Sept. 29, 1931. G. G. McKAY 1,825,081

MACHINE FOR EXPANDING CYLINDERS

Filed July 1, 1927 2 Sheets-Sheet 1

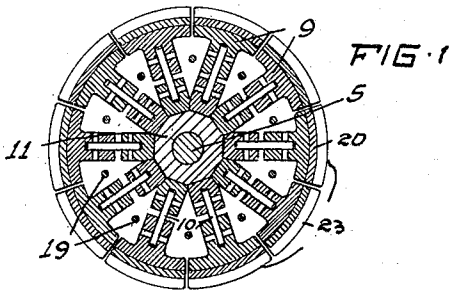


FIG. 1

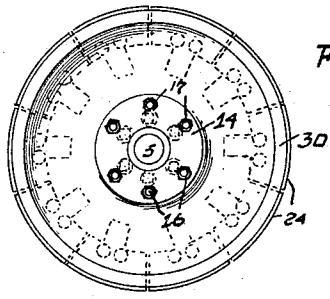


FIG. 3

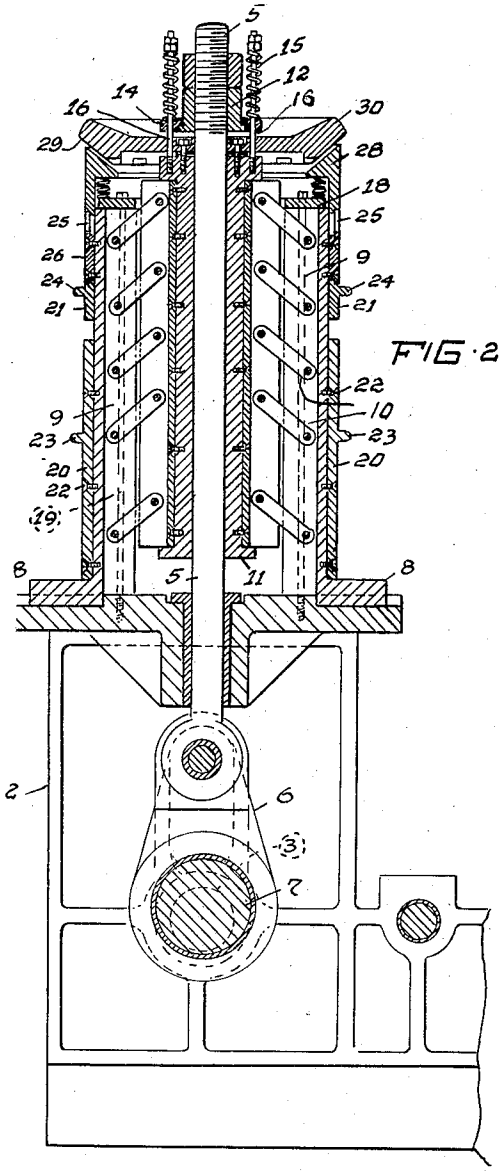


FIG. 2

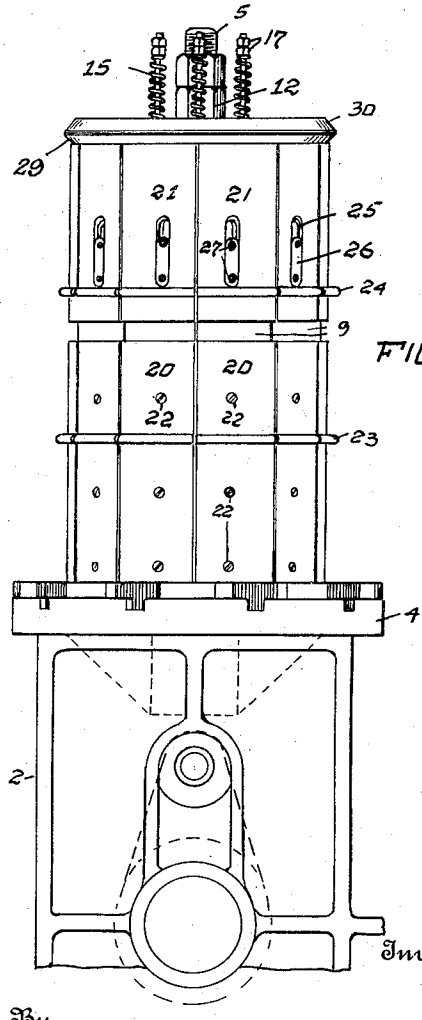


FIG. 4

Inventor

By GEORGE G. McKAY

Fisher, Moser & Moore
Attorney

Sept. 29, 1931. G. G. McKAY 1,825,081

MACHINE FOR EXPANDING CYLINDERS

Filed July 1, 1927 2 Sheets-Sheet 2

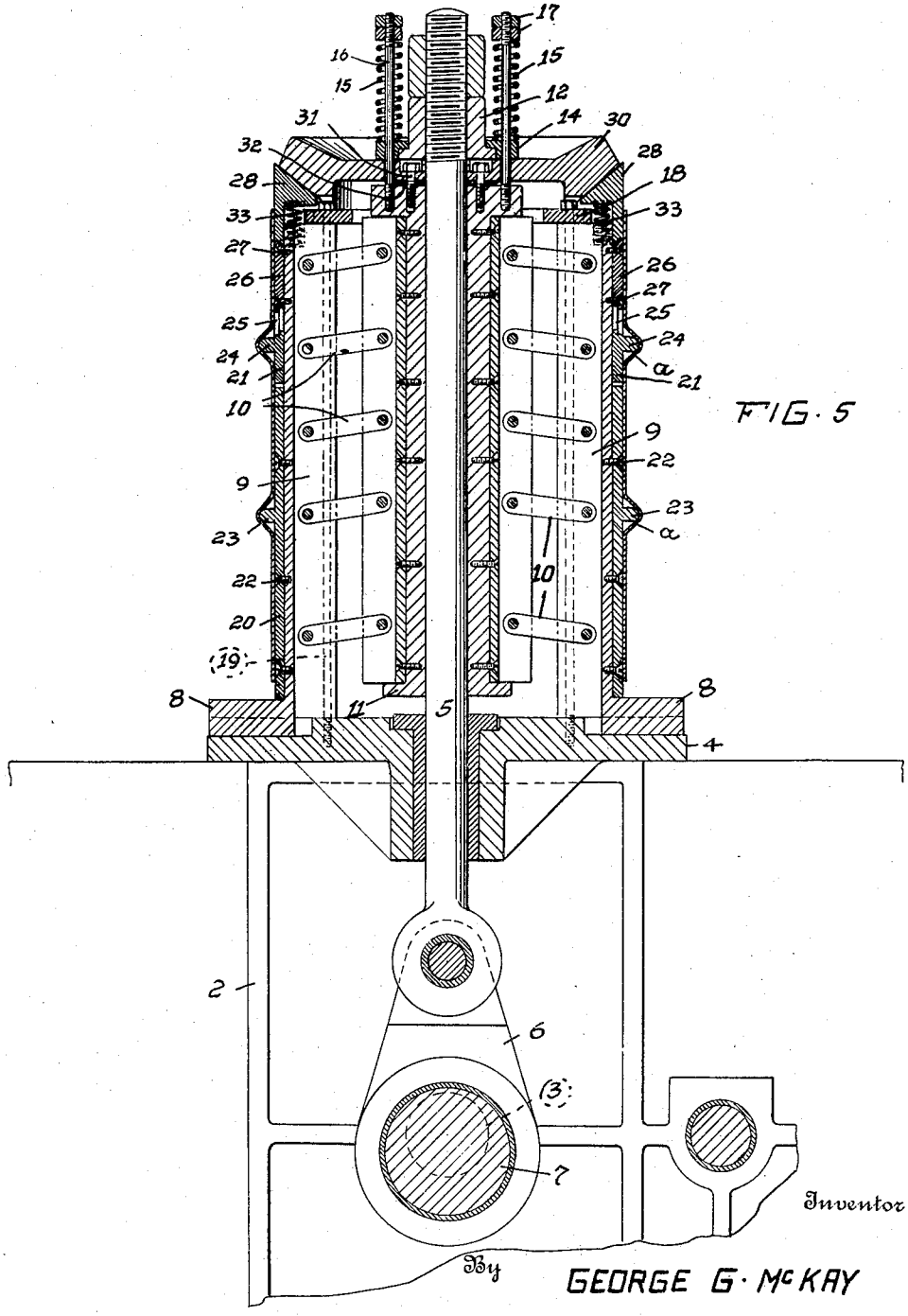


FIG. 5

Inventor

By GEORGE G. McKAY

Fisher, Moser & Morse
Attorney

Patented Sept. 29, 1931

1,825,081

UNITED STATES PATENT OFFICE

GEORGE G. McKAY, OF YOUNGSTOWN, OHIO, ASSIGNOR TO THE OHIO CORRUGATING COMPANY, OF WARREN, OHIO, A CORPORATION OF OHIO

MACHINE FOR EXPANDING CYLINDERS

Application filed July 1, 1927. Serial No. 202,915.

This invention pertains to a machine for producing annular corrugations in cylindrical shipping containers, such as sheet metal drums, steel barrels, etc., and the present machine embodies certain new and useful improvements in the apparatus shown and described in the application for patent filed by H. G. Vaughn, on the first day of July, 1927, Serial No. 202,916. Thus, the apparatus referred to comprises separate sets of corrugating dies arranged circularly and adapted to be expanded on radial lines to produce a pair of corrugations or rolling ribs annularly in a cylinder, one set of dies being arranged to slide longitudinally, that is, parallel with the axis of the cylinder, coincidently with their radial movements, and the sliding movement being effected automatically by the movement or flow of the material in contact with the dies. The present machine operates correspondingly except that one set of dies is caused to slide longitudinally of the cylinder in a positive manner during expanding operations, the dies being engaged at one end by a follower member and the sliding movement being timed to the draw movement of the stock, all as hereinafter more particularly described and pointed out in the claims.

In the accompanying drawings, Fig. 1 is a horizontal section, and Fig. 2 a vertical section, of a machine embodying my improvement. Figs. 3 and 4 are top and side views, respectively, of the same machine. Fig. 5 is a sectional view of the machine corresponding to Fig. 2, but on a larger scale and showing the dies expanded with a cylinder in place and corrugated.

The machine comprises a frame 2 in which a rotatable cam shaft 3 has bearing. Surmounting frame 2 is a bed plate 4 through which a vertical shaft or thrust rod 5 extends. An eccentric strap 6 connects this rod with a cam or eccentric 7 on shaft 3, whereby reciprocating movements may be imparted to the rod. Bed plate 4 is channeled radially to seat the ribbed feet 8 of a series of upright die-carrier members 9 arranged in a circle. Toggle links 10 connect members 9 with a sleeve member 11 on vertical shaft or thrust rod 5. A flanged nut 12 on the upper screw-threaded end of rod 5 supports a flanged collar 14 upon which a series of compression springs 15 rest, and connecting rods 16 extend through these springs and the collar to the upper end of sleeve member 11. Nuts 17 on connecting rods 16 rest upon the springs 15, thereby supporting sleeve member 11 yieldingly upon thrust rod 5. However when thrust rod 5 is drawn downwardly by the cam or eccentric the sleeve member is positively actuated to straighten toggle links 10 and force the die-carrier members 9 outwardly uniform distances on radial lines. A holding ring 18 bears against the upper ends of die-carrier members 9, and tie rods 19 secure this plate fixedly to bed plate 8.

Each die-carrier member supports two dies 20 and 21, respectively, of segmental form, and said dies in the present instance are ribbed transversely. Dies 20 are fixed by screws 22 to members 9 and the ribs 23 thereon are located approximately in the same plane midway of the length of the die body. Dies 21 are mounted to slide vertically upon members 9, being spaced apart from dies 20 to permit a sliding movement of dies 21 longitudinally toward dies 20 and each die 21 is formed correspondingly with a transverse rib 24 near its lower end. Dies 21 contain rabbeted slots 25 in which a correspondingly rabbeted piece of metal 26 of shorter length fits, and these pieces 25 are secured by screws 27 to hold the dies 21 slidably in position upon their respective members 9. The upper ends 28 of dies 21 extend inwardly toward the axis of the machine and are beveled upwardly and outwardly on top at an angle of approximately forty-five degrees to correspond with the beveled face or conical surface 29 of a cone or cam-shaped disk 30 which is secured by bolts 31 to the upper end of sleeve member 11. Connecting rods 16 and thrust rod 5 pass freely through the central perforated body of disk 30, which is shown in the present machine as interposed between flanged nut 12 and the enlarged upper end of sleeve member 11. Removable shims 32 are also inserted between

disk 30 and the upper end of sleeve member 11 to permit adjustment of and to time the initial contact of the cone disk in respect to the beveled ends of the sliding dies 21. Compression springs 33 are seated upon the upper ends of the die-carrier members 9, and these springs press upwardly against the extensions 28 of dies 21, thereby serving to always raise this set of dies when the cone disk is raised and the end pressure on the dies 21 is relieved.

At the beginning of operations, sleeve 11 and cone disk 30 are in a raised position and all the dies are contracted, that is, drawn inwardly toward the axis of the machine. Dies 21 are also pressed upwardly to their limit by springs 33. Assuming a plain sheet metal cylinder is to be operated upon, the cylinder is first sleeved over the circle of dies and placed at rest upon the lateral extensions or ribbed feet 8 of die-carrier members 9. The machine may then be started, and as cam or eccentric 7 makes one-half of a revolution the thrust rod 5 and sleeve 11 and cone 30 are drawn downwardly together. In this stroke the die-carrier members 9 are forced outwardly in gradually increasing degree as the toggle-links move in an arc from an inclined position to a horizontal position. The spaced ribs 23 and 24 on the dies 20 and 21, respectively are thereby brought into contact with the cylinder wall and this wall expanded circumferentially in two places simultaneously. In so doing the sheet metal body is shortened, that is, the stock draws or flows from both ends of the cylinder toward the two zones of expansion. Moreover the middle part of the cylinder must also be permitted to stretch or draw longitudinally of the cylinder, otherwise this part of the cylinder would also expand partly and be weakened or ruptured. The sliding dies 21 permit the dies to follow the longitudinal drawing movement of the stock in the middle area or zone of the cylinder as well as the drawing movement from the upper end of the cylinder downwardly toward the lower set of dies. But in expanding certain kinds of stock or sheet metal of a given gauge it is desirable to shift the sliding dies 21 toward the dies 20 in a positive manner to divide the stresses and strains, and cone disk 30 serves that purpose by pressing downwardly upon the beveled ends of the sliding dies 21 as they follow the drawing movement of the stock, thereby relieving the middle area of the cylinder of excessive stretching strains while permitting two relatively deep corrugations or rolling ribs *a*—*a* to be made simultaneously at widely spaced intervals in the cylinder. In this expanding operation, as cone disk 30 moves downwardly the sliding dies 21 move outwardly on radial lines, but the angle of inclination where the cone contacts with the dies is such that longitudinal pressure is constantly applied to the dies by the cone disk during the movements of the parts at right angles. The outward pressure exerted by the cone on the sliding dies also relieves the dies of bind against the carrier members so that they slide freely during expanding operations. When the corrugating operation is finished the last half revolution of the cam or eccentric collapses the die carrying members, that is, restores them to their starting position, and the corrugated cylinder may be removed to permit a repetition of operations on another plain cylinder.

What I claim, is:

1. A machine for expanding cylinders, comprising a set of rigid expanding dies, means arranged to move said dies simultaneously on radial lines in respect to the axis of a cylinder, and means arranged to move said dies longitudinally in respect to the axis of the cylinder concurrently with their radial movement.

2. A machine for expanding cylinders, comprising a set of rigid radially-arranged and radially shiftable corrugating dies, means adapted to shift said dies simultaneously on radial lines to expand a sheet metal cylinder, and a follower member adapted to forcibly shift said dies longitudinally of the cylinder during their outward movements radially of the cylinder.

3. A machine for expanding cylinders, comprising separate sets of radially arranged and radially shiftable rigid corrugating dies, means adapted to shift both sets of dies simultaneously on radio lines within a sheet metal cylinder, and means acting positively on one set of dies to reciprocate the same in limited degree lengthwise of the cylinder during radial movements of both sets of dies.

4. A machine for expanding cylinders, comprising separate sets of dies adapted to corrugate a sheet metal cylinder circumferentially in a plurality of places, means adapted to force both sets of dies outwardly on radial lines, and a beveled member adapted to shift one set of said dies lengthwise of the cylinder conincidently with the expanding movements of said dies.

5. A machine for expanding cylinders, comprising radially-arranged members, separate sets of corrugating dies secured to said members, one set of dies being mounted to slide toward the other set of dies and yieldingly supported apart therefrom by springs, toggle link mechanism adapted to distend said members and dies on radial lines, and a cone follower member adapted to force said slidable set of dies toward the other set of dies coincidently with the expanding movements of said dies.

6. A machine for expanding cylinders, comprising a set of radially-arranged mem-

bers, a reciprocable device in toggle connection with said members, a set of dies mounted slidably upon said members having beveled extremities, and a cone fixed adjustably to said reciprocable device adapted to bear against the beveled extremities of said dies and impart a slidable movement thereto coincidently with the expanding movements of said dies.

7. A machine for expanding cylinders, comprising expanding dies adapted to form an annular corrugation in a cylinder, means adapted to shift said dies longitudinally of the cylinder coincident with the expansion movements thereof, and means adapted to adjustably fix the working relations of the said means to said dies.

8. A machine for expanding cylinders, comprising separate sets of corrugating dies, means adapted to expand said dies on radial lines, one set of dies being movable lengthwise of the cylinder, and adjustable means adapted to shift said movable dies lengthwise of the cylinder coincident with their radial movements.

9. A machine for expanding cylinders, comprising rigid radially shiftable expanding means adapted to form a plurality of annular corrugations in the wall of a sheet metal cylinder, and mechanism to positively shift said corrugating means lengthwise of the cylinder during corrugating operations and shortening movements of the cylinder.

10. A machine for expanding cylinders, comprising rigid radially shiftable expanding means adapted to produce annular corrugations at two places simultaneously in a sheet metal cylinder, said means including rigid corrugating devices movable lengthwise of the cylinder and mechanism adapted to force said devices lengthwise of the cylinder concurrently with the corrugating operation and the flow of the stock.

In testimony whereof I affix my signature.

GEORGE G. McKAY.