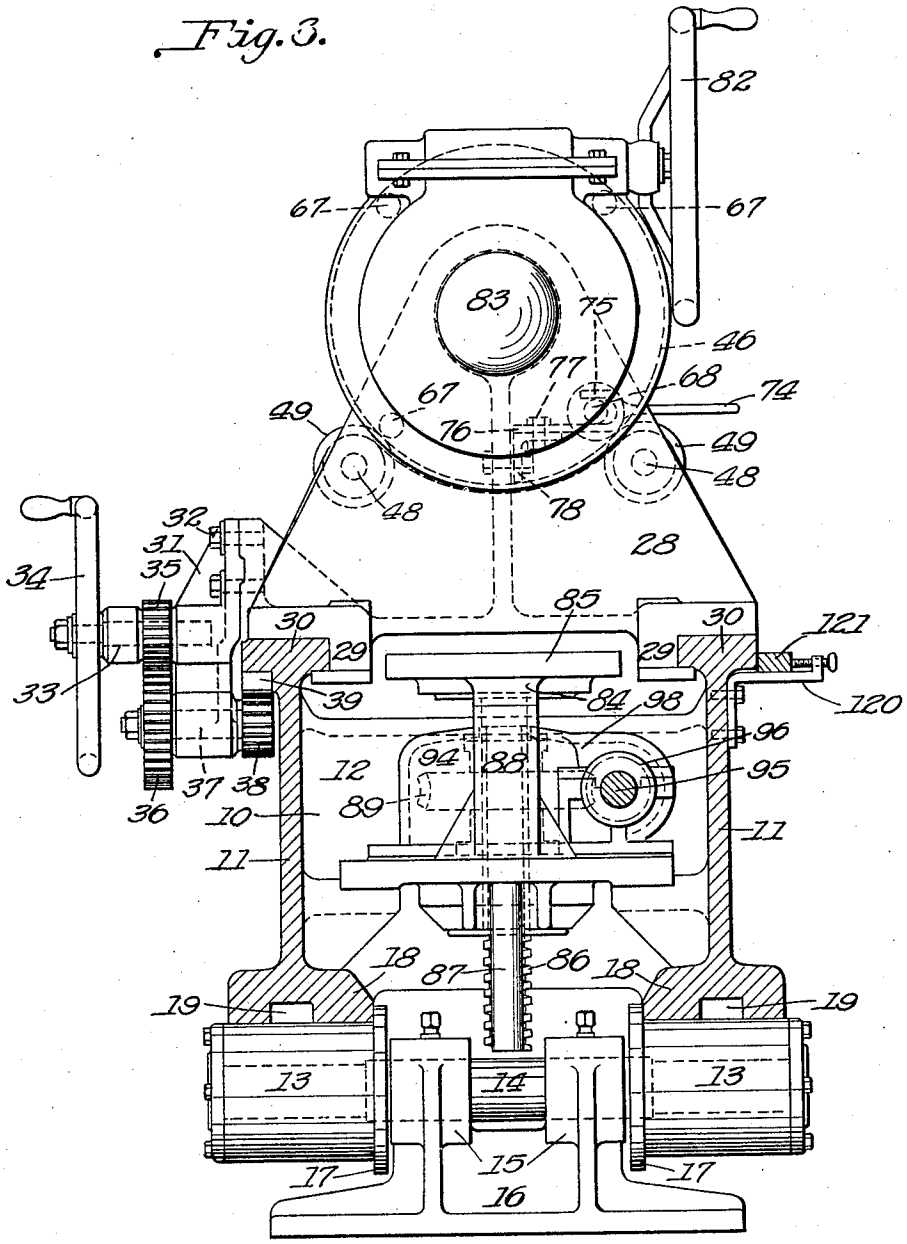
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Fig. 3.



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Fig. 4.

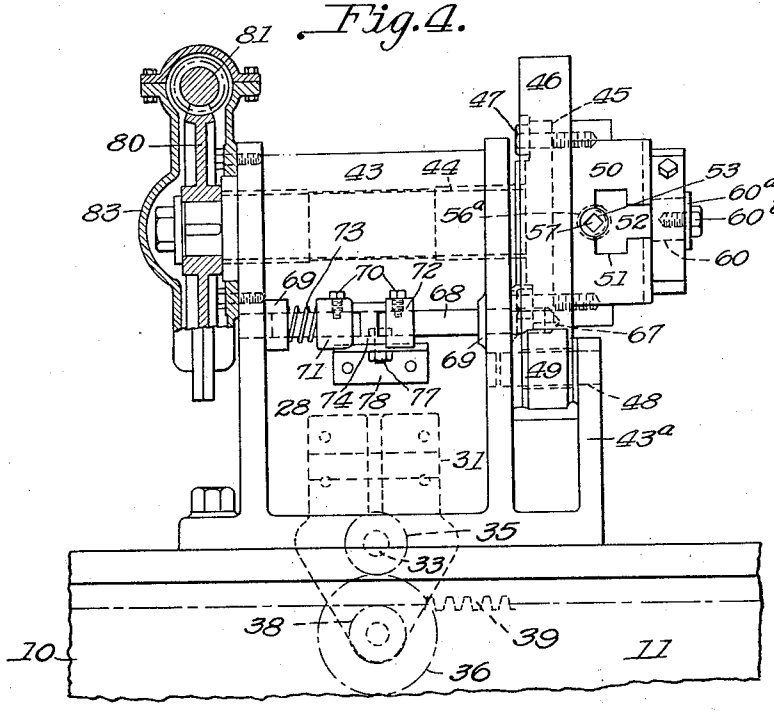
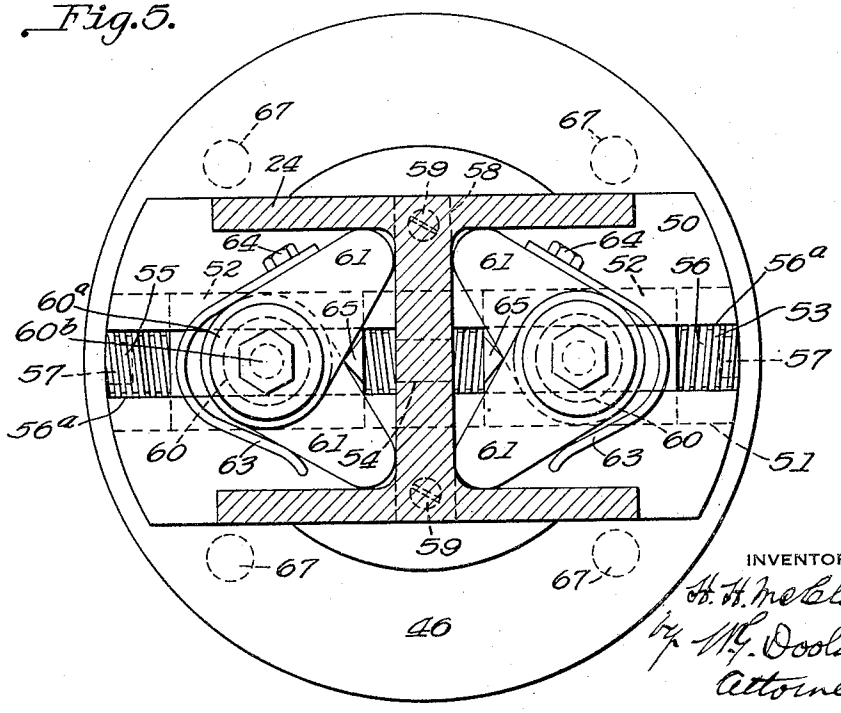


Fig. 5.



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Fig. 6.

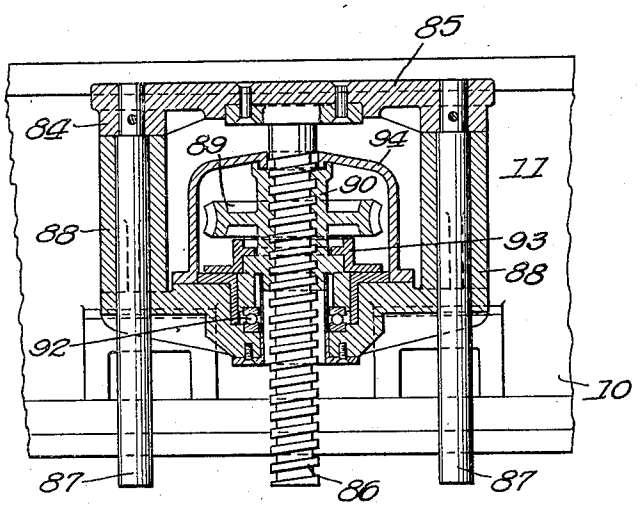
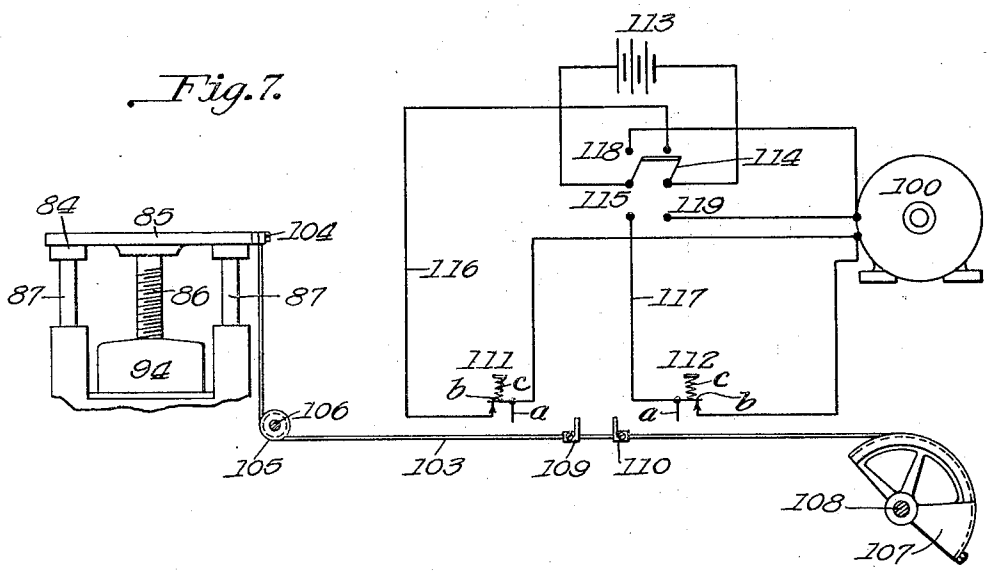


Fig. 7.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR POSITIONING STRUCTURAL MEMBERS FOR DRILLING AND LIKE OPERATIONS

Application filed June 1, 1928. Serial No. 282,143.

This invention relates to an apparatus for centering, holding and turning structural members to permit drilling, punching, riveting, or like operations thereon.

According to the present method of drilling large structural shapes, the work must be moved about the drill by hand, which is slow, inaccurate, and expensive. Heretofore, it has been considered impractical to mount and handle such structural members in machines, due to the great weight of such structural members.

The prime object of the present invention is to provide a strong durable and efficient apparatus or cradle structure capable of handling and positioning the structural members, regardless of their weight and size, whereby the drilling and like operations may be performed expeditiously, precisely, and at a minimum cost.

Another object is to provide a machine of this character capable of longitudinal movement, provided with power-operated jacks to receive and lift the work, and with head and tail stocks provided with novel work-engaging chucks.

A further object is to provide such a machine wherein one of the chucks may be turned to rotate the work and may, in a novel manner, be secured in different positions in the path of a circle.

Various additional objects and advantages will be pointed out or become apparent from a consideration of the description following taken in connection with the accompanying drawings illustrating a practical embodiment.

In said drawings:

Fig. 1 is a side elevational view of the invention in work-engaging position;

Fig. 2 is a top plan view thereof, with the head and tail stocks removed;

Fig. 3 is an enlarged vertical sectional view, partly in elevation, taken on the line III–III of Fig. 1;

Fig. 4 is an enlarged side elevational view of the head stock, partly broken away to show details;

Fig. 5 is an enlarged face view, showing one of the work-engaging chucks in engagement with the work;

Fig. 6 is an enlarged vertical sectional view through one of the lifting jacks, said view being taken on line VI—VI of Fig. 2; and

Fig. 7 is a diagrammatic view, showing limiting means for the lifting jacks.

Referring to the drawings, 10 designates generally a bed or movable supporting body comprising, as illustrated, a cast metal structure including side members 11, connected at intervals by transverse webs or members 12. The bed is mounted for longitudinal movement upon a series of rollers 13, the latter being journalled on transversely extending shafts 14 projected through bearings 15 of base members 16 placed on the floor or other support.

At their inner ends, rollers 13 have peripheral flanges 17 which overlap the inner edges of the lower portions 18 of the side members 11, thus guarding against lateral displacement of the bed 10. The under surfaces of the angles 18 are centrally provided with longitudinally extending rows of rack teeth 19, designed to mesh with pinions or gear wheels 20 keyed to a shaft 21 journalled in suitable bearings. Shaft 21 is driven from a motor, preferably a reversible electric motor 22, through the medium of speed reducing gearing 23, but generally shown. It will be realized that with the motor 22 operating, gear wheels 20 through their engagement with racks 19 will cause longitudinal movement or shifting of the bed 10.

The work, for which an H-beam is representative, is adapted to be engaged by chucks 25 of a head stock 26 and a tail stock 27. Said stocks 26 and 27 have many similar parts; for instance, carriages 28 which are slidable along the bed 10 and have depending hook flanges 29 engaging the upper angles or heads 30 of the side members 11. Each stock 26 and 27 has a bracket 31 bolted or otherwise fastened thereto at 32, said brackets each journalling a shaft 33 adapted to be turned through the operation of a hand wheel 34. Keyed to the shaft 33 is a pinion or gear wheel 35, which is in mesh with a pinion or gear wheel 36 rigid on a short shaft

37, journalled in bracket 31, and which shaft 37 also has a pinion or gear wheel 38 keyed thereto. Gear wheels 38 are in mesh with rack teeth 39 provided throughout the length of one of the heads 30 on its under surface.

Journalled in the bodies 43 of the carriages 28 adjacent their upper portions are shafts or spindles 44. Spindles 44 may have heads or plates 45 to which drums 46 are secured by bolts 47. The drums 46 extend between the inner end of thte bodies 43 and vertical walls 43*a* integral therewith, and which walls mount short shafts 48 on which rollers 49 are journalled and arranged in contact with the periphery of drums 46 so as to assist in sustaining the weight and strain imposed thereon, especially under the exceedingly heavy work in connection with which the machine is worked.

Said drums 46 constitute the bases of chucks 25 and carry diametric blocks 50 provided with centered longitudinal T-shaped slots 51 extending completely therethrough. T-shaped studs 52 occupy and are slidably mounted in said slots 51. Adjusting screws 53 are centrally journalled, as at 54, in the blocks 50 and on opposite sides of their journals 54 have opposite screw threads 55 and 56, one-half of said threaded portions being received in semi-circular recesses 56*a* of blocks 50. The studs 52 rest on the threads 55 and 56 and have corresponding threads meshing therewith, so that, according to the direction of rotating screw 53, the studs 52 will be moved closer together or farther apart. To permit rotation of said screw 53, it is provided with square sockets 57 to accommodate a key or turning tool.

Each journal or bearing portion 54 may be engaged by a retaining strip 58 detachably screwed or otherwise secured to the block 50, as at 59. A bolt or pivot member 60 is secured on the outer end of each stud 52 and has two jaws or gripper members being reduced at their overlapping portions so that the upper and lower faces of the remainder thereof will be in the same plane. Jaws 61 are retained on the members 60 by washer 60*a* and cap screws 60*b*.

In order to prevent collapse or displacement of the jaws 61 when not engaged with work, and particularly when moving relatively thereto, each upper jaw 61 has a generally arcuate spring 63 fastened thereto at 64 and which partially surrounds and resiliently supports the lower jaw from below. In addition, fixed lugs or stops 65 are provided on the blocks 52 which preclude lowering movement of the upper jaws 61. It will accordingly be seen, especialy from Fig. 5, that when the shaft 53 is turned in one direction, the threads 55 and 56 will move the studs 52 toward each other, so that through the contact of the free ends of the jaws 61 with the work 24 they will spread and engage in corners of the H-shaped beam or work 24, thus centering and tightly gripping and holding it. In order to release the work, said shaft 53 is turned in the opposite direction, so that the jaws will be moved away from the work.

The drum 46 and chuck of the tail stock 27 are always free for rotation to accommodate adjustment of the work. The drum and chuck of the head stock 26, however, are adapted to be securely locked and held in different positions according to the particular drilling or operations to which the work is to be subjected. In this connection, the H-beam 24 is adapted to occupy four different positions with respect to the drilling tool, as conventionally suggested at 66, and, therefore, four locking recesses 67 are provided in the drum 46 of the head stock. Adapted to enter said recesses 67 is a bolt or rod 68 which is slidably mounted in suitable bearings 69 on the head stock body 43. Screwed to the bolt 68 at 70 are spaced collars 71 and 72. An expansive coil spring 73 is positioned on shaft 68, between collar 71 and a bearing 69, to urge the projection of bolt 68 so that it will automatically enter one of the recesses 67 when brought into register therewith.

A retracted lever to move bolt 68 out of the recesses 67 is provided at 74, such lever having a yoke 75 engaging the bolt 68 between the collars 71 and 72 and having one of its arms 76 extended and pivotally bolted or otherwise fastened, at 77, to an angle bracket 78 secured to the head stock body 43.

In addition, the spindle 44 of the head stock has a worm wheel 80 keyed to its outer end and which is in mesh with a worm 81 located at the top thereof. Worm 81 has a hand wheel 82 secured thereto. Said worm wheel 80 and worm 81 are housed within and protected by a suitable sectional casing 83 fastened to the head stock body 43. Through the turning of the hand wheel 82 and intermeshing of gears 81 and 80, when bolt 68 is retracted, the spindle 44 of the head stock may be turned so as to correspondingly turn its chuck, the work held thereby, and the chuck and spindle of the tail stock.

In order to form a supporting means to initially receive the work or H-beam 24 and to adjust it vertically for engagement by the chucks of the head and tail stocks, a plurality of lifting jacks are provided at 84. Said jacks may consist of supporting heads or plates 85 on which the work is adapted to rest and which have depending lifting screws 86 rigid therewith. Also depending from the plates 85 are guide members 87 slidably disposed in housing 88 suitably mounted between the side members 11 of the bed. Co-acting with the lifting screws 86 are rotatable worm wheels 89 having extended hubs 90 provided with an interior worm thread meshing with the thread of the screws 86. Worm wheels 89 ro-

tate on ball bearings 92 supported within the casing 88 and are held against vertical displacement by hold-down plates 93 and casing 94.

In order to rotate the worm wheels 89 in unison to either raise or lower the screws 86 and accordingly the jacks and the work, a power shaft 95 is journalled longitudinally of the bed 10 and, at intervals, has worms 96 coupled therein, as at 97. The worms 96 are in mesh with the peripheral teeth of the worm wheels 89 and each casing 94 is extended or provided with a section 98 adapted to house and protect the worms 96.

A bracket 99 is fastened to one end of the bed 10 and mounts an electric motor 100, of the dynamic braking type, preferably of the General Electric type R. F. shunt wound, whose main shaft drives a pinion 101 disposed in mesh with a gear wheel 102 keyed to the power shaft 95.

To guard against the jacks 84 raising or lowering beyond a predetermined safe limit, means are provided to cut out the operating motor 100 at either of said limits. In this connection, a cable or draw element 103 is fastened at 104 to one of the platforms or heads 85 and is trained under a direction pulley 105 suitably journalled at 106 on the bed 10. The lower end of cable 103 is fastened to a counter-weight 107 which is pivoted at 108 to said bed 10. Counter-weight 107 always maintains the cable 103 taut.

Adjustably secured to cable 103 are trip lugs 109 and 110, adapted to engage limit switches 111 and 112, respectively, said switches being of the well known type. The switches are provided with pivotally mounted trips *a* and contacting arms *b*, normally held in closed position by compression springs *c*. A source of electrical energy 113 is connected across the movable member 114 of a double-throw switch 115.

As shown, switch 112 limits the downward motion of the jacks 84, and switch 111 the upward movement thereof. One side of the switch 111 is connected by wire 116 to one side 118 of the double-throw switch 115, through the motor 100 and back to the opposite contact of said switch. Similarly, switch 112 connects with the opposite side 119 of double-throw switch 115 by a wire 117, through the motor and back to the other side of the switch 112. Owing to the fact that switches 111 and 112 are normally closed, it will be seen that operation of the switch 115 will operate motor 100 to raise or lower the jacks 84.

Assuming that the closing of side 118 of the switch 115 will cause the motor 100 to raise the jacks 84, it will be seen that when the desired height is reached, trip lug 109 will break the circuit through switch 111, causing motor 100 to stop, thereby stopping the jacks. Upon engaging side 119 of switch 115, the motor 100 will rotate in the reverse direction, lowering the jacks until stopped by trip lug 110 engaging switch 112. The switch 115 may be opened by the operator at any time, thus providing a flexible control of the machine.

Fastened to one of the side members 11 adjacent its top are supporting brackets 120 which mount a templet 121 to aid in positioning or centering the structure relatively to the drill 66.

Presuming operation, the work, such as an H-beam 24, is lowered by a crane or otherwise onto the heads 85 of the jacks 84. Such H-beam 24 as accommodated by the present machine is exceedingly heavy and of a weight heretofore considered impractical for handling in a machine. After the work 24 is placed on the jacks 84, motor 100 is operated so as to drive the power shaft 95 through the medium of the gears 101 and 102. Such power shaft 95, through the medium of worms 96 and worm wheels 89, causes the lifting screws 96 to elevate, in order to elevate the work 24 to the proper height for engagement at its opposite ends by the chucks 25 of the head and tail stocks 26 and 27, respectively. When the work 24 is at the proper height, the circuit through the motor 100 may be broken or, if desired, the parts arranged so as to automatically open the switch 111 at such instant.

With the work 24 at the proper elevation and the chuck jaws 61 retracted, wheels 34 are turned by hand so as to rotate spindle 33, pinions 35, pinions 36, shafts 37, and pinions 38, so that the latter through engagement with racks 39 will cause movement of the carriages toward the ends of the work 24. In the latter positions, screws 53 are turned so as to move the studs 52 toward each other in order to allow chuck jaws 61 to embrace and hold the beam or work 24. Thereupon, the motor 22 may be set in operation in order that through the medium of gear wheels 20 and their co-action with racks 19, the bed 10 and parts mounted thereon may be moved longitudinally to the proper position for engagement by the drills 66. At desired times, such work 24 may be turned about a horizontal axis which is the axis of spindles 44, in order to present various faces or surfaces of the work 24 for engagement by the drills or punches 66.

The specific work shown is adapted to occupy four different positions in a circle about the horizontal axis mentioned and to be locked in each one of them by the engagement of bolt 68 in the cooperating recess 67. In order to rotate the work 24 about the horizontal axis, the jacks 84 are lowered and then the lever 74 is actuated to retract the bolt 68, whereupon hand wheel 82 is operated to drive worm 81, worm wheel 80, and spindle 44, thus moving the spindles 44, drums 46, the chucks, and the work. When the bolt 68 is

out of register with the recesses 67, the drum 46 of the head stock is free to be turned a part of a revolution or until one of the recesses 67 registers with the bolt 68, when it is automatically projected by the spring 73 into such recess 67, thereby stopping the rotative movement. It will be understood that the raising and lowering and the limit of travel of the jacks 84 is controlled by the mechanism heretofore described co-acting with the cable 103.

Notwithstanding the fact that the present machine particularly operates in connection with work heretofore considered too heavy for a machine of this general character, the same may nevertheless be expeditiously positioned and handled with less labor and at less expense than heretofore, with minute precision, and under complete control at all times. The rollers 49 afford a very efficient reinforcing support for the chucks and associated parts, especially under the weight of the work, since they are located adjacent the ends of the work or zone of engagement of the chucks therewith.

Various changes may be resorted to, provided they fall within the spirit and scope of the invention.

I claim:

1. In apparatus of the class described for holding and positioning elongated structural members for perforating operations, a longitudinally movable bed, power operated jacks carried by said bed to engage the work, and means on said bed engageable with the work and operable to turn the same about an axis passing longitudinally thereof, said jacks being operable to position the work in substantial alignment with said means.

2. In apparatus of the class described for holding and positioning elongated structural members for perforating operations, a bed, power means to longitudinally move said bed, jacks on said bed to engage the work, means on said bed operable to simultaneously actuate said jacks, and means on the bed operable to turn the work about an axis passing longitudinally thereof, the operation of the jacks serving to substantially align the work with the last mentioned means.

3. In apparatus of the class described for holding and positioning elongated structural members for perforating operations, a bed, means operable to longitudinally move the bed, jacks on said bed for engagement by the work, means operable to simultaneously operate said jacks, a head stock and a tail stock, one of said stocks being movable longitudinally of the bed, said jacks also serving to support the work during perforating operations, each of said stocks having chucks to engage the work, the operation of the jacks serving to substantially align the work with said chucks, means to turn the chucks to accordingly turn the work, and means to secure the chucks and work at different positions to which same may be turned.

4. An apparatus of the class described for holding and positioning elongated structural members for perforating operations consisting of a bed, means operable to longitudinally move said bed, jack mechanism engageable with the work at spaced points, means on the bed to operate said jack mechanism so as to simultaneously raise or lower both ends of the work, means on the bed having chucks engageable with the work, the operation of the jacks serving to substantially align the work with the chucks, said jacks also serving to support the work during perforating operations, and means mounting the chucks for turning so that the position of the work may be varied.

5. An apparatus of the class described for holding and positioning elongated structural members for perforating operations comprising rollers having peripheral flanges, means mounting said rollers, a bed mounted on said rollers and held against lateral displacement by said flanges, means operable to bodily move the bed over said rollers, said bed having head stocks slidable along said bed and having hooked flanges engaging the same, means on the stocks and engaging the bed operable to move the stocks longitudinally of the bed, chucks carried by the stocks and adapted to rotatably support the work, and jack means carried by the bed adapted to receive the work in substantially horizontal position, and power means to operate the jack means so as to align the work for engagement by the chucks.

6. A work-cradle mechanism for holding and positioning elongated structural members for perforating operations of the class described comprising a bed, power means to longitudinally move the bed, supporting means for the work mounted on the bed, stocks mounted on the bed, said stocks having spindles journalled therein, drums carried by the spindles, chucks carried by said drum and turnable on a horizontal axis to engage the ends of the work and rollers carried by the stocks in peripheral engagement with the drums to constitute auxiliary supports therefor.

7. A work-cradle mechanism for holding and positioning elongated structural members for perforating operations comprising a bed, power means to move the said bed longitudinally, jack mechanism to support the work, said jack mechanism having screws, worm wheels journalled on the bed having threaded engagement with said screws, a power shaft having worms in mesh with said worm wheels, means to operate said power shaft, stocks mounted on said bed, chucks carried by the stocks and engageable with the work, the work being operable by the jack mechanism to position the same hori-

zontally in alignment with the chucks, means operable to turn one of said chucks about an axis extending longitudinally of the machine, and a lock means engageable with said chuck to hold it at different adjustments.

8. A work-cradle mechanism for holding and positioning elongated structural members for perforating operations comprising a bed, power means to move said bed longitudinally, jack mechanism to support the work, said jack mechanism having screws, worm wheels journalled on the bed having threaded engagement with said screws, a power shaft having worms in mesh with said worm wheels, means to operate said power shaft, stocks mounted on said bed, chucks carried by the stocks and engageable with the work, the work being operable by the jack mechanism to position the same horizontally in alignment with the chucks, means operable to turn one of said chucks about an axis extending longitudinally of the machine, said chuck having a plurality of recesses arranged in a path concentric with its axis, a locking bolt to engage said recesses, means operable to retract the said bolt, and means urging projection of said bolt.

9. A work-cradle mechanism of the class described comprising a base, rollers journalled thereon, a bed having side members engaging said rollers, said side members at their lower portions having racks, power driven means engageable with said racks to impart longitudinal movement to the bed, work-engaging jacks carried by the bed between said side members, said jacks having lifting screws, worm wheels engaging said screws and mounted on the base against vertical movement, a power shaft on said bed having worms in mesh with the first mentioned worm wheels to operate the jacks, stocks slidable on the heads of said side members and having hook flanges engaging said heads, the under surface of one of said heads having rack teeth, mechanism on each stock engageable with said rack teeth through operation to cause longitudinal movement of the stocks, chucks engageable with the work and rotatably mounted on said stocks.

10. A work-cradle mechanism of the class described comprising a base, rollers journalled thereon and having peripheral flanges, a bed having side members engaging said rollers and prevented from lateral displacement by said flanges, said side members at their lower portions having racks, power driven means engageable with said racks to impart longitudinal movement to the bed, work engaging jacks carried by the bed between said side members, said jacks having lifting screws, gear wheels engaging said screws and mounted on the base against vertical movement, a power shaft on said bed having gear wheels in mesh with the first-mentioned gear wheels to operate the jacks, stocks slidable on the heads of said side members and having hook flanges engaging said heads, the under surface of one of said heads having rack teeth, mechanism on each stock engageable with said rack teeth through operation to cause longitudinal movement of the stocks, chucks rotatably mounted on said stocks and engageable with the work, means associated with one of the chucks having recesses in a row concentric with its axis, a locking bolt engageable with said recesses, means urging projection of said bolt, means operable to retract said bolt, and means operable to turn said chuck when said bolt is retracted.

11. A work-cradle mechanism of the class described comprising a base, rollers journalled thereon and having peripheral flanges, a bed having side members engaging said rollers and prevented from lateral displacement by said flanges, said side members at their lower portions having racks, power driven means engageable with said racks to impart longitudinal movement to the bed, work engaging jacks carried by the bed between said side members, said jacks having lifting screws, gear wheels engaging said screws, and mounted on the base against vertical movement, a power shaft on said bed having gear wheels in mesh with the first mentioned gear wheels to operate the jacks, stocks slidable on the heads of said side members and having hook flanges engaging said heads, the under surface of one of said heads having rack teeth, mechanism on each stock engageable with said rack teeth through operation to cause longitudinal movement of the stocks, chucks rotatably mounted on said stocks and engageable with the work, said chucks each having two pairs of pivotally mounted jaws, means holding one of the jaws of each pair against displacement when disengaged with the work, and an element extending from the last-mentioned jaws and embracing the co-acting jaw to prevent displacement thereof when disengaged with the work.

12. In apparatus of the class described for holding and positioning elongated structural members for perforating operations, a bed having a rectilinear movement, vertically movable jack mechanism carried by the bed to engage the work, an electric power motor for moving the jack mechanism to substantially center the work, means for limiting the movement of said jack mechanism, and means on the bed to support and permit turning of the work about an axis passing longitudinally thereof, said limiting means including a weighted cable secured to the jack mechanism, an electric circuit leading to the said motor, a switch mechanism, and stops adjustable on the cable co-acting with the switch mechanism whereby the work may

be raised into substantial alignment with the second mentioned means.

13. In apparatus of the class described for holding and positioning elongated structural members for perforating operations, a rectilinearly movable bed, mechanism on said bed to support work and permit turning thereof on its axis to different positions, means to secure the work in said different positions, and mechanism on the bed operable to jack the work into substantial alignment with and for engagement by the first mentioned mechanism.

14. An apparatus of the class described for holding and positioning elongated structural members for perforating operations consisting of a base having rollers, a bed having side members disposed on said rollers, rack teeth on one of the side members, means engageable with the rack teeth and operable to bodily move said bed, jack mechanism on the bed to engage the work, means on the bed to operate said jack mechanism, mounting members on the bed having chucks engageable with the ends of the work, one of said members being a slide, means operable to bodily move said slide on said bed, means mounting the chucks for turning on a horizontal axis so that the position of the work may be varied, and means for securing one of the chucks in different positions to which it is turned.

15. A work cradle mechanism for holding and positioning elongated structural members for perforating operations, comprising a bed, power means to move the bed longitudinally, jacks to support the work, a power shaft on the bed, means to operate the jacks from the power shaft, means to operate said power shaft, stocks mounted on said bed, chucks carried by the stocks and engageable with the work, the work being operable by the jack mechanism to position the same horizontally substantially in alignment with the chucks, means operable to turn one of said chucks about an axis extending longitudinally of the machine, and means to hold the latter chuck at different angular positions.

16. An apparatus of the class described for holding and positioning elongated structural members for perforating operations, comprising rollers, a bed mounted on said rollers, flanges for preventing lateral movement of the bed on the rollers, means operable to bodily move the bed over said rollers, said bed having head stocks and having guide means engaging the bed, means engaging the bed operable to move one of the stocks longitudinally of the bed, chucks carried by the stocks adapted to rotatably support the work, and jack means carried by the bed adapted to receive the work in substantially horizontal position, and power means to operate the jack means so as to substantially align the work for engagement by the chucks.

17. An apparatus of the class described for holding and positioning elongated structural members for perforating operations, a rectilinearly movable bed, mechanism on said bed to support work and permit turning thereof on a substantially horizontal axis to different positions, mechanism on said bed whereby the work may be jacked into position for engagement by the first mentioned mechanism, and means operable automatically to cut off the operation of the second mentioned mechanism when the work is substantially aligned with the first mechanism.

18. An apparatus of the class described for holding and positioning elongated structural members for perforating operations, a bed having a rectilinear movement, vertically movable jack mechanism carried by the bed to engage the work, an electric power motor for moving the jack mechanism to substantially center the work, means for limiting the movement of said jack mechanism, means on the bed to support and permit turning of the work about an axis passing longitudinally thereof, said limiting means including a weighted cable secured to the jack mechanism, an electric circuit leading to the said motor, a switch mechanism, and stops adjustable on the cable coacting with the switch mechanism whereby the work may be raised into alignment with the second mentioned means.

19. A work cradle mechanism of the class described for holding and positioning elongated structural members for perforating operations, comprising a bed, power means to longitudinally move the bed, jack mechanism for the work mounted on the bed, slidable stocks mounted on the bed, a drum rotatably mounted on one of said stocks, a chuck mechanism carried by the drum.

In testimony whereof I affix my signature.

HOWARD H. McCLINTIC.