April 8, 1924. 1,489,894

J. C. MONTEITH ET AL

METHOD OF MAKING SPRINGS

Original Filed Aug. 13, 1919 2 Sheets-Sheet 1

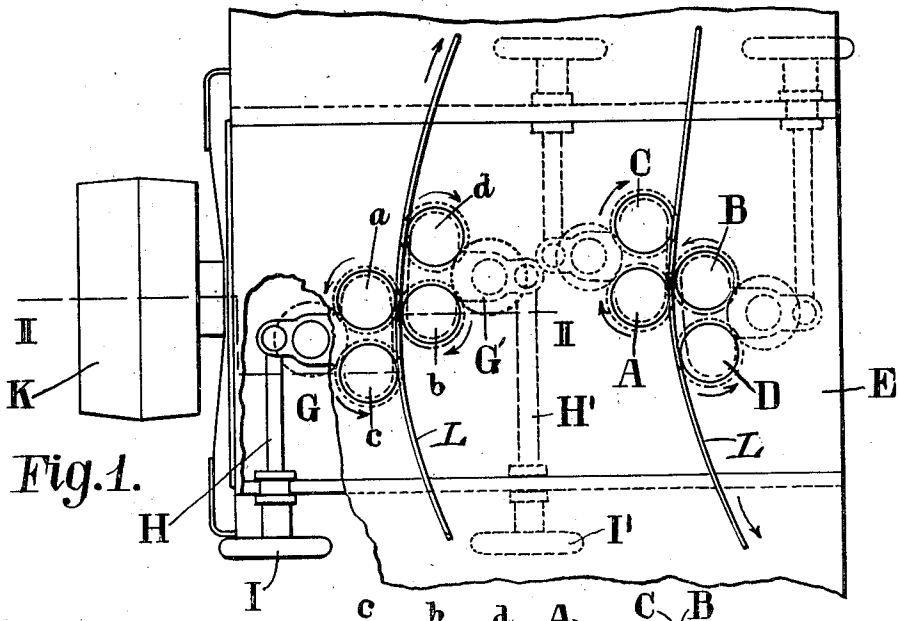


Fig. 1.

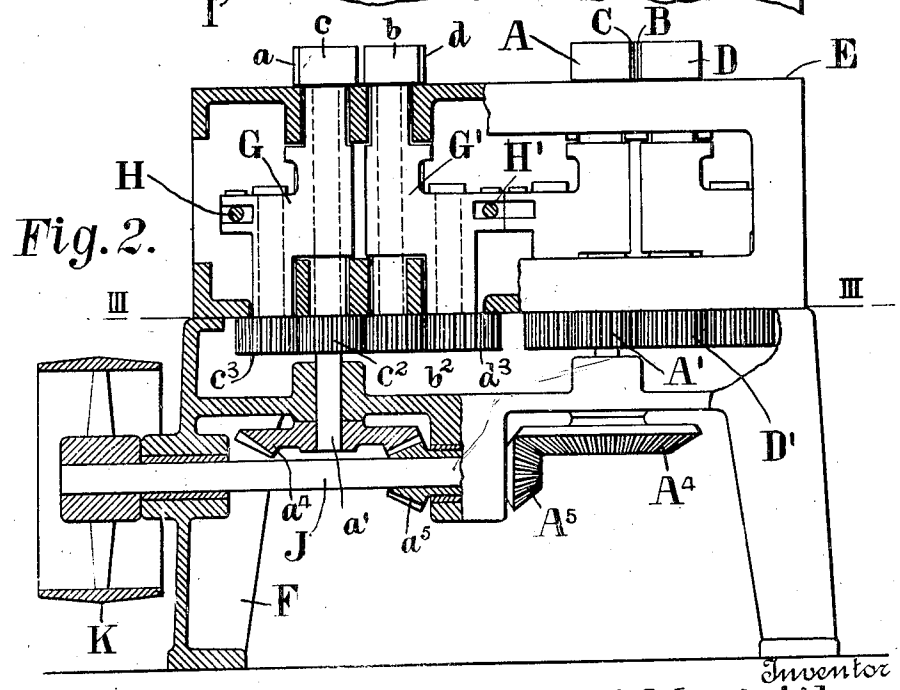


Fig. 2.

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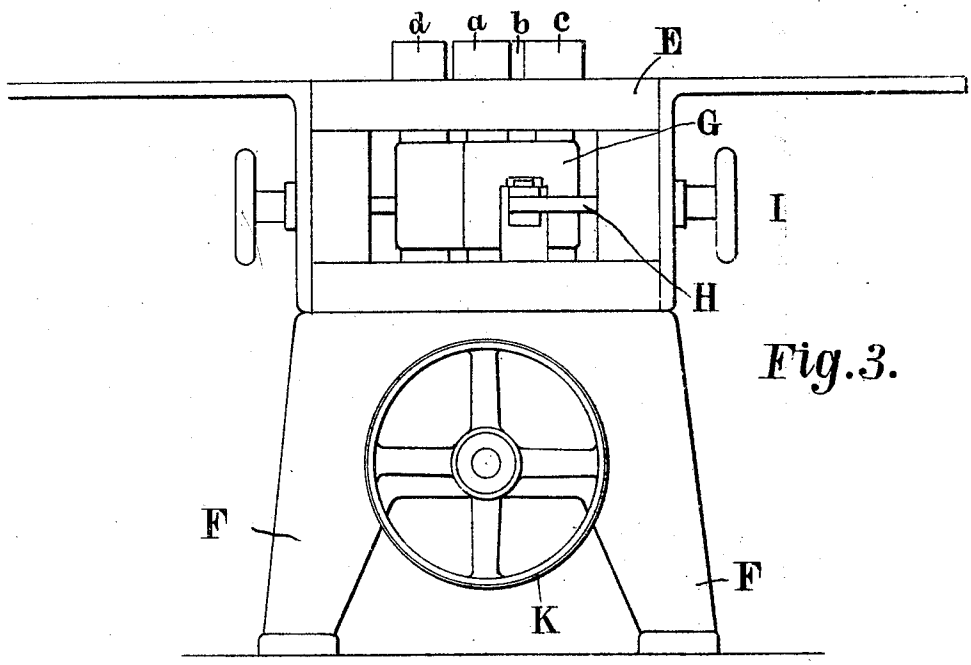


Fig.3.

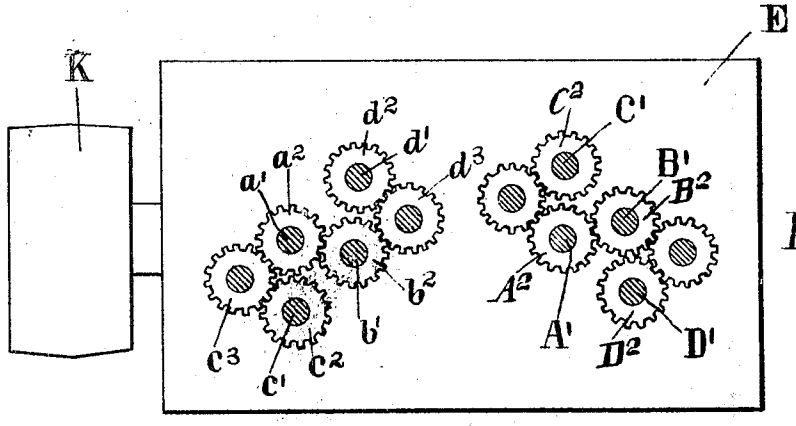


Fig.4.

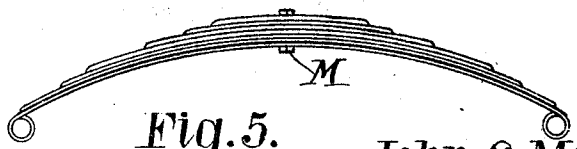


Fig.5.

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UNITED STATES PATENT OFFICE.

JOHN C. MONTEITH, OF CLEVELAND, AND LEE A. FRAYER, OF COLUMBUS, OHIO; SAID MONTEITH ASSIGNOR TO STERLING SPRING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF DELAWARE.

METHOD OF MAKING SPRINGS.

Original application filed August 13, 1919, Serial No. 317,132. Divided and this application filed March 21, 1921. Serial No. 454,261.

To all whom it may concern:

Be it known that we, JOHN C. MONTEITH and LEE A. FRAYER, citizens of the United States, residing at Cleveland, in the county of Cuyahoga, State of Ohio, and Columbus, in the county of Franklin and State of Ohio, respectively, have invented a certain new and useful Improvement in Methods of Making Springs, of which the following is a specification.

The object of this invention is the successful cold rolling of the leaves of an elliptical spring, so called, such as is commonly used in vehicles of various kinds. The problems involved in such an aim are chiefly first to so roll the leaf that the curvature at its ends conforms substantially to the curvature of the portion intermediate the ends; and secondly to impart to all the different lengths of leaves to be used in the same spring substantially the same curve. Another object of the invention is to relieve the rolled metal of internal strains set up by such a process in forming the leaves.

The invention is embodied in the process herein described and finally claimed.

In carrying out our process we prefer to employ a machine such as herein described and shown in the accompanying drawings in which—

Figure 1 is a top plan view with a portion broken out.

Fig. 2 is a combined vertical section and side view, the section being taken on the line II—II Fig. 1.

Fig. 3 is a side elevation as viewed from the left hand side of Fig. 1.

Fig. 4 is a horizontal section on the line III—III Fig. 2.

Fig. 5 shows the type of spring made up of the leaves to be made with the machine.

In the views E designates a table or superstructure that is supported upon a suitable frame having legs F. The rolls are shown as arranged in two groups A, B, C and D and a, b, c and d projecting above the table, one group to take the first pass and the other to take the second, the latter pass being made by sending the leaf through the rolls in reverse direction.

The rolls A, B, C and D have spindles equipped with gears A^2, B^2, C^2 and D^2 in the same manner and relation to each other as the rolls a, b, c and d and the rolls C and D are adjustable by like means arc-wise in relation to the rolls A and B respectively as the rolls c and d to the rolls a and b respectively, the only difference being that the position of the rolls C and D with respect to the rolls A and B respectively is the reverse of the position of the rolls c and d with respect to the rolls a and b respectively.

All the rolls of each group or set are driven, the arrows Fig. 1, indicating the direction of motion in each group.

To impart motion simultaneously to the two groups the spindles a' and A' of the rolls a and A are made longer and provided with crown gears a^4 and A^4 respectively, said gears being engaged by beveled pinions a^5 and A^5 respectively fixed on a shaft J having a driving pulley K (see Fig. 2). The pinions a^5 and A^5, of course, drive the shafts a' and A' in opposite directions and consequently the rolls in the two groups in the respective directions indicated.

In practice the strips or leaf blanks of metal are primarily straight. As shown in the machine the strip L lying edgewise on the table is first passed through the groups A, B, C and D in the direction indicated by the arrow. When the strip in this pass leaves tangential contact with the roll C, the bending action of that roll is reduced and ceases hence a short portion is left substantially unbent or not conforming to the curve of the part bent by the joint action of the other rolls. To correct this the leaf is next passed with the unbent end inserted first between the rolls a and b so that the rolls a, b and c shall impart to the uncurved end the desired curve conforming as nearly as practicable to the curve of the rest of the leaf. The unbent end referred to can, of course, be corrected if desired by passing the leaf in reversed position through the first group of rolls, A, B, C and D.

When a strip of steel is bent to a desired form cold by bending it in a positive direction only, there remains in the metal internal strains which tend to return the piece to its original shape. When steel so formed is heated (as for tempering in the case of springs) the various leaves or plates change considerably in the heat, bath and draw, the amount being very variable according to the condition of the metal before cold forming, the method of forming and whether formed in a single operation or several. To give the leaves the desired form and so that they shall retain their forms upon tempering we have found a plurality of passes through different groups of rolls desirable, the arrangement of the rolls and the passes being such that the final pass reduces the curve or camber of the strip and thus relieves the strains occasioned by the first or preceding pass.

In the primary series the two major rolls A and B are fixed in relation to one another and rolls are used of diameters such that there is just a sufficient space between them to accommodate the desired thickness of steel to be formed. Thus both A and B lie practically on one of the radii of the curve to be rolled. The roll C is adjustable about A as its center to give the desired curvature and should be termed as a positive roll. The roll D is adjustable about B as a center and may be termed a negative roll.

The steel bar on entering the rolls A, B, C is given a positive bend to a radius less than that desired and on passing through this given a negative or straightening action between A, B, D to a radius greater than that finally desired. On the lead end of the leaf for a distance from A to D this negative action will not be in effect and this portion will not have a true curvature. Each group is substantially identical with the other but arranged in reversed position for the purpose of facilitating manipulation of the leaf in the passes. A description of one group of the rolls will suffice substantially for both and for this purpose we will describe that shown at the left hand side of the machine as it appears in Figs. 1 and 2. The rolls a and b are fixed on the shafts or spindles a', b' the lower ends of said spindles being geared together by gears a^2 and b^2 to rotate in opposite directions. The roll c is fixed on a spindle c' having a gear c^2. The gears a^2 and c^2 are engaged by an intermediate gear c^3 to cause the roll c to rotate in the same direction as the roll a. The position of the roll a is fixed while the roll c, its gear c^2 and the gear c^3 are carried in a frame G adjustable around the axis of the roll a. The means for adjusting and fixing the frame G comprises a horizontal rod H hinged at one end to the frame G and having its other end threaded and engaged by a threaded hand wheel I loosely mounted in the vertical wall of the table. By turning the hand wheel I in the proper direction the roll c can be moved transversely with reference to the feed line between the rolls a and b and so vary the degree of bend imparted to the leaf.

The roll d has spindle d' and gear d^2 and the gears b^2 and d^2 are engaged by an intermediate gear d^3 to cause the roll d to turn in the same direction as the roll b.

The position of the roll b is fixed while the roll d, its gear d^2 and the gear d^3 are carried in a frame G′ adjustable around the axis of the roll b. The means for adjusting the frame G′ comprises a rod H′ and hand wheel I′ like those described and represented at H and I and operating in the same manner.

On the follow end of the leaf for a distance from B to C the positive bending action will not be in effect and this end will not have a true curvature. To overcome this the second group is arranged, a and b being the major rolls, c a positive bending roll, d a negative bending roll, substantially duplicating the first group. Through this group the follow end of the leaf becomes the lead end and the lead end the follow end. In practice the roll c is adjusted to a slightly less radius than C and d to a slightly greater radius than D. This reverses the condition causing the inaccuracies in the first pass and practically rectifies them. By adding further groups of rolls and alternating, making one end of the leaf the lead and follow end the defect at the end can be reduced to a negligible quantity.

The group a, b, c and d for finally bending the leaves are set to impart substantially the same curve to all the leaves of a given spring. When the leaves are so curved and superposed upon each other a narrow arcuate space is left between the middles of the leaves with the ends lapped. The application of the usual bolt M or clip closes said spaces, as seen in Fig. 5.

The distance between the peripheries of the rolls A and B and a and b, for example, can be changed with small expense by substituting rolls of different diameters on the same shafts.

The forms of the parts can be varied without departing from the gist of the invention as claimed.

The subject of the present application is a division of an application pursuant to which Letters Patent of the United States was issued to us August 16, 1921, and having Number 1,387,934.

What we claim is:

1. The method of manufacturing a leaf for a spring of the elliptic type consisting in passing the leaf through rolls to first bend the same to a curve of smaller radius than ultimately desired to set up therein in-

ternal strains and subsequently permanently bending the leaf to a curve of larger radius to reduce such strains.

2. The method of manufacturing a leaf spring of the elliptic type consisting in passing the leaf through rolls to first bend the same to a curve of smaller radius than ultimately desired to set up therein internal strains and subsequently passing the leaf through rolls in the opposite direction to permanently bend the same to a curve of larger radius to reduce such strains and substantially equalize the curvature of the ends of the leaf.

JOHN C. MONTEITH.
LEE A. FRAYER.