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FEED MECHANISM FOR INDUCTION HEATING APPARATUS

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Fig. 1.

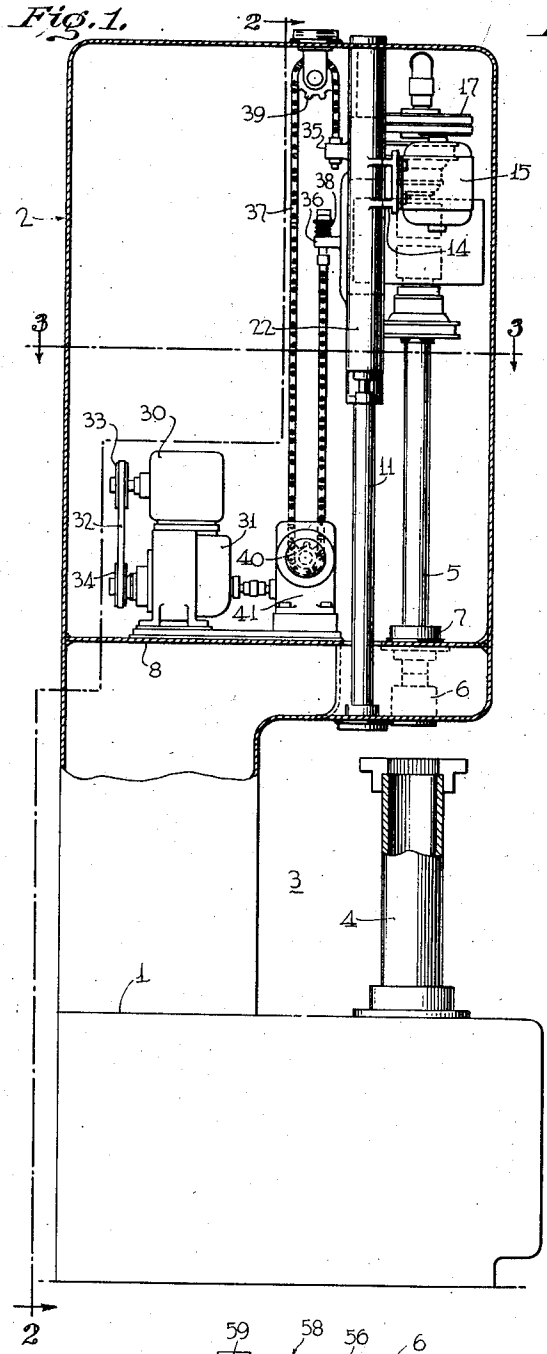
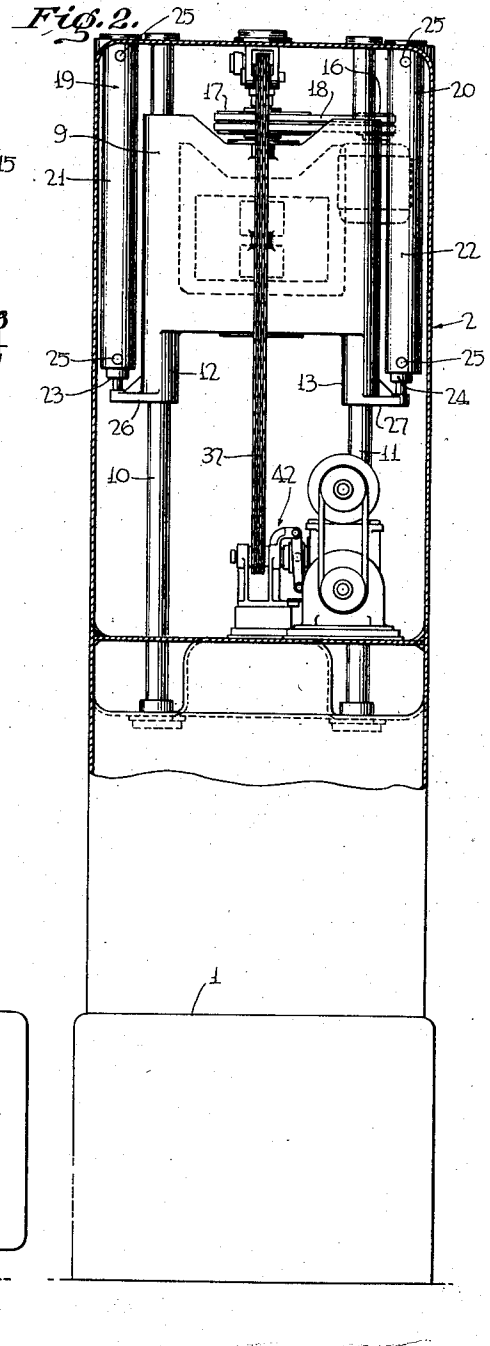


Fig. 2.



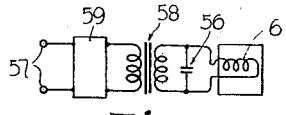


Fig. 5

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Fig. 3.

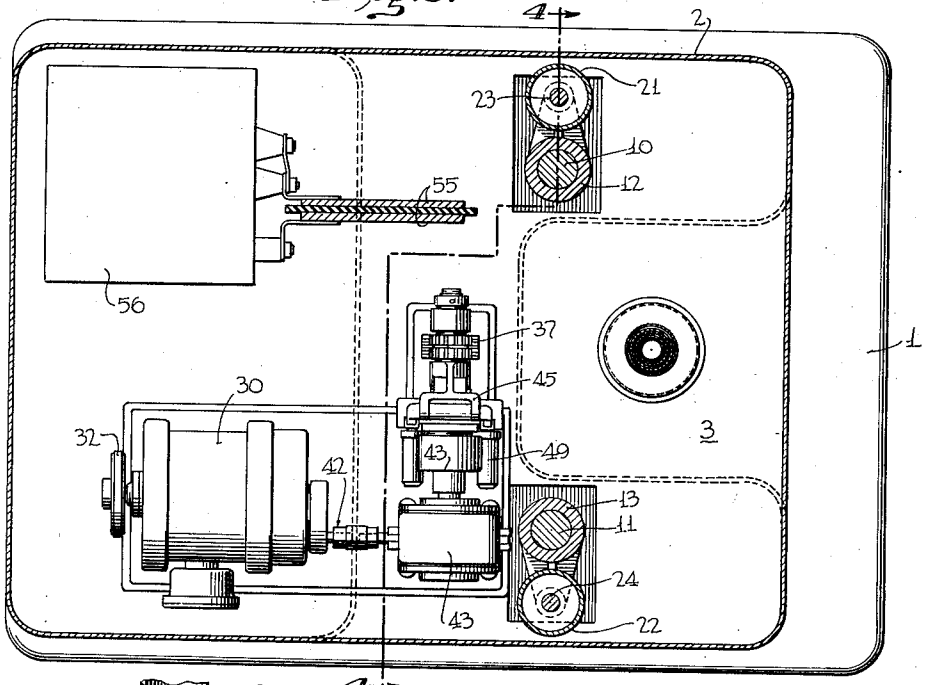
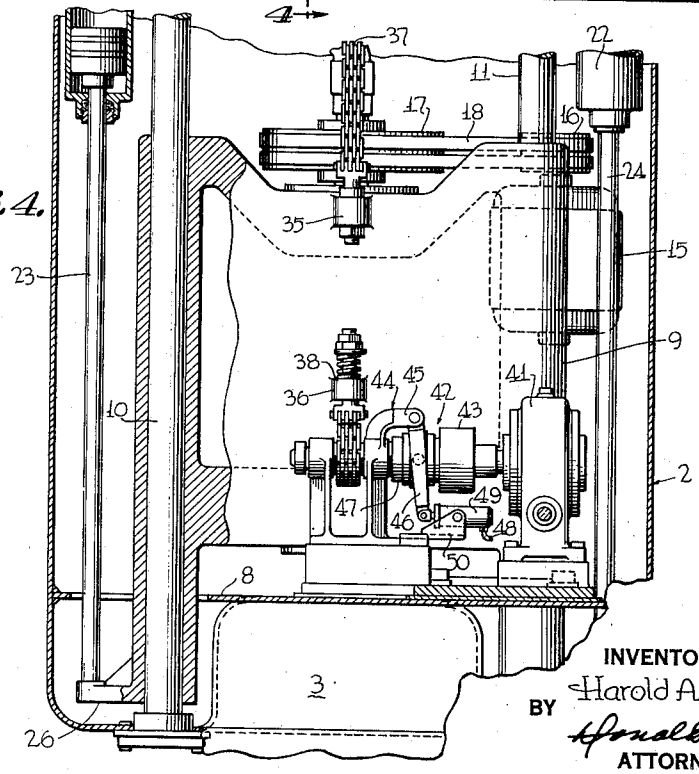


Fig. 4.



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FEED MECHANISM FOR INDUCTION HEATING APPARATUS

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3 Claims. (Cl. 263—6)

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This invention relates to induction heating apparatus of the type having progressive feeding mechanism, with special reference to the mode of actuation of an inductor head forming a part of the apparatus.

An important object of the invention is to provide a feed mechanism for inductor units which may be moved rapidly into heating position and then relatively slowly moved in relation to the workpiece to secure progressive heating thereof.

Another object of the invention is to provide in conjunction with the linear movement of the inductor a rotational movement simultaneously therewith.

An associated object is to provide reciprocation and rotation in an inductor head which may be carried on either simultaneously or in sequence.

Still another object of the invention is to provide simplified means of association with a power source of an inductor support susceptible to both linear and rotational movement and slow and fast linear movement without disturbance of the connecting means to the power source.

An object also is the provision of means for preventing transmission of reverse power to the material from the movable inductor unit.

A general object of the invention is to provide simplified means for transmission of power from the power source to the inductor head which will include variations in rectilinear motion.

In the drawing:

Figure 1 is an elevation, partly in section, illustrating the relative position of the inductor unit to the power mechanism;

Figure 2 is an elevational view taken along lines 2—2 of Figure 1;

Figure 3 is a plan view in section of the apparatus taken along lines 3—3 of Figure 1;

Figure 4 is an enlarged detail showing the transmission mechanism and clutch as employed in this apparatus; and

Figure 5 is a wiring diagram.

The inductor unit is mounted upon a base 1 from which extends upwardly a casing 2 adapted to contain the power mechanism and arbor for support of the inductor unit. A recess 3 is provided in the casing 2 adjacent the base and at a median point along one edge of the same for reception of a workpiece, such as the tubular workpiece 4 as shown in Figure 1. The arbor 5 supporting the inductor head 6 is positioned directly above the recess and is adapted for reciprocation to bring the head 6 within the space of the recess and within the workpiece for heating thereof. The arbor 5 is provided with a lower

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guide 7 mounted on an intermediate partition support plate 8 in the casing and upper supporting means fixedly attached to a frame 9 which is adapted for movement on the guide rods 10 and 11 through the edge tubing 12 and 13. Integral with this frame is a bracket 14 for support of an electric motor 15. This motor is provided for rotation of the arbor 5 by means of pulleys 16 and 17 and pulley belt 18.

Reciprocation of the frame 9 is accomplished by means of fluid motors 19 and 20 which take the form of extended tubular casings 21 and 22 within which pistons having rods 23 and 24 have movement through the base ends of the casings. Fluid power is supplied through the various ports in these casings, as indicated by the numeral 25. In operation, on supply of pressure to the upper ports the pistons are moved outwardly and downwardly and through direct connection by means of the piston rods 23 and 24 to the frame tubing 12 and 13 by means of the lugs 26 and 27 the frame is carried downwardly carrying with it the arbor 5 with the attached inductor head 6.

The action of the reciprocating motors is primarily to produce a downward movement of the frame which is relatively rapid so that the inductor head 6 may be quickly brought into the lowermost position adjacent the workpiece in preparation for a relatively slow upward movement with heat energization. The upward movement is accomplished by means of the motor 30, shown at the left of Figure 1, within the casing and mounted on the transverse support plate 8. In the preferred method of operation there is utilized in conjunction with this motor a variable speed reduction drive 31 which, as indicated, may be placed directly beneath the motor as an intermediate support thereof. Any desired speeds may be used, values found desirable being approximately 1800 R. P. M. for the motor and 0 to 1000 for the speed reduction drive. The power transmission between these two units is by means of the pulley belt 32 operatively engaging pulleys 33 and 34 attached respectively to the shafts of the motor and the reduction drive unit.

There is provided on one face of the frame 9 two projecting lugs 35 and 36 which form the attachment means for a drive sprocket chain 37. One end of this chain is fixed to the lug 35 and the other end is yieldably attached to the lug 36 by means of a spring 38 enclosing a rod movable through an opening in the lug. The chain passes over a guide sprocket wheel 39 attached to the top of the casing 2 approximately directly above the lug 35 and in juxtaposition to the guide rods 10

and 11 at their upper ends. A second sprocket wheel 40 is adapted to engage the chain 37 at a point directly beneath the sprocket wheel 39, the position of the two sprocket wheels relative to the chain being such as to maintain a fairly taut state for the chain when the ends are attached to lugs 35 and 36. The sprocket wheel 39 is freely rotatable upon its support; the sprocket wheel 40 is mounted on a shaft projecting from a worm wheel within the gear speed reducer 41. The worm wheel has connection to a worm shaft which extends from within the speed reducer externally thereof to and in alignment with the mating shaft of the variable speed drive unit 31.

Connection between these mating shaft units is obtained by means of the coupler unit 42, as shown in enlarged form in Figure 4. This coupler includes friction elements 43 normally coacting under pressure and an actuating device 44 including the fixed pivot arm 45, the pivoted lever arm 46, and the clutch element 47, to which the arm 46 is attached. Power is applied to the end of the operating lever 46 opposite from the pivot point by means of a fluid motor 49, with its associated piston movable on pressure supplied through the conduit 48 to relieve pressure on the clutch 43. The motor 49 is preferably pivotally mounted on a support 50 attached to the base of the speed reducer unit.

It is apparent that by the interposition of the worm gear speed reducer, which may have a ratio, for example, of 40 to 1, power may be transmitted in one direction only between the motor and the arbor support frame 9, and consequently although the motor may operate to elevate the frame as desired, on cessation of motor effort the weight of the frame will not bring about a reverse movement of the driving connection and motor.

Energy supply for the inductor unit 6 is secured from external sources of alternating current properly transformed and led through bus bars 55 with parallel connection to the capacitor unit 56, as indicated in Figures 3 and 5, leading to an electrical distributing unit (not shown) and to the inductor arbor and head 6. In Figure 5 the main details of the circuit are indicated, current being supplied from a source 57 to a transformer 58 through a contactor control or timer unit 59.

The fluid pressure for clutch motor 49 and frame motors 21 and 22 is preferably common so that on movement of the frame the clutch is forced to open position. Release of pressure results in closure of the clutch by spring or similar mechanism.

In the operation of the apparatus, assuming the frame 9 with its supported arbor and inductor head at the upper limit of possible movement within the casing 2, the workpiece is placed within the recess 3 upon the base 1 in position to receive the inductor head. The operator then supplies fluid pressure to the fluid motors 19 and 20 bringing about a rapid downward movement of the inductor head within the workpiece to the lowermost point at which heat is to be applied. Quenching flow is then released at the base of the head and the circuit with the power source completed to the inductor head and the motor 15. Pressure on the fluid motors 19 and 20 is then released accompanied by release of pressure in the fluid motor 49. While these two motor units are connected to the same source of fluid pressure so that the action of the two may be simultaneous, it is understood that activation in sequence may be utilized. The release of pressure in the motor 49 permits the spring mechanism in the clutch to bring about a frictional engagement of the same as between the worm gear speed reducer 41 and the variable speed drive 31, and since the motor 38 is constantly in operation power is immediately applied to the sprocket wheel 40 of the reducer 41 to cause movement of the chain 37 and a relatively slow upward movement of the frame with its attached inductor head 6. This movement with its accompanying heating and quenching of the workpiece continues until the inductor head clears the workpiece as controlled by a timer previously set for the operation, at which time pressure is supplied the fluid motor 49 to bring about release of the clutch. Pressure is simultaneously applied to the fluid motors 21 and 22 to lift the inductor rapidly above the workpiece in position for insertion of a new unit. The workpiece may then be removed and a new workpiece substituted for a single heat treatment.

From the above it appears that the action of the apparatus is to move the inductor head rapidly in position with reference to the workpiece and then to move the head slowly while the heat treatment proceeds until the treatment is completed, while simultaneously rotating the inductor by means of the auxiliary motor 15.

The apparatus lends itself to application both as to the mechanism for initiating power movement and for the transmitting elements, and hence no restriction is intended by the specific showing, the scope of the invention being determined by the claims hereto appended.

What is claimed is:

1. In heat treating apparatus comprising two elements having relative axial movement with respect to each other and out of physical contact with each other, the one carrying a heating device and the other carrying a workpiece to be heated, the improvement which comprises a first motive means for moving one of said elements rapidly for a full length stroke in one direction and for a part of the length of the stroke in the other direction, the part stroke at high speed being that part where the heating device is clear of the workpiece, and a second motive means for moving one of said elements slowly and at a more closely controllable speed for that part of the other stroke in which the heating device is moving along the length of the workpiece.

2. In heat treating apparatus comprising two elements having relative axial movement with respect to each other and out of physical contact with each other, the one carrying a heating device and the other carrying a workpiece to be heated, the improvement which comprises a first motive means for moving one of said elements rapidly for a full length stroke in one direction and for a part of the length of the stroke in the other direction, the part stroke at high speed being that part where the heating device is clear of the workpiece, and a second motive means of more accurately controllable speed characteristics than the first motive device for moving one of said elements slowly for that part of the other stroke in which the heating device is moving along the length of the workpiece.

3. In heat treating apparatus comprising two elements having relative axial movement with respect to each other and out of physical contact with each other, the one carrying a heating device and the other carrying a workpiece to be heated, the improvement which comprises a first motive means for moving one of said elements rapidly for a full length stroke in one direction and for a part of the length of the stroke in the other di-

rection, the part stroke at high speed being that part where the heating device is clear of the workpiece, and a second motive means of more accurately controllable speed characteristics than the first motive device for moving one of said elements slowly for that part of the other stroke in which the heating device is moving along the length of the workpiece, said second motive means being operated continuously and including means for placing it in operable control of the moving element during the time in which the heating element and workpiece have slow movement relative to each other.

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