

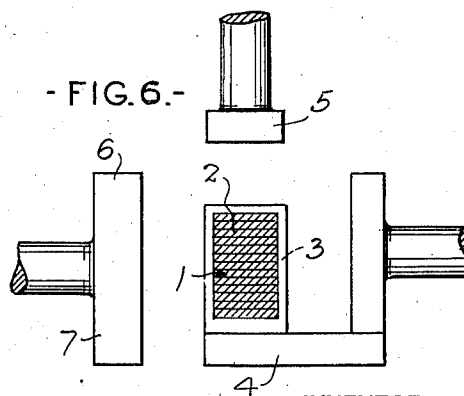
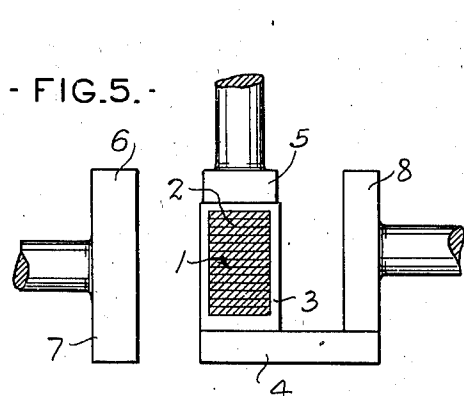
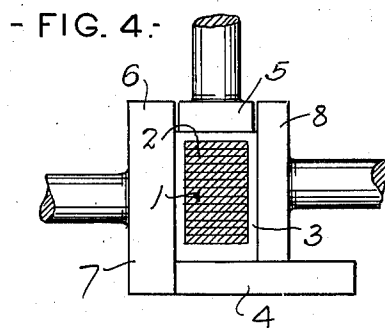
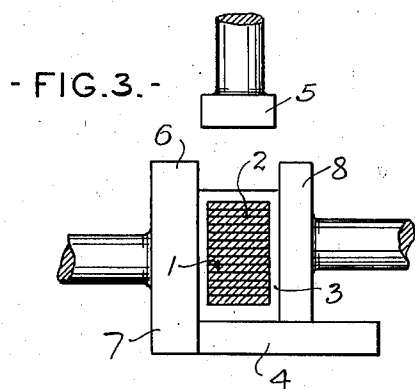
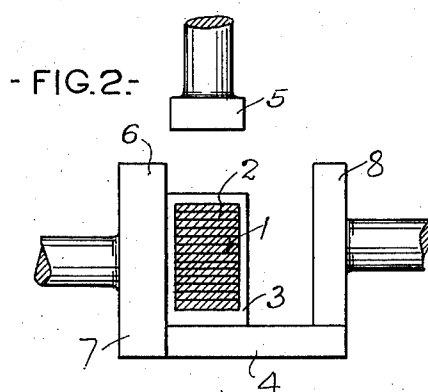
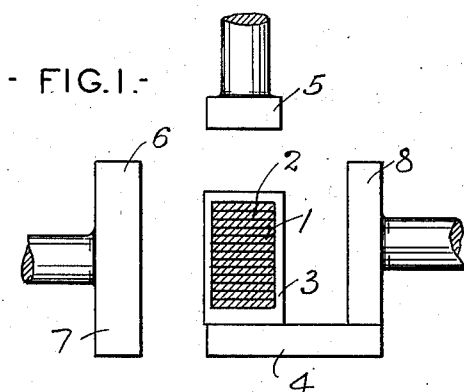
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MANUFACTURE OF LEAF SPRINGS

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MANUFACTURE OF LEAF SPRINGS

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This invention relates to the manufacture of leaf springs of the type comprising a set of superimposed spring plates held together by an embracing band, and has for its object the devising of a comparatively simple method for expediting the manufacture of such springs requiring comparatively simple apparatus for carrying out the method.

The accompanying drawing shows diagrammatically parts of an apparatus of simple construction involving dies for carrying out the method of the present invention, the several views showing the dies in various relative positions appropriate for the carrying out of the method, and a spring assemblage shown in transverse cross section supported by the dies.

Figure 1 illustrates appropriate relative positions of the dies when the spring assemblage is first placed in the apparatus; Fig. 2 illustrates other appropriate relative positions of the dies when the spring is first placed in the apparatus or it may illustrate a subsequent appropriate relative position of the dies in the carrying out of the method; Fig. 3 illustrates appropriate relative positions of the dies that may be given them subsequent to the positions shown in Fig. 2; Fig. 4 illustrates appropriate relative positions of the dies that may be given them before the positions thereof illustrated in Fig. 5; Fig. 5 illustrates appropriate relative positions of the dies during cooling of the band; and Fig. 6 illustrates the relative positions of the dies when the band is sufficiently cooled for removal of the assemblage from the apparatus.

Referring to the drawing, the spring assemblage 1 is intended to illustrate that of any type of leaf spring, such as for instance the elliptic leaf spring or semi-elliptic leaf spring employed in railway vehicles, which comprises a set of spring plates, illustrated by the plates 2 (Fig. 6), superimposed one upon the other in the usual manner, and a band 3 which embraces the plates of the set, holding them together in the usual manner, and which in the case of the elliptic and semi-elliptic types is disposed at the longitudinal center of the set of plates.

In the manufacture of springs of the present types an accepted procedure is to stack the plates 2 of the spring, and while temporarily holding them as thus stacked, assembling the band therewith by passing the set of plates through the band until the band assumes its proper position relative thereto. The band is relied upon to hold the plates in place until the assemblage is placed in the dieing or shaping apparatus (hereafter

for convenience termed the dieing apparatus). The band is of the endless type and is heated to a suitable temperature before its assemblage with the set of plates so that it will be sufficiently enlarged (due to expansion) to permit the assemblage with comparative ease, and will be of a temperature high enough to permit reshaping of the band by the dieing apparatus. As thus far considered the method of manufacture is conventional.

The assemblage of plates and heated band is then placed in the dieing apparatus. This may be any appropriate apparatus designed to carry out the steps of the present method, and as it forms no part of the present invention only the dies of such apparatus are shown, the showing of these being merely diagrammatic.

Accordingly the apparatus comprises a stationary die 4, a die 5 disposed above, and in opposed relation to, the die 4, a die 6 disposed at one side of the die 5, and desirably extending at its lower end portion 7 to overlap the end of the die 4 adjacent thereto, and a die 8 disposed at the opposite side of the die 5, in opposed relation to the die 6, and desirably with its lower end adjacent the upper face of the die 4.

The spring assemblage is placed upon the stationary die 4. The other dies are movable to and from the assemblage, their movements being controlled in order that the dies may be given independent backward and forward movements relative to the assemblage. Any desired means for controlling such movements and the pressures exerted by the dies to effect various of the subsequent steps of the method of the present invention may be employed.

The assemblage of the plates and heated band presents a loose construction which is not adequately corrected by the mere contraction of the cooled band without the aid of the pressure dies. There will not be sufficient compactness of the plates to insure them against creeping in a longitudinal direction relative to the band and to each other which would render the spring practically useless.

Mass production is an essential factor to profitable manufacture of springs, and, to save time, the spring is made up from plates quickly shaped, with the result that they often do not accurately fit one upon another, and there is therefore often more or less space between the plates in the locality of the band. In view of this it is an object of banding methods to force the plates forming the set tightly together, which is generally effected by pressing upon the sides of the

band adjacent the outer plates with pressure dies so that the plates will be tightly compacted. Great force is required to so compact the set of plates, and the plates of the set accordingly exert a considerable reacting force tending to stretch the sides of the band adjacent the edges of the plates, the effect of which must be counteracted during the manufacture of the spring while these sides of the band are in a highly heated state.

When the plates are compacted the sides of the band adjacent the edges of the plates will be too long and they are accordingly reformed to suitably shorten them. In prior practices the four sides of the band are held between the four pressing dies until the sides of the band adjacent the edges of the plates are sufficiently cooled to withstand the aforesaid force exerted by the plates tending to stretch them. This is objectionable for various reasons. The cooling of the sides of the band adjacent the edges of the plates, by such prior practices, is retarded and the adjacent portions of the plates become heated by the band often to an extent which deleteriously affects the quality of the plates, and furthermore this heating of the plates reduces the temperature differential between the plates and the sides of the band adjacent the edge thereof so that the contractive effect of these sides of the band to hold the plates together to the highest degree of compactness is lessened.

Furthermore these prior practices of maintaining the four dies about the four sides of the band, which results in materially retarding the cooling of the band, requires the assemblage to be left in the apparatus for an excessive length of time, thereby greatly reducing the output of the apparatus, high output being a factor of prime importance, as already stated.

It is also old practice to remove the assemblage from the apparatus before the band has sufficiently cooled to give it the required resisting strength. But in such cases the plates are held in their compacted state by temporary appliances which grip the outer plates beyond the band. This requires too expensive apparatus to render the practice practical, and moreover far too much time is spent in applying the gripping appliances, which is done after the heated band has been assembled with the plates, and before the assemblage is placed in the dieing apparatus which is specially constructed for receiving the gripping appliances. Also much time is lost in removing the gripping appliances from the assemblage after it has been removed from the apparatus. Furthermore, in such cases, the band, not being in contact with the appliances, is entirely free when the assemblage has been removed from the apparatus, and therefore the portions of the plates which are held by the band are, to some extent, free to react, that is to say to open up slightly or spread apart, thereby exerting a stretching force upon the sides of the band adjacent to the edges of the plates at these portions, which sides are then at a high temperature, so that there is not a maximum compacting of the plates by the band when the band cools, which correspondingly lessens the ability of the band to hold the plates against relative slipping longitudinal movement when in service.

Referring now more particularly to the present novel method, the assemblage, comprising the set of superimposed plates 2 and the heated band 3, is placed on the stationary die 4, the dies 5 and

8 being first moved backward out of the way, as shown in Figs. 1 and 2, and the die 6 moved backward, as shown in Fig. 1, or moved to its position shown in Fig. 2, as desired. This die 6 is made movable to adapt the apparatus for the practicing of the present method and should be held in the position shown in Fig. 2, with a pressure behind it, to prevent its being moved backward, preferably of considerably greater magnitude than the pressure exerted by the die 8. The die 6, in its position as shown in Fig. 2, abuts, at its lower portion 7, the adjacent end of the stationary die 4, and, for illustrative purposes, the pressure resisting the movement of the die 6 backwards may be a hydraulic pressure say of 100 tons, which only acts to prevent the die 6 from moving backward, whereas the pressure operating the die 8 may be say 60 tons, which is exerted against the side of the band adjacent thereto, to press the band and included portions of the plates against the die 6, the die 8, at its lower end, preferably riding on the top of the adjacent portion of the stationary die 4 so that the pressure of the die 8 upon the band may be selectively applied and released in the desired manner that best practice will dictate during the reshaping of the band.

The die 5 operates similar to the die 8, but preferably under a higher pressure, say 100 tons, and, similar to the die 8, the die 5 may be manipulated so that the manipulation of the dies 5 and 8 will result in reshaping the band to tightly fit about the set of plates when suitably compacted, the die 5 at that time holding the plates in such compacted condition.

Figs. 3 and 4 show the die 8 in engagement with the side of the band adjacent thereto. Fig. 3 shows the die 5 separated from the side of the band adjacent thereto, and Fig. 4 shows this die 5 engaging the side of the band adjacent thereto, it being understood however that the dies 5 and 8 may be manipulated as aforesaid in any desired manner to effect the aforesaid reshaping of the band and compacting of the plates.

Assuming Fig. 4 to show the plates so compacted and the band so reshaped, the next step is to move the dies 6 and 8 away from their adjacent sides of the band, as shown in Fig. 5, while the die 5 still exerts the required pressure upon the side of the band adjacent thereto, the band and plates being then compactly held between the dies 4 and 5.

It will of course be understood that as soon as the band is reshaped, as shown in Fig. 4, the dies 6 and 8 are moved backward to expedite the method and also to minimize the transmission of heat from the adjacent sides of the band to the edges of the plates.

In the position shown in Fig. 5 the sides of the band adjacent the dies 6 and 8 are still too hot to entirely resist the stretching force that would be applied thereto by the expansive force of the compacted set of plates were the pressure from the die 5 removed. Therefore this pressure is maintained, and the exposed sides of the band are immediately subjected to the cooling action of jets of a cooling fluid which is applied to the exposed sides. The fluid may be either a gas or liquid, but is preferably a liquid such as water or oil, or a mixture of these, which is preferably ejected upon the exposed band surfaces from nozzles. The cooling liquid is thus flowed over these sides of the band until

the temperature of the sides is reduced to the desired extent.

It requires a comparatively short time to reduce the temperature of the exposed sides of the band to the required extent to give them sufficient strength to withstand the aforesaid stretching force of the set of plates. The die 5, when this temperature has been attained, is moved from the assemblage, as shown in Fig. 6, and the assemblage is then removed from the apparatus, the spring being finished as far as the assemblage comprising the plates and band is concerned.

It will thus be obvious that the spring assemblage is in the apparatus for a short period of time in comparison to the period required in former comparable methods, and therefore in mass production there is a material saving of time in the manufacture of the springs, and moreover the method results in providing a band that tightly holds the plates of the spring together, preventing any longitudinal slipping of the plates when the spring is in service.

The invention claimed and desired to be secured by Letters Patent is:

1. In the manufacture of leaf springs of the type comprising a set of superimposed spring plates held together by an embracing band, the method which consists in heating said band; assembling said heated band and said set of plates; subjecting the four sides of said heated band of said assemblage to the action of pressure dies for pressing said plates tightly together to compact them and for shaping said band to tightly embrace said set of compacted plates; thereafter removing the dies from the opposed sides of said heated band adjacent the edges of said plates while maintaining die pressure on the other two

sides of said heated band sufficient to hold said plates compacted; subjecting said opposed sides of said heated band to the cooling action of a flow of cooling fluid, while continuing said holding die pressure, until said opposed sides are sufficiently strengthened by cooling to resist the stretching force thereupon of said compacted plates; and thereafter removing said assemblage from said dies.

2. In the manufacture of leaf springs of the type comprising a set of superimposed spring plates held together by an embracing band, the method which consists in heating said band; assembling said heated band and said set of plates; subjecting the four sides of said heated band of said assemblage to the pressing action of pairs of pressure dies, said band, during said pressing action, being supported at adjacent sides by a die of each pair of dies while subjected upon its other sides to the manipulated pressing action of the other two dies selectively applied until said plates are tightly pressed together to compact them and said band is shaped to tightly embrace said set of compacted plates; thereafter removing the dies from the opposed sides of said heated band adjacent the edges of said plates while maintaining die pressure on the other two sides of said heated band sufficient to hold said plates compacted; subjecting said opposed sides of said heated band to the cooling action of a flow of cooling fluid, while continuing said holding die pressure, until said opposed sides are sufficiently strengthened by cooling to resist the stretching force thereupon of said compacted plates; and thereafter removing said assemblage from said dies.

THEODORE R. WEBER.