Aug. 31, 1926. 1,598,294

E. A. LUNDVALL

PROCESS AND MEANS FOR MAKING PRESSURE GAUGE SPRINGS

Filed March 16, 1925 2 Sheets-Sheet 1

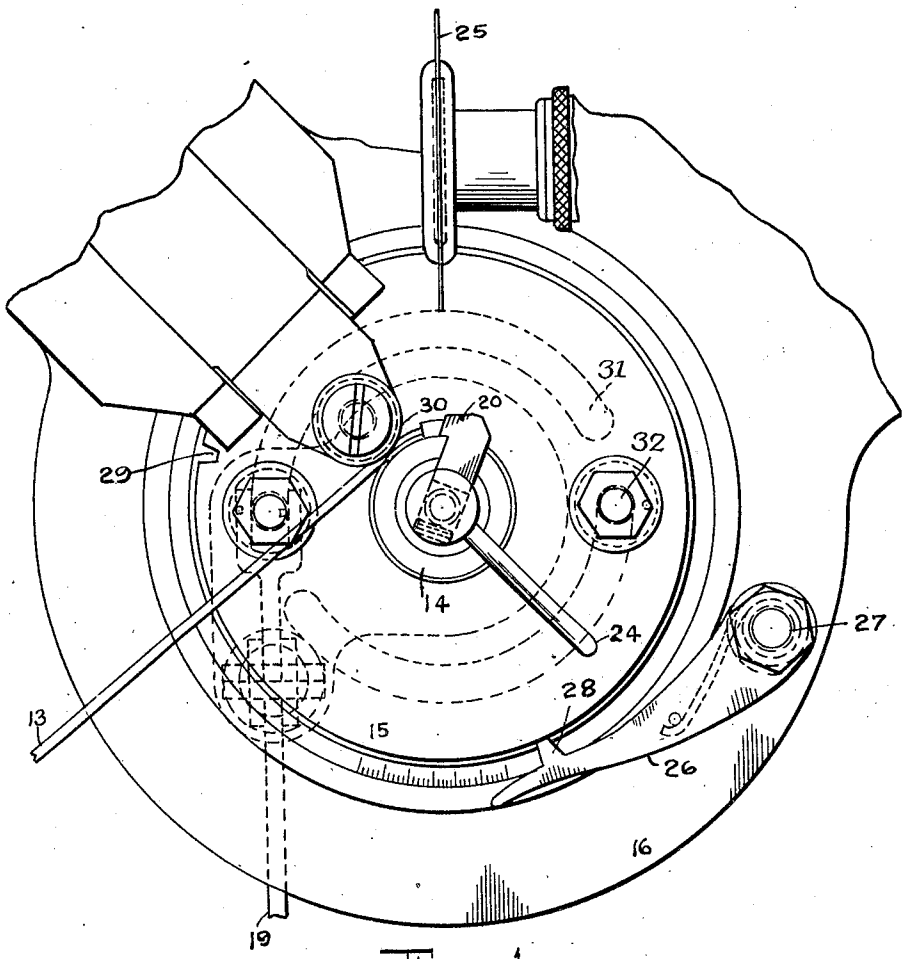


Fig. 1

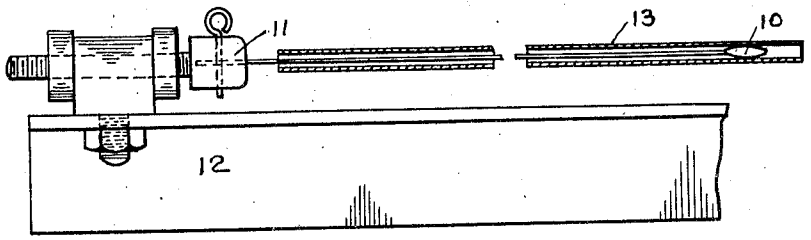


Fig. 2



Fig. 3

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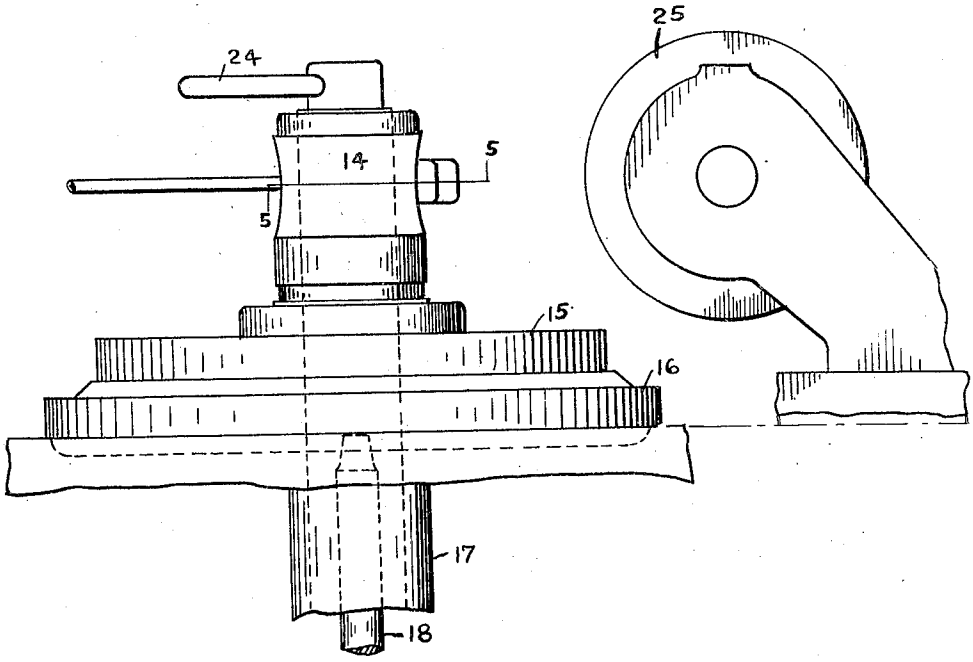


Fig. 4

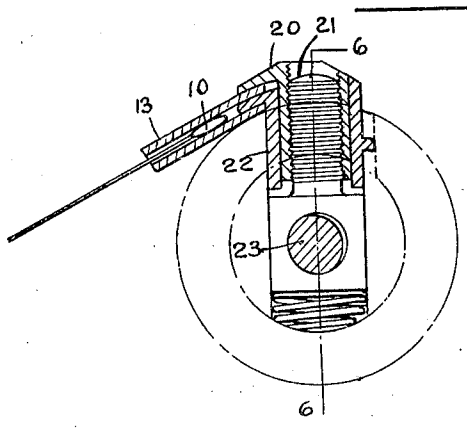


Fig. 5

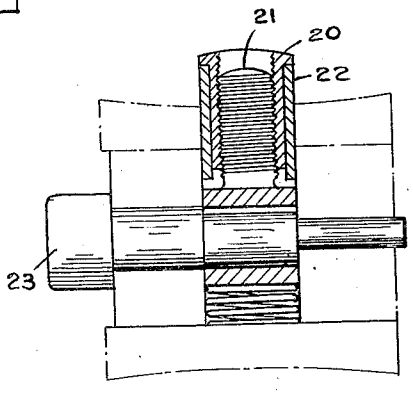


Fig. 6

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UNITED STATES PATENT OFFICE.

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PROCESS AND MEANS FOR MAKING PRESSURE-GAUGE SPRINGS.

Application filed March 16, 1925. Serial No. 15,836.

My invention relates to an improvement in a process for the making of pressure gauge springs and the means for carrying out said process and the novelty consists in the steps of the process and the combination and arrangement of parts for carrying out said process as will be more fully hereinafter pointed out.

There have been many simple mechanical methods used in the forming of gauge springs from Bourdon tubes but all of these methods have involved the use of a sand filler for the tube in order to assure a uniform and perfect bending of the tube. These various methods based on the use of a filler of sand are all slow and tedious and therefore expensive and entail the use of very highly skilled labor. My method has eliminated the use of a sand filler and has thereby permitted the use of a machine whereby the springs can be accurately and quickly bent to the desired arch insuring at the same time uniformity and accuracy with a quick operation and less skilled labor thereby making it possible to turn out a large number of well made gauge springs at a very low cost. My method and means for carrying out the same make it possible to use a long tube bending the section desired to be used for a spring and cutting it off and repeating this operation until the entire length of tube is used up thereby speeding the operation in a very substantial manner and making it a continuous operation.

In order to make clear the means whereby my method of forming gauge springs may be carried out I have set forth in the accompanying drawings the essential or characteristic portions of the machine, it being understood that the portions which are not shown are of well known and usual construction and which could be readily supplied by anyone skilled in the art having the drawings as shown herein.

Referring to the drawings Figure 1 is a top plan view of the principal parts of my device showing the Bourdon tubing in position for use. Figure 2 is a side view of the fixed arbor, part of which is broken away for convenience in illustration. Figure 3 is a cross section of the tubing after it has been bent to form the spring. Figure 4 is a side view of the gripping member and rotating arbor showing the driving connections and the rotary saw in its relative position thereto, the rest of the device being broken away for convenience in illustration. Figure 5 is a cross section of the gripping members and connecting means on the line 5—5 of Figure 4. Figure 6 is a section on the line 6—6 of Figure 5.

In the drawings 10 is an arbor adapted to be rigidly secured at 11 in a fixed position to a frame 12 of my device. A Bourdon tube 13 is adapted to be slid over said fixed arbor 10 the position of the means for securing said arbor at 11 being sufficiently removed from means adapted to grip the upper end of the Bourdon tube 13 so that a full length of such Bourdon tubing can be mounted over said arbor 10 at the beginning of each operation. A rotating or roll arbor 14 is rigidly secured to a graduated index plate 15 and this index plate 15 is adapted to be locked to a positive plate 16 which is keyed to a driving shaft 17 so that it rotates therewith. The locking may be accomplished as shown by arranging slots 31 in positive plate 16 through which pass bolts 32 which are fixed in index plate 15 so that when they are tightened the two plates are firmly clamped together. The arrangement must be such that plate 15 can be adjusted with respect to plate 16. A positive locking pin 18 controlled by an end lever 19 is adapted to engage the positive plate 16 so as to lock it in the starting position. The gripping member consists of a fixed member 20 which is threaded on to a movable shaft 21 and an outer movable member 22 which registers over the fixed member 20. The shaft 21 has an eccentric pin 23 running through the same, horizontal to the direction of the shaft 21 which has a handle 24 and said eccentric shaft 23 is adapted to be turned to raise or lower movable shaft 21 thereby effecting a gripping or locking between the members 20 and 22 as the end of the Bourdon tube 13 is inserted between the lips of the gripping members 20 and 22 so as to hold the same rigidly in position as the bending operation is performed and drawing the tube 13 as hereinafter described. A circular rotary saw 25 of usual construction is adapted to be mounted on my device so that it can be manually or mechanically operated to slide forward and cut the tube 13 when the bending operation is completed. A stop pawl 26, mounted at 27 under the usual spring tension, has a tooth 28 adapted to register in a notch 29 in the graduated index plate 15. A presser or ironing mem-

ber 30 is independently mounted on my device so that it will iron out any wrinkles which are liable to occur on the tubing 13 and which also acts as a burnisher for stretching the material on the outside of said tubing 13 for variations in the different radius on the outside and inside dimensions of said tubing 13 as it is bent. This presser or ironing member 30 also has a fine adjustment whereby the slightest change in variation of the pressure can be obtained by means of usual screw attachments graduatel to one-thousandth of an inch. This presser 30 also compensates for the variation in large and small diameter tubes but such adjustment is only necessary to operate when a new length of tube 13 is being inserted.

I carry out my method of bending gauge springs by placing a full length Bourdon tube 13 in a position over the fixed arbor 10, adjusting the graduations of index plate 15 with respect to the zero mark on positive plate 16 so that the exact length of tubing to be cut is accurately determined, securing the upper end of said tube 13 in the gripping members 20 and 22 by means of the operation of the eccentric 23 turned by the handle 24 and having thus locked the upper end of the tube 13 between gripping members 20 and 22, I then adjust the presser or burnishing member 30 against the tube 13, the fixed arbor 10 having first been adjusted so that a variation of the thickness of the spring can be made to suit the different pressures of the pressure member. I then adjust the presser or burnisher member 30 to the exact position desired and by throwing the hand operated lever 19 release the locking pin 18 from the fixed plate 16 thereby permitting the shaft 17 to rotate carrying the plate 16 and graduated index plate 15 with it and the gripping members 20 and 22 so that the tube 13 is drawn around the roll arbor 14 until the tooth 28 of the pawl 26 drops into and engages the notch 29 thereby stopping such rotation. The rotary saw 25 is then pressed down so as to cut off the portion of the tube 13 which has been bent thereby completing said gauge spring which will have a cross sectional arrangement similar to that shown in Figure 3. The pawl 26 is then raised to release the tooth 28 from the notch 29 and the shaft 17 is turned in the opposite direction from the original turning thereby returning the rotating parts to the original position until the pin 18 again engages the plate 16 and locks it in position ready for the cycle to be repeated.

The graduated index plate 15 can be adjusted as may be desired before repeating this operation to obtain the exact length of spring desired and it will be seen that the adjustments having been made for a given length and type of gauge spring the operations described can be repeated without the resetting of any of the measuring or control parts thereby permitting the operator to repeat this operation rapidly with exactness in each operation.

I claim:

1. The automatic process of bending gauge springs comprising mounting a full length Bourdon tube over a fixed adjustable arbor, securing the upper end of said tube to a roller arbor held by a stop, adjusting an ironing member against said tube, releasing said stop, automatically limiting said rotation and cutting said spring.

2. The continuous process of bending gauge springs consisting of mounting a full length Bourdon tube over a fixed arbor, securing the upper end of said tube to a roller arbor held in normal position by a stop adjusting an ironing member against said tube in a fixed position, releasing said stop, automatically limiting said rotation, cutting off the portion of said tube which has been bent and restoring the roller arbor to the original position and repeating the cycle of operations.

3. In a gauge spring bending device a fixed arbor, a roller arbor, means for securing a full length Bourdon tube over said fixed arbor to said roller arbor, a finely adjustable ironing member, means for rotating and adjusting said roller arbor, means for measuring and regulating said rotation, means for holding said roller arbor against said rotation, means for releasing said holding means and means for cutting off the portion of said tube which has been bent.

4. In a gauge spring bending device a fixed arbor, a roller arbor, means for securing a full length Bourdon tube over said fixed arbor to said roller arbor, a finely adjustable ironing member, means for rotating and adjusting said roller arbor, means for measuring and regulating said rotation, means for holding said roller arbor against said rotation, means for releasing said holding means, means for cutting off the portion of said tube which has been bent and means for restoring said roller arbor to the original position.

5. In a device for bending and cutting small tubes, the combination of a positive plate, means for rotating said positive plate, an index plate positioned over said positive plate and rotatable about the same axis, members fastened to said index plate and extending into grooves in said positive plate, said members being movable in said grooves upon relative rotation of said plates, a zero mark on said positive plate, graduations on said index plate, means to tighten said members to clamp said plates together, a roller arbor and tube end clamping means movable with said index plate, a notch in said index plate, a stop adapted to enter said

notch and stop rotation of said plates, said arbor and said clamping means, whereby the adjustment of said graduations with respect to said zero mark controls the amount of said rotation and the length of tube cut can be accurately determined.

6. In a device for bending and cutting small tubes, in combination an automatic rotating arbor, a tube clamping means comprising an eccentric stud carrying a movable and a fixed lip member mounted thereon, said stud being mounted through the center of said rotating arbor, a stop to check said rotation and means to adjust the tube clamping means with respect to the stop.

7. In a device for bending and cutting small tubes in combination, a positive plate, means to rotate said positive plate, an index plate positioned over said positive plate, tube end clamping means movable with said index plate, means to accurately adjust said index plate with respect to said positive plate and means to secure said index plate to said positive plate.

8. In a device for bending small tubes a tube end clamping means comprising an outer fixed sleeve, an inner movable sleeve, lips on each of said sleeves, a member adapted to move said inner sleeve and having a hole therein, an eccentrically mounted pin in said hole, means to rotate said member and a spring bearing against said member.

In testimony whereof I affix my signature.

ERIK A. LUNDVALL.