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DEVICE FOR FORMING CORRUGATIONS IN METALLIC SHEET OR PLATE

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DEVICE FOR FORMING CORRUGATIONS IN METALLIC SHEET OR PLATE

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This invention relates to a machine for forming sheets of metal into particular shapes or forms and more particularly for shaping metallic sheets of steel, aluminum, and other metals to impart the desired strength and rigidity whereby such formed or shaped sheets may be used for a variety of purposes such as in building construction, roofing, siding for freight cars, etc.

For a number of years it has been well known in the art that metal sheets can be formed and shaped by machines wherein the sheet is fed or drawn through a set or sheets of spaced rotating forming wheels designed to operate simultaneously on opposite faces of the sheet. Thus the forming wheels can be mated in a metal forming machine to form parallel strengthening-beads in the metal sheet as the sheet is processed through the machine in a manner illustrated in the Platan Patent No. 819,644.

The metal sheet can be corrugated by a machine of the general type contemplated by my invention as shown, for example, in the Connor Patent No. 1,491,983, or in a Crafton Patent No. 2,708,958. In such arrangements the sheet of metal being processed can be deformed or shaped in a number of ways depending on the contour design of the mating forming wheels and the spacing of these forming wheels across the width of the sheet of metal.

However, as far as I know, previously devised machines of the general type with which my invention is concerned have operated on the principle that the mating forming wheels are raised and lowered with respect to the two faces of the sheet to be acted upon but that such movement of these forming wheels involves no sideways or transverse movement with respect to these two faces. Thus, the forming or shaping of the metal sheet with previously devised sets of mating forming wheels has heretofore been confined to deformed portions in the sheet which are longitudinally directed along the length of the sheet as the sheet passes through the machine. It was also desired to provide transversely extending deformations in the sheet of metal, a separate and distinct operation was performed.

My invention provides means whereby the positions of the mating forming wheels in the machine may be readily shifted transversely across the width of the sheet being processed simultaneously with the operation of these forming wheels along the length of the sheet. Furthermore, my invention provides means whereby this transverse shifting of the forming wheels may be accomplished manually by an operator or automatically by a programming device. Consequently my invention provides an extremely convenient arrangement whereby metal forming machines of this general type can now be used to form and shape metal sheets in a wide new range of forms. For example, using my invention a metal sheet can now be formed having sinusoidal corrugations extending longitudinally of the sheet. Or, as another example, the sheet may be formed with certain sections being deformed along longitudinal lines extending down the length thereof while intermediate sections may be deformed transversely and simultaneously with the longitudinal deformation. These uses are mentioned only as an example and it will be readily apparent to those skilled in the art, with the simultaneous control of transverse and longitudinal movement of the forming wheels now possible through my invention, that many new patterns for forming metal sheets are now available.

In addition, my invention provides means whereby the rate of movement of the forming wheels in the transverse direction across the sheet can be readily varied with respect to the rate of movement of these rollers along the length or longitudinal direction of the sheet.

Therefore an object of my invention is to provide a means whereby the mating forming wheels of a metal working machine may be simultaneously moved in a plurality of directions across the faces of a sheet of metal being drawn through the forming wheels of the machine.

It is also an object of my invention to provide means whereby the mating forming wheels of a metal working machine may be simultaneously moved transversely of the sheet of metal being processed and longitudinally of this sheet.

It is a further object of my invention to provide control means which may be manually operated or automatically operated to direct the simultaneous transverse and longitudinal movements of mating forming wheels of a metal working machine in the desired directions during operation of the machine.

FIGURE 1 represents a cross sectional view through one of a pair of mating forming wheels of a metal working machine illustrating diagrammatically a means of accomplishing the objects of my invention.

FIGURE 2 is a view illustrating a means of urging the mating forming wheels together.

Referring then to the drawing, it can be seen that the forming wheel 1 is in mating engagement with another forming wheel 17 and these wheels are adapted to deform a metal sheet 16 when said forming wheels are urged into contact with opposite faces 21 and 22 of metal sheet 16. The particular form of this deformation, one form of which is illustrated at 28, depends on the contour of the peripheries of the forming wheels. This manner of operation of a machine wherein mating forming wheels are used is well known in the art, and the drawing discloses only that portion of the machine involving the structure of the rotating forming wheels and the means for moving these forming wheels transversely of the sheet 16. It should also be understood that while the drawing shows in detail the structural features of the drive for forming wheel 1 that similar structural means for the drive of the mating forming wheel 17 is also provided and synchronized therewith.

Forming wheel 1 has laterally extending hub portions generally indicated at 23 and the interior surfaces of the laterally extending portions 23 are threaded as at 24. The laterally extending portions 23 of forming wheel 1 are keyed by means of splines 25 secured to the outer surface of hollow shaft 3, and these splines 25 fit into slots 18 in the laterally extending portions 23. A worm gear 2 is mounted on shaft 4 and it so disposes that the worm gear 2 engages with the screw threads 24 of the laterally extending portions 23 of forming wheel 1. It can be seen that the hollow shaft 3 is cut away at 26 so that the worm gear 2 can extend into operating engagement with screw threads 24.
Shaft 4 is rotatably supported in bearings 6 and 8 which are in turn fixed within hollow shaft 3. Hollow shaft 3 in turn is rotatably supported by bearings 5 and 7 at one end of shaft 3 and corresponding bearings at the opposite end of the shaft (not shown). Hollow shaft 3 carries a sprocket wheel 9 splined thereto and this sprocket wheel 9 is connected by a roller chain 11 to shaft 27 of electric motor 13. The opposite extensions of shaft 27 of electric motor 13 is operatively associated with a variable speed device 14 controlled by manual control wheel 15. The details of this variable speed device 14 are not set forth in this application because various types of speed control devices are well known in the art, and by means of which the speed ratio existing between two shafts may be modified. For example, a speed control device having a plurality of gear reduction arrangements would be suitable for operation in applicant's invention. Extending from the variable speed device 14 is an output shaft 20 carrying roller chain 12, and roller chain 12 is in operative engagement with sprocket wheel 10 suitably secured to shaft 4.

One means of urging the mating wheels 1 and 17 into engagement with opposite faces 22 and 21 of metal sheet 16 is shown in FIGURE 2. In this view it is seen that wheel 17 is mounted on a rotatable shaft 29 which is supported at both extremities by bearings 30. Each bearing 30 (one is shown) is supported by a threaded shaft 31 extending at right angles to the axis of shaft 29. Shafts 31 are free to rotate relative to bearing 30. Shafts 31 extend through spur gears 32 which have internally threaded axial bores to receive the shafts 31. Spur gears 32 are horizontally disposed and supported on circular bearings 34 so that the same are free to rotate relative to the supporting surface. Gear 32 meshes with a like gear 33 mounted on the end of shaft 35 of motor 36. A similar motor 36 and train of gears controls a bearing 30, not shown, on the other extremity of shaft 29, being synchronized so as to operate in unison with each other and also with forming wheels 1.

The operation of the control means for the metal forming machine, as illustrated in the drawing, is as follows. It is assumed that the metal sheet 16 is being fed or drawn through the machine and that hollow shaft 3 is being rotated through the roller chain drive from shaft 27 of electric motor 13 to sprocket wheel 9 on hollow shaft 3. Operation of motor 36 will be effective to urge the mating forming wheels 1 and 17 into engagement with faces 22 and 21 of metal sheet 16. As hollow shaft 3 is rotating, the metal sheet 16 will be formed as at 28. Assuming that the output shaft 20 of speed control device 14 is turning the sprocket wheel 19 at the same rate of speed as shaft 27, then shaft 4 will rotate at the same speed as the hollow shaft 3, and worm gear 2 will simply rotate within the internal threads 24 of lateral extensions 23 and there will be no relative motion transversely along hollow shaft 3 by forming wheel 1. However, if it is desired to cause a relative transverse movement or displacement of forming wheel 1 along hollow shaft 3 at the same time that forming wheel 1 is being rotated by hollow shaft 3, then the speed control device can be operated through control wheel 15 to either speed up output shaft 20 of the speed control device or to reduce the speed of the output shaft 20 with reference to the speed of shaft 27 of the electric motor 13. Such action will then cause shaft 4 to rotate at a different rate of speed than hollow shaft 3 and it will be apparent that such action will cause worm gear 2 to interact on threads 24 of lateral extensions 23 on forming wheel 1 to cause the forming wheel 1 to be moved transversely along hollow shaft 3. The direction of relative motion of forming wheel 1 along hollow shaft 3 will depend upon the speed differential and the magnitude of this differential between hollow shaft 3 and shaft 4.

Control wheel 15 can be manually operated by an operator, or if desired, a programmed input into wheel 15 can be made through suitable mechanical, hydraulic, or electronic means. As an example, if it is desired to produce a continuously varying sinuous corrugation in metal sheet 16, an oscillating motion would be applied to control wheel 15 so that the motion of the forming wheels 1 and 17 would be alternately left-right, right-left as viewed in the drawing.

What I claim as my invention is:

1. A metal sheet forming machine, a plurality of mating forming wheels adapted to be urged into forming contact with opposite faces of said sheet, a first means for rotating said wheels so that said sheet will pass between said wheels during the forming operation, a second means associated with said first means and adapted to simultaneously move said mating wheels in a direction transverse with respect to the common plane of rotation of said mating forming wheels, to provide a sinuous deformation of said sheet.

2. A machine for forming sheets of metal including a plurality of mating forming wheels carried by rotatable hollow shafts, means for urging said wheels together to a forming contact with the oppositely disposed faces of a sheet being drawn therebetween, said wheels being mounted on said shafts for positive rotation therewith but with a permitted lengthwise movement along said shafts and transversely of said sheet, power means associated with said rotating shafts, a second means associated with said power means to cause the permitted movement of said wheels with relation to said shafts, whereby said wheels are adapted to simultaneously deform said sheet along both longitudinal and transverse paths.

3. In a machine for forming a sheet of metal, a plurality of mating forming wheels, rotatable shaft means disposed to carry wheels and spaced from other shaft means carrying the other wheels, means adapted to urge said wheels together so as to deform a sheet being drawn therebetween, second means for rotating the shaft means carrying said wheels, a third means associated with said second means and adapted to move the mating wheels transversely with respect to the plane in which said wheels are rotating so as to simultaneously deform the sheet longitudinally and transversely.

4. A machine for forming a sheet of metal being drawn there-through between a plurality of mating forming wheels which are adapted to be urged into forming contact with the opposite faces of said sheet, first means for rotating said wheels, second means associated with said first means for moving the rotating wheels transversely with respect to the plane wherein said wheels are being rotated.

5. The machine defined by claim 4 wherein said first means is an electric motor and said second means is a variable speed device.

6. The machine as set forth in claim 5 wherein the variable speed device has control means adapted for manual or automatic operation.

7. The machine of claim 4 wherein said first means includes a power source having a rotating output shaft and said shaft is operatively connected to spaced shafts carrying said wheels, said second means being operatively associated with the rotating output shaft.

8. In a machine for forming a sheet of metal, a pair of spaced rotors of movement of said shafts each carrying forming wheels which are adapted to deform a sheet of metal being drawn therebetween as the hollow shafts are urged together, each of the forming wheels being secured to its
associated hollow shaft by means of a spline which provides for positive rotation of the forming wheel with the hollow shaft but also permits a limited lengthwise movement of the forming wheel along said shaft, power means operatively connected to said hollow shafts to cause rotation thereof, a second shaft disposed within each of the said hollow shafts and having a worm gear thereon adapted to coact with a threaded portion on each of the forming wheels carried by the hollow shaft, means for rotating said second shafts from said power means to cause the limited lengthwise movement of said forming wheels along said hollow shafts through the drive of said worm gears, control means interposed between said power means and said second shafts to vary the rate of speed of rotation of said second shafts as compared to the rate of speed of rotation of said hollow shafts.

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