

Oct. 28, 1952

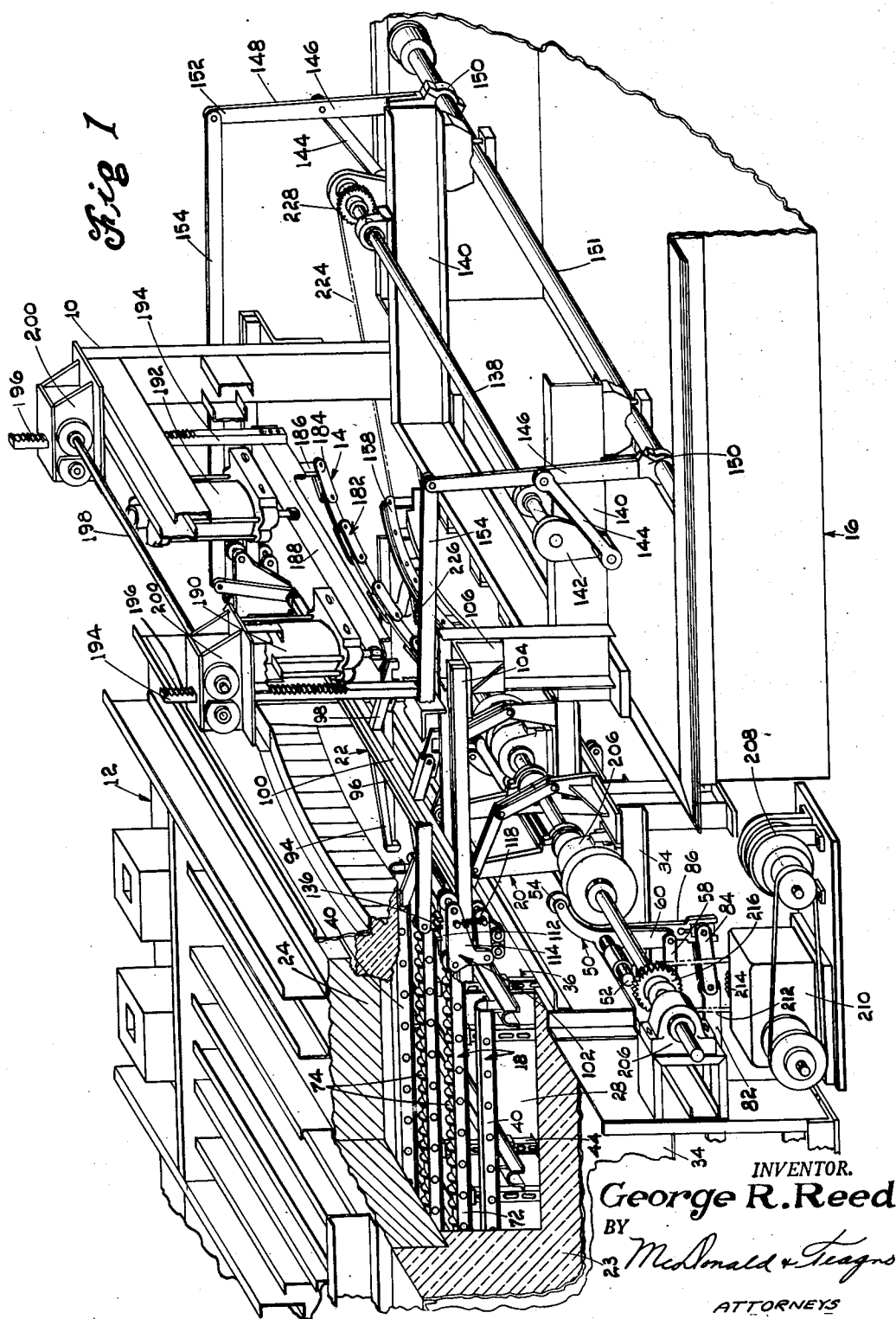
G. R. REED

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CONVEYER MECHANISM FOR SPRING CAMBERING MACHINES

Filed Dec. 12, 1946

3 Sheets-Sheet 1



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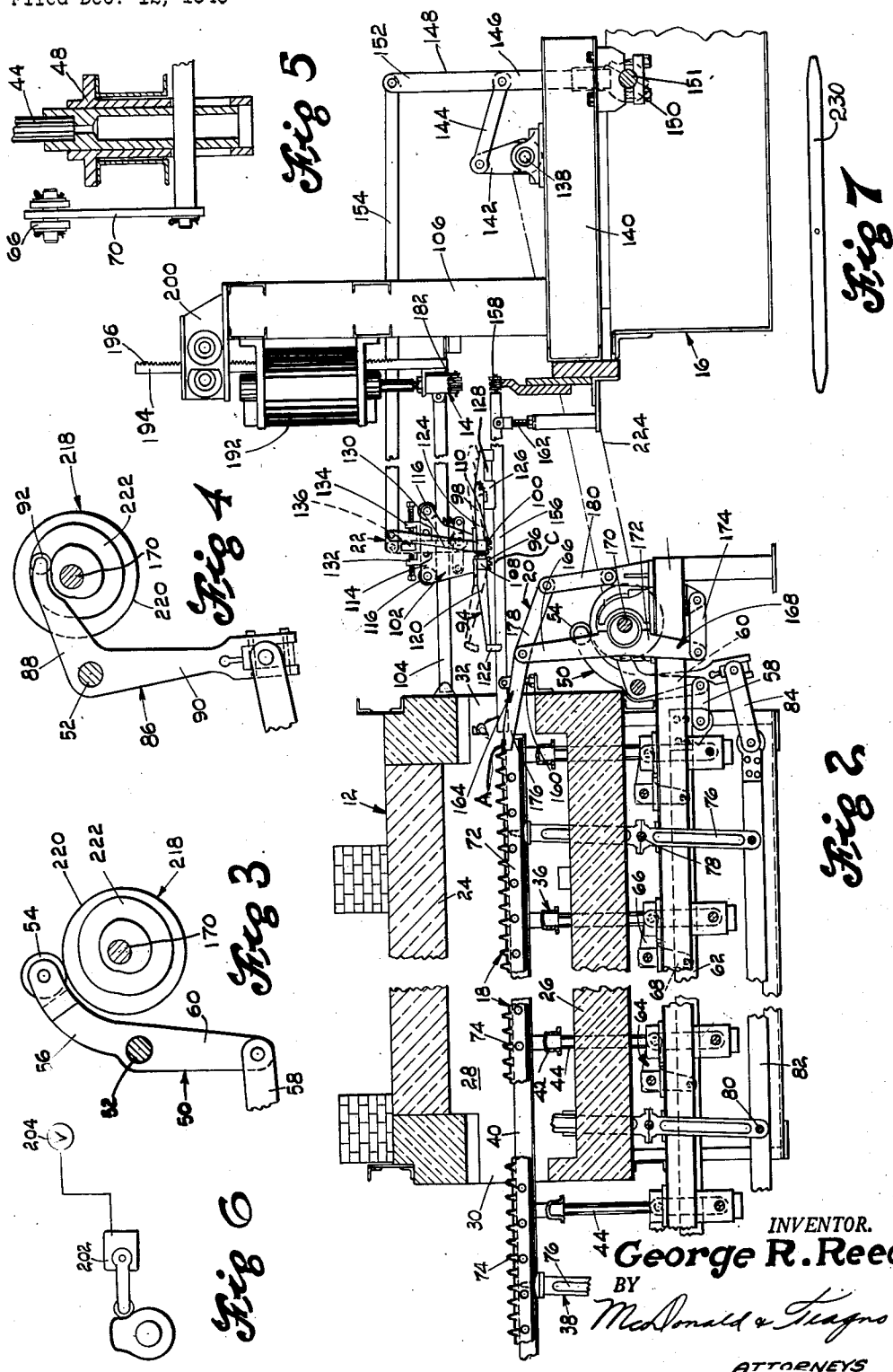
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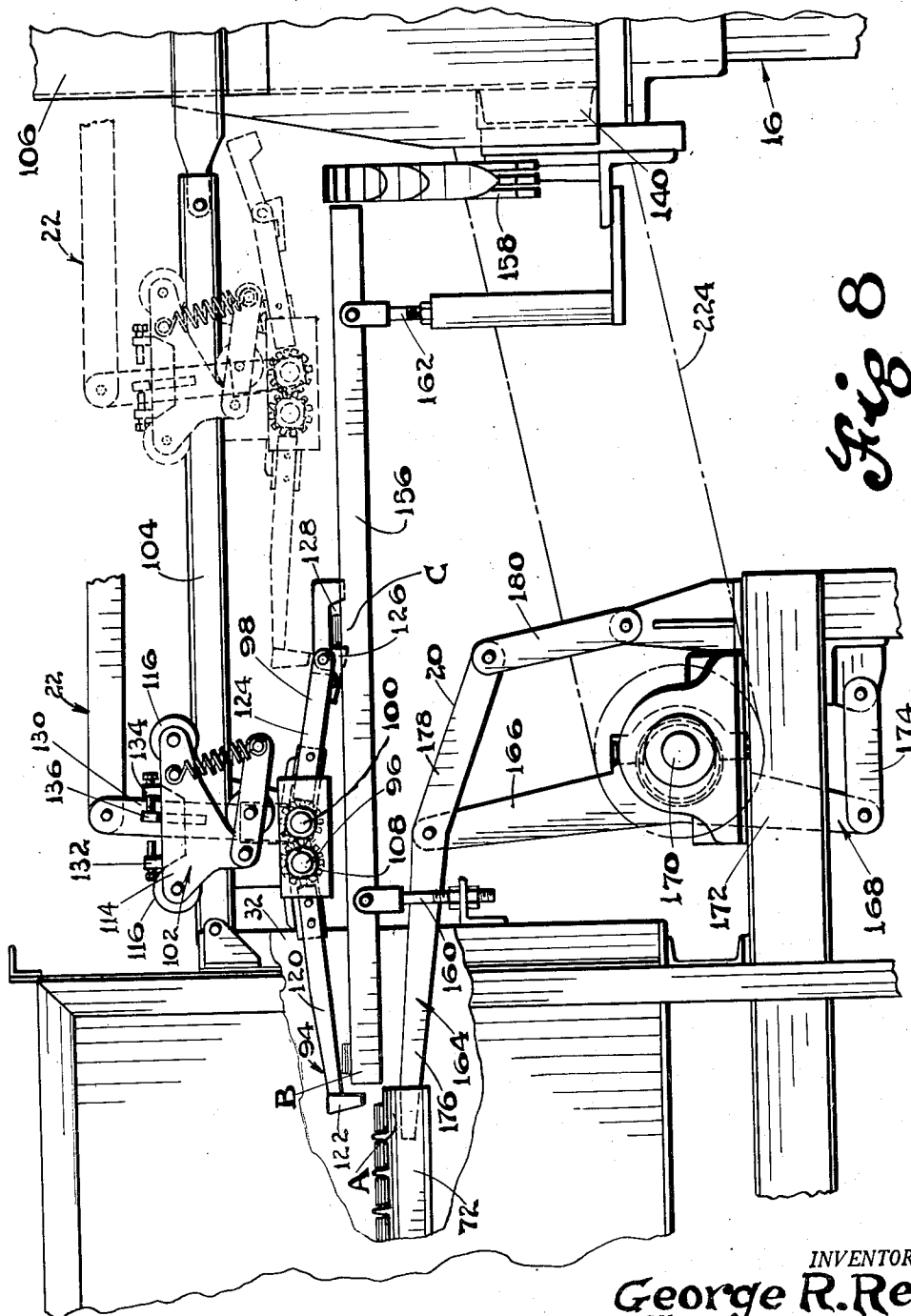
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CONVEYER MECHANISM FOR SPRING CAMBERING MACHINES

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3 Sheets-Sheet 3



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CONVEYER MECHANISM FOR SPRING
CAMBERING MACHINES

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6 Claims. (Cl. 198—221)

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This invention relates to springs and more particularly to mechanism for forming cambered leaf springs.

Broadly the invention comprehends the provision of mechanism for cambering and heat treating leaf springs for automotive vehicles wherein the leaf springs upon once being manually deposited in a heating furnace they are fed therethrough and delivered therefrom to a cambering die and thence cast into a quenching tank for heat treatment thereof, all automatically and in properly timed sequence.

Heretofore in the production of cambered leaf springs and especially with regards to the combined cambering and heat treatment of leaf springs it has been customary to perform almost all the steps incident thereto by manual means, that is, the springs are manually placed in the heating furnace, and manually extracted therefrom and placed in the forming dies for the cambering thereof prior to the quenching of same. The present machine through the incorporation of ingenious cam, gearing and leverage mechanism has entirely eliminated the manual work heretofore required with the exception of the placing of the spring leaves in the furnace thereby providing for the more efficient, economical and improved quality of production of cambered and heat treated leaf springs.

An object of the invention is the provision of a machine for cambering and heat treating leaf springs having means associated therewith for automatically carrying out the process for the production of improved quality cambered leaf springs in an efficient and economical manner.

Another object of the invention is the provision of means for automatically extracting heated leaf springs from a heating furnace and immediately delivering them to a forming die for the cambering thereof.

Another object of the invention is the provision of means for automatically transporting leaf springs through a furnace operating at elevated temperatures and in proper parallel alignment, extracting them from the furnace in predetermined timed arrangement and then automatically delivering same to a forming die for the cambering thereof.

A further object of the invention is the provision of a machine for cambering and heat treating leaf springs comprising means for properly feeding the springs through an elevated temperature furnace, means for extracting the springs from the furnace and means for delivering said extracted springs to a forming die, said means

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and die all being automatically operated in timed sequence.

Other objects and advantages of the invention will appear from the following description taken in connection with the drawings, forming a part of the specification; and in which:

Fig. 1 is a fragmentary partially cross-sectionalized perspective view of an automatic combination heat treating and cambering machine for vehicle leaf springs.

Fig. 2 is a cross sectional view taken substantially in a vertical plane passing through the center of the machine along the length thereof.

Fig. 3 is a fragmentary view showing the cam operation for the lifting bar.

Fig. 4 is a fragmentary view of the cam mechanism for the axial moving bar.

Fig. 5 is a sectional view illustrating the leverage mechanism of the lifting bar.

Fig. 6 is a diagrammatic view showing the switch mechanism for controlling the operation of the die.

Fig. 7 is an illustration of a flat leaf spring prior to the cambering thereof; and

Fig. 8 is a side elevation view of the machine of Fig. 1.

Through the provision of automatic mechanical means for the heat treating and cambering of vehicle leaf springs, as taught by the instant invention, it has become possible to produce higher quality leaf springs in a quicker, more efficient and economical manner.

The instant machine comprises primarily a heating furnace having a movable track means therein for transporting the springs through the furnace from their point of deposit to the furnace exit in parallel alignment such that the springs are maintained perpendicular to the side walls of the furnace in their travel through the furnace and are so positioned at the exit from the furnace, means for extracting or unloading the springs from the furnace, means for delivering the springs upon extraction from the furnace to a forming die for cambering the springs and means for ejecting the cambered springs from the die into an oil quenching tank to thereby affect a heat treatment thereof, said track, unloading and delivery means, and forming die being operable automatically in relatively timed sequence.

Referring to the drawings for more specific details of the invention 10 represents generally a combined apparatus for the cambering and heat treatment of leaf springs for vehicles comprising a heating furnace 12, a cambering or forming die 14, an oil quench tank 16, a conveyor means 18

arranged in the furnace for transporting the springs through the furnace in proper parallel alignment, a means 20 for unloading the springs from the furnace, mechanism 22 for moving or delivering the springs from the exit of the furnace to the die 14 after they have been removed from the furnace, and motor driven means providing for the automatic sequential timed operation of the die 14, conveyor 18, unloader means 20 and delivery means 22.

The furnace 12 may be of the conventional gas burning type and as here shown by the drawings includes a pair of fire brick side walls 23, top wall 24 wherein the gas burners, not shown, are adapted to be supported, and a bottom apertured wall 26 and provides a chamber 28 extending throughout the length of the furnace communicating with openings 30 and 32 respectively at the entrance to an exit from the furnace. The furnace proper is supported upon a base framework 34.

The conveyor means 18 is arranged in the furnace between the side walls 22 and comprises a spring supporting lifting beam mechanism 36 and a spring travel or axially moving beam mechanism 38. The mechanism 36 includes a pair of parallel horizontally arranged beams or bars 40 upon which the beams are supported and lifted while in the furnace, said bars being supported on a framework 42 and adapted to be moved by a plurality of vertically disposed rods 44 having one end affixed to the framework 42 and its free end journaled for sliding engagement in bearings 48 mounted on base 34. The rods 44 are adapted to be actuated by mechanism, to be later described, through a series of links and levers including a bell crank 50 pivoted upon a rotatable shaft 52, having a cam roller 54 mounted at the extremity of one of its arms 56 and a link 58 pivoted upon the extremity of its other arm 60, said link 58 in turn being secured at its other end to a horizontally arranged draft bar 62. The draft bar 62 is connected through a series of axially spaced bell cranks 64 pivoted upon base 42 and including arms 66 and 68, arms 68 being pivotally secured to the draft bar and arms 66 being linked to the rods 44 by links 70. It is to be understood that a like arrangement of rods 44, links 70, bell cranks 64, draft bar 62, and bell cranks 50 are provided on either side of the machine.

The travel beam mechanism 38 comprises a pair of substantially horizontal beams or bars 72 arranged in the furnace parallel to one another and to the bars or beams 40 between beams 40. The bars 72 have a plurality of equidistantly spaced short ears 74 on the upper side thereof arranged perpendicularly to the bars 72 and side walls of the furnace such that the space between each set of the ears is predetermined in size to accommodate the springs to be conveyed through the furnace and hold them therebetween perpendicularly to the bars and furnace side walls. The bars 72 are supported in their horizontal position by a plurality of vertical supporting bars or levers 76 adapted to provide for a rocking longitudinal motion of bars 72, said levers being pivoted intermediate their length at portion 78 upon framework 34 and having ends 80 thereof connected to horizontally movable draft bars 82 arranged on opposite sides of the furnace underneath bars 72. The draft bars 82 are adapted to be actuated by way of links 84 connecting the bars to bell crank levers 86. Bell crank levers 86 similar to bell crank levers 50 are journaled in-

intermediate arms 88 and 90 thereof upon shaft 52, the extremity of arms 90 being connected to links 84 and the arms 88 having rollers 92 mounted at the extremity thereof the purpose of which will hereinafter appear.

Because of the structure provided by mechanisms 36 and 38 of conveyor 18 it is possible to operate the furnace 12 at elevated temperatures thereby providing for the effective heating of the springs as they pass through the furnace.

The spring pushing or delivery means 22 comprises a plurality of retrieving arms 94 affixed at spaced points upon a longitudinally extended bar 96 and a plurality of delivery arms 98 affixed similarly as arms 94 upon a bar 100 extending parallel to bar 96 and spaced a short distance therefrom. The arms 98 extend from bar 100 oppositely disposed to arms 94. The bars 96 and 100 are journaled at the extremities thereof upon carriages 102 mounted for movement upon cross bars or tracks 104 arranged at the opposite sides of furnace exit opening 32 supported between the furnace 12 and a supporting frame work 106 mounted upon tank 16. The bars 96 and 100 have intermeshing gears 108 and 110 respectively mounted at the ends thereof the purpose of which will hereinafter appear.

The carriages 102 each comprise end plates 112 and 114 respectively having mounted therebetween a pair of rollers 116 for travel upon track 104, and a spring pressed roller mechanism 118 bearing upon the underside of track 104 opposite from rollers 116.

The arms 94 comprise a substantially, horizontally extended portion 120 and a short, substantially, vertically, extended portion 122 whereas the arms 98 comprise a substantially, horizontal portion 124 and a finger mechanism 126 pivoted at the extremity thereof, said finger mechanism having a slotted portion 128 adapted to receive the springs therein during the operational function of arm 98.

The gears 108 and 110 are actuated through the movement of levers 130 fixedly mounted upon the ends of bar 100, said levers 130 being limited in movement through the arrangement of end stops 132 and 134 mounted upon plates 112 adapted to be engaged by a tongue member 136 affixed to lever 130 and extending intermediate to stops 132 and 134.

The levers 130 are actuated through a series of links and levers, from a source of power to be later described, comprising a rotatable shaft 138 journaled upon supporting beams 140 fixedly secured to the framework 106 and extending over the quench tank, crank levers 142 secured at opposite ends of shaft 138, links 144 connecting the free ends of levers 142 with intermediate portions 146 of levers 148 having ends 150 thereof pivotally affixed upon a rotatable shaft 151 journaled on the side of the quench tank and supported on the underside of beams 140 and having their ends 152 connected by substantially, horizontally, extended links 154 to the free ends of levers 130.

A pair of slide tracks 156 are arranged in parallel extension to beams 40 and 72 between the exit from the furnace and the base portion 158 of a forming die 14 mounted fixedly upon the framework 106. The tracks 156 are supported near the opposite ends thereof upon adjustable supports 160 and 162 respectively, support 160 being mounted upon supporting framework 34 at the furnace exit and support 162 being mounted upon the framework 106 secured to

the quench tank, and are adjustable through the adjustment of the supports so as to provide for the proper alignment of the tracks relative to the removal of the springs from the furnace and proper delivery thereof to die 14.

The spring furnace retrieving means or unloading means 20 includes lever arms 164 pivoted at their centers upon arms 166 of crank levers 168 mounted for eccentric movement about the power drive shaft 170, arms 172 of the crank levers being pivotally connected at their ends to links 174 that are mounted for pivotal motion at their other ends upon base 34 of the furnace. Arms 176 of levers 164 are adapted to pick springs from bars 40 and deposit them upon the end of slide tracks 156 arranged in the exit opening of the furnace and extension 178 of levers 164 provide for the controlled movement of levers 164 in being pivoted at their extremities to links 180 which are in turn pivoted at their end to the upper side of the base 34.

The spring forming or cambering die 14 in addition to the base portion 158 includes a top section 182 constructed of a plurality of links 184 pivotally joined together in series and pivotally supported at the extremities of the link mechanism upon posts 186, said posts being secured to a cross bar 188 arranged in parallel relation to the cambering die sections 158 and 182 adapted to be actuated by a pair of air cylinders 190 and 192 mounted upon framework 106. As a means for controlling the identical movement of both ends of die section 182 the cross bar 188 thereof has secured at the ends thereof vertically disposed posts 194 having gear racks 196 thereon adapted to mesh with gears, not shown, arranged at the end of shaft 198 journaled in housing 200 mounted upon the framework 106. The section 182 of die 14 is made of linked sections to permit variations in the adjusted camber arrangement of die section 158 within predetermined limits.

Air cylinders 190 and 192 are controlled for timed relation with the rest of the operating mechanism constituting the complete machine 10 by way of a limit switch 202 arranged at the extremity of power shaft 170 effective to actuate a valve mechanism 204 for controlling the admission of air to or discharge from the cylinders 190 and 192 for the actuation of die section 182.

The power drive shaft 170 which constitutes the controlled drive mechanism for all the operation elements of the apparatus 10, is journaled at its extremities and supported at its center upon bearings 206 mounted upon the furnace base 34. The shaft 170 is driven from any suitable source of power such as motor 208, shown by Fig. 1, through a speed reduction gear box 210, said gear box having a chain drive connection 212 with the shaft 170 by way of gear 214 of gear box 210 and gear 216 affixed upon shaft 170.

Cam mechanism 218 comprising external cams 220 adapted for operating engagement with rollers 54 and internal cams 222 for operating engagement with rollers 92 are fixedly secured upon drive shaft 170 for rotation therewith effective to provide for the proper timed relation of operation of the apparatus associated therewith.

The shaft 138 which is adapted to provide for the operation of the spring delivery means 22 is driven from the power shaft 170 by way of a chain drive 224 connecting a gear 226 affixed to the drive shaft 170 with the gear 228 affixed to the shaft 138.

In a normal operation the apparatus 10 wherein

the motor 208 has been placed in operation and the flat spring leaves 230 such as shown by Fig. 7 are placed upon travel beams 72 in perpendicular arrangement to the horizontal motion of the beams singularly or in nested stacks of a plural quantity between adjacent ears 74 of the beams 72, the motion of the motor is transmitted to drive shaft 170 resulting in the rotation thereof and providing for the rotation of cam mechanism 218 and the eccentrics of levers 168 and gear 226.

Upon the rotation of shaft 170 and the consequent rotation of the various elements attached thereto motion is imparted to the various members engaged by the elements in accordance with the predetermined sequence of operation of the various operating parts going to make up the whole machine.

Although all the operating parts are placed in timed operating motion with the rotation of the shaft 170, the leaf spring unloader 20, leaf spring delivery means 22 and forming die 14 do not perform any useful work until such time as the springs reach said operating station.

After the springs are placed upon travel beams 72 they are passed through the furnace by the combined action of travel beams 72 and lifting beams 40 from the entrance of the furnace to the exit thereof during which time the furnace is in operation at elevated temperatures providing for the proper heating of the springs preparatory to the cambering and quenching thereof.

Through the rocking or pivotal motion of travel beams 72 as affected by the actuation of crank levers 86 from internal cam 222 the springs which have been stacked upon the travel beams at the entrance to the furnace are moved forward and at the point of maximum forward travel of the beams 72 the lifting beams 40 are actuated in timed sequence through the actuation of crank levers 50 thus operating to remove the springs from the travel beams and holding same momentarily until the travel beam has moved to its substantially maximum backward travel and then moving downwardly until the springs are deposited in the next adjacent forward position between the cams on the travel beams by the lifting beams. This forward motion process is continued with regards to one spring or stack of springs occupying a single channel space between the ears on the travel beams until the spring or stack of springs arrives at the end of the lifting beam near the exit from the furnace, at which time the unloader 20 through the action of arm 176 controlled by the movement of lever 168 about shaft 172, with its rear extremity reaching out and lifting the spring or stack of springs from position A on the beam 40 and moving in an arcuate path to deposit said spring or springs at position B on slide tracks 156.

With the spring in position B on slide tracks 156 and the delivery means 22 in operation through the actuation thereof from shaft 170 by the transmission of power therefrom to shaft 138, which in turn affects the manipulation of links 154, resulting in shifting the levers 130 in the direction of the motion of the links 154, the levers 130 are moved to abutment against limit stops 132 and provide for the consequent adjustment of arms 94 and 98 to the dotted line positions shown by Fig. 2. As the carriages 102 are moved along tracks 104 by the horizontal movement of links 154 in a direction toward position B on slide tracks 156 the arms remain in an upward dotted line position until such time as the move-

ment of the carriages, arms and link reaches the furthest position in a direction of travel toward the furnace. Upon reaching this position the motion of links 154 is reversed by the action of levers 148 and links 144 resulting in moving levers 130 to abutment against limit stops 134 thereby moving the arms downwardly so as to place fingers 122 of arms 94 on the side of the spring between the spring and lifting beam 40 when the spring is in position B on slide tracks 156. With the continued movement of links 154 and carriages 102 in a direction away from the furnace the fingers on arms 94 affect a shoving action upon the springs and provide for the movement thereof to position C on the tracks 156. At the same time that the fingers of arms 94 engage the spring at position B the slotted portions 128 of fingers 126 on arms 98 receive the spring at position C and while one spring or stack of springs is moved by fingers 122 from portion B to C, the fingers 124 on arms 98 move the spring or stack of springs from position C past the end of tracks 156 and deposit same on the die section 158 of forming die 14.

The die section 182 of die 14 operates in timed sequence immediately after the placing of the spring or stack of springs on die section 158 through the actuation of the air cylinders 192 and 194 as controlled by valve 204, said valve in turn being controlled for operation from a switching mechanism actuated by the shaft 170.

Fingers 126 in addition to moving the spring or stack of springs from position C to the die section 158 operate through the abutment of the end of fingers 126 against the preceding spring or springs in the die to shove the cambered springs from the die into the quenching tank 16 for the heat treatment thereof.

It is a very essential characteristic of this machine that a proper timing cycle is maintained providing for the production of cambered springs in an economical expeditious manner while at the same time providing for proper hardness and spring life. By automatically controlling the timing and operational functions of the various limits of the machine the springs produced thereby are practically identical in all respects.

While this invention has been described in connection with certain specific embodiments, the principle involved is susceptible of numerous other applications that will readily occur to persons skilled in the art. The invention, therefore, is limited only as indicated by the scope of the appended claims.

What I claim is:

1. Mechanism for conveying articles between two given points comprising a slide track extending between the points, and a carriage movable in the direction of the tracks comprising a pair of gear intermeshing pivotal arms extending substantially in opposite directions to one another and lying substantially parallel to the slide track movable toward and away from the track, one of said arms having a pusher element at its free end and the other arm having a finger element freely pivoted at its free end and a single means for simultaneously moving the carriage parallel to the track and pivoting the arms.

2. Conveyor mechanism comprising a track along which the article to be conveyed is moved, and a carriage suspended for movement along a path parallel to the track comprising a pair of arms disposed in opposite directions to one another substantially parallel to the track and

pivotaly geared together for synchronous substantially vertical motion toward and away from the track, one of said arms having a pusher element at its free end and the other arm having a finger element freely pivoted at its free end, means for actuating the carriage and simultaneously pivoting the arms and means for limiting movement of the arms toward and away from the track.

3. Mechanism for conveying an article during the manufacture thereof from one stage of operation to another comprising a track upon which the article is moved, a track suspended in substantially parallel relation to and disposed vertically away from the first track, a carriage mounted for movement along the second track having a pair of arms pivoted therein for movement toward and away from the second track, article engaging means on the free end of each of the arms, gear intermeshing means on the pivot axis of the arms, means connected to the axis of one arm and engageable with the carriage for simultaneously pivoting the arms and moving the carriage along the track, and means for limiting the pivotal movement of the arms.

4. Mechanism for conveying an article from one stage of operation thereon to a subsequent stage of operation to be performed thereon comprising a pair of tracks extending between the operation stages along which the article is slid, a second set of tracks extending parallel to and spaced apart from the first set of tracks, and carriages carried by and movable along the second set of tracks comprising sets of oppositely disposed arms pivotaly mounted thereon having geared relation therebetween and fingers at the extremities thereof adapted to engage and move the articles to be conveyed along the track, and means for moving the carriage and simultaneously rotating the gears so as to affect pivotal movement of the arms toward and away from the first set of tracks.

5. Mechanism for conveying articles between two stations in parallel array comprising horizontally arranged walking beam means for conveying slender articles in parallel array from one spaced point to another in a horizontal manner from one end to the other end thereof, an articulated arm means for retrieving the articles moved to one end of the walking beam means and depositing same at a point beyond the end of the walking beam from which retrieved and maintained in parallel array to the articles on the beam, horizontal slide means on which the retrieved articles are deposited and adapted to be moved, and reciprocated arm means for sliding the articles along the slide means in parallel array from the deposited end to the point of discharge therefrom at its other horizontally disposed end.

6. Mechanism for conveying articles between two stations in parallel array comprising horizontally arranged walking beam means for conveying slender articles in parallel array from one spaced point to another in a horizontal manner from one end to the other end thereof, an articulated arm means for retrieving the articles moved to one end of the walking beam means and depositing same at a point beyond the end of the walking beam from which retrieved and maintained in parallel array to the articles on the beam, horizontal slide means on which the retrieved articles are deposited, reciprocated arms for sliding the articles along the slide

means in parallel array from the deposited end to the point of discharge therefrom at its other horizontally disposed end, and a power driven shaft interconnected to the walking beam means and articulated and reciprocated means for the simultaneous and proper sequential timed operation thereof.

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