G. R. LANG.

APPARATUS FOR AND METHOD OF TEMPERING SPRINGS.

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1,362,708. Patented Dec. 21, 1920.

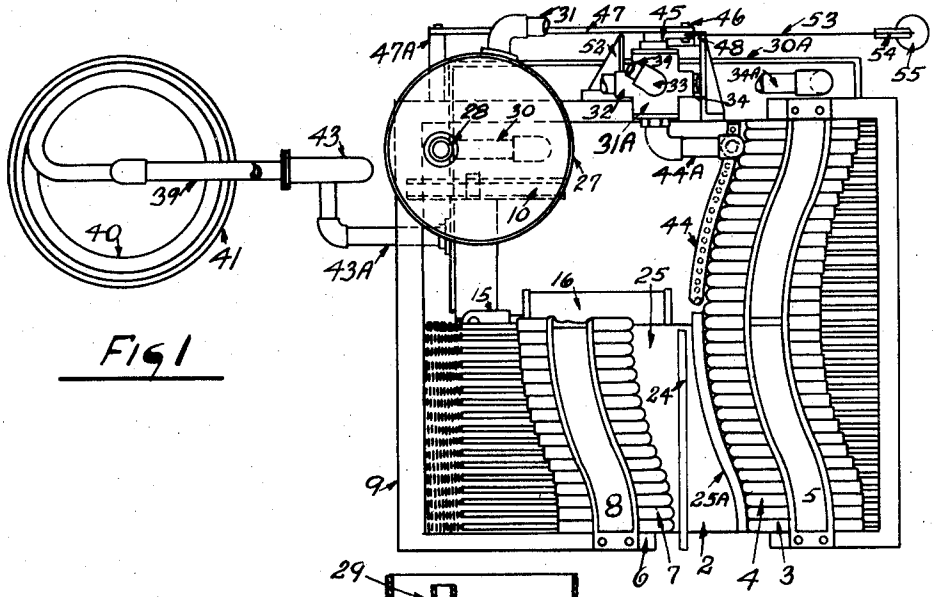


Fig 1

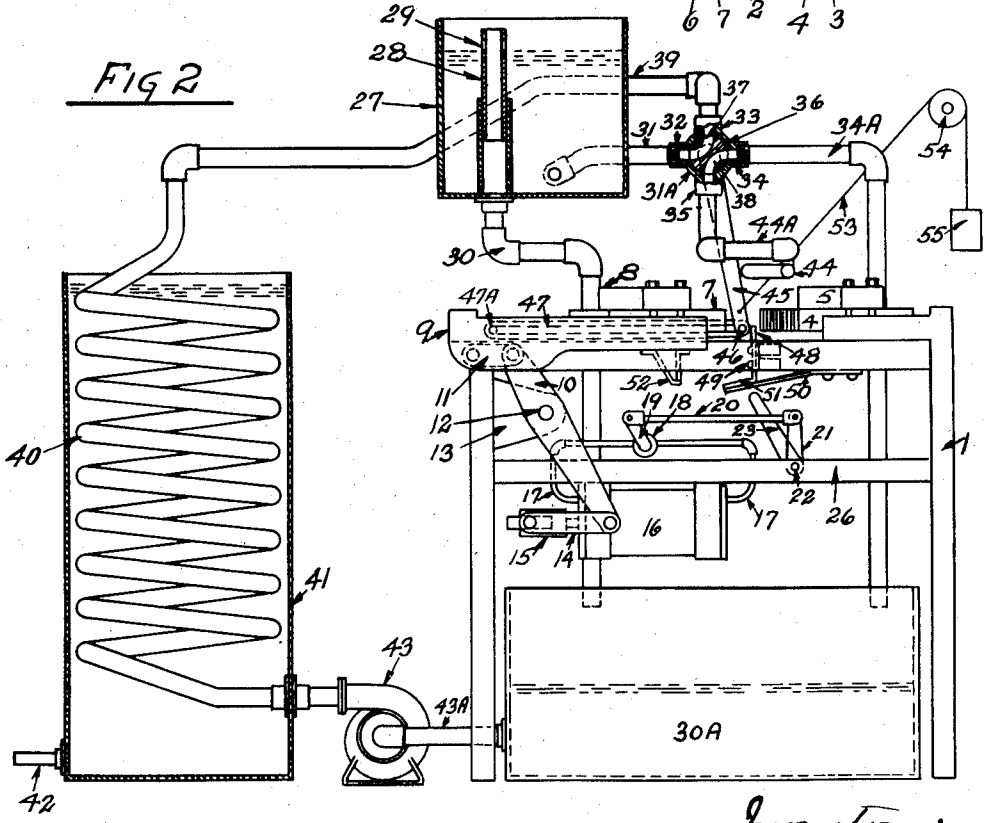


Fig 2

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APPARATUS FOR AND METHOD OF TEMPERING SPRINGS.

1,362,708. Specification of Letters Patent. Patented Dec. 21, 1920.

Application filed September 10, 1919. Serial No. 322,804.

To all whom it may concern:

Be it known that I, GEORGE R. LANG, a citizen of the United States, residing at Beaver, in the county of Beaver and State of Pennsylvania, have invented new and useful Improvements in Apparatus for and Methods of Tempering Springs, of which the following is a specification.

In tempering springs the usual method is to heat them to a high temperature, for instance 1650° Fahrenheit, form them, and then plunge them immediately into oil, thus cooling the spring. The spring is then again heated up to a pre-determined temperature of 850° F. and then allowed to cool in the air.

The correct tempering of the spring depends on carrying out the relation and as the steps are increased the chances for variations in the tempering increase.

In carrying out my method the spring is formed and preferably while held in the form the cooling liquid as oil is poured over the spring. The quantity of cooling liquid is controlled and also its temperature and this is so proportioned to the spring and the temperature to which it has been raised as to reduce the temperature of the spring to the final temper that is desired in a single operation. Thus the plate may be heated to 1650° F. and then such a quantity of oil and at such a temperature poured on that it will reduce the temperature of the spring, or plate to 850° F. In this way there is little chance for failure as to uniformity and the whole process is accomplished in one operation. Preferably the handling of the oil is controlled automatically by the machine and the spring is tempered while being held in the form of the machine.

The machine for carrying out the method and the apparatus exemplifying my invention is shown in the accompanying drawings as follows wherein,

Figure 1 shows a plan view of the machine, a part being broken away to better show construction.

Fig. 2 an elevation with parts in section to better show construction.

1 marks the table on which the forming machine 2 is mounted. The forming machine has the usual form 3 made up of a large number of elements 4 which are clamped by a plate 5 so as to give the desired form. A movable form 6 is made up of the elements 7 clamped together by a plate 8 and carried by a movable frame 9. The form 6 conforms to the form 3 so that when they are moved together with a spring blade between them, they give to the spring the desired form.

A lever 10 is connected by a link 11 with the movable frame 9. The lever is fulcrumed on a pin 12 carried by a bracket 13 on the frame. The lever 10 is connected by a link 14 with a cross head 15, the cross head being actuated from an air motor, or pressure device having the cylinder 16. Air is delivered to either end of the cylinder by a pipe 17, this being controlled by a valve 18. An arm 19 operates the valve 18. The arm is connected by a link 20 with an arm 21. The arm is carried by a shaft 22 and a hand lever 23 is fixed on the shaft 22 by means of which the air may be reversed in the cylinder 16 and consequently the movable frame 9 is moved into forming position, or retracted as desired. So far the mechanism as described does not differ materially from machines of this type in common use.

A spring blade 24 is laid on a platform 25 between the forms 3 and 6 so as to be engaged by the movable frame and moved into forming position. At the completion of the tempering operation and the opening of the forms, the blade drops through a slot 25^a in the table and is carried away on a platform 26 by any means desired.

A tank 27 is arranged directly above the machine. It has an adjustable over-flow tube 28 with an over-flow opening 29. A pipe 30 leads from the over-flow opening into position to deliver the over-flow to a tank 30^a below the table. A pipe 31 leads to a valve 31^a. This valve has the ways 32, 33, 34 and 35 and a valve plug 36 has the ways 37 and 38. The way 33 is connected by a pipe 39 with a cooling coil 40. The cooling coil is arranged in a cooling tank 41 supplied by a continuous stream from a pipe 42. A pump 43 is arranged in a pipe 43^a leading from the coil to the tank 30^a. So long as the valve 31^a is open as shown in Fig. 2 oil is carried from the tank 30^a through the cooling coil to the valve and delivered to the tank by way of the pipe 31. A nozzle 44 is connected by a pipe 44^a with the way 35. The nozzle 44 conforms to the shape of the formed spring and may be provided with nozzle openings sufficiently close

together to uniformly cover the spring from end to end, or if desired may be provided with a slot for discharging the liquid. When the valve 31ª is turned so as to bring the way 37 between the ways 32 and 35 the oil in the tank 27 will be immediately discharged by way of the nozzle on to the spring.

I prefer to accomplish the control of the oil automatically. The valve plug 36 has an operating handle 45. A pin 46 is arranged in this handle and extends through a slotted link 47. The link is pivotally secured by means of a pin 47ª on the sliding frame 9. The arm 45 is held in a position to connect the pipe 31 with the pipe 39 by a catch 48. The catch is slidingly mounted on pins 49 secured on the frame and is held in its upper position by a spring 50. The lower end of the catch is provided with a cam surface 51 which is in the path of a projection 52 carried by the sliding frame 9. When the sliding frame is moved into position to form a spring it carries the lug 52 over on to the cam 51 and thus retracts the catch 48 against the spring 50 so as to disengage the arm 45. A cable 53 extends over a pulley 54 and is provided with a weight 55. As soon as the arm 45 is released from the catch 48, the weight 55 acting through the cable swings the arm upwardly and moves the way 37 so as to connect the pipe 31 with the pipe 44ª. It will be observed that the link 47 will have moved forward with the sliding frame so that the slot in this link will permit the movement of the arm under the influence of the weight. The end of the slot on the pin 46 acts as a stop for the arm 45. On the return movement of the sliding frame 9 the arm is carried with it so as to position the arm in front of the catch 48. While the arm is in its upper position and oil is discharging through the nozzle the pipe 39 is connected through the way 38 with the way 34. A pipe 34ª leads from the way 34 so as to deliver oil to the tank.

The water circulating through the cooling tank 45 is intended to have a sufficient cooling effect to maintain an approximately constant temperature of the oil and this temperature may be varied slightly. Where the temperature is high the adjustable overflow pipe 28 may be adjusted so as to raise the level of liquid in the tank and thus increase the quantity of liquid that is delivered to the spring, so that the cooling effect will remain the same. By thus adjusting or varying the quantity of liquid the proportioning of the quantity at the temperature to which the cooling liquid is brought by the cooling tank is readily controlled.

In operation the operator first heats a blade of a blank to the desired high temperature, places it on the table, operates the lever 23 so as to close the forming die, and closes this form, the die automatically trips the valve 31ª so that a pre-determined quantity of liquid in the tank 27 is delivered on the spring, thus tempering it to exactly the desired amount. The operator then opens the form, the spring drops out and the device is ready for a new operation.

What I claim as new is:—

1. The method of tempering springs which consists in heating the spring, forming the same, and subjecting the same to the cooling effect of a pre-determined quantity of liquid sufficient to partially cool the spring to a predetermined temperature.

2. The method of tempering springs which consists in heating the spring, forming the same, subjecting the same to a cooling liquid, and controlling the quantity and temperature of the liquid.

3. The method of tempering springs which consists in heating the spring, forming the same, and subjecting the same while held by the form to the cooling effect of a predetermined quantity of liquid sufficient to partially cool the spring to a pre-determined temperature.

4. The method of tempering springs which consists in heating the spring, forming the same, subjecting the same while held by the form to the cooling effect of a liquid, and controlling the quantity and temperature of the liquid.

5. The method of tempering springs which consists in heating the spring, forming the same, and subjecting the same to the cooling effect of a pre-determined quantity of liquid by pouring the liquid upon the spring.

6. The method of tempering springs which consists in heating the spring, forming the same, and subjecting the same to the cooling effect of a pre-determined quantity of liquid by pouring the liquid upon the spring simultaneously throughout its length.

7. In an apparatus for tempering springs, the combination of means for forming the spring; means for pouring simultaneously throughout the length of the spring a cooling liquid; and means controlling the quantity of liquid.

8. In an apparatus for tempering springs, the combination of means for forming the spring; means for pouring throughout the length of the spring a cooling liquid; and means for controlling the temperature of the liquid.

9. In an apparatus for tempering springs, the combination of means for forming the spring; means for pouring throughout the length of the spring a cooling liquid; and means for controlling the quantity and temperature of the liquid.

10. In an apparatus for tempering springs, the combination of means for forming the spring; and means for pouring simultane-

ously throughout the length of the spring a cooling liquid while the spring is held in the form.

11. In an apparatus for tempering springs, the combination of means for forming the spring; means for pouring simultaneously throughout the length of the spring a cooling liquid while the spring is held in the form; and means for controlling the quantity of liquid.

12. In an apparatus for tempering springs, the combination of means for forming the spring; a constant level tank; a nozzle conforming to the shape of the spring; and a connection between the tank and nozzle.

13. In an apparatus for tempering springs, the combination of means for forming the spring; a constant level tank; a nozzle conforming to the shape of the spring; a connection between the tank and nozzle; and automatic means controlling the connection as the form is operated.

14. In an apparatus for tempering springs, the combination of means for forming the spring; a constant level tank; a nozzle conforming to the shape of the spring; a connection between the tank and nozzle; a receptacle receiving liquid as it leaves the spring; and means for returning the cooling liquid to the tank.

15. In an apparatus for tempering springs, the combination of means for forming the spring; a constant level tank; a nozzle conforming to the shape of the spring; a connection between the tank and nozzle; a receptacle receiving liquid as it leaves the spring; means for returning the cooling liquid to the tank; and means for cooling the liquid.

16. In an apparatus for tempering springs, the combination of means for forming the spring; a constant level tank; a nozzle conforming to the shape of the spring; a connection between the tank and nozzle; a receptacle receiving liquid as it leaves the spring; means for returning the cooling liquid to the tank; and means for cooling the liquid, said cooling means being arranged in the means for returning the liquid to the tank.

17. In an apparatus for tempering springs, the combination of a forming device; a constant level tank; a nozzle conforming to the shape of the spring; a connection between the nozzle and the tank; a four-way valve in the connection; a receptacle for receiving the oil from the spring; a return pipe from the receptacle to the tank by way of the four-way valve; and a return connection from the four-way valve to the receptacle, the throwing of the four-way valve connecting the tank with the nozzle and the return connection with the connection leading to the receptacle.

18. In an apparatus for tempering springs, the combination of a forming device; a constant level tank; a nozzle conforming to the shape of the spring; a connection between the nozzle and the tank; a four-way valve in the connection; a receptacle for receiving the oil from the spring; a return pipe from the receptacle to the tank by way of the four-way valve; a return connection from the four-way valve to the receptacle, the throwing of the four-way valve connecting the tank with the nozzle and the return connection with the connection leading to the receptacle; and means connected with the forming device for automatically actuating said valve.

In testimony whereof I have hereunto set my hand.

GEORGE R. LANG.