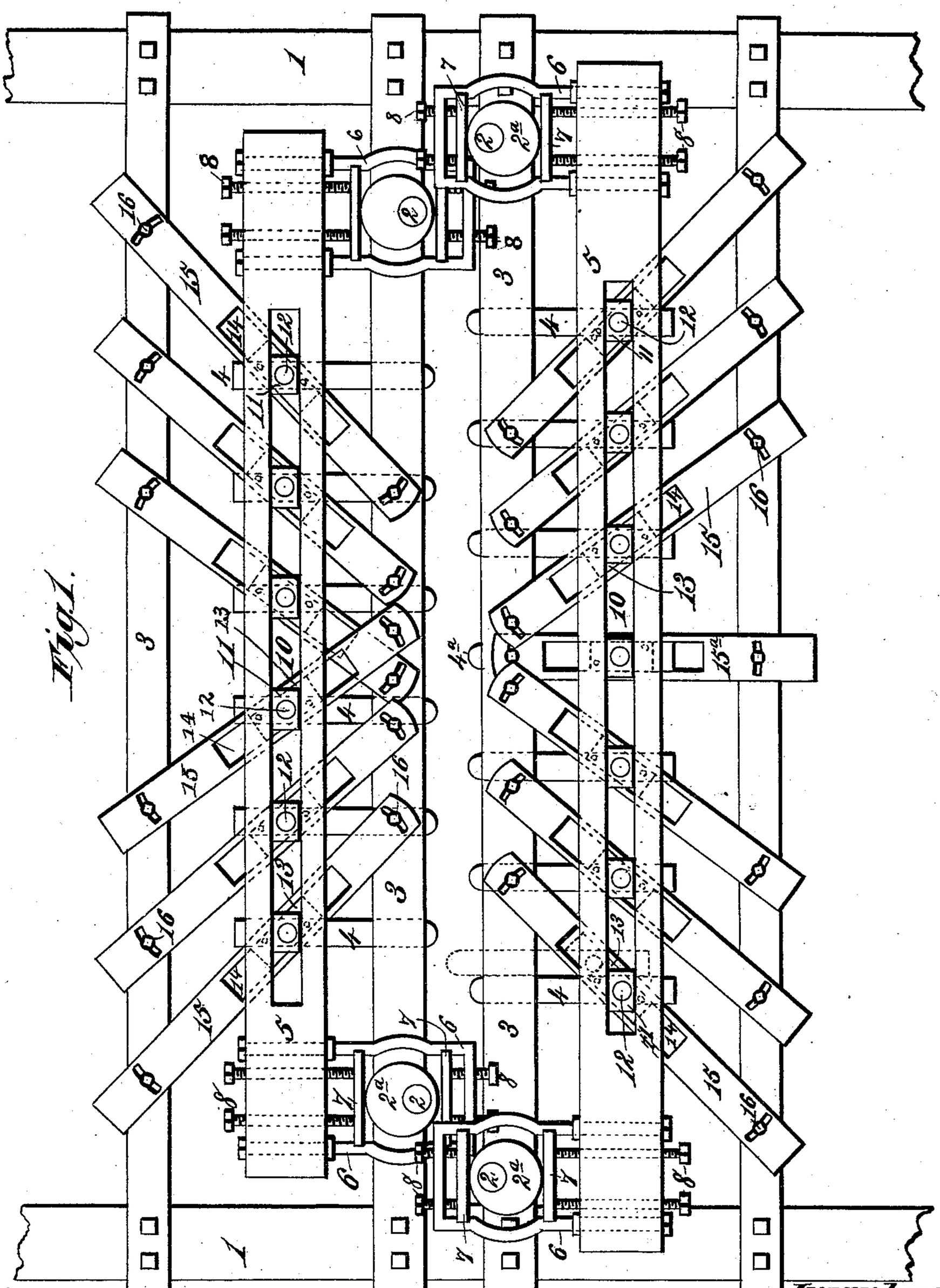
(No Model.) 2 Sheets—Sheet 1.

B. F. CALDWELL & W. F. PETERSON.

MACHINE FOR CORRUGATING SHEET METAL.

No. 370,682. Patented Sept. 27. 1887.

Fig. 1.



Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

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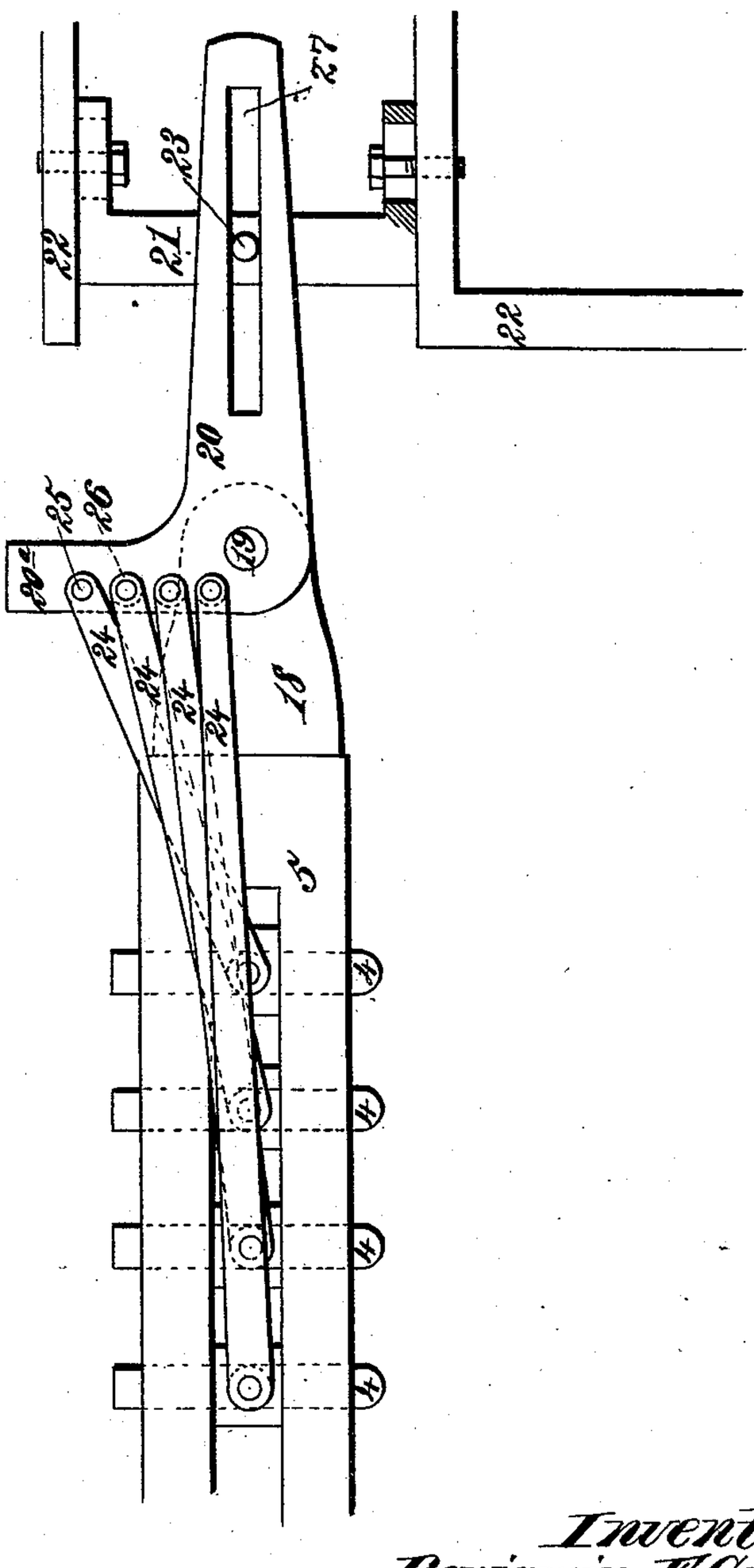
Fig. 2.



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UNITED STATES PATENT OFFICE.

BENJAMIN F. CALDWELL AND WILLIAM F. PETERSON, OF WHEELING, WEST VIRGINIA.

MACHINE FOR CORRUGATING SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 370,682, dated September 27, 1887.

Application filed March 31, 1887. Serial No. 233,203. (No model.)

To all whom it may concern:

Be it known that we, BENJAMIN F. CALDWELL and WILLIAM F. PETERSON, citizens of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented new and useful Improvements in Machines for Corrugating Sheet Metal, of which the following is a specification.

Our invention relates to machines for corrugating sheet metal for roofing purposes. Heretofore this operation has generally been performed by passing the metal between rolls having the necessary projections upon their peripheries. Dies have also been used for the same purpose. In another instance the sheet has been corrugated by means of rolls which have an inward movement toward a central roll which has vertical movement only, the inward movement being effected by right-and-left-hand screw-shafts having threads of varying pitch. Mandrels have also been used having unequal inward movement toward a central mandrel, which has vertical movement only; but, as will readily be understood, such mechanism cannot satisfy the requirements, since at each corrugation outside those adjacent to the one formed by the mandrel having vertical movement only the strain upon the metal increases rapidly. The objection to these methods, with the exception of the third, is that a great strain is exerted upon the metal in order to draw it into the necessary form, and the metal is frequently ruptured thereby, or so badly weakened as to impair its value. Moreover, it has never yet been possible to form the corrugations of uniform gage when a large number of sheets are corrugated. In other words, when the rolls are set for one thickness or gage of metal, no other gage can be rolled with corrugations of similar size, and it is impossible to roll an unlimited number of sheets with the usual rapidity of manufacture and have them all of exactly the same gage, and the consequence is that the corrugations are not of uniform size. Again, corrugating-rolls will form only corrugations of a given depth, and in order to vary the latter it is necessary to change the rolls. Stamps or dies have been employed; but their action is not only extremely slow, but causes too much stress to the fiber of the metal. The objection to the use of the rolls having inward adjustment by means of right-and-left-hand screw-threads is that the machine is exceedingly complicated and cumbersome, and, inasmuch as the rolls act only upon one portion of the metal at the same time, the strain upon succeeding parts must be the same or nearly the same as if the inward adjustment were not employed.

Our invention has for its object the avoidance of all these objections and to provide mechanism of a simple character which may be easily and quickly adjusted to corrugate the metal to any depth and of any width without danger of straining or fracturing the metal.

The invention consists in the several novel features of construction and combination of parts, hereinafter set forth, and definitely pointed out in the claims.

In the accompanying drawings, Figure 1 is an end elevation of a machine embodying our invention. Fig. 2 is a view showing a different means for applying the same principle.

In the said drawings, the reference-numeral 1 designates the frame of the machine, having suitable supports, within which are journaled shafts 2, extending from end to end of the machine. Two of said shafts are placed in front and two at the rear, the axes of each pair being in different vertical planes.

Within horizontal supports 3 on the machine-frame are mounted a series of mandrels, 4, carried by a beam, 5, the ends of which are mounted on yokes 6, which straddle the shafts 2. Sliding on the vertical arms of these yokes are pieces 7, capable of adjustment by means of set-screws 8, which are tapped through the ends of the beams 5. These pieces 7 have bearing upon an eccentric, 2^a, on the shaft 2. By adjusting the screws 8 the beams 5 may be raised or lowered at each end. The construction set forth is the same at each end of each of the beams 5.

Upon the uprights of the machine-frame are mounted horizontal bars 3, one being placed above and one below each of the beams 5. In each beam 5 is cut a central longitudinal slot, 10, extending nearly from end to end, and in this slot are placed the head-blocks 11, which

upport the mandrels 4. These head-blocks are so constructed as to slide freely in the slot 10, and from their outer faces project studs 12, which engage with independent blocks 13, capable of rotation on the studs. These blocks 13 lie within slots 14, formed in diagonally-arranged bars 15, the ends of the latter being rigidly attached to the horizontal bars 3 by means of set-screws 16. It will now be seen that if vertical reciprocation is given to the lower beam 5 the mandrels 4, carried by said beam, will have a movement upward and to the right and left, the block 11 having movement in the slot 10, and simultaneously the block 13 being carried up in the diagonal slot 14. The mandrel carried by the block at the left-hand end of the lower beam in the figure will therefore occupy the position denoted by dotted lines in the drawings.

In corrugating sheet metal each corrugation will contract the width of the sheet a distance equal to the difference between the lengths of the curves of the corrugations and the chord subtending the curves. Now, it is evident that if a series of corrugations are simultaneously formed the shrinkage or contraction in width will be equal to the sum of the several contractions produced by each corrugation. Therefore, while each edge of the sheet will be drawn inward toward the center a distance equal to one-half the entire contraction, each point of the sheet between the edge and the center will have an inward movement less than that of the edge, the difference being governed by the difference in the number of corrugations lying between the said intermediate point and the center. It will be apparent, therefore, that while each of the mandrels on the opposite sides of the central mandrel, 4^a, should have an inward movement equal to the contraction in width produced by two corrugations, the next succeeding mandrels will have, necessarily, an inward movement equal to that of the preceding mandrel, plus the amount of contraction produced by itself. In other words, proceeding from the central mandrel, 4^a, toward the ends of the series, each should move inward, or toward the center, a distance equal to the contraction produced by itself, plus that produced by all the mandrels between it and the central mandrel, plus one-half the contraction produced by the other. In order, therefore, to compensate for these successive increments of contraction, we simply arrange the diagonal bars 15 at increasing angles successively with the central bar, 15^a, which is vertical, thereby causing each head-block 11 to have an increased horizontal movement in the slot 10 of the beam 5. The diagonal arrangement of the bars 15 is the same upon each of the beams 5, said bars being of course inclined toward the central mandrel.

By adjusting the screws 8 the beams 5 may be raised and lowered, and the depth of the corrugations produced by the mandrels 4 correspondingly varied. In accordance with such variation the diagonal bars 15 must be adjusted in inclination, their angles with the vertical being increased in proportion to the depth of such corrugations, and vice versa.

By this invention the metal may be crimped or corrugated with great rapidity and without the slightest danger of weakening or fracturing its fiber, as is the case with both rolls and dies.

Our invention is not intended to simply cover the application of the idea shown in our illustrations, but to embrace the principle of one vertical mandrel holding the metal on which it acts firmly in place, while the other mandrels are actuated by slides inclined at angles sufficient to produce horizontal movements in the mandrels equal to the contractions of the sheet.

As an example of the scope of our invention we have shown in Fig. 2 a method of applying the principle, as follows: In this construction the support 5, within which the mandrels are carried, is mounted on pivotal bearings 18, connected by a joint, 19, to a lever, 20, having a movable fulcrum, 21, mounted on suitable supports, 22, on which it is adjustable to bring the fulcrum-point 23 nearer to or farther from the end of the support 5 or the pivotal point 19.

The mandrels 4 are constructed and arranged in the manner already shown; but instead of the devices for controlling their horizontal movement, shown in Fig. 1, each mandrel is connected to one end of a bar, 24, the other end thereof being pivotally connected to the lever 20, the several points of connection approaching or receding from the pivotal point 19 in proportion to the position of the mandrels relatively to the central mandrel. In other words, the outer mandrel will be connected to a bar 24 having its other end pivoted to the lever at the point 25, the second mandrel will be moved by a bar 24 pivoted at 26, and so on. The lever 20 has an extension, 20^a, to accommodate these pivotal attachments, and it will be seen that as the support 5 rises and falls the several mandrels will receive the required movement from said bars 24. The ends of the levers 20 have slots 27 to permit the reciprocation of the mandrel-support 5, and by moving the fulcrum-bar 21 inward or outward the horizontal movement of the mandrels will be relatively increased or decreased, whereby the necessary compensation may be made for corrugations of different depths.

Having thus described our invention, what we claim is—

1. The combination, with a rising and falling support, of a series of mandrels carried thereby, those mandrels upon opposite sides of the center having a movement toward said center simultaneously with the vertical movement, and guides having a constantly-increasing inclination by which the inward movement of said mandrels is effected, substantially as described.

2. The combination, with supports which recede from and approach each other, of a se-

ries of mandrels carried by each support, each mandrel having horizontal movement on its support, and stationary inclined guides upon each side of the center of the series, whereby said mandrels are moved toward and from said center at the same time with their vertical movement, substantially as described.

3. The combination, with supports which recede from and approach each other, of a series of mandrels carried by each support and having horizontal movement on their supports, stationary inclined guides engaging with blocks on said mandrels, and means for varying the inclination of said guides, substantially as described.

4. The combination, with supports which recede from and approach each other, of shafts having eccentrics, devices for raising and lowering said supports relatively to their shafts, a series of mandrels upon each support, each mandrel having a head-block moving in a horizontal slot in the support, inclined guides mounted on stationary supports and having slots engaging with independent blocks on said mandrels, and means for varying the inclination of said supports, substantially as described.

5. The combination, with the shafts 2, having eccentrics 2^a, of the beams or supports 5, adjustably connected with said eccentrics, mandrels 4, having head-blocks 11, moving in slots 10 in said beams, inclined slotted guide-bars 15, mounted on stationary supports or beams 3, independent blocks 13 on the mandrels, moving in the slots of the guide-bars, and means for varying the inclination of the latter, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

BENJAMIN F. CALDWELL.
WILLIAM F. PETERSON.

Witnesses:
THOS. MINNS,
JOHAN SOMBE,
JAMES A. HENRY.