Sept. 4, 1928. 1,682,734

J. F. BEANS ET AL

SPRING FORMING AND TEMPERING MACHINE

Filed Sept. 2, 1927 5 Sheets-Sheet 1

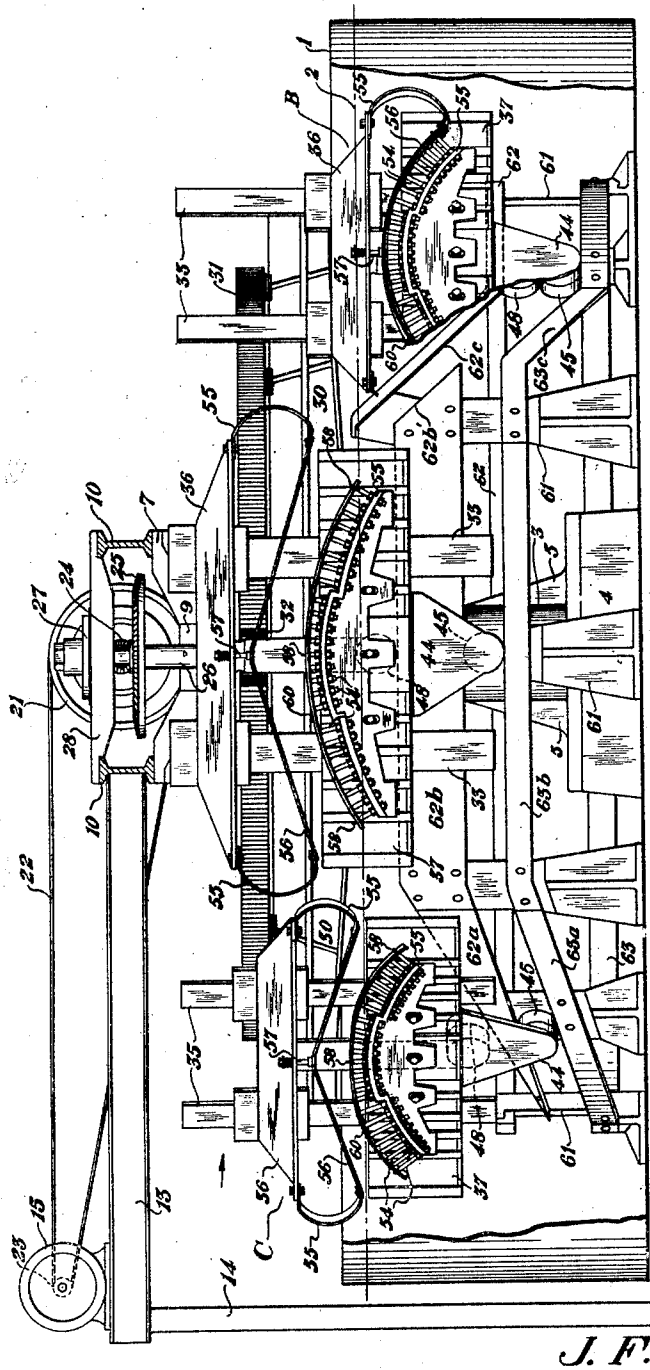

Fig. 1

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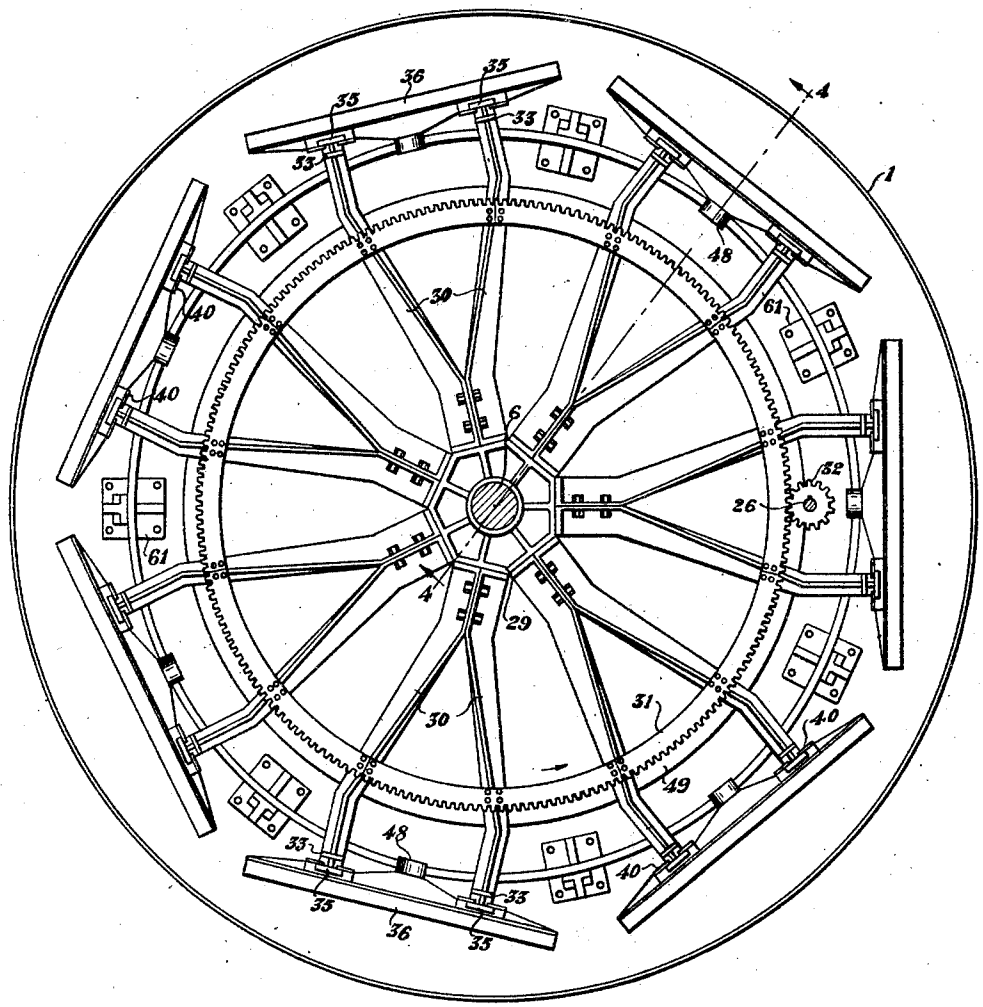

Fig. 2

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SPRING FORMING AND TEMPERING MACHINE

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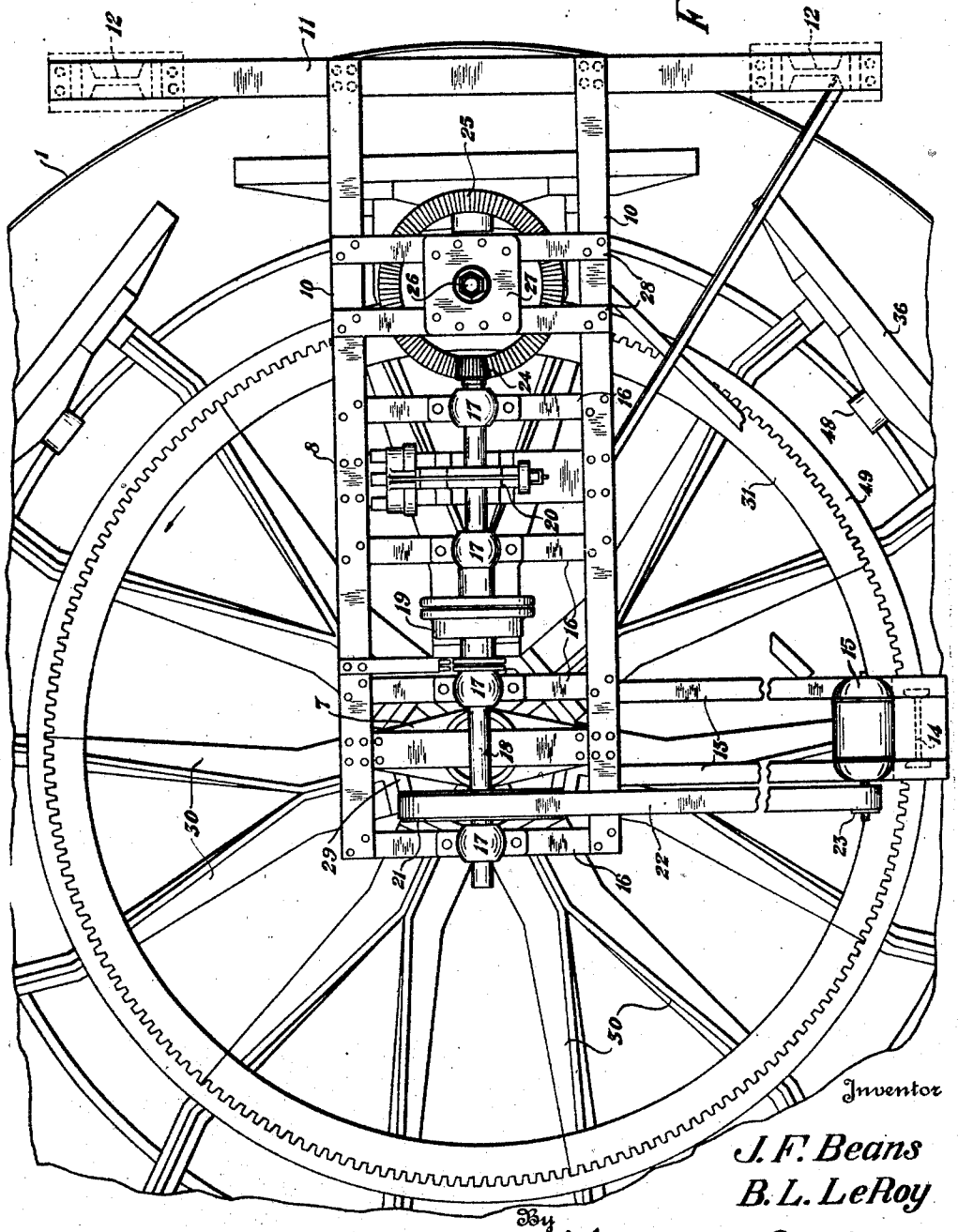
Fig. 3



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SPRING FORMING AND TEMPERING MACHINE

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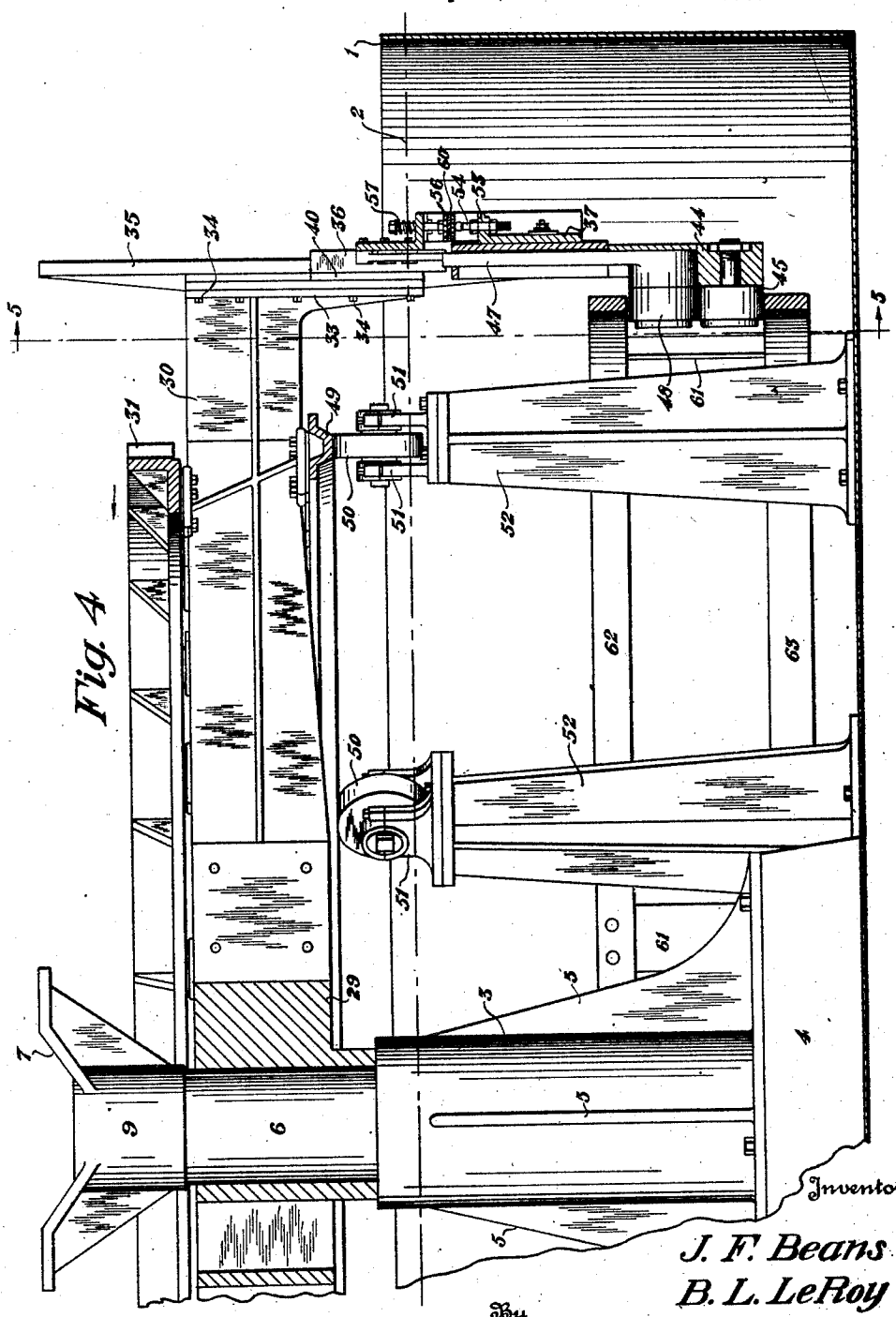

Fig. 4

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SPRING FORMING AND TEMPERING MACHINE

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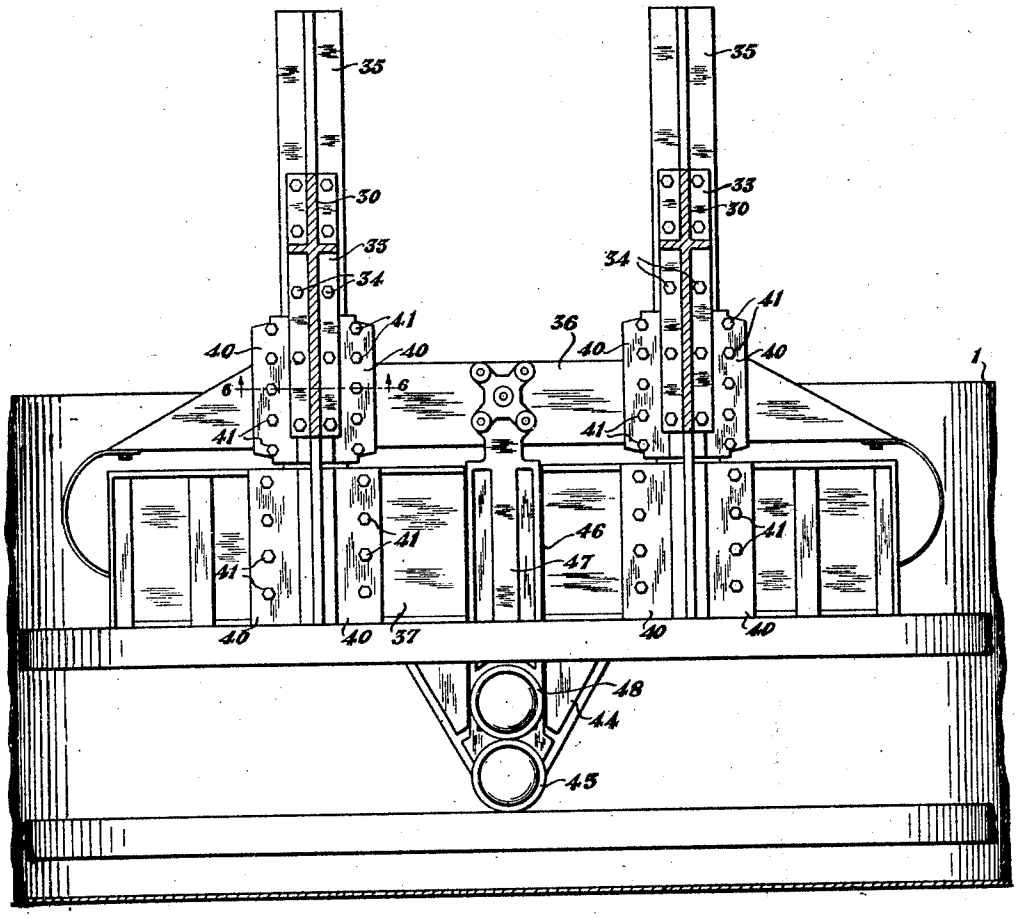

Fig. 5

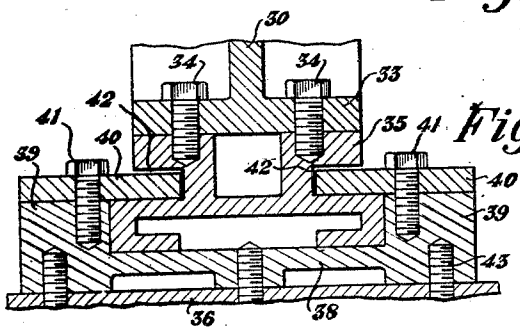

Fig. 6

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Patented Sept. 4, 1928. 1,682,734

UNITED STATES PATENT OFFICE.

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SPRING FORMING AND TEMPERING MACHINE.

Application filed September 2, 1927. Serial No. 217,144.

The invention relates to apparatus for forming and tempering the leaves of springs such as are used for automobiles and the like.

Each of these leaves is made from a flat bar of steel which must be cambered to an exact curvature and tempered or hardened to retain its curvature. The desired number of these leaves, each formed to the same curvature, are then associated together to form the complete spring, and it is necessary that the leaves making up the spring should be uniformly cambered and hardened throughout.

The object of the present improvement is to produce a machine for uniformly and exactly cambering and hardening such spring leaves, rapidly and continuously and with a minimum expenditure for production cost and labor.

The above and other objects are attained by providing a machine including a rotatable frame carrying a plurality of pairs of guide bars, a pair of independently movable heads being slidably mounted upon each pair of guide bars, an oil tank being associated with the rotatable frame, and cam tracks being provided for opening and closing the heads and conveying them through the oil.

An embodiment of the invention is illustrated in the accompanying drawings, in which

Figure 1 is a front elevation of the improved spring forming and tempering machine, a portion of the oil tank being broken away for the purpose of illustration.

Fig. 2, a plan sectional view of the machine, with the driving mechanism removed;

Fig. 3, a plan view, on an enlarged scale, of the driving mechanism, a portion of the machine being shown beneath the same;

Fig. 4, an enlarged, vertical section, taken substantially on the line 4—4, Fig. 2;

Fig. 5, a section on the line 5—5, Fig. 4, and

Fig. 6, an enlarged detail section of one of the guides, taken on the line 6—6, Fig. 5.

Similar numerals refer to similar parts throughout the drawings.

The apparatus is mounted within a circular tank 1 adapted to contain oil substantially to the level of the broken line indicated at 2. A post 3 is mounted in the center of this tank as upon the base 4 and may be provided with the radial strengthening rib 5.

A journal portion 6 is provided at the upper portion of the post 3 upon which all of the rotating portion of the machine is journaled.

Above this journal portion of the post is mounted a bracket 7 for supporting one end of a superstructure, indicated generally at 8, upon which the drive mechanism for the machine is supported. A collar 9 is formed upon this bracket to receive the upper reduced end of the post 3 for supporting the bracket thereon.

The structure for supporting the drive mechanism may comprise a pair of I-beams 10, each supported near one end upon the bracket 7 and at its other end upon a horizontal member, such as the I-beam 11, the latter being supported at its ends as by the uprights 12.

I-beams 13, located at right angles to the I-beams 10, may be supported at one end from said superstructure and at their other ends as by the standard 14, a motor 15 being mounted upon the outer end portions of the I-beams 13.

A plurality of struts 16 is supported upon the I-beams 10, at spaced intervals from each other, and each is provided with a pillow block 17 in which may be located a suitable anti-friction bearing.

The shaft 18 is journaled in these bearings and, for the purpose of instantaneously starting or stopping the machine as desired, may be equipped with a magnetic clutch 19 and magnetic brake 20.

A pulley 21 is fixed upon one end of the shaft 18 and is connected, as by the belt or chain 22, with the pulley 23 upon the shaft of the motor 15.

A bevel pinion 24 is fixed upon the other end of the shaft 18 and meshes with the bevel gear 25 mounted upon a vertical shaft 26 journaled at its upper end in a bearing 27 carried by the struts 28.

A heptagonal bearing 29 is journaled upon the journal portion 6 of the central post and to each face thereof is attached a pair of arms 30.

It should be noted at this point that if more or less than seven pairs of the arms 30 are to be provided, the bearing 29 may be of any other desired polygonal shape instead of the septangle as shown.

A ring gear 31 is fixed to the arms 30, at points spaced from the ends of the arms, and meshes with a pinion 32 fixed upon the vertical shaft 26.

Each arm 30 may be provided with the ver-

tical pad 33, at its outer end, to which is connected, as by the bolts 34, an upright guide bar 35.

Slidably mounted upon each pair of guide bars 35 is an upper head and a lower head indicated at 36 and 37 respectively.

Each of these heads is independently slidably mounted upon the pair of guide bars as by a slide plate 38 having the ribs 39 at its vertical edges for slidable engagement with the sides of the guide bar, a gib plate 40 being connected to each rib 39, as by screws 41, and slidably extending into the vertical grooves 42 formed in the sides of the guide bars.

Each slide plate 38 may be attached to the corresponding upper or lower head as by screws 43. With this construction each head may be independently, vertically movable upon the guide bars 35.

The lower head 37 is provided with a depending portion 44, upon which is journaled a roller 45, and has the central vertical groove 46 to slidably receive the depending arm 47, fixed to the upper head and provided at its lower end with a roller 48.

A ring 49 may be fixed to the under sides of the arms 30, at a point near their ends, and is supported upon the rollers 50 journaled in bearings 51 which are mounted upon the pedestals 52 located at intervals around the tank for the purpose of supporting the weight of the arms and heads.

Each of the lower heads 37 is provided at its upper edge with a curved flange 53 through which are adjustably mounted the fingers 54 disposed toward the upper head.

The upper heads 36 may each be provided with a depending curved spring arm 55 at each end, to the lower inturned ends of which are connected opposite ends of a flexible chain or the like 56, the central portion of which is connected to a bolt 57 flexibly connected to the lower edge portion of the head 36.

Certain of the fingers 54 of the lower head may be provided at their ends with reduced pins 58 adapted to be received through the usual apertures formed in the spring leaves 60.

A plurality of uprights 61 is located around the oil tank and supports the spaced upper and lower tracks 62 and 63 respectively which extend slightly more than half-way around the tank.

The upper track 62 is arranged to be engaged, upon its under edge, by the roller 48 carried by each upper head 36 while the upper edge of the lower track 63 is arranged to be engaged by the roller 45 carried by each lower head 37.

In this position the heads are held together in the position shown in Figs. 4 and 5 and at B in Fig. 1, clamping the spring leaf, in cambered position, between the heads.

At the opening point the lower track 63 is inclined upward, at a slight angle, as shown at 63^a and then extended horizontally, for a distance at the charging and discharging point, at a higher level than the remaining portion of the track 63, as shown at 63^b.

Beyond the charging and discharging point the lower track descends at a sharper angle, at the closing point, as shown at 63^c, again joining the lower level of the track 63.

The upper track 62 terminates at the opening point at which is located a tapered section of track 62^a, the under edge of which is parallel with the section 63^a of the lower track, while the upper edge thereof is inclined upward at an angle thereto.

This section of track is joined to the horizontally disposed section 62^b, at the charging and discharging point of the machine and terminates in the inclined edge $62^{b'}$ parallel to the section 63^c of the lower track.

Spaced from this inclined end $62^{b'}$, at a distance substantially equal to the diameter of the roller 48, is a downwardly inclined section 62^c joining the horizontal portion 62 of the upper track.

In the operation of the machine, assuming the motor to be operating and the magnetic brake 20 released, when the magnetic clutch 19 is thrown in, the ring gear 31 will be continuously or intermittently rotated, through the gearing above described, rotating the arms 30 and the heads carried thereby in the direction of the arrows shown upon the drawings.

As each head approaches the opening point, the roller 48 of the upper head will ride upward upon the upper edge of the tapered section 62^a of the upper track while the roller 45 of the lower head will ride between this tapered section 62^a and the inclined section 63^a of the lower track, thus separating the heads as shown at C in Fig. 1.

As the rollers reach the raised horizontal sections 62^b and 63^b of the tracks, the heads will be separated to the maximum position, the roller 45 of the lower head being located between the sections 62^b and 63^b while the roller 48 of the upper head will ride upon the top of the section 62^b.

At this point, a cambered and tempered spring leaf may be removed from the heads and a red hot leaf may be inserted therein, being placed upon the fingers of the lower head in the position shown at 60 in Fig. 1.

If desired, the magnetic clutch 19 and brake 20 may be operated to stop the movement of the machine during this discharging and charging operation, after which the movement may be continued.

As the heads reach the end of the section 62^b, the lower head will be carried downward, at a sharp incline, by means of the roller 45 passing down the inclined section 63^c of the lower track, while the upper head will move down to meet the same, the roller 48 thereof passing down between the inclined end $62^{b'}$

and the inclined track section 62e, bringing the upper and lower heads into clamped position upon the hot spring leaf and bringing the rollers 48 and 45 together between the track sections 62 and 63 in the position shown at B in Fig. 1.

The spring leaf at this point is entirely beneath the oil level and is carried at this level around the machine until the head reaches the opening point, cambering and hardening the spring leaf as it passes through the oil.

Each head, as it reaches the opening point, is opened as above described, permitting the formed and tempered spring leaf to be removed therefrom at the discharging and charging point, while a new heated spring leaf is placed beneath the heads at this point.

It will be understood that by variation and adjustment of the fingers 54, in the lower head, many different curvatures and forms of spring leaves may be produced by the machine, the flexible chain 56 and springs 55, of the upper head, accommodating themselves to any curvature of the lower head to clamp the hot spring leaf between the heads and hold the same in this position until cooled and tempered.

It will be seen that as the heads reach the charging and discharging point, the forming fingers of the lower head, and the entire upper head, are above the level of the oil permitting ready removal of the finished spring leaf and charging of a new leaf.

It should be noted that as each pair of heads reaches the position indicated at C in Figure 1, and starts to separate and move upward along the slightly inclined track, another pair of heads will be rapidly closing and descending the sharply inclined section of track at the point indicated at B in said figure.

This quickly descending pair of heads at the point B will tend to balance the machine and assist the separating and rising pair of heads at the point C, thus permitting the machine to be uniformly operated with a minimum power supply.

We claim:

1. A cambering machine including a tempering bath, a rotatable frame mounted above said tempering bath, a series of independently movable upper and lower heads carried by said frame, a cam track in said tempering bath and means upon the heads, cooperating with said track for raising each upper and lower head from the bath and separating the heads at a predetermined point and for clamping each upper and lower head upon a heated metal blank and returning the heads in clamped position to the bath.

2. A cambering machine including a tempering bath, a bearing journaled above said bath, a plurality of arms carried by said bearing, a series of independently movable upper and lower heads carried by said arms, a cam track in said tempering bath and means upon the heads co-operating with said cam track for raising each upper and lower head from the bath and separating the heads at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position, to the bath.

3. A cambering machine including a tempering bath, a rotatable frame mounted above said bath, a series of guide bars carried by said frame, a series of independently movable upper and lower heads mounted upon said guide bars, a cam track in said tempering bath and means upon the heads, co-operating with said track for raising each upper and lower head from the bath and separating the heads, at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads in clamped position to the bath.

4. A cambering machine including a tempering bath, a bearing journaled above said bath, a plurality of arms carried by said bearing, guide bars carried by said arms, a series of independently movable upper and lower heads mounted upon said guide bars, a cam track in said tempering bath and means upon the heads, co-operating with the cam track, for raising each upper and lower head from the bath and separating the heads at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position, to the bath.

5. A cambering machine including a tempering bath, a plurality of upper and lower heads, means for moving said heads in a substantially horizontal orbit through said bath, means for slowing raising each pair of heads from the bath and slowly separating said heads, at a predetermined point in said orbit and for comparatively rapidly clamping the heads together upon a heated metal blank and comparatively rapidly returning the heads to the bath.

6. A cambering machine including a tempering bath, a bearing journaled above said bath, a plurality of pairs of substantially horizontal arms carried by said bearing, a vertical guide bar carried by each arm, an independently movable upper and lower head slidably mounted upon each pair of guide bars, a cam track in said tempering bath and means upon the heads, co-operating with said cam track, for raising each upper and lower head from the bath and separating the heads, at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position, to the bath.

7. A cambering machine including a tempering bath, a rotatable frame mounted above said tempering bath, a series of independently movable upper and lower heads carried by said frame, a cam track in said

tempering bath, means upon the heads, co-operating with said track for raising each upper and lower head from the bath and separating the heads at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads in clamped position to the bath, and means for instantly stopping the movement of the machine at any desired point.

8. A cambering machine including a tempering bath, a bearing journaled above said bath, a plurality of arms carried by said bearing, a series of independently movable upper and lower heads carried by said arms, a cam track in said tempering bath, means upon the heads co-operating with said cam track for raising each upper and lower head from the bath and separating the heads at a predetermind point, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position, to the bath, and means for instantly stopping the movement of the machine at any desired point.

9. A cambering machine including a tempering bath, a rotatable frame mounted above said bath, a series of guide bars carried by said frame, a series of independently movable upper and lower heads mounted upon said guide bars, a cam track in said tempering bath, means upon the heads, co-operating with said track for raising each upper and lower head from the bath and separating the heads, at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads in clamped position to the bath, and means for instantly stopping the movement of the machine at any desired point.

10. A cambering machine including a tempering bath, a bearing journaled above said bath, a plurality of arms carried by said bearing, guide bars carried by said arms, a series of independently movable upper and lower heads mounted upon said guide bars, a cam track in said tempering bath, means upon the heads, co-operating with the cam track, for raising each upper and lower head from the bath and separating the heads at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position, to the bath, and means for instantly stopping the movement of the machine at any desired point.

11. A cambering machine including a tempering bath, a plurality of upper and lower heads, means for moving said heads in a substantially horizontal orbit through said bath, means for slowly raising each pair of heads from the bath and slowly separating said heads, at a predetermined point in said orbit and for comparatively rapidly clamping the heads together upon a heated metal blank and comparatively rapidly returning the heads to the bath, and means for instantly stopping the movement of the machine at any desired point.

12. A cambering machine including a tempering bath, a bearing journaled above said bath, a plurality of pairs of substantially horizontal arms carried by said bearing, a vertical guide bar carried by each arm, an independently movable upper and lower head slidably mounted upon each pair of guide bars, a cam track in said tempering bath, means upon the heads, cooperating with said cam track, for raising each upper and lower head from the bath and separating the heads, at a predetermined point, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position to the bath, and means for instantly stopping the movement of the machine at any desired point.

13. A cambering machine including a tempering bath, a plurality of upper and lower heads, means for moving said heads in a substantially horizontal orbit through said bath, means for raising each pair of heads slowly from the bath and separating said heads, at a predetermined point in said orbit, and means for simultaneously rapidly closing another pair of heads and returning them to the bath, to counterbalance the raising and separating movement of the first named pair of heads.

14. A cambering machine including a tempering bath, a rotatable ring associated with the bath, a series of independently movable upper and lower heads carried by said ring, a cam track associated with said tempering bath, means upon the heads cooperating with the cam track for raising each upper and lower head from the bath, and for clamping each upper and lower head upon a heated metal blank and returning the heads, in clamped position to the bath.

In testimony that we claim the above, we have hereunto subscribed our names.

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