March 18 , 1924. 1,486,977

B. J. LINDGREN

CORRUGATING MACHINE

Filed Aug. 22. 1921 4 Sheets-Sheet 1

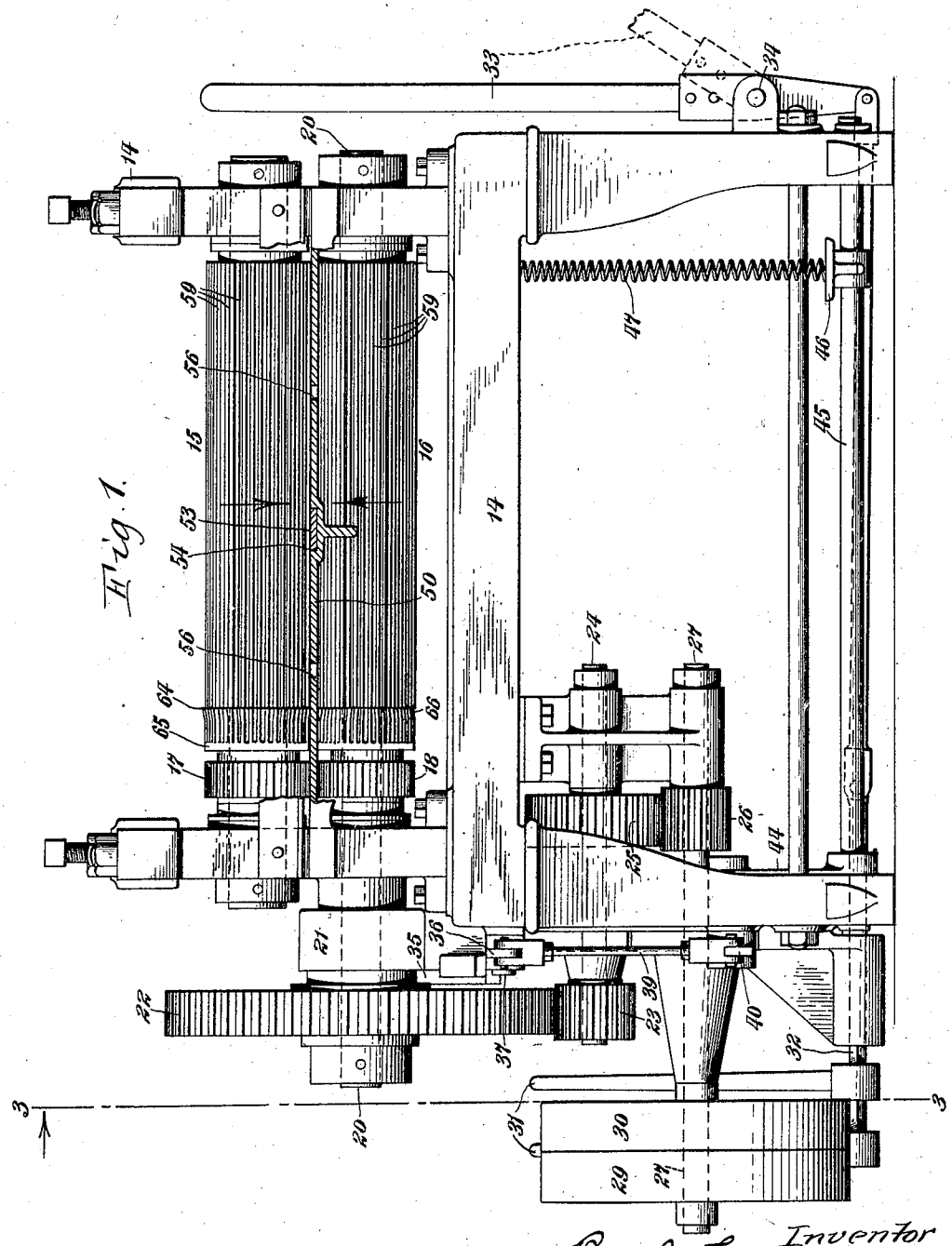

Fig. 1.

Inventor
Bror J. Lindgren
by Eyer & Popp
Attorneys

March 18, 1924. 1,486,977

B. J. LINDGREN

CORRUGATING MACHINE

Filed Aug. 22, 1921 4 Sheets-Sheet 2

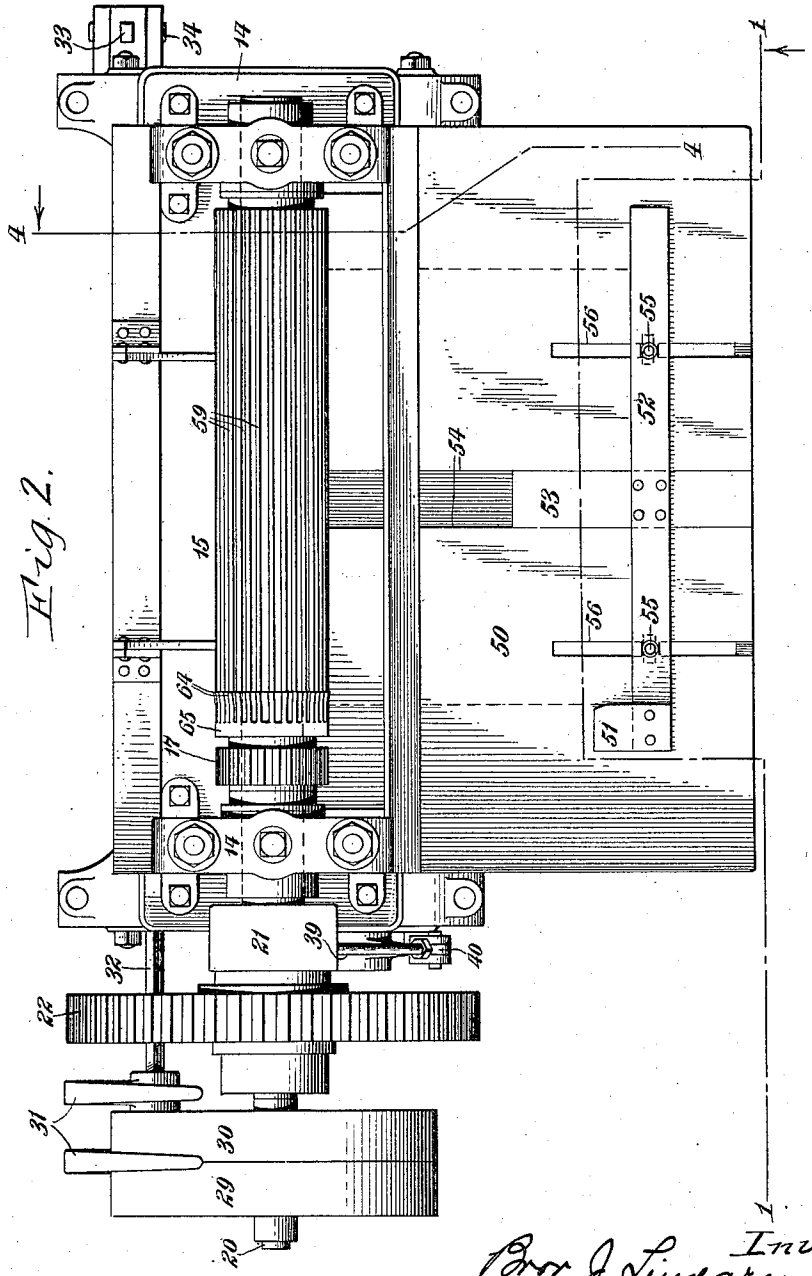

Fig. 2.

Inventor
Bror J. Lindgren
by Egan & Pappe
Attorneys

March 18, 1924. 1,486,977

B. J. LINDGREN

CORRUGATING MACHINE

Filed Aug. 22, 1921 4 Sheets-Sheet 3

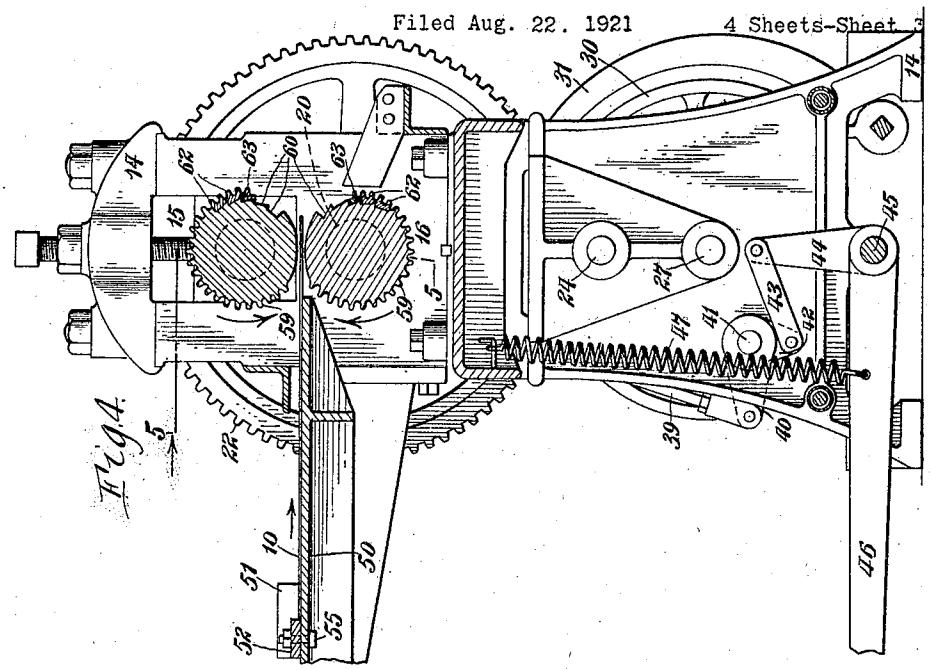

Fig. 4.

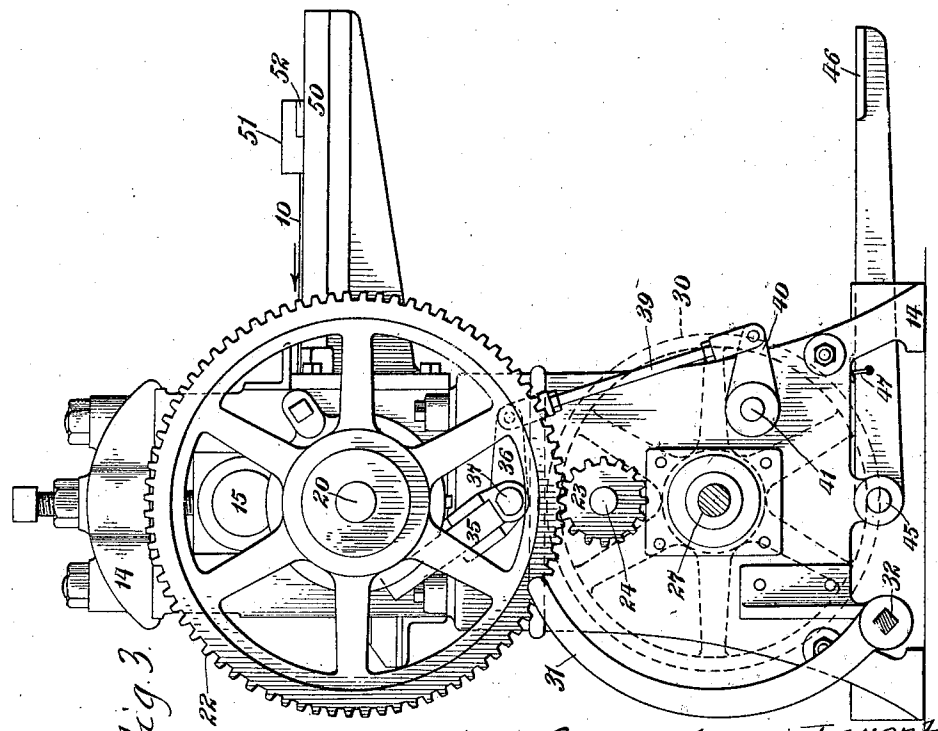

Fig. 3.

Inventor
Bror J. Lindgren
by Geyer & Popp
Attorneys

March 18, 1924. 1,486,977

B. J. LINDGREN

CORRUGATING MACHINE

Filed Aug. 22, 1921 4 Sheets-Sheet 4

Fig. 5

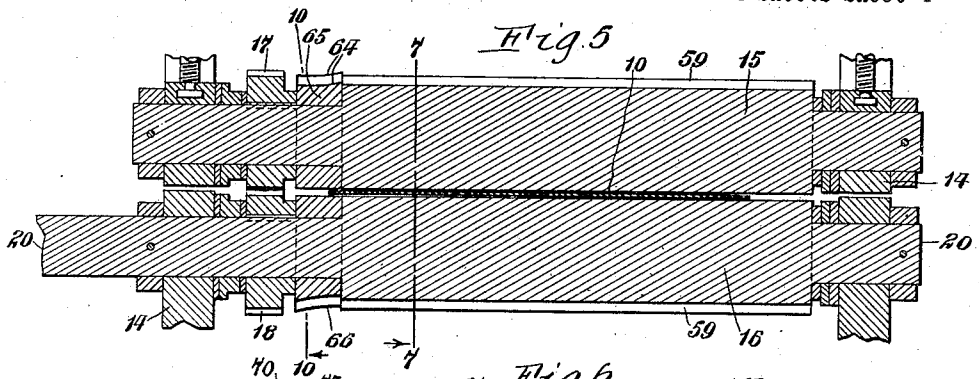

Fig. 6.

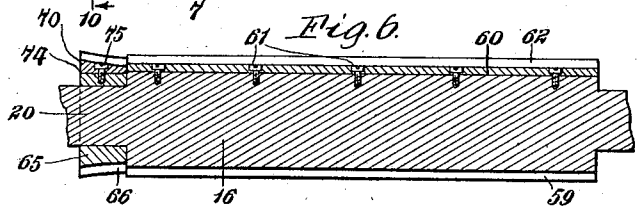

Fig. 7.

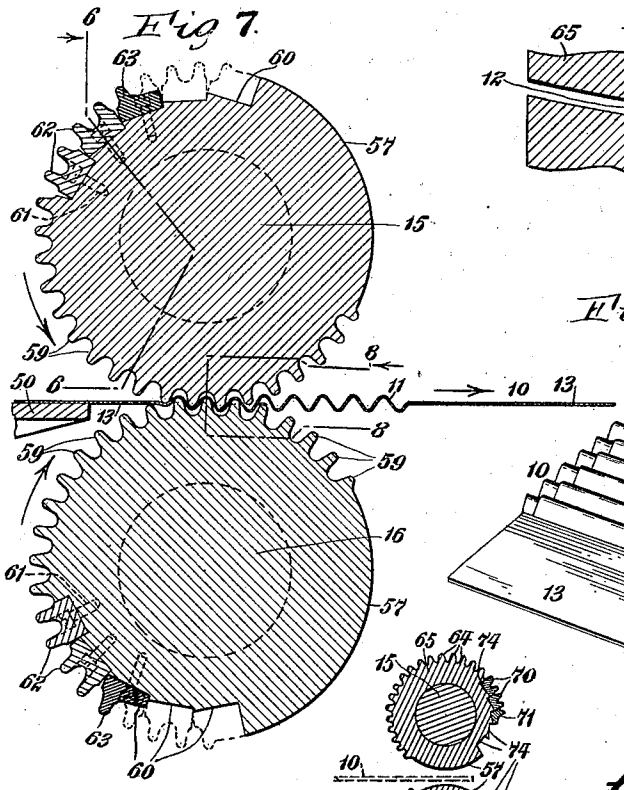

Fig. 8.

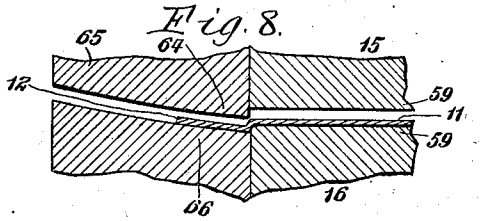

Fig. 9.

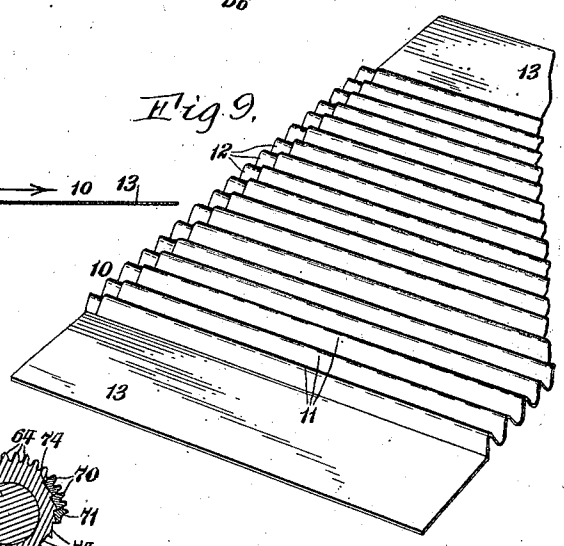

Fig. 10.

Inventor
Bror J. Lindgren
by Geyer & Popp
Attorneys

Patented Mar. 18, 1924. 1,486,977

UNITED STATES PATENT OFFICE.

BROR J. LINDGREN, OF BUFFALO, NEW YORK, ASSIGNOR TO NIAGARA MACHINE & TOOL WORKS, OF BUFFALO, NEW YORK, A CORPORATION.

CORRUGATING MACHINE.

Application filed August 22, 1921. Serial No. 494,044.

To all whom it may concern:

Be it known that I, BROR J. LINDGREN, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Corrugating Machines, of which the following is a specification.

This invention relates to a power driven machine for corrugating sheet metal and relates more particularly to a machine for performing the initial operation upon sheet metal plates which, after undergoing a number of further consecutive mechanical steps, finally become sheet metal, corrugated stove pipe elbows or L's.

One of the objects of the present invention is to provide a machine which may be adjustably altered so as to produce plates of different size and having a different number of corrugations so as to enable the same to be fabricated into stove pipe elbows of different commercial sizes. A further object of the invention is to produce in said plates, not only a plurality of longitudinal corrugations, but also offset corrugations as well, so as to permit said plates to be subsequently curled into cylindrical shape with their overlapping edges fitting together snugly and smoothly.

In the accompanying drawings: Figure 1 is a front view of the complete corrugating machine, partially in section and taken on line 1—1 Figure 2. Figure 2 is a top plan view of the machine. Figure 3 is a left end elevation of the same, partially in section and taken on line 3—3 Figure 1. Figure 4 is a vertical, transverse section through the machine taken on line 4—4 Figure 2. Figure 5 is an enlarged, vertical, longitudinal, fragmentary section through the upper and lower corrugating rollers and taken on line 5—5 Figure 4. Figure 6 is an enlarged, substantially vertical, longitudinal, fragmentary section through the upper roller and taken on line 6—6 Figure 7. Figure 7 is a very greatly enlarged, vertical, transverse section through the rollers taken on line 7—7 Figure 5. Figure 8 is a very greatly enlarged, vertical, longitudinal, fragmentary section through the rollers taken on line 8—8 Figure 7. Figure 9 is a fragmentary perspective view of a typical corrugated metal plate such as produced by the machine. Figure 10 is a fragmentary vertical transverse section somewhat similar to Figure 7 but showing the construction of the removable offset blocks and taken on line 10—10 Figure 5.

Similar characters of reference indicate corresponding parts in the several views.

Figure 9 illustrates the product which the machine produces and which consists of a plate 10 of sheet metal provided with a plurality of longitudinal corrugations or corrugated ribs 11 and a plurality of offset corrugated ribs 12 (see Figure 8) formed at the one end of said longitudinal ribs. The said corrugated ribs 11 and 12 stop short of the opposite ends of the plate and thereby form flat end extensions 13. The width of said extensions (i. e., the distance across the same measured transversely of the ribs 11) is the same for all ordinary sizes of stove pipe elbows. Also the length of the offset corrugated ribs 12 is the same for all ordinary sizes of stove pipe elbows. The total overall length and width of the plate 10 and also the number of corrugated ribs 11 and 12 are, however, somewhat different for the different sizes of pipe elbows. To produce or corrugate these different sized plates on the one machine is the principal object of the present invention.

14 represents the main frame of the machine in which are suitably journaled an upper corrugating roll 15 and a lower corrugating roll 16, said rolls being disposed horizontally and parallel to each other and caused to rotate synchronously with each other by reason of a pair of meshing spur gears 17 and 18. The shaft 20 upon which the lower corrugating roll is mounted, projects longitudinally outwardly a considerable distance and is supported by a heavy bearing box 21, and upon its extreme outer end, is journaled a large driving spur gear 22. The latter meshes with a pinion gear 23 mounted on a jack shaft 24, which latter is suitably journaled in the main frame of the machine and carries a driven spur gear 25 at its inner end. The latter gear, in turn, meshes with a driving pinion 26 mounted on a pulley shaft 27 which is suitably journaled in the main frame of the machine and carries the customary tight and loose pulley wheels 29 and 30 at its outer end, the same being suitably belted to any available source

of power. The engagement of the driving belt (not shown) with either the loose or the tight belt pulley 29 or 30 as the case may be is controlled by the usual pair of belt tongues or arms 31 which are secured to a longitudinally-slidable, square shaft 32 actuated at the opposite end of the machine by a suitable belt-control lever 33 which is pivoted to the main frame of the machine at 34.

Arranged upon the lower, corrugating roller shaft 20 is a clutch 35, which is actuated by a suitable bell-crank lever 36 pivoted to the main frame of the machine at 37. This lever 36 is operatively connected through a link 39 with an outer arm 40 secured to a short, stub shaft 41 suitably journaled in one of the end plates of the main machine frame. The inner end of said stub shaft carries an arm 42 which is operatively connected, through a suitable link 43 and arm 44, with a long, horizontal, longitudinal, pedal shaft 45 which extends the full length of the machine frame and is suitably journaled at opposite ends therein. This pedal shaft is provided near its one end with a substantially horizontal, forwardly extending pedal 46, which is normally held resiliently in its upper position by means of a suitable tension spring 47 (or otherwise), whose upper end is secured to the main frame of the machine (see Figure 4).

When the machine is in normal operation, the pulley shaft 27 and the jack shaft 24 and also the large driving gear 22 are all rotating constantly, but the rest of the machine is idle. Now when the operator of the machine desires to impart motion to the corrugating rolls 15 and 16, he depresses the pedal 46 which actuates the bell-crank lever 36 and also the aforementioned clutch 35, thereby power-connecting the large driving gear 22 to the lower corrugating roll shaft 20, and causing the latter to rotate. By means which are well known in the art and do not concern the present invention, this shaft 20 is always brought to a stop in the same position and is only permitted to rotate one revolution for each depression of the aforesaid pedal 46. It is thus evident that the corrugating rollers 15 and 16 remain at rest (in the position of Figure 4) until the operator depresses the pedal 46, whereupon both of said rollers make one complete revolution and again come to rest.

Secured to the main frame of the machine is a forwardly projecting, horizontal table 50 upon which the operator places the blank of sheet metal which is to be corrugated, said blank being properly positioned thereon by a side locating block or stop gauge 51 and a lengthwise gauge or front stop bar 52. The latter is adjustably movable forwardly and backwardly and is rigidly secured to a horizontally slidable cross-head or guiding plate 53 whose opposite longitudinal sides bear snugly against the inner vertical walls of a guide 54 formed in the upper face of the table 50. By reason of this guide 54 and cross-head 53, the front stop bar or gauge 52 is caused to remain parallel at all times to the corrugating rolls 15 and 16. Said gauge 52 is adapted to be secured in any desired position by means of adjusting bolts 55, whose shanks are received within suitable slots 56 and whose heads are adapted to bear upwardly against the under surface of the table 50.

A portion of the periphery of each of the corrugating rollers 15 and 16 is a smooth, cylindrical and unbroken surface 57. The said cylindrical surface, however, of neither of said rollers ever touches the sheet metal plate 10 (see Figure 4). Formed upon each of the corrugating rolls, adjacent to the said cylindrical surface 57 thereof, are a plurality of longitudinal corrugations 59 which extend a considerable distance around the periphery of each of said corrugating rolls and extend substantially the full length of the same. Also formed longitudinally in each of said corrugating rolls and disposed intermediately of the longitudinal corrugations 59 and the cylindrical surface 57 thereof, are a plurality of flat recesses 60 whose bottoms are disposed obliquely relatively to a radius theoretically drawn therethrough from the axis of rotation of the companion corrugating roll. Adapted to be arranged in said recesses and suitably secured in place by cap screws 61 are a number of detachable, corrugated bars 62 having two corrugations formed on each of the same. Also adapted to be disposed, if desired, in one of the said recesses 60 of each of said corrugating rolls 15 and 16 is a modified detachable, corrugated bar 63 having only one corrugation formed on the outer face of the same. When the machine is being set up for producing corrugated metal sheets 10 intended to be suitable for fabricating the smallest size of stove pipe elbow, then both the corrugated bars 62 and 63 are removed entirely. If, on the other hand, it is desired to produce a larger size of stove pipe elbow requiring, for instance, the addition of an even number of corrugated ribs 11, then one or more bars 62 are placed in position in the aforesaid recesses 60 and secured therein by the screws 61. If, however, the desired additional number of corrugated ribs 11 is an odd number, then one of the single corrugation bars 63 is employed, and (if also required) one or more of the double corrugated bars 62 in addition thereto. (See Figure 10).

Formed in the corrugating roll 15 at one end of the longitudinal corrugations 59 thereof are a plurality of outwardly offset corrugations 64 which are of substantially

the same shape as, and are longitudinally in line with, said longitudinal corrugations 59, but their inner ends are disposed outwardly somewhat therefrom, i. e., further outwardly from the axis of said roll 15. These outwardly offset corrugations 64 may be made integral with the main body of the corrugating roll, but for purposes of manufacture, the same are preferably constructed, as shown, on the periphery of a separate, offset corrugation collar 65 which is preferably press-fitted over the reduced end or journal of the said roll 15. Cooperating with said outwardly offset corrugations 64 arranged upon said upper roll are a plurality of inwardly offset corrugations 66 arranged upon the lower roll, the inner ends of said corrugations 66 being disposed inwardly of the main longitudinal corrugations 59 of the lower roll, i. e., closer to the axis of rotation thereof. It is the co-action (see Figure 8) of these outwardly offset corrugations 64 and inwardly offset corrugations 66 which produces the offset corrugated ribs 12 of the metal plate 10 heretofore described. The purpose of said ribs 12 is best comprehended when it is understood that after the initial operation upon the sheet 10 has been completed by the hereindescribed corrugating machine, that said sheet 10 is curved up into a cylindrical tube the axis of which is transverse of the ribs 11, and with the aforesaid offset ribs 12 overlapping the opposite extreme ends of the said ribs 11. It should be noted that in any sized sheet 10 whatsoever the number of ribs 11 and 12 are in all cases equal to each other. This means merely that, when a certain number of corrugated bars 62 and 63 are added to or removed from the corrugating rolls 15 and 16, a like number of outwardly, offset, double-corrugated blocks 70, (and perhaps, in addition a single-corrugated, outwardly offset block 71) are added to the upper corrugating roll 15 and the same arrangement and number of inwardly offset blocks 72 and 73 added to the lower corrugating roll 16. These offset blocks are received within longitudinal recesses 74 which are formed adjacent to the outermost offset corrugations 64 and 66 respectively and similarly to the manner in which the corrugated bars 62 and 63 are received within the recesses 60, and similarly secured therein by cap screws 75.

The manipulation of the machine is as follows: The operator first moves the belt lever 33 from its dotted line position to its full line position, thereby shifting the usual flexible driving belt (not shown) to the tight belt pulley 30. Then he places a blank piece of flat, sheet metal (previously cut to a proper length and width) upon the table 50 in the position indicated in Figures 2, 3, 4, and 5, with its outer edge or rear bearing against the inner face of the gauge 52 and its left edge positioned by the side gauge 51. In this position the front portion of the said blank extends forwardly through the interstice between the rollers 15 and 16 (see Fig. 4) without, however, gripping the same because of the smooth cylindrical faces 57 of said rolls. The operator then presses down on the pedal 46, which causes the one revolution clutch 35 to rotate both of the corrugated rolls 15 and 16 just one single revolution. This brings the innermost of the corrugations 59 into contact with the metal blank, thereby not only crimping or corrugating the same in the manner of Figure 7 but also causing the said blank to be drawn forwardly between the rotating rolls. The extreme forward and rear parts 13 of the sheet or plate 10 are, however, left uncorrugated, these portions 13 going to make up the male and female ends of the stove pipe elbow which ends are formed during a subsequent operation upon the sheet 10 and permit the completed stove pipe elbow, in the usual and well known manner, to slip respectively into and around the adjacent male and female ends of adjacent stove pipes, so as to effect a smoke tight junction therewith. If the operator desires to alter the machine, so as to produce either larger or smaller plates 10 and create a larger or smaller number of corrugated ribs 11 and 12 thereon, then he adds to or removes from both rollers 15 and 16, a like number of double corrugated bars 62 (and if necessary the single bars 63) and also the offset double corrugated blocks 70 and 72 (and if necessary the single corrugated blocks 71 and 73). These bars and blocks are detachably held in their oblique-bottomed recesses by the several cap screws 61 and 75. It is obvious that for larger or smaller sizes of plates 10, the gauge bar 52 must be set either rearwardly or forwardly, and locked in position by adjustment bolts 55, but the same is always retained in a position parallel to the corrugating rolls 15 and 16 by reason of the co-action of the sliding head 53 and guide 54. The longitudinal position of the end gauge block 51 is, however, never shifted, because the overlapping or offset corrugated ribs 12 are of the same length for every size of stove pipe elbow. The length of the corrugated ribs 11 of any sized plate 10 is determined merely by the overall width of said plate. For small plates, such as shown in Figure 5, the right edge of the said plate 10 does not extend over to the right end of the rolls, and the extreme ends of the corrugations 59, in such a case, perform no function. A larger plate, of course, utilizes more of said corrugations 59 and extends further to the right. These aforementioned changes are all that are re-

quired to produce either larger or smaller plates for the different sized stove pipe elbows.

I claim as my invention:

1. A corrugating machine comprising a pair of cooperating corrugating rolls each having a plurality of integral, longitudinal corrugations formed on its periphery and also having a plurality of longitudinal recesses having obliquely formed buttons; and a plurality of longitudinal corrugated bars adapted to be disposed within said recesses.

2. A corrugating machine comprising a pair of co-operating corrugating rolls each having a plurality of integral, longitudinal corrugations formed on its periphery and also having a plurality of longitudinal recesses having obliquely formed bottoms, said bottoms being disposed at equal angles relatively to a radius drawn through each of the same; and a plurality of longitudinal corrugated bars adapted to be disposed within said recesses.

3. A corrugating machine comprising a pair of co-operating corrugating rolls each having an integral longitudinal corrugation and an offset corrugation and also having a longitudinal recess and a locating shelf disposed longitudinally in line with each other; a corrugated bar adapted to be disposed in said longitudinal recess; and an offset corrugated block adapted to be disposed upon said locating shelf.

4. A corrugating machine comprising an upper corrugating roll having longitudinal corrugations and inwardly offset corrugations located at one end of said longitudinal corrugations; a corrugated bar arranged adjacent to said longitudinal corrugations of said upper roll; an inwardly offset corrugated block arranged adjacent to the said inwardly offset corrugations of said upper roll; a lower corrugating roll having longitudinal corrugations and outwardly offset corrugations; a corrugated bar arranged upon said lower roll; and an outwardly offset block arranged upon said lower roll.

BROR J. LINDGREN.