Feb. 26, 1924.

1,485,313

J. W. TAYLOR

BENDING MACHINE

Filed June 21, 1921 2 Sheets-Sheet 1

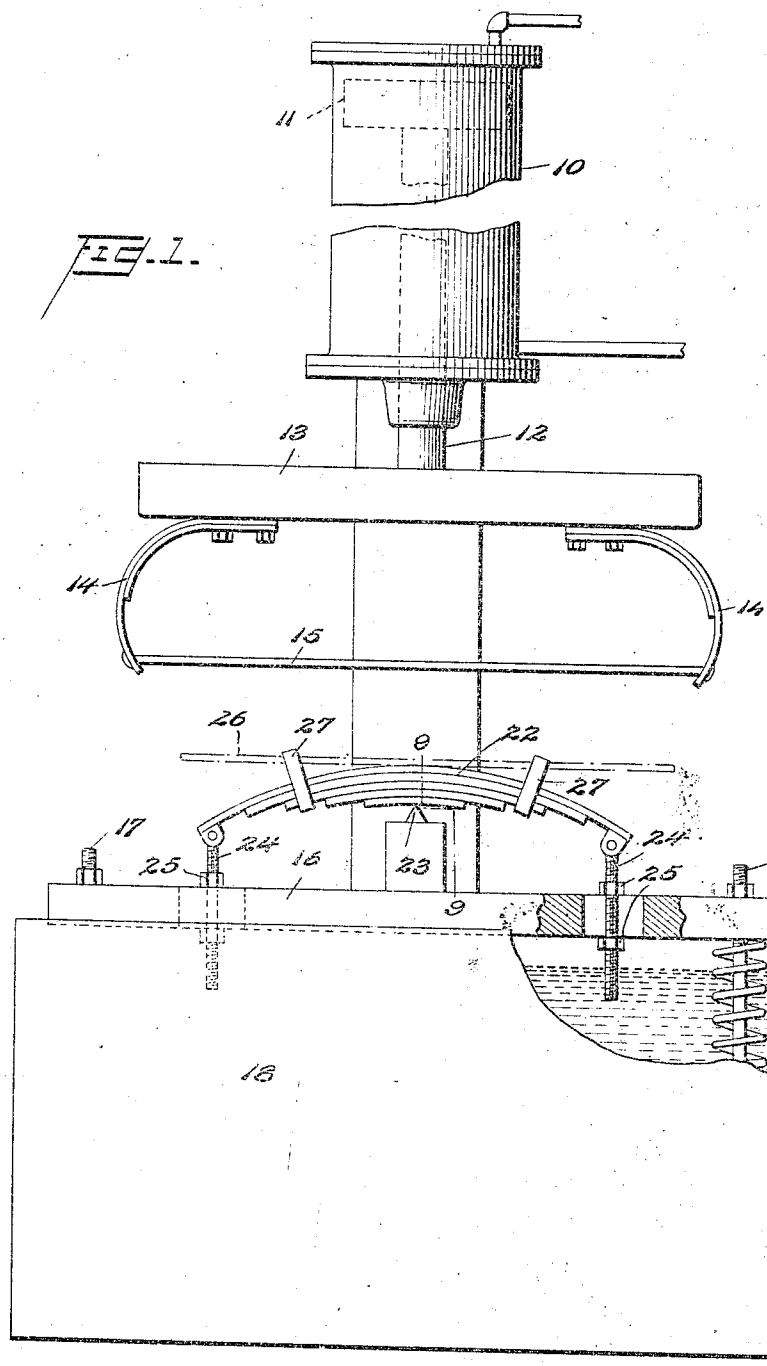


FIG. 1.

Inventor

J. Wallace Taylor,

By Watson, Cole, Morse & Grindle,

Attorney

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FIG. 2.

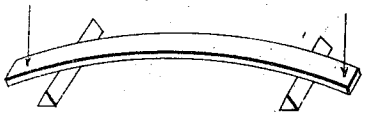


FIG. 3.

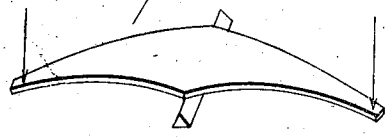


FIG. 4.

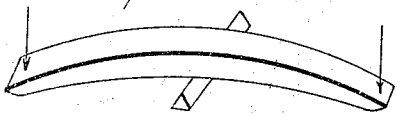


FIG. 5.



FIG. 6.



FIG. 7.

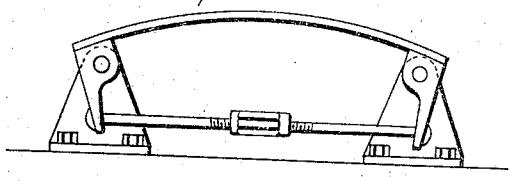
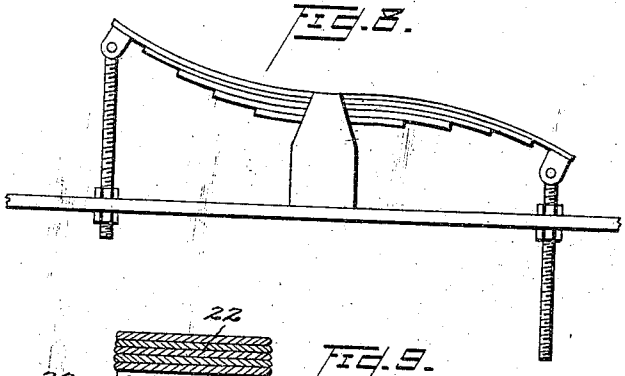


FIG. 8.



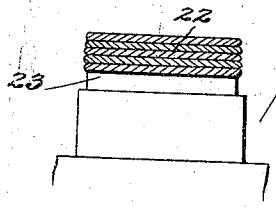


FIG. 9.

Inventor

J. Wallace Taylor,

By Watson, Cole, Morse & Grindle,

Attorney

Patented Feb. 26, 1924. 1,485,313

UNITED STATES PATENT OFFICE.

JOHN WALLACE TAYLOR, OF CLEVELAND, OHIO.

BENDING MACHINE.

Application filed June 21, 1921. Serial No. 479,354.

To all whom it may concern:

Be it known that I, JOHN WALLACE TAYLOR, a citizen of the United States, and residing at Cleveland, county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Bending Machines, of which the following is a specification.

The present invention relates to machines for curving metal articles and particularly to mandrels for machines used in curving the individual leaves of built-up leaf springs of the curved cantilever or semi-elliptic type.

In shaping the leaves of built-up curved leaf springs the leaves are received from the furnace in a highly heated condition and substantially straight and are then curved in a press while hot, to the desired configuration and immediately thereafter plunged into or quenched in a fluid cooling medium such as water or oil, generally the latter. The leaf springs may of course be built-up of straight leaves but are usually curved into the well known curved cantilever or semi-elliptic form for mechanical reasons, depending upon the use to which they are to be put. For instance, vehicle springs are usually semi-elliptic to provide the necessary clearance between the vehicle axles and the vehicle body, and generally two semi-elliptic springs are joined to form a full elliptic spring, to provide additional clearance.

In order that the springs, whether straight or curved, may be made as light as possible for a given strength they are formed substantially as beams of uniform strength, the thickness of the spring gradually increasing from the end or ends bearing the loads toward the point of support. For a number of reasons it is not desired to form such springs of a single member which gradually increases in thickness toward the point of support but they are built-up in the well known manner, of a plurality of superposed individual leaves of different lengths which are secured together at one point. In theory, the spring being designed as a beam of uniform strength, each leaf will be equally stressed when the spring is loaded and furthermore the stress throughout the length of each leaf of the spring will be the same under any given load. Therefore, when such a spring is loaded and flexes under the load the curve which it assumes will be the arc of a circle inasmuch as the unit stress from end to end of the spring will be the same and hence the deformation of each unit length will be the same, and each unit length stretching the same amount or contracting the same amount, as the case may be, causes the curve to be circular, provided of course, that before loading the spring was either straight or curved along the arc of a circle.

In the manufacture of curved leaf springs therefore it has been the practice to form the individual leaves as arcs of circles, the radius depending of course on the size of the spring and upon the use to which it is to be put. A number of types of machines have been heretofore designed or suggested for curving the individual leaves of such springs. One of such machines contemplates the use of a flexible plate adjustably supported at a number of points so that its radius of curvature may be varied at will, this plate constituting the special form or mandrel upon which the leaf spring is shaped and having a head or plunger associated therewith for bending the leaf placed on the mandrel so that it conforms to the shape thereof. In another type of machine heretofore employed a plurality of aligned adjustable pins have been provided the pins being closely arranged and together constituting the mandrel. In each of these types much time is lost when it is desired to change the radius to which spring leaves are to be bent, it being necessary to individually adjust the separate pins and repeatedly check them to ascertain whether or not they are properly positioned. Solid mandrels have been used but these are of course entirely non-adjustable, and also in some cases sample spring plates have been rigidly supported and used as mandrels.

The object of the present invention is to improve upon such machines heretofore employed in the curvature of leaf springs or similar metal articles by providing an improved mandrel which may be adjusted to different radii of curvature quickly, and by making a single adjustment in the case of a cantilever spring, or two adjustments only in the case of the semi-elliptic spring, all other adjustments being avoided. To this end I employ as a mandrel a built-up leaf spring either of cantilever or semi-elliptic type the spring being supported at its heavy end in the case of the cantilever and loaded

at its light end, or supported at its middle point in the case of the semi-elliptic type and loaded at each end. By varying the loads the radius of curvature of the mandrel may be changed at will, the curve however remaining practically the arc of a true circle at all times.

In the following specification and in the accompanying drawings the invention will be disclosed, several different embodiments being described and illustrated. In the drawings:

Figure 1 is a front elevation of a press for curving leaf springs, the mandrel shown being for the purpose of forming springs of the semi-elliptic type;

Figs. 2, 3 and 4 illustrate diagrammatically mandrels which may be substituted for the mandrel of Fig. 1, and which, when loaded and supported at the points indicated, will curve uniformly, that is along circular arcs;

Fig. 5 illustrates diagrammatically the mandrel illustrated in Fig. 1;

Fig. 6 illustrates diagrammatically the mandrel for a cantilever spring showing the method of supporting and loading the same;

Fig. 7 shows a mandrel which may be used in place of the mandrel of Fig. 1;

Fig. 8 shows a mandrel adjusted to obtain a reverse curve; and

Fig. 9 is a section on line 9—9 of Fig. 1.

Referring to Fig. 1 it will be seen that the machine comprises essentially a fluid pressure cylinder 10 having a piston 11 therein which is connected by the piston rod 12 to a transversely extending head 13 so that this head is reciprocated vertically with the piston as fluid under pressure is introduced into the ends of the cylinder alternately. To the under side of member 13 are rigidly secured the spaced leaf spring members 14 which extend downwardly and have their lower ends tied together by the flexible band 15 which may be a chain, leaf spring, or similar member which will readily bend about the mandrel as the piston descends. The springs 14 normally keep member 15 stretched tight or in a horizontal position as shown in Fig. 1.

Parallel to and directly underneath the head 13 is a table 16 which is vertically movable along guide rods 17 downwardly into the oil tank 18, springs 19 normally opposing this movement and keeping the table 16 above the level of the oil.

Supported on table 16 is a mandrel 22 which in the form shown comprises a semi-elliptic leaf spring, this mandrel being supported at its center by member 23 and having its ends pivotally connected to vertical threaded bolts 24 which extend downwardly through slots in the table 16 and are provided with adjusting nuts 25. By adjusting the ends of the spring mandrel its configuration may be changed and if the loads imposed upon the ends by bolts 24 are equal, the curvature of the mandrel will always be along the circumference of a true circle. By merely adjusting bolts 24 therefore the mandrel may be caused to assume curves of different radii and it is unnecessary to check the position of the mandrel at any points between its center and ends, since it always is truly circular. If the mandrel were rigidly held at its center, as shown in Fig. 8, unequal loads may be applied to its ends so that the radius of curvature on one side of the support is different from that on the other, and in fact the two sides may be reversely curved.

In operation, a heated straight leaf 26 is placed on top of the mandrel as shown in Fig. 1, guides 27 being provided to assist in positioning the work, and fluid introduced into the fluid pressure cylinder to cause the head 13 with its flexible pressure band 15 to descend and forcibly curve the spring leaf 26 to conform to the shape of the mandrel, the band 15 curving until it lies parallel to the mandrel. When the heated leaf has been given the desired curvature the movement of the piston is continued, to force the mandrel, work, and flexible member 15 beneath the surface of the oil to quench the leaf while forcibly held to the proper degree of curvature. After being held in the oil a sufficient length of time, the piston is lifted and the work removed, after which the cycle may be repeated with a new spring leaf.

Instead of the mandrel shown in Fig. 1 the cantilever mandrel illustrated diagrammatically in Fig. 6 may be utilized, or the mandrels illustrated diagrammatically in Figs. 2, 3 and 4, these diagrams illustrating various types of simple beams of uniform strength.

It will be obvious to one skilled in the art that the invention may be embodied in still other forms and that the design and arrangement of parts may be changed without departing therefrom.

Throughout the specification and claims the word "load" is used to designate the force applied to the mandrel to effect the adjustment thereof. The mandrel may be loaded in various ways to effect the desired adjustments, as will be evident.

What is claimed is:

1. A bending machine including in combination, a flexible mandrel, spaced supporting elements for the mandrel, said elements being relatively adjustable so that the mandrel may be flexed to different degrees of curvature, the mandrel so diminishing in cross section from one supporting element toward the adjacent element that the portion thereof between said supports automatically assumes a circular curve for all adjustments of the supporting means.

2. A bending machine including in combination, a flexible mandrel, spaced supporting elements for said mandrel one of said elements being stationary and an other adjustable relatively thereto so that the mandrel may be flexed to different degrees of curvature, the mandrel so diminishing in cross section from one supporting element toward the other element that the portion thereof between said supports automatically assumes a circular curve for all adjustments of the supporting means.

3. A bending machine including in combination, an elongated flexible mandrel, three supporting elements engaging said mandrel at different points along its length one or more of said elments being adjustable so that the mandrel may be flexed to different degrees of curvature, the mandrel so diminishing in cross section from the intermediate element toward each of the outer supporting elements that each portion thereof between the intermediate element and an outer supporting element automatically assumes a circular curve for all relative adjustments of said intermediate and outer elements.

4. A bending machine including in combination, an elongated flexible mandrel, supporting means for said mandrel including three supporting elements one of said elements rigidly supporting the mandrel at its middle and the other elements connected to the ends of the mandrel respectively and being adjustable relatively to the intermediate support, and said mandrel so diminishing in cross section from said stationary central support to each of said adjustable supports that the mandrel automatically assumes a circular curve for all adjustments of the supporting means.

In testimony whereof I hereunto affix my signature.

JOHN WALLACE TAYLOR.