Sept. 15, 1964 J. GOGAN 3,149,189

BAR QUENCHING MACHINE

Filed May 6, 1960 5 Sheets-Sheet 1

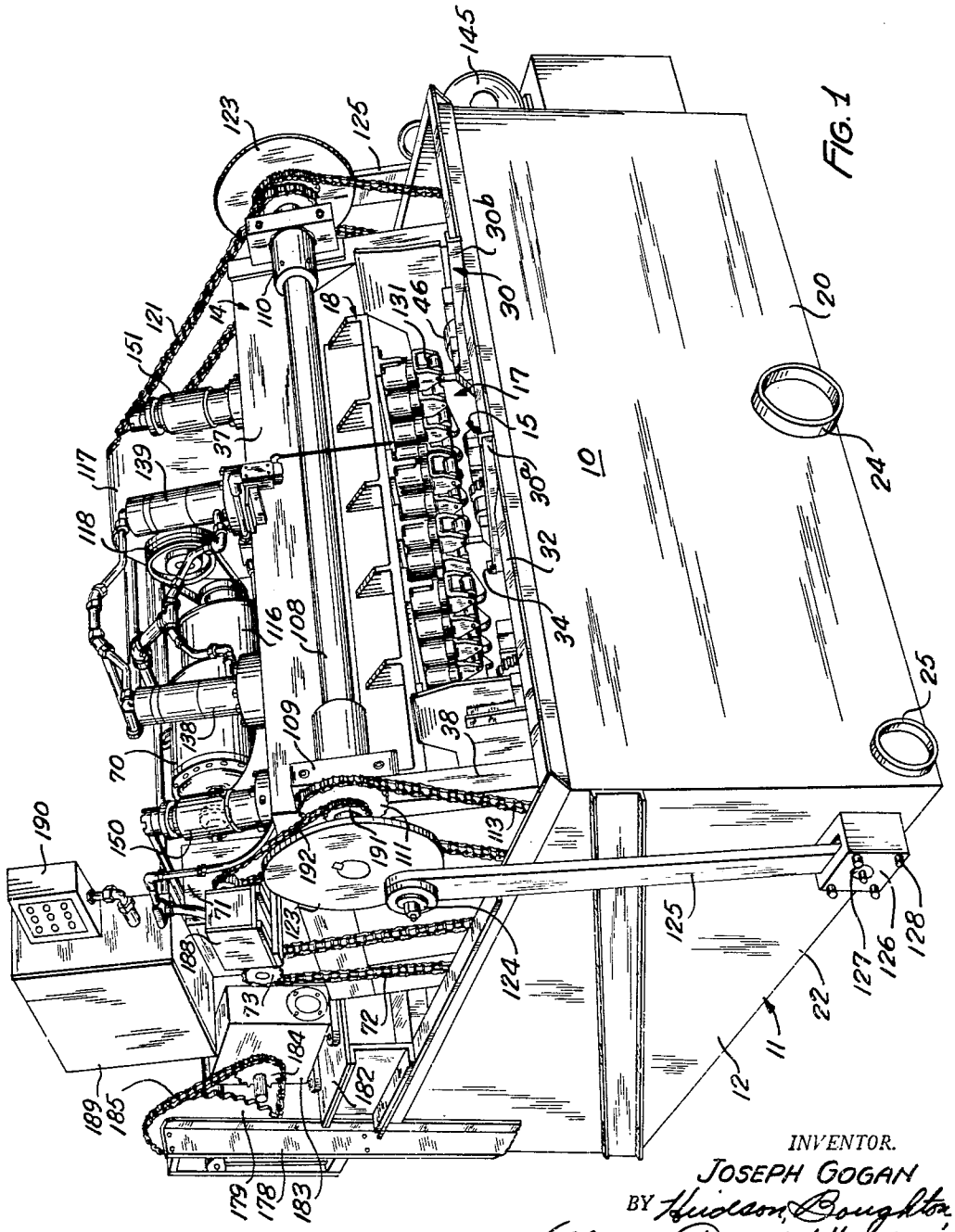


FIG. 1

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BAR QUENCHING MACHINE

Filed May 6, 1960 5 Sheets-Sheet 2

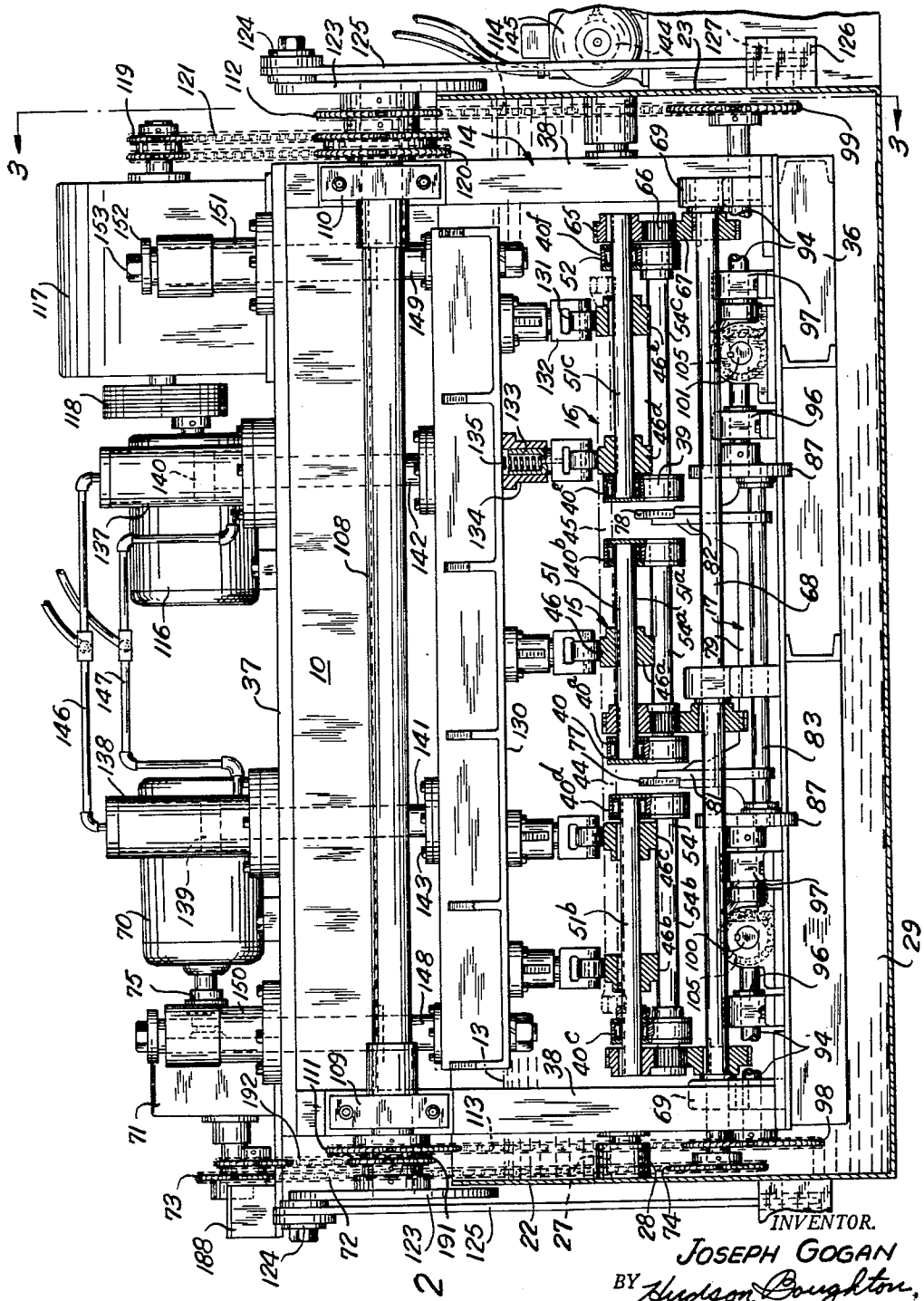


FIG. 2

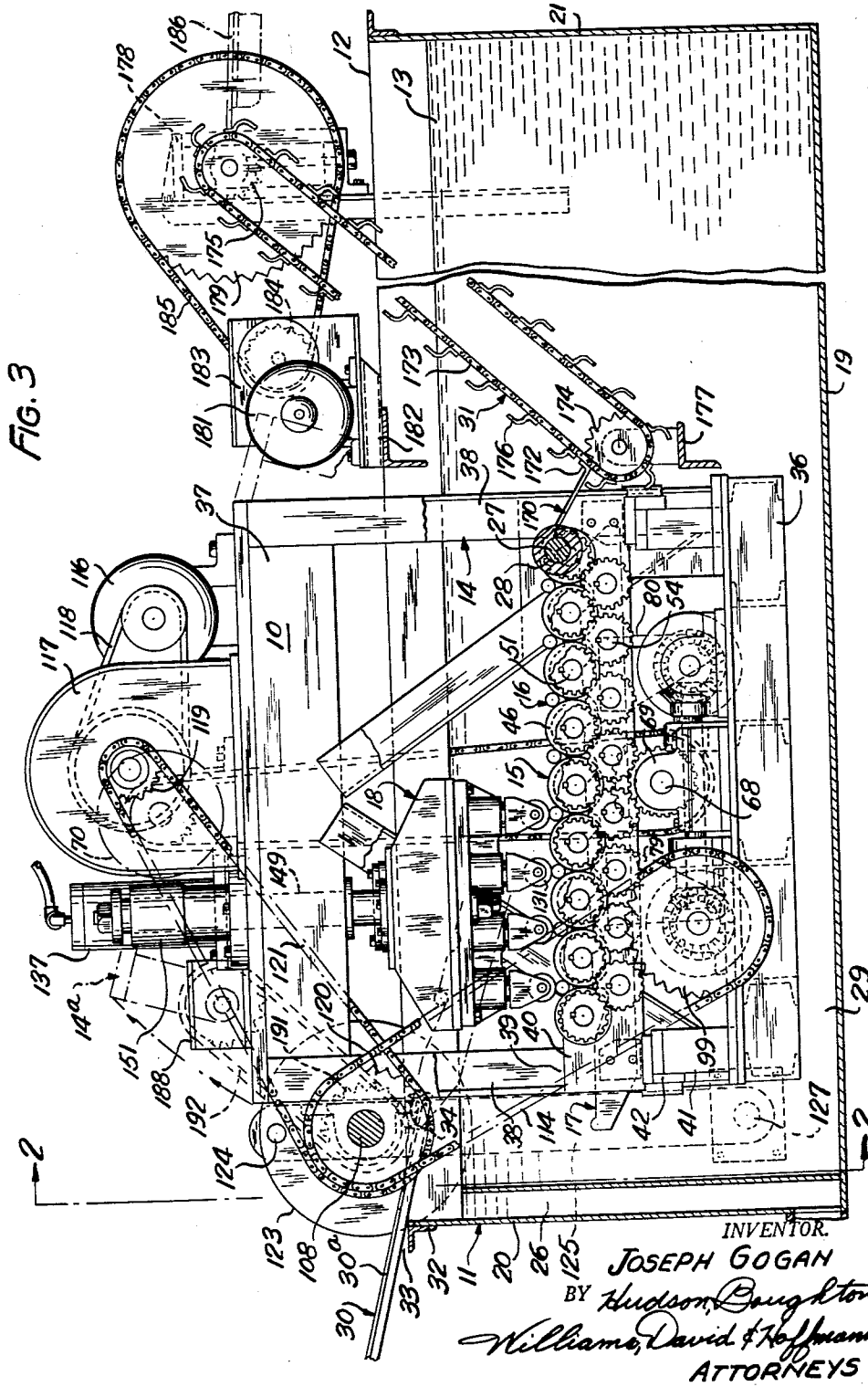
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BAR QUENCHING MACHINE

Filed May 6, 1960 5 Sheets-Sheet 3

FIG. 3



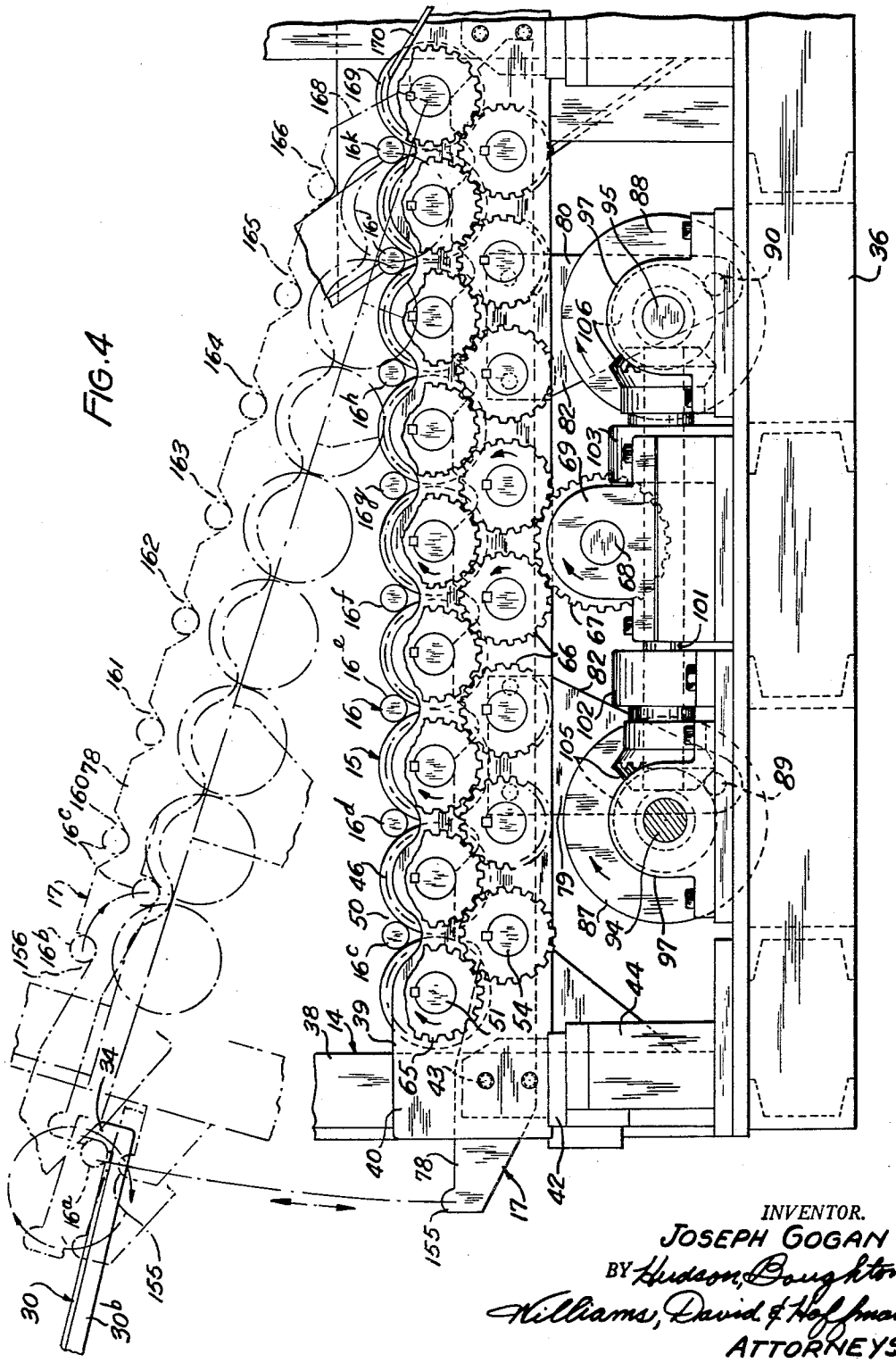
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Sept. 15, 1964 J. GOGAN 3,149,189

BAR QUENCHING MACHINE

Filed May 6, 1960 5 Sheets-Sheet 4

FIG. 4



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Sept. 15, 1964 J. GOGAN 3,149,189

BAR QUENCHING MACHINE

Filed May 6, 1960 5 Sheets-Sheet 5

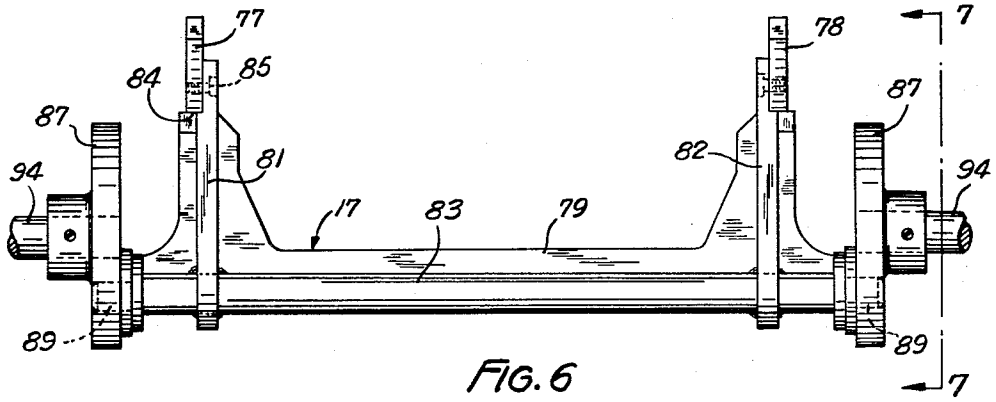


FIG. 6

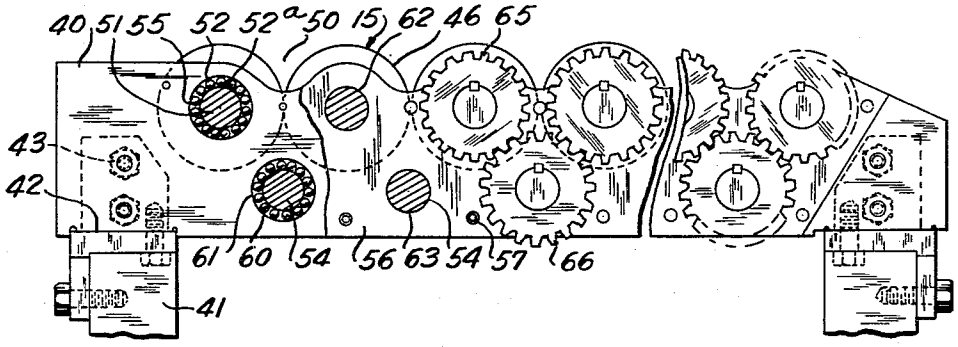


FIG. 5

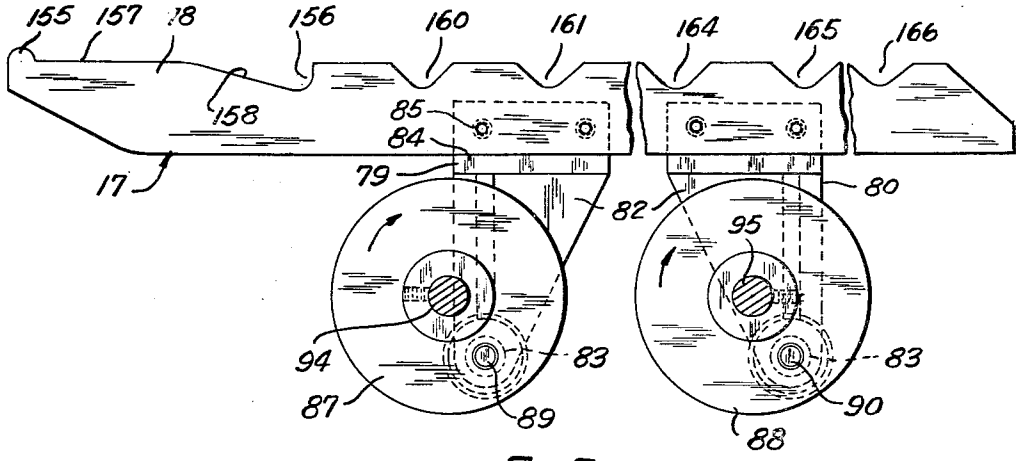


FIG. 7

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United States Patent Office 3,149,189 Patented Sept. 15, 1964

3,149,189
BAR QUENCHING MACHINE

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Filed May 6, 1960, Ser. No. 27,325
18 Claims. (Cl. 266—6)

This invention relates to quenching machines for carrying out a quenching operation on rod-like workpieces such as torsion bars, axle shafts and the like and, as one of its objects, aims to provide a novel method and a novel construction for a machine of this kind, by which a considerably larger quantity of the workpieces can be quenched in a given time interval than has been possible heretofore.

Another object is to provide a novel quenching machine and method in which a work support means supports a plurality of such rod-like workpieces as a series and in a parallel-axes relation for the quenching operation, and a transfer means advances the workpieces step-by-step along the series so that by the time any given workpiece has traversed the series it will have undergone the proper period of quenching.

Still another object is to provide a novel quenching machine of the kind indicated above and having rows of work supports extending in a front-to-rear direction of the machine for supporting the series of parallel workpieces in a crosswise relation to such rows, and wherein the transfer means comprises arm means extending in the same direction as said rows and having a cyclical transfer movement for advancing the workpieces along the rows.

A further object is to provide a novel quenching machine of the character just above referred to wherein the work support means is movable between a treating position and a loading and transfer position, and wherein the workpieces received on the support means are always in a submerged condition in the quenching liquid so that the quenching operation need not be interrupted during the loading of the workpieces and the advancing thereof along the work support means.

This invention also provides a novel quenching machine of the kind mentioned above and having supply means at one end of the work support rows for supplying new workpieces and receiver means at the other end for receiving the quenched workpieces.

Additionally, this invention provides such a novel quenching machine in which the work support means comprises support rollers for rotatably supporting the workpieces, and preferably also comprises co-operating pressure roller means for straightening the workpieces.

Other objects and advantages of this invention will be apparent in the following detailed description and in the accompanying drawings forming a part of this specification and in which,

FIG. 1 is a front and side perspective view of a quenching machine provided by this invention and usable in the method thereof;

FIG. 2 is a transverse vertical section taken through the machine adjacent the front end thereof as indicated by section line 2—2 of FIG. 3, and with portions of the machine broken away at various points for clarity of illustration;

FIG. 3 is a vertical longitudinal section taken through the machine adjacent one side thereof as indicated by section line 3—3 of FIG. 2;

FIG. 4 is a view corresponding with a portion of FIG. 3, but on a larger scale and somewhat diagrammatic in form, and further illustrating the work support means and the operation of the transfer means which loads and advances the workpieces;

FIG. 5 is a partial side elevation, with portions in section, showing one of the bearing support bars of the work-supporting portion of the machine;

FIG. 6 is a partial front elevation of the transfer means and the associated structure for supporting and actuating the same; and

FIG. 7 is a side elevation of the transfer means when viewed as indicated by the directional line 7—7 of FIG. 6.

In the embodiment of the quenching machine 10 shown in the accompanying drawings this machine comprises, in general, a support structure 11 including a tank 12 adapted to contain a suitable quenching liquid 13, and a frame 14 disposed in the tank and having work support means 15 thereon for supporting a series of rod-like workpieces 16 such as torsion bars, axle shafts or the like in a parallel-axes relation. The machine 10 also comprises loading and transfer mechanism 17 operable to load and unload workpieces with respect to the work support means 15 and to advance the workpieces from station-to-station along such work support means. The machine 10 preferably also includes straightening means 18 co-operable with portions of the work support means 15 for performing a straightening operation on the workpieces 16.

The tank 12 forms the base of the support structure 11 and is of a suitable size and shape such as the quadrangular shape shown in the drawings. The tank 12 has a flat bottom 19 adapted to rest on a floor or the like, and pairs of upright walls comprising front and rear walls 20 and 21 and a pair of side walls 22 and 23. The tank 12 is preferably provided with inlet and outlet connections 24 and 25 for a flow of the quenching liquid 13 into and out of the chamber or reservoir 29 of the tank. The outlet 25 is connected with the lower end of an upright overflow passage 26 provided in the tank adjacent the left front corner thereof and which maintains the quenching liquid 13 as a predetermined level in the tank.

The frame 14 is pivotally connected at opposite sides thereof with the tank 12 for swinging from a lowered or submerged treating position for the workpieces 16 as shown in full lines in FIG. 3, to an upper loading and transfer position 14^a indicated in phantom lines, as will be further explained hereinafter. The pivot means for thus swingably connecting the frame 14 with the support structure 11 comprises laterally projecting pivot pins 27 on the frame adjacent the rear end thereof, and pivot bearing sleeves 28 mounted on the side walls 22 and 23 of the tank and in which such pivot pins are received as shown in FIGS. 2 and 3.

The machine 10 also comprises work supply means 30 at one end thereof, in this case the front end, for supplying workpieces to the front end of the work support means 15, and work delivery means 31 adjacent the other or rear end of the machine and here shown as being a conveyor 31 for delivering quenched workpieces received thereby from the rear end of the work support means.

The work supply means 30 is shown as comprising bars 30^a and 30^b supported in a laterally spaced relation on the transverse top rail 32 of the front wall 20 of the tank and attached thereto as by welded connections 33. The bars 30^a and 30^b are disposed in an overhanging and downwardly sloping position on the front wall 20 and are provided at their inner or lower ends with stop projections 34 for receiving thereagainst a new workpiece in a feeding or pick-up position 16^a for pick-up engagement by the transfer means 17 as will be explained hereinafter.

The frame 14 is here shown as comprising a suitable base 36, a top section or head 37, and upright corner posts 38 connecting such top section with the base. The frame 14 also comprises an intermediate portion 39 on which the work support means 15 is mounted. This intermediate portion comprises pairs of parallel bearing support bars 40 extending in a front-to-rear direction of the machine 10, in this case, three pairs of such bars. These pairs of support bars consist of spaced-apart center bars

40a and 40b and pairs of spaced side bars 40c, 40d and 40e, 40f on the left and right sides of such center bars.

The individual bars of these pairs are supported on the base 36 (see FIGS. 3 and 4) in a spaced relation thereabove by means of short posts 41 rising above such base and brackets 42 seated on the posts and having the ends of the bars connected therewith by bolts 43. The center support bars 40a and 40b are spaced from the adjacent side bars 40d and 40e by intervening spaces 44 and 45 in which portions of the transfer mechanism 17 are movable as is explained hereinafter.

The work support means 15 comprises work support rollers 46 in parallel rows extending in a front-to-rear relation of the machine 10 and here shown as comprising a center row 46a of such rollers and two pairs of side rows 46b, 46c and 46d, 46e on the left and right sides of such center rows. The pairs of adjacent rollers of each row provide work stations defined by the gaps or downwardly converging bights 50 between such pairs of rollers and in which the workpieces 16 are received as shown in FIG. 4. In this case, the workpieces 16 are of a length to extend across all of the rows of work support rollers 46 of the machine.

The series of workpieces 16 on the work support means 15 thus comprises workpieces supported in a spaced parallel-axes relation with the workpieces extending transversely of the rows of work support rollers 46. FIGS. 3 and 4 of the drawings show the workpieces 16 supported in this relation on the rollers 46. The workpieces of the series have been designated in a front-to-rear relation by the reference numerals 16c, 16d, 16e, 16f, 16g, 16h, 16j and 16k.

The work support rollers 46 are secured, as by keys, on support shafts 51 mounted in the support bars 40 and which shafts comprise banks of shafts disposed in a parallel-axes relation. These banks of support shafts consist of a center bank 51a and side banks 51b and 51c located on the left and right sides of such center bank. The individual shafts of these shaft banks all extend in a direction transverse to the rows of work support rollers 46 and are rotatably supported by antifriction bearings 52 provided in the bearing support bars 40.

To further identify the rows of work support rollers 46 and their associated support shafts 51, it is pointed out that the center row of support rollers 46a is secured on the support shafts comprising the center bank 51a which are rotatably mounted in the center pair of support bars 40a and 40b. The left side rows of support rollers 46b and 46c are secured on the left bank of support shafts 51b which are mounted in the left pair of support bars 40c and 40d. Similarly, the right side rows of support rollers 46d and 46e are secured on the right bank of support shafts 51c which are rotatably mounted in the right pair of support bars 40e and 40f.

The banks of roller support shafts 51a, 51b and 51c are driven by drive shafts 54 comprising corresponding banks of such drive shafts 54a, 54b and 54c. The banks of drive shafts are located immediately below the banks of roller support shafts and are also rotatably mounted in the pairs of support bars 40, the bank of drive shafts 54a being mounted in the center pair of bars 40a and 40b, the left bank of drive shafts 54b being rotatably mounted in the left pair of support bars 40c and 40d, and the right bank of drive shafts 54c being rotatably mounted in the right pair of support bars 40e and 40f. The adjacent ends of the banks of roller support shafts 51 and the adjacent ends of the banks of drive shafts 54 are spaced apart by the intervening spaces 44 and 45 which accommodate portions of the transfer mechanism 17 as mentioned above.

The bearings 52 by which the roller support shafts 51 are rotatably mounted in the pairs of support bars 40 comprise annular groups of bearing rollers 52a located in openings 55 which are provided in the support bars and into which the end portions of these shafts extend. The groups of bearing rollers 52a surround the shafts 51 and are retained in the openings 55 by cover plates 56 which are secured against opposite sides of the bars 40 as by means of screws 57. Bearings 60 of a similar construction and provided in other openings 61 of the pairs of bars 40, as shown in FIG. 5, rotatably support the drive shafts 54. The cover plates 56 have openings 62 and 63 coaxial with the bearing openings 55 and 61 to accommodate the shafts 51 and 54.

The roller support shafts 51 are connected with the drive shafts 54 by gear trains comprising gears 65 secured on the support shafts and gears 66 meshed therewith and secured on the drive shafts. The drive shafts 54 are mounted in the support bars 40 so as to be located between and below the pairs of support shafts 51, as shown in FIGS. 4 and 5, so that the gear 66 of each drive shaft will be in driving engagement with the gears 65 of the adjacent pair of support shafts 51.

By reason of this arrangement for the gearing it will be seen that when rotation is imparted to one or more of the gears 66 of the drive shafts 54, as by means of a power input gear 67 (see FIG. 4), all of the gears 65 of the support shafts 51 will be rotated in the same direction to cause rotation of the rollers 46 and the workpieces 16 supported thereby. The direction of rotation of the rollers 46 is shown in FIG. 4 as being a clockwise rotation which may be desirable as consistent with, and helpful to, the front-to-rear movement of the workpieces of the series during the operation of the transfer mechanism 17 to be described hereinafter. If desired, however, the rollers 46 can be rotated in a counterclockwise direction to retard any self-shifting tendency of the workpieces.

For driving the three banks of drive shafts 54a, 54b and 54c simultaneously, the machine 10 is provided with a transverse power input shaft 68 which is common to these banks and supported in suitable laterally spaced bearings 69 mounted on the base 36. The banks of drive shafts 54 are connected with the power input shaft 68 by the provision of three of the power input gears 67 on this shaft at appropriately spaced points therealong for meshed engagement with gears 66 of certain of the drive shafts of the three shaft banks 54a, 54b and 54c.

The power input shaft 68 is suitably driven by an electric motor 70 through a gear reduction drive 71 and through a chain 72 extending around sprockets 73 and 74. The motor 70 and the gear reduction device 71 are mounted on the top section 37 of the frame 14 so that the work support rollers 46 can be driven continuously without being interrupted or otherwise affected by the lifting and lowering movements of the frame. The motor 70 has the armature shaft thereof connected with the input shaft of the reduction gear device 71 by a coupling 75, and the power output shaft of the gear reduction device has the sprocket 73 secured thereon.

The transfer mechanism 17 comprises a pair of laterally spaced parallel arm members 77 and 78 extending in a front-to-rear direction and located in the above-mentioned spaces 44 and 45. The arms 77 and 78 are supported by a pair of yokes 79 and 80 which are spaced apart in a front-to-rear direction of the machine 10 and each of which comprises a pair of laterally spaced bracket members 81 and 82 secured on a transverse connecting bar 83 and extending thereabove. The brackets 81 and 82 are spaced apart along the bar 83 a distance corresponding with the distance between the spaces 44 and 45 as shown in FIG. 2. The arms 77 and 78 are mounted on the upper ends of the brackets 81 and 82 by being received on shoulder portions 84 thereof and also by suitable attaching screws 85.

The front and rear yokes 79 and 80 are supported and actuated by pairs of front and rear eccentric disks 87 and 88 spaced apart transversely of the machine 10 whereby the desired feeding and transfer movements of the arms 77 and 78 are imparted thereto, as will be described hereinafter. The bar 83 of the front yoke 79 has crank pin extensions 89 on the ends thereof which are received in

along the arms and down the inclined portions 158 thereof into the front notches 156.

The arms 77 and 78 have other picker elements thereon comprising notches 160, 161, 162, 163, 164, 165 and 166 which are spaced apart along the arms at distances corresponding with the spacing of the work stations provided by the bights 50 between the pairs of work support rollers 46. The picker notches 160 to 166 operate during the lifting movement of the arms 77 and 78 to pick up the workpieces 16^d to 16^j from the corresponding work stations at which these workpieces are then located.

When the upward movement of the arms 77 and 78 has lifted the picked workpieces to an elevation above the work support rollers 46, the endwise translatory movement of the arms in the rearward direction advances the workpieces to new or advanced locations above the bights 50. Thereupon the downward movement of the arms 77 and 78 lowers the workpieces and deposits the same into the bights adjacent such new locations and disengages the picker notches from the workpieces leaving the same supported by the rollers 46 in positions advanced one work station along the workpiece series.

The arms 77 and 78 are provided at the rear end thereof with picker elements comprising downwardly and rearwardly inclined pushing cams 168 which are engageable with the rearmost or fully quenched workpiece 16^k of the series for discharging the same from the workholder means 15 by pushing this workpiece over the rearmost work support rollers 169. As the workpiece 16^k passes over the rollers 169 it drops onto downwardly and rearwardly inclined receiver means 170 and is supported thereby in a position to be picked up by the delivery conveyor 31. The receiver means 170 is provided with upturned stop elements 172 at the lower end thereof which serve to thus position the quenched workpiece for the conveyor 31.

The delivery conveyor 31 comprises an endless chain or the like 173 extending around a lower support sprocket 174 and an upper drive sprocket 175, and pocket-forming brackets or pick-up members 176 at spaced points along the chain. Advancement of the pick-up members 176 by the conveyor chain 173 causes the same to pick up the quenched workpiece whenever such a workpiece is in the pick-up position against the stop elements 172 of the receiver means 170.

As shown in FIG. 3, the lower or receiving end of the conveyor 31 is disposed within the tank 12 and is supported by transverse support means 177 so as to be located adjacent to, and beneath, the lower end of the receiver means 170. The upper or delivery end of the conveyor 31 extends out of the tank 12 and is supported by auxiliary transverse frame means 178 mounted on the tank at opposite sides thereof.

The drive sprocket 175 of the conveyor 31 is connected with a power input sprocket 179 which is driven from a conveyor motor 181 mounted on a suitable support bracket 182. The motor 181 is connected with a gear reduction device 183 having a power output sprocket 184 to which the input sprocket 179 is connected by a chain 185 extending therearound. The quenched workpieces delivered by the upper end of the conveyor 31 are dropped onto a receiver means 186 by which they are temporarily supported until removed or are directed into a container or the like where they are to be collected.

While the machine 10 is in operation, the work support rollers 46 are driven by the shaft 68 during the running of the electric motor 70 so as to continuously rotate all of the workpieces 16 located on the work support means 15, regardless of whether the frame 14 is in its lowered position or in its lifted position. The main shaft 108, however, is driven only intermittently by an intermittent running of the electric motor 116 so that, when the frame 14 is in the lowered positioned with the workpieces 16 submerged in the quenching liquid 13, the rest intervals during which the motor 116 is stopped will contribute to or provide the time period necessary for quenching treatment of the workpieces.

When the electric motor 116 is restarted after each rest interval, it will cause a cycling of the machine 10 by which the frame 14 is swung upwardly to the loading position 14^a by the action of the eccentric devices 123, and will also cause the transfer mechanism 17 to be actuated through its loading and transfer movements to pick the new workpiece from the feed position 16^a of the supply means 30 to advance the previously fed workpieces 16^c to 16^j along the work stations as explained above. This actuation of the transfer means 17 also causes the discharge of the rearmost workpiece 16k, whose quench treatment has been completed, onto the receiver means 170 as explained above.

The operation of the straightening means 18 is synchronized with the lifting and lowering movements of the frame 14 so that the pressure rollers 131 will be disengaged from the workpieces 16 upon or before the arrival of the frame at the loading position 14^a, and will be re-engaged with the workpieces after the loading and transfer operation of the transfer means 17 has been carried out but prior to the downward movement of the frame to the workpiece-submerged treating position. This timed operation of the straightening means 18 will enable the same to act on the new workpiece while it is in its initial heated condition.

The cyclical movements of the frame 14 and of the transfer means 17, as well as the cyclical operation of the straightening means 18, are controlled by suitable conventional control apparatus comprising timer mechanism, switches, relays and the like, located in electrical cabinets 188, 189 and 190, all of which are supported by the frame 14. The timing mechanism of the control apparatus is located in the cabinet 188 and is driven from the main shaft 108 by a sprocket 191 secured on the left end of this shaft and connected with a sprocket of the timing mechanism by a chain 192.

As the frame 14 is swung upwardly to the loading position 14^a, the arms 77 and 78 of the transfer mechanism 17 are lifted to a position immediately beneath the lower end of the supply means 30 so that the continued or subsequent actuation of these arms by the pairs of eccentric disks 87 and 88 causes the picker lugs 155 to pick the new workpiece from the feeding position 16^a of the supply means in the manner already explained above. Thus each time that the frame 14 is swung upwardly to the loading position 14^a a new workpiece will be picked from the supply means 30 and fed or transferred to the bight 50 corresponding with the front work station of the work support means 15, and all of the other workpieces already present in the bights of the work support means will be advanced one station along the series by the arms 77 and 78. This same cycle of operation of the arms 77 and 78 causes the rearmost workpiece 16^k of the series to be delivered to the receiver means 170 as explained above. Immediately following the completion of the loading and transfer cycle of the transfer mechanism 17, the straightening means 18 is actuated to its closed position for carrying out the straightening operation, after which the frame 14 is lowered to the workpiece-treating position in the quenching liquid 13.

From the construction of the quenching machine 10 and the cyclical operation thereof as explained above, it will now be recognized that this machine will operate in a practical and efficient manner to carry out the quenching of a series of workpieces in a more or less continuous manner so long as new workpieces in a heated condition are made available on the supply means. It will also be seen that since workpieces on the support means are always submerged, the quenching of the workpieces is continued without interruption during the lifting of the frame to the loading and transfer position, and consequently, the period of time during which the machine is in operation is used to maximum advantage and re-

offset openings of the front pair of eccentric disks 87. Similarly, the bar 83 of the rear yoke 80 has crank pin extensions 90 on the ends thereof which are received in offset openings of the rear pair of eccentric disks 88.

The pairs of front and rear eccentric disks 87 and 88 and the crank pins 89 and 90 engaged therewith thus provide a suspension for the arms 77 and 78 by which a gyratory feeding and transfer movement will be imparted to these arms by the rotation of the eccentric disks. The eccentric disks 87 and 88 rotate in a clockwise direction as seen in FIGS. 3, 4 and 7, and the transfer movement imparted to the arms 77 and 78 thereby comprises rising and falling movements for the arms during certain portions of the rotative movement of the disks and translatory endwise forward and return movements of the arms during other portions of the rotative movement of the disks. The action of the arms 77 and 78 in loading and advancing the workpieces 16 with respect to the work support means 15 in response to these movements will be further explained hereinafter.

The front and rear eccentric disks 87 and 88 on each side of the machine 10 are driven as a pair and, for this purpose, are secured on the inner ends of pairs of parallel front and rear drive shaft 94 and 95 which are rotatably mounted in pairs of laterally spaced bearings 96 and 97 provided on the base 36. The outer ends of the front drive shafts 94 project beyond the sides of the base 36 and have sprockets 98 and 99 secured thereon.

The rear shaft 95 having the rear eccentric disks 88 secured thereon are driven from the front shaft 94 through short connecting shafts 100 and 101 extending in a front-to-rear direction and mounted in spaced support bearings 102 and 103 of the base 36. The front ends of the connecting shafts 100 and 101 are connected with the front drive shafts 94 by sets of cooperating bevel gears 105, and the rear ends of these connecting shafts are connected with the rear drive shafts 95 by similar sets of co-operating bevel gears 106.

The front drive shafts 94 are driven from a main drive shaft 108 which extends transversely of the machine 10 and is mounted on the front of the frame 14 adjacent the top thereof as by laterally spaced bearings 109 and 110. The ends of the main shaft 108 project laterally from the frame 14 and have sprockets 111 and 112 secured thereon. The sprockets 98 and 99 of the front shafts 94 are connected with the sprockets 111 and 112 by chains 113 and 114 extending around these pairs of sprockets.

The main shaft 108 is driven by suitable power means provided on the frame 14 such as an electric motor 116 mounted on the top section 37 and drivingly connected with a reduction gear device 117 by belt means 118. The power output shaft of the reduction gear device 117 has sprocket means 119 thereon which is drivingly connected with sprocket means 120 of the main shaft 108 by a group of chains 121.

In addition to driving the front and rear shafts 94 and 95 of the transfer mechanism 17, the main shaft 108 also causes the swinging movement of the frame 14 between its lower treating or submerged-workpiece position and its upper loading and transfer position 14^a. For this purpose, eccentric drive devices are provided at opposite ends of the main shaft 108 and are connected between this shaft and the stationary support structure 11. These drive devices each comprise a driving disk 123 secured on an outer end of the main shaft 108 and carrying a crank pin 124 disposed in an offset relation to the rotation axis of the shaft.

Each of these eccentric drive devices also comprises an upright thrust link 125 having the upper end thereof connected with the crank pin 124 and the lower end thereof connected with a pivot box 126 by a pivot pin 127. The pivot box 126 is located on the outside of the tank 12 and is secured against a side wall thereof as by suitable screws 128. The thrust links 125 are reactively effective between the pivot boxes 126 of the support structure 11 and the shaft 108 in response to rotation of the latter for causing lifting and lowering of the frame 14 between its treating and loading positions referred to above.

The straightening means 18 comprises a laterally elongated carrier 130 and a plurality of pressure rollers 131 carried thereby for engagement with certain of the workpieces 16 being supported by the work support rollers 46. The pressure rollers 131 are provided in suitable number and, as here shown, comprise five laterally spaced parallel rows of such rollers extending in a front-to-rear direction and corresponding with the five rows of work support rollers 46. Each row of pressure rollers 131 is here shown as comprising four such pressure rollers, as represented in FIG. 3, for engagement with the first or front four workpieces 16^c, 16^d, 16^e and 16^f of the workpiece series.

The pressure rollers 131 are mounted in yokes 132 which have hollow stems 133 extending upwardly into guide openings of mounting members 134 secured to the underside of the carrier 130. The stems 133 are slidable in the guide openings of the mounting members 134 and compression springs 135 provided in the mounting members extend into the hollow stems and are effective against the yokes for forcing the pressure rollers 131 downwardly against the workpieces 16. The pressure of the rollers 131 against the workpieces 16 while the latter are in a heated condition and are being rotated by the support rollers 46 produces a desired straightening effect on the workpieces.

The carrier 130 is located in the open space within the frame 14 and beneath the top section 37 thereof and is moved in closing and opening directions toward and away from the work support means 15 by power devices 137 and 138. The power devices 137 and 138 are here shown as being double-acting hydraulic cylinder devices mounted on the top section 37 and having pistons 139 and 140 connected with piston rods 141 and 142 whose lower ends are secured to the carrier 130 by suitable screws 143.

The machine 10 includes a source of hydraulic pressure fluid for actuating the cylinder devices 137 and 138 and which pressure source is here shown as comprising a pump 144 driven by an electric motor 145 and connected with opposite ends of the cylinder devices by conduits 146 and 147.

The carrier 130 is guided during its opening and closing movements by suitable guide means which is here shown as comprising guide rods 148 and 149 having their lower ends secured to the carrier and their upper end portions extending through guide sleeves 150 and 151 mounted on the top section 37. The upper ends of the guide rods 148 and 149 preferably project from the sleeves 150 and 151 and have stop washers 152 secured thereto by screws 153 for retaining engagement with the upper ends of the sleeves.

Reverting now to the transfer mechanism 17, it is pointed out that the arms 77 and 78 are provided with picker means comprising suitable picker elements for cooperation with the workpieces 16 during the loading and transfer movements of the arms. These picker elements comprise lug projections 155 on the front ends of the arms 77 and 78 for picking a new workpiece from the feeding position 16^a of the supply means 30, and front notches 156 in the upper edges of the arms at a point spaced from the picker lugs for initially receiving the new workpiece picked from the supply means by such lugs. The front notches 156 temporarily support the new workpiece in the position 16^b for delivery to the first work station represented by the workpiece 16^c of the workpiece series.

When the new workpiece is picked from the supply means 30 by the picker lugs 155, the workpiece first lies on straight portions 157 of the arms 77 and 78 but, by reason of the inclined position assumed of the arms when at the loading station 14^a, the picked workpiece will roll

sults in the delivery of a large quantity of quenched workpieces.

Although the quenching machine and method provided by this invention have been illustrated and described herein to a somewhat detailed extent it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope but includes all changes and modifications coming within the terms of the claims hereof.

Having described my invention, I claim:

1. In a quenching machine, a support structure including container means adapted to contain quenching liquid, movable frame means having work support means thereon comprising parallel rows of spaced work supports adapted to support rod-like workpieces in a series relation and in work positions extending transversely of said rows, movement confining means effective between said support structure and frame means and providing for movement of the latter from a first position to a treating position in which said work supports and the workpieces thereon are immersed in said liquid, actuating means connected with said frame means for moving the same to said treating position, transfer means on said movable frame means comprising arm means adjacent said work supports and extending in substantially the same direction as said rows, and supporting and actuating means connected with said arm means for causing lifting movement and lateral translatory movement of said arm means relative to said movable frame means for transferring said workpieces from one to another of said work supports.

2. A quenching machine as defined in claim 1 and comprising supply means for supporting a new workpiece to be fed, and picker means on said arm means for picking the new workpiece from said supply means and depositing the same on certain of said work supports.

3. A quenching machine as defined in claim 1 and comprising supply means adjacent said structure for supporting a new workpiece to be fed, and picker means on said arm means for picking the new workpiece from said supply means and depositing the same on certain of said work supports, said first position of said frame means being a loading position and said transfer means being carried by said frame means for picking co-operation of said picker means with said supply means when the frame means is at said loading position.

4. A quenching machine as defined in claim 1 wherein said work supports comprise rollers for rotatably supporting the workpieces received thereon.

5. A quenching machine as defined in claim 1 wherein said work supports comprise rollers for rotatably supporting the workpieces received thereon, and wherein driving means for imparting rotation to said rollers comprises gear trains connected therewith.

6. A quenching machine as defined in claim 1 wherein said movement confining means comprises a pivot means, and the movement of said frame means to said treating position comprises a swinging thereof on said pivot means.

7. A quenching machine as defined in claim 1 wherein said movement confining means comprises a pivot means and the movement of said frame means to said treating position comprises a swinging thereof on said pivot means, and wherein the actuating means for said frame means is connected between said support structure and frame means for swinging the latter and comprises rotatable eccentric drive means and thrust link means connected therewith.

8. In a quenching machine, a support structure including container means adapted to contain quenching liquid, a movable frame means, work support roller means on said frame means comprising parallel rows of work support rollers adapted to support rod-like workpieces in a series relation and in work positions extending transversely of said rows, carrier means having pressure roller means thereon, said carrier means being mounted on said frame means and movable relative thereto for engaging said pressure roller means with said workpieces, movement confining means effective between said frame means and said support structure and providing for movement of said frame means relative to said support structure and container means from a first position to a treating position in which said work support means and the workpieces thereon are immersed in said liquid, a first actuating means connected with said frame means for moving the same to said treating position, a second actuating means connected with said carrier means for moving the same to cause the engagement of said pressure roller means with the workpieces, and driving means connected with one of said roller means for imparting rotation to the same and to the workpieces in engagement therewith.

9. A quenching machine as defined in claim 8 wherein said driving means is connected with and rotates said work support rollers.

10. In a quenching machine, a support structure including tank means adapted to contain quenching liquid and having front and rear portions; movable frame means; work support means on said frame means comprising work support rollers disposed in spaced-apart parallel rows extending in a front-to-rear direction; pairs of adjacent rollers of said rows defining work stations for supporting rod-like workpieces in a front-to-rear series relation and in work positions extending transversely of said rows; drive means connected with said support rollers for rotating the same; movement confining means effective between said support structure and frame means and providing for movement of the latter relative to said support structure and tank means to an upper position, and from said upper position to a lower position in which said support rollers and the workpieces thereon are immersed in said liquid; actuating means connected with said frame means for moving the same to said upper and lower positions; supply means adjacent said front portion for supporting a new workpiece in a position to be fed; receiver means adjacent said rear portion for receiving quenched workpieces, the end of said receiver means adjacent to said rear portion being immersed in said liquid; transfer means on said movable frame means comprising arm means extending in said front-to-rear direction adjacent said work support means and having a transfer movement comprising a lifting movement and an endwise translatory movement relative to said movable frame means toward said rear portion; said arm means being effective in response to said lifting and translatory movements to transfer said new workpiece from said supply means to said work support means, and to advance the workpieces on said work support means from one to another of said work stations, and to also transfer a quenched workpiece from said work support means to said receiver means within said quenching liquid; and other actuating means operable to impart said lifting and translatory movements to said arm means.

11. A quenching machine as defined in claim 10 wherein said other actuating means is intermittently operable for imparting the transfer movement to said arm means only when said frame means is adjacent its upper position; and wherein said supply means is located at an elevation for engagement of said new workpiece by said arm means when said frame means is adjacent said upper position.

12. A quenching machine as defined in claim 10 wherein said receiver means comprises conveyor means having receiving portions disposed adjacent the rear ends of said rows for receiving quenched workpieces from the work support means.

13. In a quenching machine, a support structure including tank means adapted to contain quenching liquid and having front and rear portions; movable frame means; work support means on said frame means comprising work support rollers disposed in spaced-apart parallel rows extending in a front-to-rear direction; pairs of adjacent

rollers of said rows defining work stations for supporting rod-like workpieces in a front-to-rear series relation and in work positions extending transversely of said rows; drive means connected with said support rollers for rotating the same; movement confining means effective between said support structure and frame means and providing for movement of the latter relative to said support structure and tank means to an upper position, and from said upper position to a lower position in which said support rollers and the workpieces thereon are immersed in said liquid; carrier means having pressure roller means thereon; said carrier means being mounted on said frame means for movement relative thereto for engaging and disengaging said pressure roller means with respect to said workpieces; a first actuating means connected with said frame means for moving the same to said upper and lower positions; a second actuating means connected with said carrier means for causing said pressure roller means to be pressed against said workpieces and to disengage said workpieces when said frame means is adjacent said upper position; supply means adjacent said front portion for supporting a new workpiece in a position to be fed; receiver means adjacent said rear portion for receiving quenched workpieces; transfer means on said movable frame means comprising arm means extending in said front-to-rear direction adjacent said work support means and having a transfer movement comprising a lifting movement and an endwise translatory movement relative to said movable frame means toward said rear portion; said arm means being effective in response to said lifting and translatory movements to transfer said new workpiece from said supply means to said work support means, and to advance the workpieces on said work support means from one to another of said work stations, and to also transfer a quenched workpiece from said work support means to said receiver means; and other actuating means operable to impart said lifting and translatory movements to said arm means.

14. In a quenching machine, a support structure including tank means adapted to contain quenching liquid and having front and rear portions; movable frame means; work support means on said frame means comprising work support rollers disposed in spaced-apart parallel rows extending in a front-to-rear direction; pairs of adjacent rollers of said rows defining work stations for supporting rod-like workpieces in a front-to-rear series relation and in work positions extending transversely of said rows; drive means connected with said support rollers for rotating the same; pivot means connecting said frame means with said support structure for swinging of the frame means relative to said support structure and tank means to an upper position, and from said upper position to a lower position in which said support rollers and the workpieces thereon are immersed in said liquid; actuating means for said frame means comprising rotatable crank and lifting link means connected between said support structure and frame means for causing the swinging of the latter; supply means adjacent said front portion for supporting a new workpiece in a position to be fed; receiver means adjacent said rear portion for receiving quenched workpieces; transfer means on said movable frame means comprising arm means extending in said front-to-rear direction adjacent said work support means and having a transfer movement comprising a lifting movement and an endwise translatory movement relative to said movable frame means toward said rear portion; said arm means being effective in response to said lifting and translatory movements to transfer said new workpiece from said supply means to said work support means, and to advance the workpieces on said work support means from one to another of said work stations, and to also transfer a quenched workpiece from said work support means to said receiver means; and other actuating means operable to impart said lifting and translatory movements to said arm means.

15. In a quenching machine, a support structure including tank means adapted to contain quenching liquid and having front and rear portions; movable frame means; work support means on said frame means comprising work support rollers disposed in spaced-apart parallel rows extending in a front-to-rear direction; pairs of adjacent rollers of said rows defining work stations for supporting rod-like workpieces in a front-to-rear series relation and in work positions extending transversely of said rows; drive means connected with said support rollers for rotating the same; pivot means connecting said frame means with said support structure for swinging of the frame means relative to said support structure and tank means to an upper position, and from said upper position to a lower position in which said support rollers and the workpieces thereon are immersed in said liquid; carrier means having pressure roller means thereon; said carrier means being mounted on said frame means for movement relative thereto for engaging and disengaging said pressure roller means with respect to said workpieces; a first actuating means comprising rotatable crank and lifting link means connected between said support structure and frame means for causing the swinging of the latter; a second actuating means connected with said carrier means for causing said pressure roller means to be pressed against said workpieces and to disengage said workpieces when said frame means is adjacent said upper position; supply means adjacent said front portion for supporting a new workpiece in a position to be fed; receiver means adjacent said rear portion for receiving quenched workpieces; transfer means on said movable frame means comprising arm means extending in said front-to-rear direction adjacent said work support means and having a transfer movement comprising a lifting movement and an endwise translatory movement relative to said movable frame means toward said rear portion; said arm means being effective in response to said lifting and translatory movements to transfer said new workpiece from said supply means to said work support means, and to advance the workpieces on said work support means from one to another of said work stations, and to also transfer a quenched workpiece from said work support means to said receiver means; and other actuating means operable to impart said lifting and translatory movements to said arm means.

16. In a quenching machine of the character described, tank means adapted to contain quenching liquid and having front and rear portions, frame means connected within said tank means and having work support means thereon normally immersed in said quenching liquid for supporting rod-like workpieces for contact by said liquid, said work support means comprising spaced-apart parallel rows of work support rollers, pairs of adjacent rollers of said rows defining work stations for rotatably supporting the workpieces in a front-to-rear series relation and in work positions extending transversely of said rows, drive means connected with said rollers to drive the same for rotating the workpieces at said stations, supply means adjacent said front portion for supporting a new workpiece in a position to be fed, receiving means adjacent said rear portion for receiving quenched workpieces, transfer means on said frame means and within said tank means operable to advance the workpieces of said series from station-to-station along said rows comprising arm means adjacent said work support means and extending in substantially the same direction as said rows, picker means on said arm means comprising spaced picker elements engageable with the respective workpieces of said series for lifting and advancing the same and to also advance a quenched workpiece from said support means to said receiver means, the lower end of said receiver means being immersed within said quenching liquid, said work support means and said arm means each being movable relative to the other and to and from an upper position wherein a new workpiece is transferred from said work supply means to a picker element on the front end of said arm

means extending above the level of said quenching liquid for further transfer to the front end of said work support means also extending above the level of said quenching liquid, means for moving said work support means, and other means effective between said frame means and said arm means for supporting and actuating the latter so as to produce the lifting and advancing action of said picker elements.

17. A quenching machine as defined in claim 16 wherein said other means comprises rotatable eccentric drive means connected with said arm means for producing the lifting and advancing action of said picker elements.

18. A quenching machine as defined in claim16 wherein said means for moving said work support means comprises rotatable eccentric drive means.

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