April 29, 1941. J. M. CHRISTMAN 2,240,090

APPARATUS FOR WORKING SHEET METAL BLANKS

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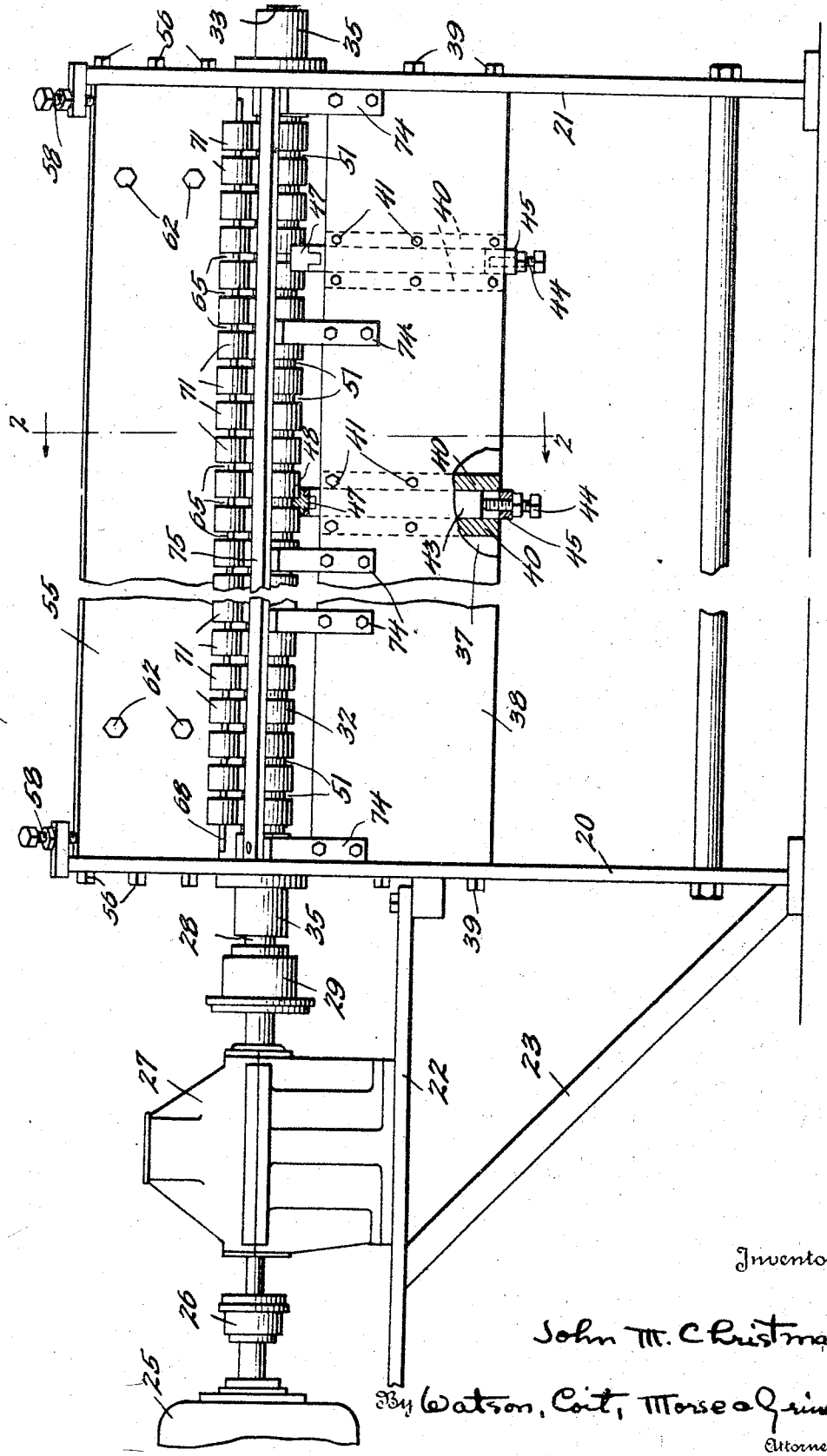


FIG. 1.

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APPARATUS FOR WORKING SHEET METAL BLANKS

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FIG. 2.

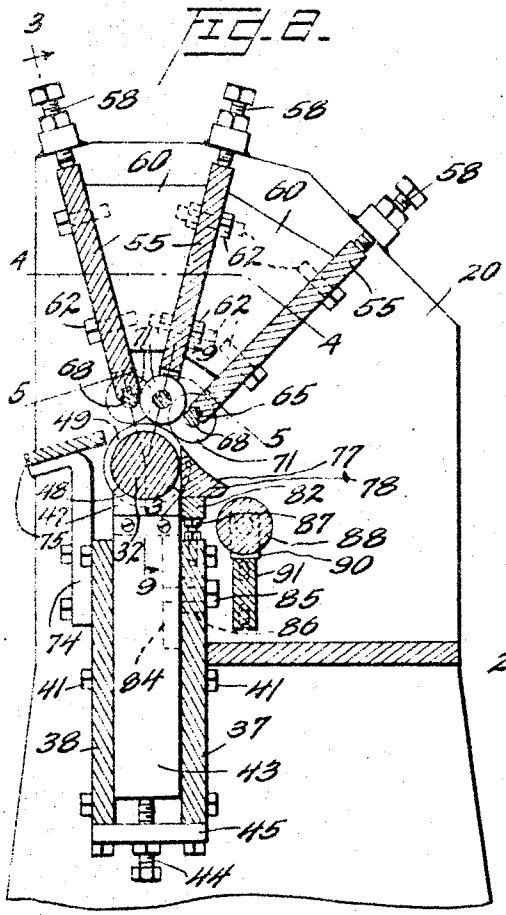


FIG. 3.

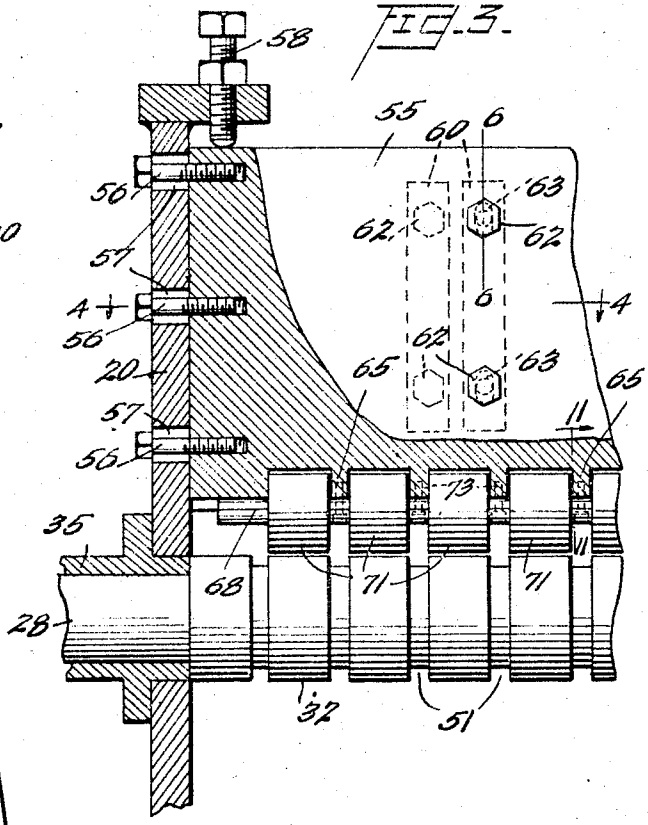


FIG. 4.

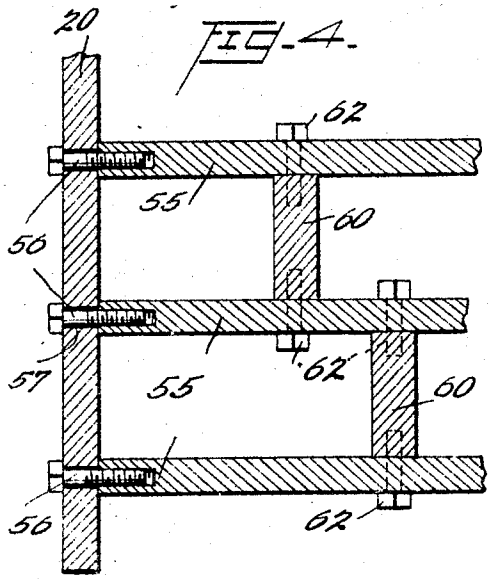
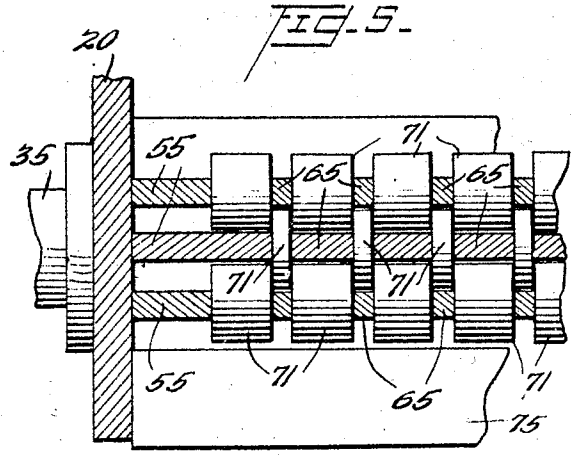


FIG. 5.



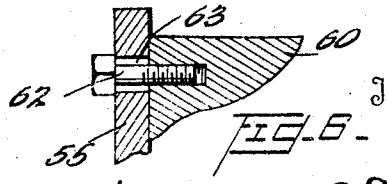


FIG. 6.

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APPARATUS FOR WORKING SHEET METAL BLANKS

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FIG. 7.

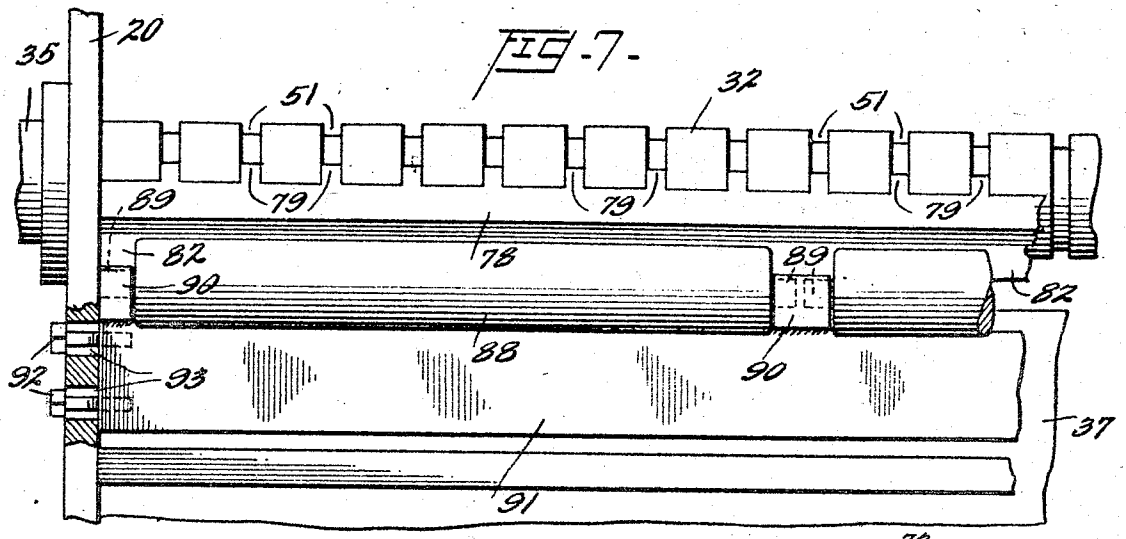


FIG. 8.

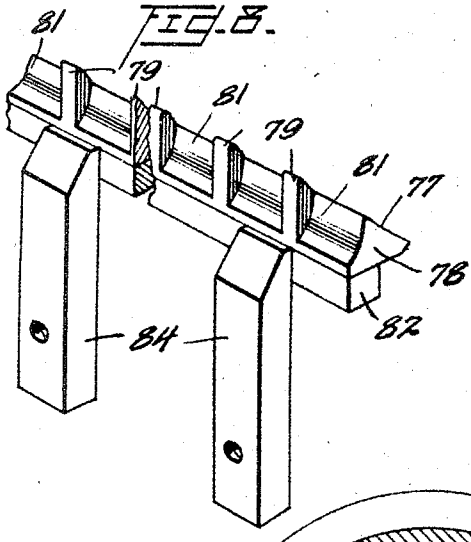


FIG. 9.

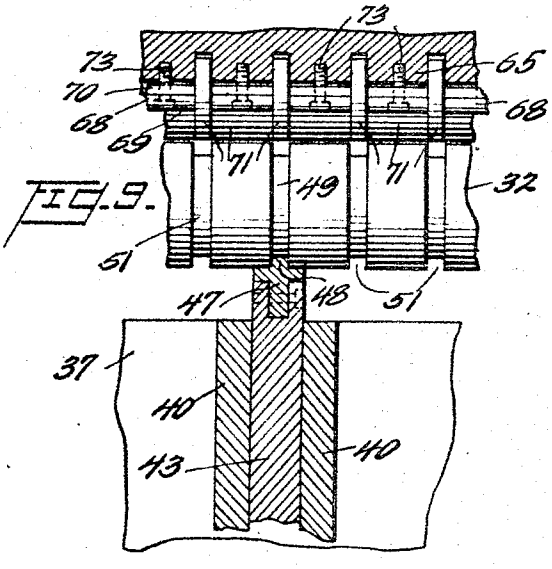


FIG. 10.

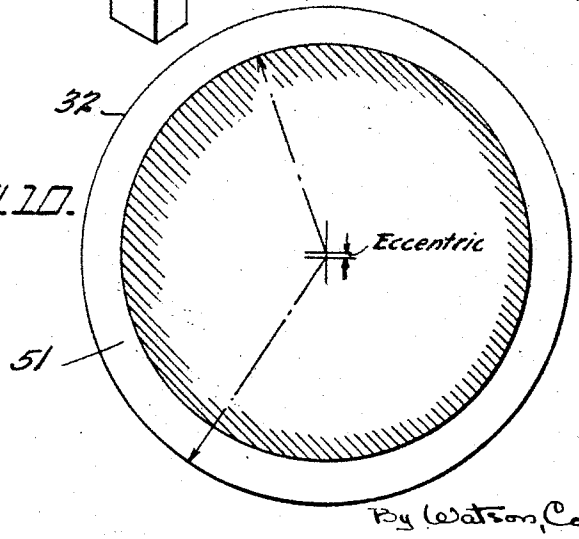
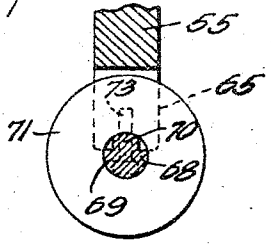


FIG. 11.



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APPARATUS FOR WORKING SHEET METAL BLANKS

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FIG. 12.

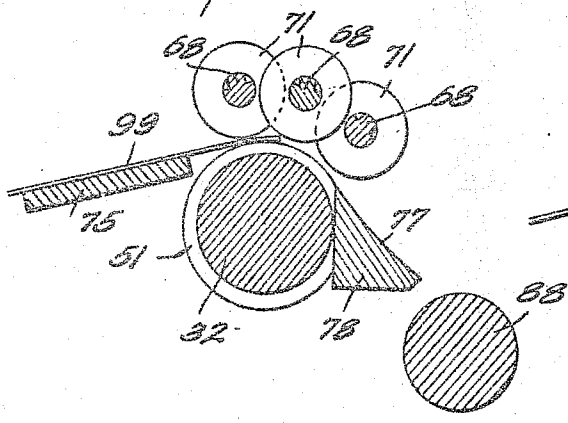


FIG. 13.

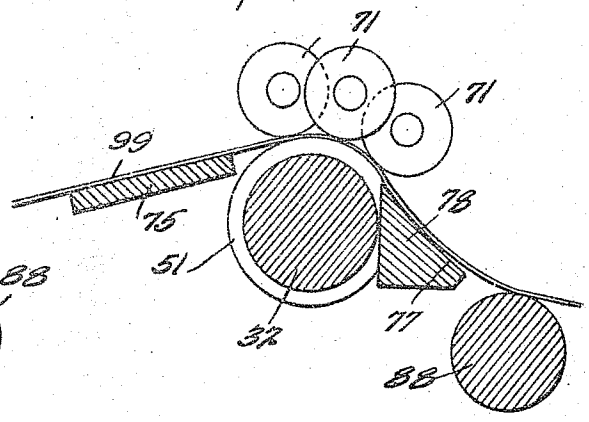


FIG. 14.

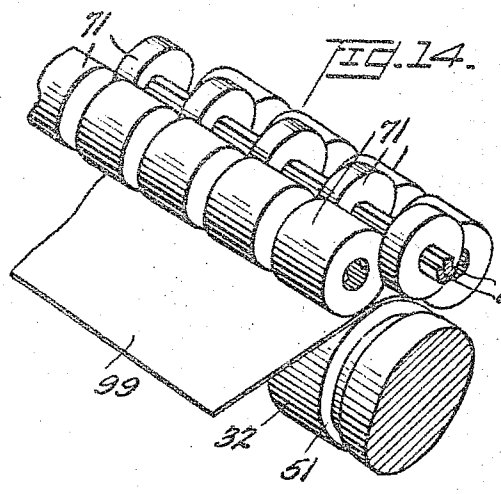


FIG. 15.

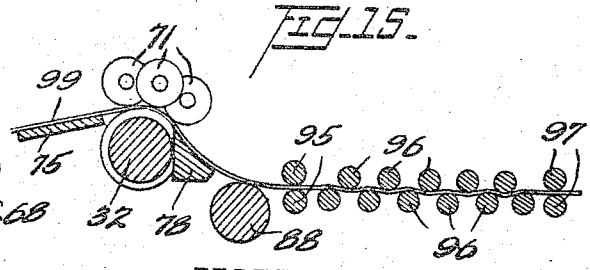


FIG. 16.

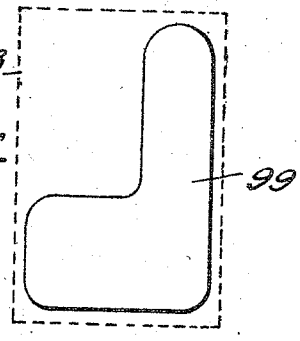
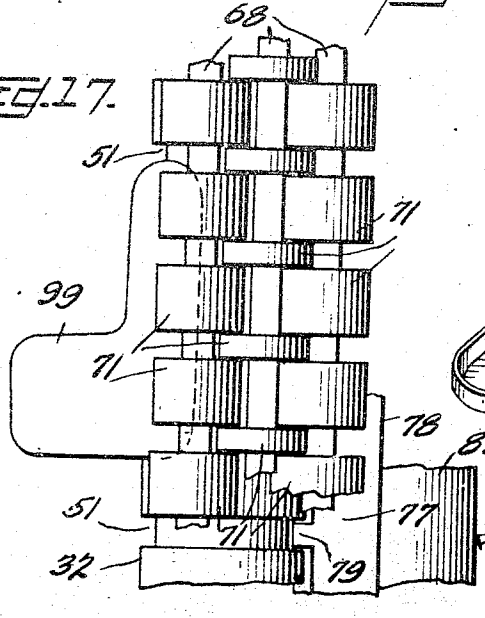


FIG. 17.



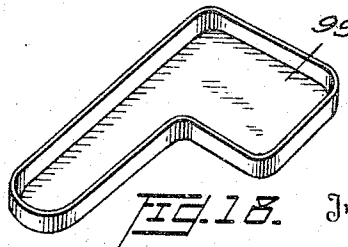


FIG. 18.

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Patented Apr. 29, 1941

2,240,090

UNITED STATES PATENT OFFICE

2,240,090

APPARATUS FOR WORKING SHEET METAL BLANKS

John M. Christman, Detroit, Mich., assignor to Packard Motor Car Company, Detroit, Mich., a corporation of Michigan

Application October 23, 1935, Serial No. 46,385

13 Claims. (Cl. 153—54)

This invention relates to the treatment of sheet metal to alter the characteristics thereof for the purpose of facilitating the forming and pressing of the metal into various shapes, and it is the principal object of the invention to provide a method and apparatus by means of which the metal may be effectively and rapidly treated with this end in view.

It has been found that sheet metal frequently becomes rough or its surface wrinkles when subjected to a die drawing or forming operation, and it is believed that the difficulty is due to peculiarities in the grain structure of the metal. Regardless of its exact nature or cause, the difficulty is appreciated in the industry, the die drawing operation being said to produce what are commonly referred to as "stretcher strains" as the result of the stretching to which the metal is subjected.

It has long been known that a sheet of metal that has been curled and then uncurled can be stretched without apparent development of roughness, provided curling to a sufficient degree is effected. It has also been known that these stretcher strains could be partially or wholly prevented by working the sheet metal shortly before the pressing or drawing operation, and a machine known as a "leveling machine" has long been in use for thus working the metal. Such a machine consists of a plurality of rolls, the rolls being arranged in two sets with the axes of the rolls in one set disposed in a plane parallel to a plane containing the axes of the rolls of the other set. The rolls in one set are arranged in staggered relation with the rolls in the other, and the planes defined by the axes of the rolls in the two sets are spaced a distance less than a roll diameter, so that the metal passing between the sets of rolls is slightly flexed first in one direction and then in the other. This machine, however, had its limitation in that the sets of rolls could be brought together only as close as would permit the end of the blank to feed from one roll to another, and for some pressing or drawing operations on sheet metal this was not sufficient.

Later, a greater degree of flexing was provided by adding a bending roll to the leveling machine above referred to, and with this machine the sheet was first fed between two of the leveling rolls and then the bending roll was bodily moved to bent the sheet around the first of the leveling rolls to approximately ninety degrees. Thereafter, the sheet was fed through and was thus subjected to a ninety-degree bend and to the action of the leveling rolls to flatten it out, so that it could then be cut and die pressed. Obviously, with this machine, a considerable portion of the blank adjacent the leading edge would have no treatment except that afforded by the leveling rolls, because it was necessary to extend that leading edge into the leveling rolls before the bending roll could become effective. Hence this untreated portion of the blank was either cut off as waste or not used in the die pressing operation.

It will be appreciated, therefore, that in this prior art machine the blank could not be cut to final shape before the bending or working operation, as in that event only part of the blank would be subjected to the bending operation. So the leveling rolls were a necessary part of the machine, these rolls bringing the blank back to a flattened condition so that it could be subsequently fed to the cutting die.

It is proposed as part of the present invention to effect progressive flexure of an entire blank including the leading edge and it will thus be appreciated that the blank may, if desired, be cut to final form before treatment, all portions of the cut blank being similarly and properly flexed and ready for the pressing or stamping operation. While metal blanks which are ready for pressing or stamping should not exhibit any very pronounced curvature, it is of course much less essential that the blank be quite flat before pressing into final form than before the cutting operation and it is thus unnecessary to take the same precautions to completely flatten the blank when the latter is cut before flexure. Accordingly the leveling operation may be dispensed with if desired and the curvature of the blank reduced less completely and by the use of simpler mechanism.

With this end in view the present invention contemplates the provision of a machine having means formed with a curved surface against which the metal is forced into substantial conformity, and further means for applying pressure to the metal in the reverse direction to effect substantial reduction of the curvature of the metal thus established. In the preferred embodiment of the invention a roll having a generally cylindrical peripheral surface is employed, the metal being passed over this roll and pressed into contact with the surface thereof over a substantial portion of the roll circumference, and guide means are disposed adjacent the roll for engagement with the concave side of the deformed metal to press the latter in the reverse

direction. Thus after the metal has been passed over the roll and the guide means it has been substantially flexed or rolled and again unrolled, and while the treated metal sheet may appear unchanged externally, the necessary alteration of the grain structure has been effected and expensive finishing operations which might otherwise be necessary after the metal is pressed into final form are avoided.

The invention is particularly applicable to the treatment of sheet metal blanks which are commonly used in the formation of panel structures employed in the bodies of motor vehicles, such panel structures being ordinarily formed by die stamping operations. It is of course essential in such structures that the outer surface be entirely smooth and that any strains due to stretching of the metal during the die stamping operation, commonly referred to as stretcher strains, be avoided. The process and apparatus outlined herein have been found quite effective in this field.

More specifically it is an object of the invention to provide apparatus comprising an elongated roll, referred to for convenience hereinafter as the master roll, having a generally cylindrical surface and a plurality of elongated rollers of lesser diameters disposed generally in parallelism with the master roll and in close proximity thereto for guiding a sheet metal blank about the master roll, the metal being passed between the master roll and the smaller rollers and being maintained by the latter in contact with the surface of the master roll over a considerable part of the circumference thereof. Stationary guide means, located adjacent the point at which the blank leaves the smaller rollers, serves to engage the blank and deflect or strip it from the master roll, applying pressure in the reverse direction so as to partly or wholly eliminate the curvature of the blank. Preferably the curved periphery of the master roll is slightly eccentric to the point of support of the roll, whereby feeding of the blanks between the rollers and the master roll and about the latter is facilitated.

It is of course not essential to the satisfactory practice of the invention outlined herein that the blank be cut to final form before flexure and it is thus sometimes desirable to employ conventional leveling means or other devices which will deliver the blank in substantially flat condition after the flexing operation. The use of such devices in combination with the preferred form of blank flexing apparatus disclosed herein is therefore contemplated.

Further objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which

Figure 1 is a rear elevation of a machine capable of effecting the hereinbefore described treatment of sheet metal blanks and embodying the principles of the present invention;

Figure 2 is a transverse vertical sectional view taken substantially on the line 2—2 of Figure 1;

Figure 3 is a partial vertical sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a section on the line 4—4 of Figure 3;

Figure 5 is a section on the line 5—5 of Figure 2;

Figure 6 is a fragmentary section on the line 6—6 of Figure 3;

Figure 7 is a partial rear elevation with certain portions of the machine removed;

Figure 8 is a perspective view of a guide element shown in Figure 2;

Figure 9 is a section on the line 9—9 of Figure 2;

Figure 10 is a transverse section through the master roll showing the eccentricity of the peripheral surface thereof;

Figure 11 is a fragmentary section on the line 11—11 of Figure 3;

Figures 12 and 13 are sectional views corresponding to a portion of Figure 2 and illustrating diagrammatically the manner in which flexure and unrolling of a metal blank may be effected;

Figure 14 is a perspective view of a portion of the structure shown in Figures 12 and 13;

Figure 15 is a transverse sectional view corresponding to Figures 12 and 13 and illustrating a modified form of the invention employing leveling rollers; and

Figures 16, 17, and 18 are views illustrating the successive steps of cutting, flexing and pressing the metal blank.

In the following description of the embodiments of the invention illustrated in the accompanying drawings, specific language is employed. It will nevertheless be appreciated that other embodiments of the invention constructed in accordance with the principles outlined herein are contemplated and that no limitation of the scope of the invention is intended other than as defined in the appended claims.

Referring specifically to the drawings, it will be observed that Figure 1 indicates the general arrangement of the machine, the frame on which the active elements of the machine are supported including end walls **20** and **21**, which may be braced in any convenient manner and which are rigidly secured together by other parts of the machine as hereinafter described, and a generally horizontal plate **22** secured to the end wall **20** and suitably braced by a member **23**, the plate **22** carrying the driving mechanism for the machine. This driving mechanism may comprise a motor **25**, the shaft of which is connected through a shaft coupling **26** with reducing gearing enclosed within a housing **27**. The gearing within the housing **27** may be of any conventional design and serves to drive a shaft **28** through a second rotary coupling **29**, the shaft **28** being constituted by a reduced end portion of a master roll **32**. The shaft **28** and the opposite reduced end portion **33** of the master roll are supported in bearings **35** which are bolted or otherwise secured to the end walls **20** and **21** respectively of the supporting frame structure. In this manner the master roll **32** is positively rotated during operation of the machine.

For the purpose of treating blanks such as are commonly employed in the formation of motor vehicle body panels, a master roll of very considerable length is required, for instance of the order of eight or nine feet, and it is important to ensure that the roll shall not be deflected between the end bearings. It is therefore preferred to support the master roll intermediate the ends thereof and for this purpose a plurality of roll engaging bearings are provided, these bearings being arranged at spaced intervals along the length of the roll, preferably at intervals of less than two feet. Thus spaced plates **37** and **38** may extend between and be secured to the end walls **20** and **21** of the supporting frame as indicated at **39**, and guide members **40** which are arranged in pairs at spaced intervals in the length of the plates **37** and **38** extend therebetween and

are bolted to the plates as indicated at 41, each pair of guide members thus forming with the plates 37 and 38 a generally rectangular guide passage within which is received a corresponding bearing supporting member 43. The bearing supporting members 43 are individually adjustable within the guide passages in a vertical direction by means of elements 44, at least one of these elements being arranged beneath each of the members 43 and being threaded within a plate 45, the latter being bolted to the transversely extending plates 37 and 38 as shown more particularly in Figure 2. To the upper end of each member 43 is secured a bearing element 47, each bearing element having a tongue portion 48 at the upper end thereof for engagement in a bearing groove 49 formed in the master roll 32, the bases of the grooves 49 being of course concentric with the axes of the end bearings 35 for the master roll. By proper manipulation of the elements 44 the bearing elements 47 may be correctly positioned to support the master roll.

As hereinbefore stated, the periphery of the master roll 32 is eccentric to the axis of the roll, the extent of eccentricity being fairly small for instance of the order of seven thousandths of an inch in a roll having a peripheral diameter of three and one-half inches. The master roll is provided at spaced intervals over its entire length with grooves 51 similar to the bearing grooves 49 but not necessarily engaged by a bearing element, the purpose of these additional grooves being hereinafter explained.

A plurality of transversely extending plates 55, three being shown in Figure 2 of the drawings, are disposed above the master roll and are arranged in generally radial relation to the axis of the latter, the plates 55 extending between the end walls 20 and 21 of the support and being secured thereto, for instance by means of bolts 56 which are threaded into the plates 55 and which extend through slightly elongated slots 57 in the end walls 20 and 21, the plates 55 being thereby adjustable toward or away from the master roll, adjustment toward the roll of each plate 55 being effected independently of the remaining plates of the series by means of set screws 58 carried by the end walls 20 and 21 and engaging the upper edges of the plates 55 at each end thereof. The plates 55 are further maintained in the proper spaced relation to each other and to the master roll by elements 60 of generally triangular shape, each element 60 being secured at its opposite side to the adjacent plates 55 by means of bolts 62 threaded into the element and extending through slots 63 in the plates 55, whereby after radial adjustment of the plates 55, the elements 60 may be properly positioned to engage and brace the plates.

Each plate 55 is formed at its lower end with a plurality of downwardly projecting slotted tongues 65, these tongues being preferably uniformly spaced in the direction of the length of the plates. Associated with each plate 55 is a rod 68, these rods being disposed approximately in parallelism with each other and with the axis of the master roll 32. Each of the rods 68 is provided with a cylindrical peripheral portion 69 which is cut away at the upper side to afford a tongue 70, the latter being dimensioned for reception in the slotted portion of the tongues 65 formed on the associated plate 55. Each rod is further secured to the associated plate by means of set screws 73 passing through the rod and threaded into the tongues 65 of the associated plate 55.

A plurality of rollers 71 are rotatably mounted on each of the rods 68, the rollers being disposed on each rod intermediate the cooperating tongues 65 on the corresponding plate 55. As shown more particularly in Figures 2 and 5, the the series of rollers 71 associated with the intermediate plate 55 are dimensioned and positioned so as to extend between and to overlap the rollers associated with the outer plates 55, the rods 68 being preferably disposed as closely together as is possible. For convenience the rollers 71 of each series may be collectively referred to as a roll, it being understood that for some purposes the preferred overlapping arrangement of the rollers may not be required, the individual rollers of each series being replaced by a single elongated cylindrical roller.

By means of the construction thus far described, it will be appreciated that the rollers 71 of each series may be adjusted toward or away from the master roll 32 by corresponding separate adjustment of the plates 55 on which the rollers are carried, the spacing between the rollers 71 and the master roll 32 being preferably just sufficient to permit the passage therebetween of a sheet metal blank, this adjustment also permitting delicate control of the pressure to be applied to the blank during such passage. Since the rods 68 are disposed in rather close proximity to each other, the blank engaging portions of the peripheries of the rollers 71 in each of the three series of rollers are closely adjacent so that a leading edge of the blank on passing between the first of the series of rollers 71 and the master roll is not likely to jam against the rollers of the second series but will engage the lower portion of the peripheries of the rollers in each series and will thus be forced to conform closely to the periphery of the master roll 32. Feeding of the blank over the master roll is facilitated by the eccentric nature of the peripheral surface of the latter, that portion of the surface of the master roll of less radius permitting the blank to enter more freely and enabling the leading edge of the blank to more readily flex about the roll.

Guide means are provided for the leading edge of the blank as it is fed between the rollers 71 and the master roll, this guide means comprising brackets 74 which are secured to the transversely extending plate 38, a guide plate 75 being in turn secured to the upper portion of the brackets.

As the curved blank emerges from between the rollers 71 and the master roll 32, it is engaged by means which strips it from the master roll and unrolls or reduces the curvature of the blank. The means for stripping the blank from the master roll is shown more particularly in Figures 2 and 8 and comprises an elongated bar 78 which may be generally triangular in cross-section and which is provided with laterally directed tongues 79 which are spaced in the direction of the length of the bar and which are arranged for reception in the grooves 49 and 51 of the master roll. Intermediate the tongues 79 the bar 78 is provided with generally rounded surfaces 81 which conform generally to the contour of the outer peripheral surface of the master roll 32 and is provided at its rearwardly directed side with a slightly curved guide surface 77 for engagement with the stripped blank, this guide surface forming an extension of the adjacent rearwardly directed faces of the tongues 79. The bar 78 may be welded or otherwise secured to an elongated rod

82 which is in turn similarly secured to a plurality of generally vertically disposed supporting elements 84, each of the supporting elements being secured to the plate 37 by means of a bolt 85 which extends through an elongated slot 86 in the plate 37 and is threaded into the element 84. Vertical adjustment of the elements 84 and the bar 78 may be effected by loosening the bolts 85, adjustment being facilitated by means of a plurality of threaded elements 87 which engage the lower side of the rod 82 and are threaded into the upper edge of the plate 37. The bar 78 may thereby be accurately positioned with respect to the master roll 32 to strip the blank from the roll, this stripping of the blank obviously applying pressure to the concave lower face thereof and tending to restore the blank to its original flattened condition. To further flatten the blank one or more rollers may be supported at the rear of the bar 78, a plurality of rollers numbered 88 being shown more particularly in Figure 7 of the drawings in end to end relation, these rollers being supported by engagement with the reduced end portions 89 thereof of a plurality of bearing members 90 which are suitably slotted to receive the same, the bearing members 90 being formed integrally with or welded to a plate 91 which extends transversely of the supporting frame and is secured to the end walls 20 and 21 thereof by means of bolts 92, the latter passing through slots 93 in the respective end walls to permit of vertical adjustment of the plate 91 and the rollers 88. If it is desired to more completely unroll the blank it will ordinarily be necessary to elevate the rollers to a position slightly above the plane defined by the guiding surface 77 of the bar 78, the blank being usually somewhat resilient and requiring considerable bending in order that permanent deformation may result.

It will be observed from the foregoing that a metal blank which is fed across the guide plate 76 is drawn between the rollers 81 and the master roll 32 by rotation of the latter, being caused to conform closely to the peripheral contour of the master roll 32 by means of the close proximity of the rollers 71 of the several series. The spacing between the first and the last series of rollers 71 must be sufficient to ensure that the blank actually conforms to the periphery of the master roll; the rollers 71 of the intermediate series obviously function principally to guide the leading edge of the blank from the rollers of the first series to the rollers of the final series and to prevent jamming of the leading edge of the blank.

Figures 12 and 13 illustrate more particularly the manner in which a blank 99 is caused to conform to a considerable portion of the master roll periphery. Thus as shown in Figure 12, the blank is introduced between the rolls 71 and master roll 32 while the master roll, owing to its eccentric mounting, is in that position in which the maximum clearance is provided for the blank, the eccentricity being exaggerated in this figure to render the mode of operation clearer. By reason of the close spacing between the rollers 71 of the several series the blank 99 is readily flexed, the point of engagement between the blank and the intermediate series of rollers being approximately as shown in this figure. In Figure 13 the blank is shown after passing about the master roll 32 and over the guide bar 78 and guide rollers 88, the leading edge of the blank having been substantially flexed and again unrolled.

The employment of a greater number of series of rollers 71 is of course contemplated, but it will be appreciated that it is only necessary to engage the blank with the master roll at two points which are spaced about the periphery thereof to a considerable extent and to ensure that the leading edge of the blank will be properly guided between these two points. Thus three series of rollers 71 are ordinarily all that is required for satisfactory operation and under some circumstances only two series of rollers will suffice, in which event the rollers in each series will engage the master roll at points spaced circumferentially of the latter to an extent sufficient to ensure that the blank will conform to the master roll. By the overlapping of the rollers of the two series as hereinbefore described, the proper guiding of the blank may be ensured.

Figure 15 illustrates a modification of the invention which may be resorted to where complete flattening of the blank after flexure is desirable. After passing between the master roll 32 and the rolls 71 and over the bar 78 and guide roller 88 the blank is led between a pair of feed rolls 95 and between a plurality of staggered leveling rolls 96, the leveling rolls of the upper and lower series being slightly offset in a vertical direction so as to slightly flex the blank in alternately opposite directions, the blank being delivered from a second set of feed rollers 97 in substantially flat condition. It will be appreciated that in this form of the invention the conventional leveling process is combined with the improved flexing process outlined herein and that other processing steps similar in effect to the leveling step may be substituted for the latter if desired.

Figures 16, 17, and 18 illustrate one method of procedure which can be followed by the use of apparatus such as shown herein whereby the blank is flexed in its entirety as distinguished from the flexing of the major part only of the blank as performed by apparatus heretofore employed. Thus in Figure 16 the flat sheet metal strip 98 as it is received from the mill is cut to form a blank 99 by any conventional means, it being understood that the shape of the blank 99 selected for the purpose of illustration is of no significance. As shown in Figure 17 the blank 99 is fed between the rollers 71 and the master roll 32 in the manner hereinbefore described and emerges in a generally unrolled but not necessarily flat condition. The blank is then pressed or die stamped to the desired and finished form shown in Figure 18, the entire finished article having been subjected to the flexing operation with resultant elimination of stretcher strains and other defects hereinbefore mentioned. This particular succession of process steps can of course be employed only when the entire blank is flexed since any treatment of the blank which does not result in flexure of the leading portion would result in the production of an article of which a portion is likely to prove defective after drawing or stamping.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll, of means for feeding the metal about said roll and maintaining the metal in conformity with a substantial portion of the roll periphery to progressively curve the metal, said means including a pair of rolls cooperating with said master roll and spaced to a substantial extent about the periphery of said master roll,

and means intermediate said pair of rolls for engaging and guiding the leading edge of the metal from one to the other of said pair of rolls, and means for thereafter applying pressure to the metal in the reverse direction to materially reduce the curvature thereof.

2. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll, of means for feeding the metal about said roll and maintaining the metal in conformity with a substantial portion of the roll periphery to progressively curve the metal, said means including a pair of rolls cooperating with said master roll and spaced to a substantial extent about the periphery of said master roll, means intermediate said pair of rolls for engaging and guiding the leading edge of the metal from one to the other of said pairs of rolls, said last named means comprising a third roll having the peripheral portion thereof disposed in overlapping relation with the peripheral portions of the rolls of said first named pair, and means for thereafter applying pressure to the metal in the reverse direction to materially reduce the curvature thereof.

3. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll, of means for feeding the metal about said roll and maintaining the metal in conformity with a substantial portion of the roll periphery to progressively curve the metal, said means including a pair of rolls cooperating with said master roll and spaced to a substantial extent about the periphery of said master roll, means intermediate said pair of rolls for engaging and guiding the leading edge of the metal from one to the other of said pair of rolls, said last named means comprising a third roll having the peripheral portion thereof disposed in overlapping relation with the peripheral portions of the rolls of said first named pair, and means for thereafter applying pressure to the metal in the reverse direction to materially reduce the curvature thereof.

4. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, and a plurality of guide rollers supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, the periphery of said roll being slightly eccentric to the axis of rotation of the roll.

5. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, and a plurality of guide rollers supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion only of the circumference of the roll and for guiding the leading end of the blank into such engagement, said rollers being arranged in a plurality of series with the rollers of each series disposed in generally coaxial relation and staggered with respect to the rolls of the adjacent series, and means for thereafter applying pressure to the metal in the reverse direction to materially reduce the curvature thereof.

6. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, a plurality of guide rollers supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion only of the circumference of the roll and for guiding the leading end of the blank into such engagement, said rollers being arranged in a plurality of series with the rollers of each series disposed in generally coaxial relation and staggered with respect to the rolls of the adjacent series, and means supporting one series of rollers for adjustment generally radially of the roll independently of another series of rollers.

7. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, and a plurality of guide rollers supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion only of the circumference of the roll, said rollers being arranged in a plurality of series with the rollers of each series disposed in generally coaxial relation and with the different series of rollers displaced circumferentially of the master roll, the rollers of one series overlapping with and extending between the rollers of another series to the extent required to guide the leading end of the blank into such engagement, and means for thereafter applying pressure to the metal in the reverse direction to materially reduce the curvature thereof.

8. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, and means supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, the periphery of said roll being slightly eccentric to the axis of rotation of the roll, and means affording bearing supports for the roll adjacent the ends of the roll and at points intermediate the ends of the roll.

9. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, means supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, and means extending within the roll periphery for stripping the blank from the roll and effecting at least a partial unrolling of the blank.

10. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, means supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, and means extending within the roll periphery for stripping the blank from the roll and effecting at least a partial unrolling of the blank, said last named means comprising a stationary member having tongue portions extending toward the roll, said roll being provided with circumferential grooves receiving the said tongue portions.

11. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, means supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, and means extending

within the roll periphery for stripping the blank from the roll and effecting at least a partial unrolling of the blank, and a roller positioned adjacent said last named means for engagement with the discharging blank to effect further unrolling thereof.

12. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, a plurality of guide rollers supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, said rollers being arranged in a plurality of series with the rollers of each series disposed in generally coaxial relation and with the different series of rollers displaced circumferentially of the master roll, a shaft for supporting each series of rollers, and means extending between adjacent rollers in each series and engaging the associated shaft to support the latter.

13. In apparatus for improving sheet metal for subjection to a stamping operation, the combination with a master roll having a generally cylindrical periphery, means for rotating said roll, a plurality of guide rollers supported adjacent said roll for maintaining engagement of a sheet metal blank with the roll periphery over a substantial portion of the circumference of the roll, said rollers being arranged in a plurality of series with the rollers of each series disposed in generally coaxial relation and with the different series of rollers displaced circumferentially of the master roll, a shaft for supporting each series of rollers, and means extending between adjacent rollers in each series and engaging the associated shaft to support the latter, said last named means being adjustable generally radially of the axis of the master roll.

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