Jan. 7, 1936. L. H. BRINKMAN 2,027,018

CORRUGATING MACHINE

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Fig. 1.

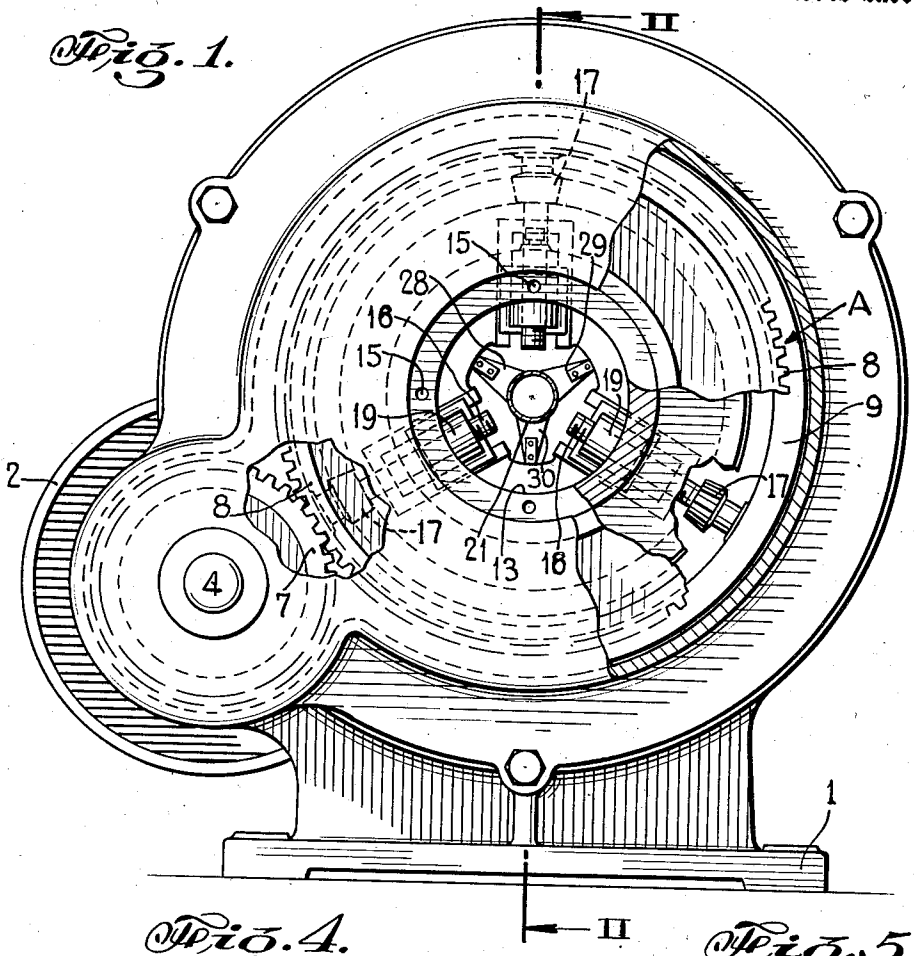


Fig. 4.

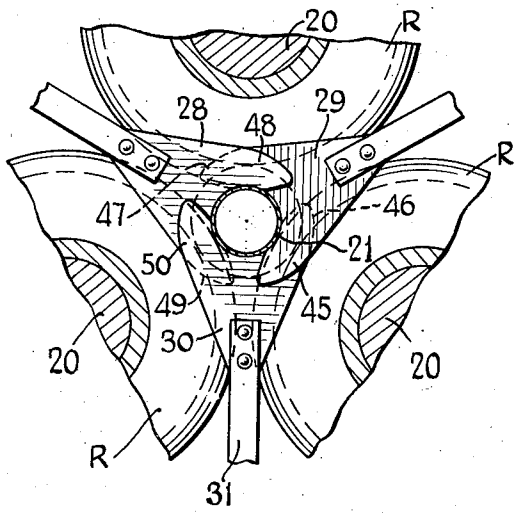
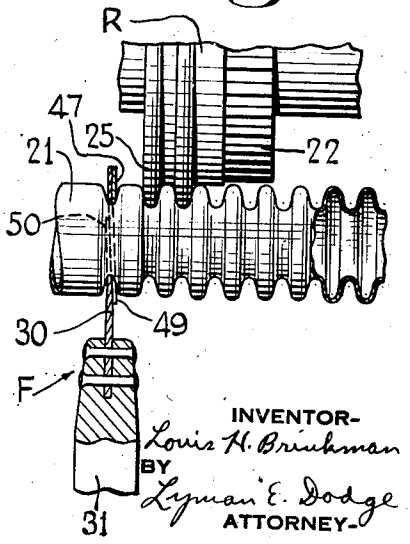


Fig. 5.



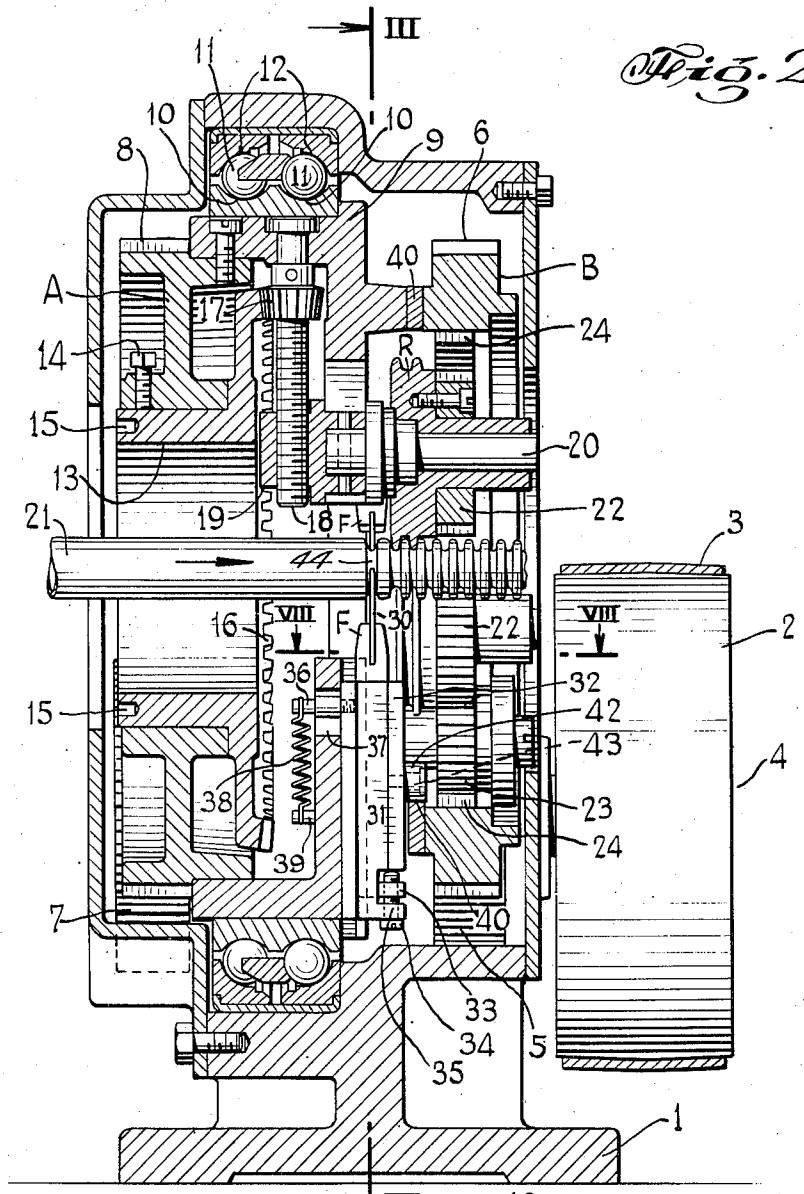
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Fig. 2.



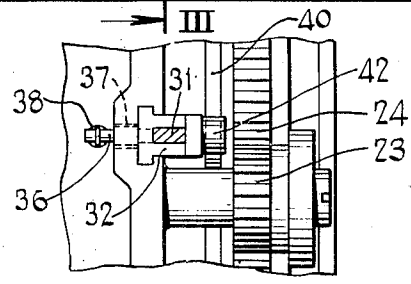


Fig. 8.

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Fig. 3.

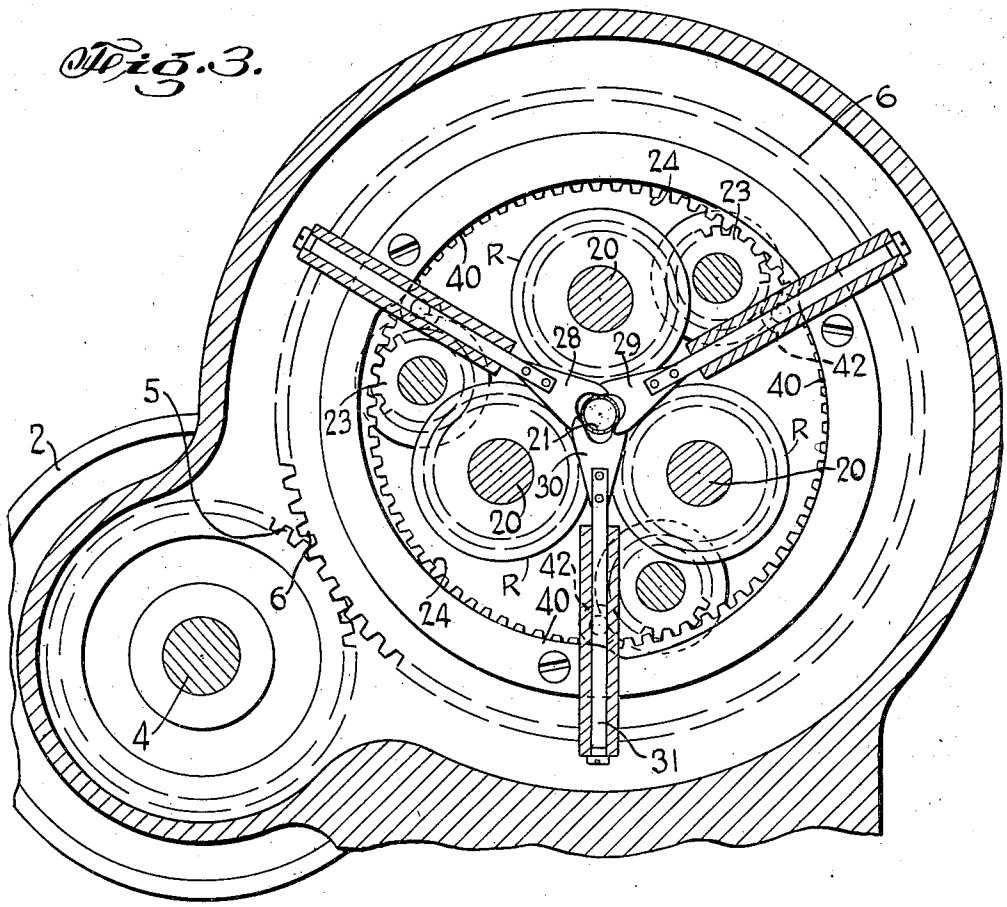


Fig. 6.

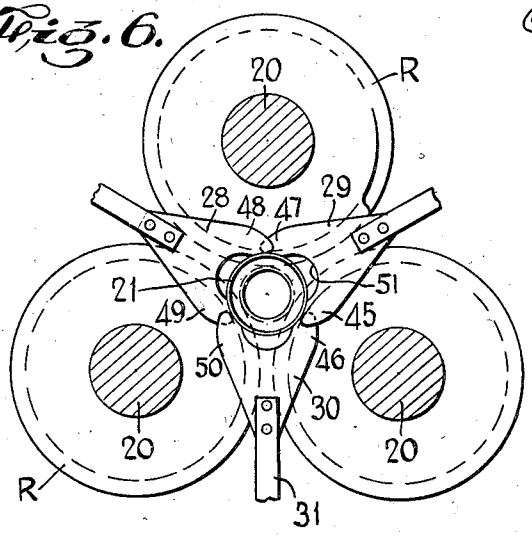
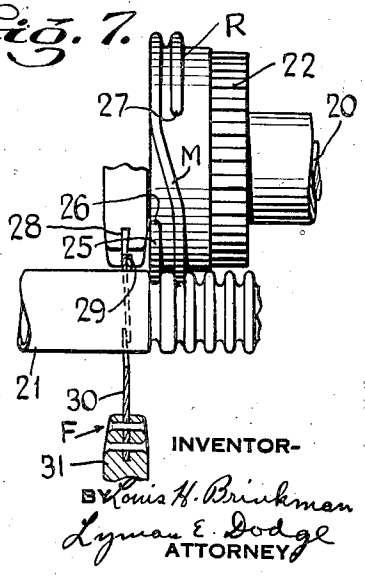


Fig. 7.



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UNITED STATES PATENT OFFICE

2,027,018

CORRUGATING MACHINE

Louis H. Brinkman, Glen Ridge Borough, N. J.

Application August 4, 1933, Serial No. 683,576

11 Claims. (Cl. 153—73)

This invention relates to metal working; especially to the working of the metal of tubes and pipes, that is, long cylindrical hollow bodies, and more especially to the corrugating of tubes or pipes.

A principal object of this invention is the production of a device by means of which the wall of a tube or pipe, especially one with a comparatively thin wall, may be formed into a series of parallel independent corrugations or folds as a continuous process applicable to tubes of any length.

Other objects and advantages will appear as the description of the particular physical embodiment selected to illustrate the invention progresses, and the novel features will be particularly pointed out in the appended claims.

In describing the invention in detail, and the particular physical embodiments selected to illustrate the invention reference will be had to the accompanying drawings and the several views therein, in which like characters of reference designate like parts throughout the several views, and in which:

Figure 1 is a front elevational view of a device constructed in accordance with applicant's invention; Fig. 2 is a cross-sectional view of the device constructed in accordance with Fig. 1 on the plane indicated by the line II—II of Fig. 1, viewed in the direction of the arrows at the ends of the line; Fig. 3 is a cross-sectional view of the device as shown by Fig. 2 on the plane indicated by the line III—III of Fig. 2, viewed in the direction of the arrows at the ends of the line; Fig. 4 is a fragmentary enlarged view illustrating the arrangement of certain elements of the device as shown by Fig. 1; Fig. 5 is a view illustrating a portion of grooving fingers and forming rolls forming part of applicant's invention as shown by Fig. 1; Fig. 6 is a view similar to Fig. 4, but with the parts in a different operative position; Fig. 7 is a view similar to Fig. 5, but with the parts in a different operative position; Fig. 8 is a fragmentary sectional view of the device as shown by Fig. 2 on the plane indicated by the line VIII—VIII of Fig. 2, viewed in the direction of the arrows at the ends of the line.

Applicant's device for corrugating, in a general way, includes two co-axial rings about the axis of which the tube to be corrugated is positioned. One of the axial rings is designated as a whole by A, best shown in Fig. 2; the other axial ring is designated B and is also best shown in Fig. 2. These two rings A and B are driven from the same driving shaft, but the connections are such that the ring B travels slightly faster than ring A. Ring A carries groove initiating fingers designated as a whole by F, and well shown in Figs. 2, 5, and 7 in side view, and in Figs. 4 and 6 in face view; and also fold or groove forming and completing rolls designated R, and also well shown in Fig. 2 and in Figs. 5 and 7. If there were no difference in speed between rings A and B the device would not operate, but due to that difference in speed, while both are revolving about the tube to be corrugated, the ring B gains slightly over the ring A. By so doing a cam formed on ring B forces the fingers F into the pipe, initiating a groove therein. At the same time, rollers R are completing the formation of previously formed grooves and folds. At a certain point in the movement of ring B in reference to ring A, the initiating grooving fingers F are withdrawn from engagement with the pipe and at the same time the forming rollers R have a portion thereof, designated M in Fig. 7, moved into one of the previously formed grooves in the pipe and by reason of the position of M at an angle to the axis of the roller, it causes a bodily forward movement of the tube being operated upon. After the forward bodily movement of the pipe the operations are again repeated, that is, the groove initiating fingers are again forced into contact with the pipe, and the regular groove forming portion of the roller R engages with the previously initially formed groove. The entire operation is dependent upon the fact that although rings A and B are driven from the same shaft they are so connected to that shaft that ring A rotates more slowly than ring B, that is, ring B advances forward in the direction of rotation as regards ring A.

In the particular form in which applicant has embodied his invention a standard or base 1 is provided, by which the device may be positioned on a suitable surface and be appropriately attached thereto.

The pulley 2 driven by the belt 3 and mounted upon the shaft 4 is the means by which power is delivered to the device. The shaft 4 extends the full length of the device, that is, from the right to the left thereof as viewed in Fig. 2, adjacent one end, that is, adjacent the pulley end, the shaft 4 carries rigidly attached thereto, the gear wheel 5 which meshes with the teeth 6 of the ring or annulus B. Adjacent the other end of the shaft 4, and rigidly attached thereto, is the gear wheel 7 which meshes with the teeth 8 of the ring or annulus A and serves to drive ring A.

The ring A includes a portion 9, which forms

practically the extreme outer periphery thereof, which is formed with ball races 10. Within these ball races rest the balls 11 which in turn bear upon the ball races 12 supported and attached to the casing 1, that is, all of the revolving parts are supported by the balls, as 11. As will be later shown the ring B is really supported and carried by the annulus A.

Within the annulus A is the jaw adjusting member 13. This jaw adjusting member is rotatably mounted as regards annulus A and is held in fixed position by any suitable or appropriate means as by the set screws 14. When it is desired to move the member 13 rotatably as regards annulus A a suitable tool is engaged with the member 13 by means of the orifices, as 15. When the jaw adjusting annulus 13 is rotatively moved as regards annulus A, the teeth 16, formed upon the face thereof, engage with the teeth 17 of a small bevel gear rigidly attached to screw threaded rods 18. The parts 13, 14, 15, 16, 17, and 18 are entirely comparable with the parts of what is known as a universal chuck, that is, a means by which a plurality of screw threaded rods, such as 18, may be simultaneously rotated a precisely equal amount. Just as ordinary chucks usually have three jaws which are moved inwardly and outwardly from the center by the operation of the adjusting means so applicant's device has three identically formed and shaped members, as 19, which are moved inwardly and outwardly by the operation of the threaded rod 18 and when once they are adjusted to the proper position inwardly or outwardly that proper position is maintained by tightening set screw 14 against annulus 13. The members 19 each bears a shaft, as 20. This shaft 20 has the roller R rotatably mounted thereon so that as the annulus A rotates around the pipe 21, the roller R revolves around the pipe.

Attached to the roller R is gear wheel 22 and meshing with gear wheel 22 is gear wheel 23 which meshes with the internal gear teeth 24 of annulus B. If annuli A and B rotate together and at exactly the same speed, the internal teeth 24 would nover move the idler 23 to cause movement of the gear wheel 22, but the gear 5 on shaft 4 meshing with teeth 6 of annulus B has more teeth therein than does the gear 7 on shaft 4 meshing with the teeth 8 of annulus A. In the particular construction illustrated, as built, applicant has seventy two teeth on the periphery of both annulus A and annulus B, but, although gears 5 and 7 are the same diameter, there are forty teeth in the gear wheel 5 and only thirty nine in the gear wheel 7. This construction, therefore, provides a device including two annular rings A and B which revolve about the pipe: one, A, carries the forming roller R which practically spins the metal of the tube 21; the other, annulus B, although rotating about the pipe 21 at a speed approximating that of the speed of annulus A, in addition drifts, or moves continuously in a forward direction in relation to annulus A. The result of this drift or forward motion causes the internal gear teeth 24 through the idler 23 to move the gear wheel 22 attached to forming roll R, and so moves R. The annulus B is really carried or supported by the three idler gears 23.

The forming roll R, as perhaps best shown in Fig. 7, is formed with forming ridges 25 which begins at the point 26, passes down as viewed in Fig. 7 and around the roller R and then at about the center of the roll as viewed in Fig. 7, it makes a decided angle with the longitudinal axis of the shaft 20 upon which the shaft is mounted, and then continues down and around the shaft R, terminating at 27. All portions of the forming ridge 25 act to complete and form grooves and corrugations except the portion M, which I have designated the advancing portion. This portion when it comes into a groove of the pipe 21 serves to move the pipe forward longitudinally.

The roller R does not initiate grooves. It only perfects grooves and corrugations already initiated. In order to initiate the grooves, applicant has provided groove initiating fingers 28, 29, and 30, best shown in Fig. 6, and designated as a whole by F in Fig. 2. These fingers are attached by any suitable or appropriate means to finger carriers, as 31. The finger carriers are supported and slide in finger carrier holders 32, best shown in Fig. 2. The finger carriers 31 are provided with a screw threaded lug 33 engaging a screw 34 passing through a projection 35 of the finger carrier holder 32 so that the position of the finger carrier 31 within the finger carrier holder 32 may be adjusted by means of the screw 34. The finger carrier holder 32 has pin 36 projecting therefrom and passing through the slot 37 of the annulus A. The pin 36 is connected by a tension spring 38, with a pin 39 attached to the annulus A. The spring connection serves as a means for retracting fingers 30 from engagement with the pipe or tube 21.

In order to move the groove initiating fingers F into engagement with the tube 21, applicant provides a cam surface 40 upon the annulus B and causes this cam surface to be engaged by a roller 42 attached by a stud 43, best shown in Fig. 2, to the finger carrier holder 32. As the annulus B drifts relatively to the annulus A, cam surface 40 passing over the roller 42 causes the fingers F to be advanced along radial lines into engagement with the pipe 21, and so causes the pipe 21 to have a groove initiated therein. This initiated groove is designated 44, and is shown in Fig. 2 and in Fig. 5. Applicant has provided three groove initiating fingers, and consequently, three cam surfaces 40, best shown in Fig. 3. After the cam has so moved as to advance the fingers to their greatest depth into the wall of pipe 21 the further advance of the cam then allows each of the fingers to be retracted to its greatest extent because the rollers 42 then bear by a slight further advance of annulus B upon the lowest portion of the cams 40.

In the operation of the device the groove initiating fingers are first forced into contact with the pipe 21 by the action of the cams 40 upon the rollers 42. While the groove initiating fingers are initiating a groove, roller R is perfecting a groove and fold previously initiated, by forming and squeezing the material between grooves, and at such time the roller R has its ridge 25 bearing in adjacent grooves, as best shown in Fig. 5. At such time it is always the portion of the ridge 25, which is at an exact right angle to the longitudinal axis of shaft 20, which is active, but after a given number of revolutions of the annulus A about the pipe 21, the annulus B will gain to such an extent upon annulus A that it will, through its internal teeth 24, idler 23 and gear wheel 22, move the roller R so that the portion M comes to the point where it enters a previously formed groove in the pipe 21. Just before the pipe advancing portion M enters a groove of the pipe 21, the groove initiating fingers are retracted by spring 38 away from in contact

with the pipe 21. A further movement of roller R about its axis then advances the pipe 21 longitudinally, and then the portion of the ridge 25 which is at a right angle to the longitudinal axis of the shaft 20 enters a groove and the groove initiating fingers are again simultaneously forced into contact with the pipe 21.

The fingers 28, 29, and 30 are so arranged that, as viewed in Fig. 6, when the fingers are in the position removed from contact with the pipe, the lower portion 45 of finger 29 is above the right hand portion 46 of finger 30; portion 47 of finger 29 is under portion 48 of finger 28; portion 49 of finger 28 is below portion 50 of finger 30. By so arranging the fingers, that they are pushed inwardly to the bottom of the grooves, as shown in Fig. 4 they will have their portions corresponding to portion 51 of finger 29 (see Fig. 6) in practically the same plane, but will mutually support and sustain each other in the groove initiating portion being sort of inter-locked one with the other, and the center of their inner ends will be practically in a plane transverse to the longitudinal axis of the annuli. This position is assisted by making the ends of the fingers relatively thin.

In operating the machine hereinbefore described, a length of pipe such as 21 is pushed into the device from the left hand side, as viewed in Fig. 2, such a distance as will bring the end of the pipe under the groove initiating fingers F. The machine is then started and the pipe 21 held from rotation manually. After a groove has been initiated, the pipe is advanced manually until the groove aligns with the straight portion of the ridge of the roller R. Another groove is then initiated and the pipe is then advanced automatically by the portion M moving into the groove first formed. The machine then continues to operate automatically to form parallel, independent corrugations or folds the entire length of pipe 21, regardless of its length. This is a continuous process, and needs to be interrupted only to start a new length of pipe.

Although I have illustrated and described one particular physical embodiment of my invention and explained the principle, construction, and mode of operation thereof, nevertheless, I desire to have it understood that the form selected is merely illustrative, but does not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a tube corrugating machine, in combination: an annulus; means for supporting and rotating the annulus; groove initiating fingers carried by the annulus, each having a tube engaging end; rolls carried by the annulus; each formed with a corrugation forming portion and a tube advancing portion; a second annulus; means for driving the annuli at slightly different rotative speeds; means carried by the second annulus for advancing the groove initiating fingers into engagement with a tube; and means also carried by the second annulus for rotating the rolls whereby at times the rolls act as forming rolls and at times as a tube advancing roll.

2. In a tube corrugating machine; in combination: groove initiating fingers; means supporting the fingers, revolving them about a tube and retracting them substantially radially of the tube; means for advancing the fingers substantially radially of the tube into contact with a tube whereby a groove is initiated in the tube; rolls, each formed with a forming ridge and an advancing ridge; means for supporting the rolls and revolving them about a tube; and means for rotating the rolls about their own axes whereby at times the forming ridge will be operative and at other times the advancing ridge will be operative.

3. In a tube corrugating machine, in combination: an annulus supporting groove initiating fingers and rotatable groove forming and tube advancing rolls in position to be revolved about a tube to be corrugated; a second annulus including means for advancing the fingers radially of a tube placed axially of the annuli and for rotating the rolls whereby the rolls at times are in groove forming position and at times in tube advancing position; and means for rotating the annuli, but at slightly different speeds.

4. In a tube corrugating machine, in combination: two annuli positioned side by side, and mounted for rotation around a stock tube traversing their axial apertures respectively; a common shaft for rotating the annuli; connections between the shaft and the annuli driving one annulus at one speed and the other at another speed in the same direction; tube-corrugating devices supported by one annulus, and revolvable therewith around said tube; and means carried by the other annulus and adapted to be revolved thereby into engagement with said corrugating devices, at positions determined by the differential speeds of rotation of said annuli, for actuating said devices into corrugating engagement with said tube, said means being organized to be operated by the annuli for corrugating a tube as a continuous process.

5. In a tube corrugating machine, in combination: a plurality of rolls mounted in spaced relation around the periphery of the tube to be treated, and adapted for rotation, and each formed with a ridge composed of a corrugation forming portion, and a tube advancing portion adapted to act in continuity with said corrugation forming portion, but independently of the corrugating function; means for initiating grooves in a tube; means for bringing the corrugation forming portion of a roll into contact with an initiated groove whereby it is completed and for bringing the tube advancing portion into each completed groove whereby said tube is advanced step by step between consecutive corrugating operations.

6. In a tube corrugating machine, in combination: an annulus mounted for rotation; means for rotating the annulus about a tube to be corrugated; a plurality of relatively thin groove initiating fingers mounted on the annulus for radial movement, the inner ends of the fingers being positioned alternately to one side and the other side of the adjacent ends of the adjacent fingers, whereby the centers of the ends of the fingers are in substantially the same plane transversely of the annulus; means for reciprocating the fingers radially for bringing them into contact with a tube for initiating a groove therein; and means for completing the groove thereby formed as a corrugation.

7. A corrugation forming and tube advancing roll comprising spaced ridges at a right angle to the longitudinal axis of the roll for a portion of the periphery of the roll and an integral tube advancing ridge at an angle to the first mentioned ridges for the remaining periphery of the roll.

8. The process of corrugating tubular stock, which consists in applying revolving groove-

initiating forces intermittently to spaced portions of said stock, and concurrently revolving corrugation-forming and tube-advancing forces successively around the circumference of each ridge intervening between said grooves, and applying a co-ordinated differential force to withdraw said groove-initiating forces from operation at intervals corresponding to the successive operations of said tube-advancing forces, between successive ridge-perfecting operations, and while said corrugation-forming and tube-advancing forces revolve constantly and operate alternatingly in uninterrupted continuity.

9. In a tube corrugating machine, in combination: a series of rolls mounted for planetary revolution around the portion of said tube to be corrugated, each roll being formed with a peripheral ridge extending around its circumference a plurality of times, constituting a dual corrugation-perfecting means for a substantial portion of its extent, with an intervening channel formed in a plane normal to the axis of rotation, said ridge terminating in free, oppositely extending ends spaced from each other circumferentially and lying on opposite sides of said channel, said ridge having a medial portion extending on a bias between and connecting the ridge portions in the circumferential space between said free ends of said ridge, and means to cause positive planetary movement of said rolls, so timed as to force the leading ridge end of each rotating roll into the wall of said stock tube, thereafter perfecting at least one annular groove therein and concurrently squeezing and perfecting an annular peripheral corrugation between two adjacent grooves until the bias ridge-portion is engaged with said corrugation and thereupon moving said tube forward, the subsequent rotation of said roll forcing said leading end into a portion of said tube wall identified with the next groove to be perfected, and thereafter squeezing and perfecting the next annular peripheral corrugation in order, while the trailing portion of said ridge tracks in the just-perfected groove and serves as the abutment for the squeeze operation on the convex portion being perfected, each such cycle of groove-perfecting, squeezing and bias-feeding steps progressing in the order named, and occupying a double rotation of said roll, with a perfected corrugation discharged at the end of each single rotation of said roll.

10. A corrugation perfecting roll for a machine of the class described, said roll being formed with a continuous peripheral ridge extending around its circumference a plurality of times constituting a dual corrugation-perfecting means for a substantial portion of its extent, with an intervening channel formed in a plane normal to the axis of roll-rotation, said ridge terminating in free, oppositely extending ends spaced from each other circumferentially and lying upon opposite sides of said channel, said ridge having a medial portion extending on a bias between and connecting the ridge portions in the circumferential space between said free ends of said ridge.

11. A corrugation-perfecting roll characterized as disclosed and claimed in claim 10 and further characterized by having said peripheral ridge-portions approach each other in the direction of operative rotation of said roll, thereby to narrow said channel and complete said squeeze in a single rotative operation.

LOUIS H. BRINKMAN.