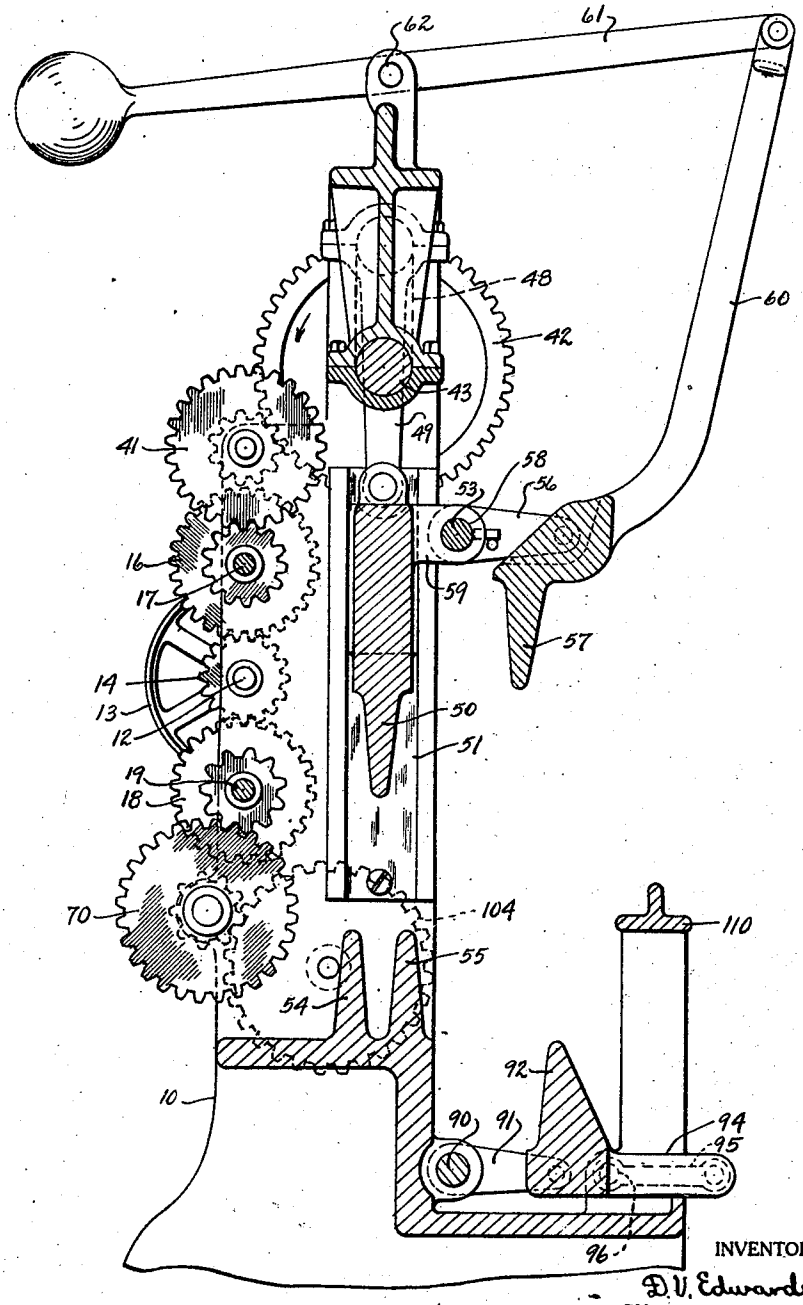
April 5, 1927. 1,623,467

D. V. EDWARDS

CORRUGATING MACHINE

Filed June 7, 1924 6 Sheets-Sheet 1

Fig 1



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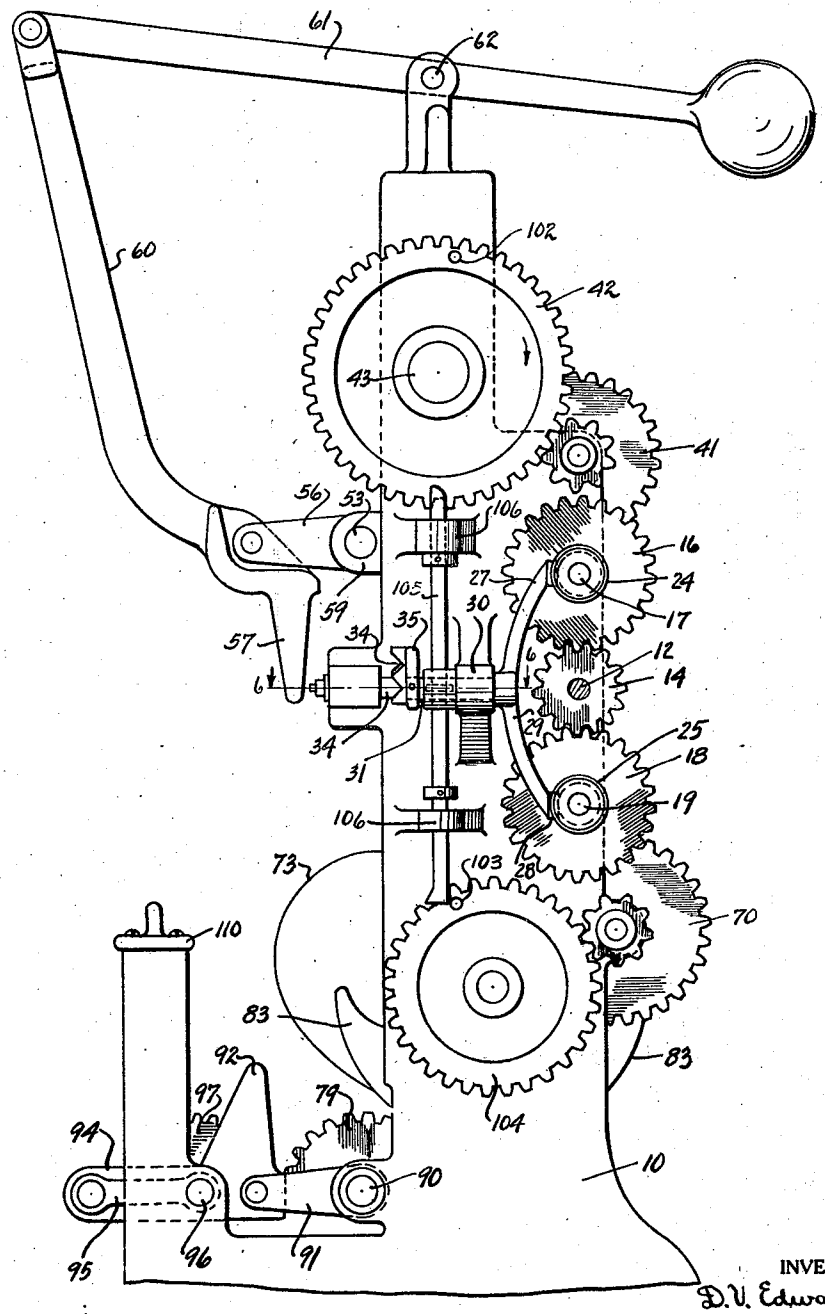
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CORRUGATING MACHINE

Filed June 7, 1924 6 Sheets-Sheet 2

Fig 2



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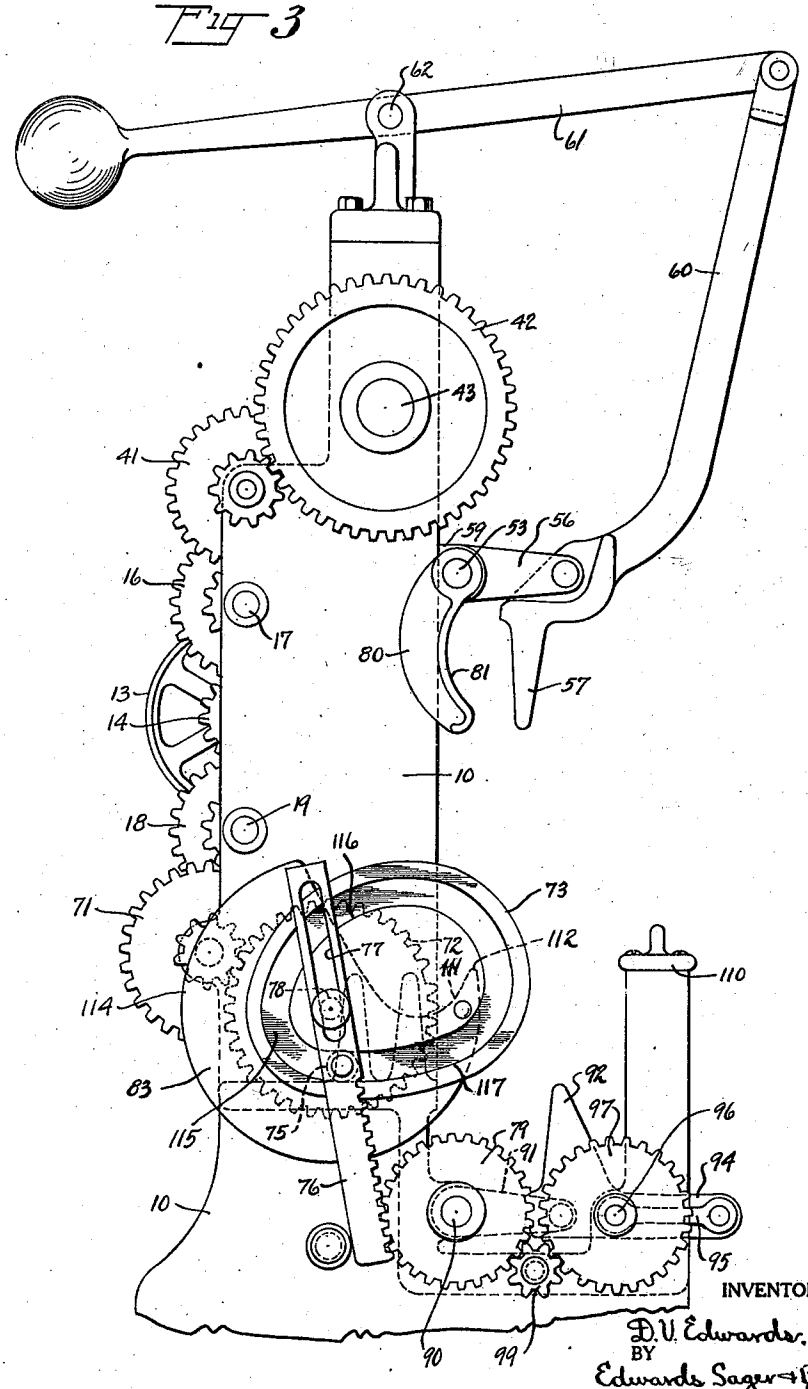
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CORRUGATING MACHINE

Filed June 7, 1924 6 Sheets-Sheet 3

Fig 3



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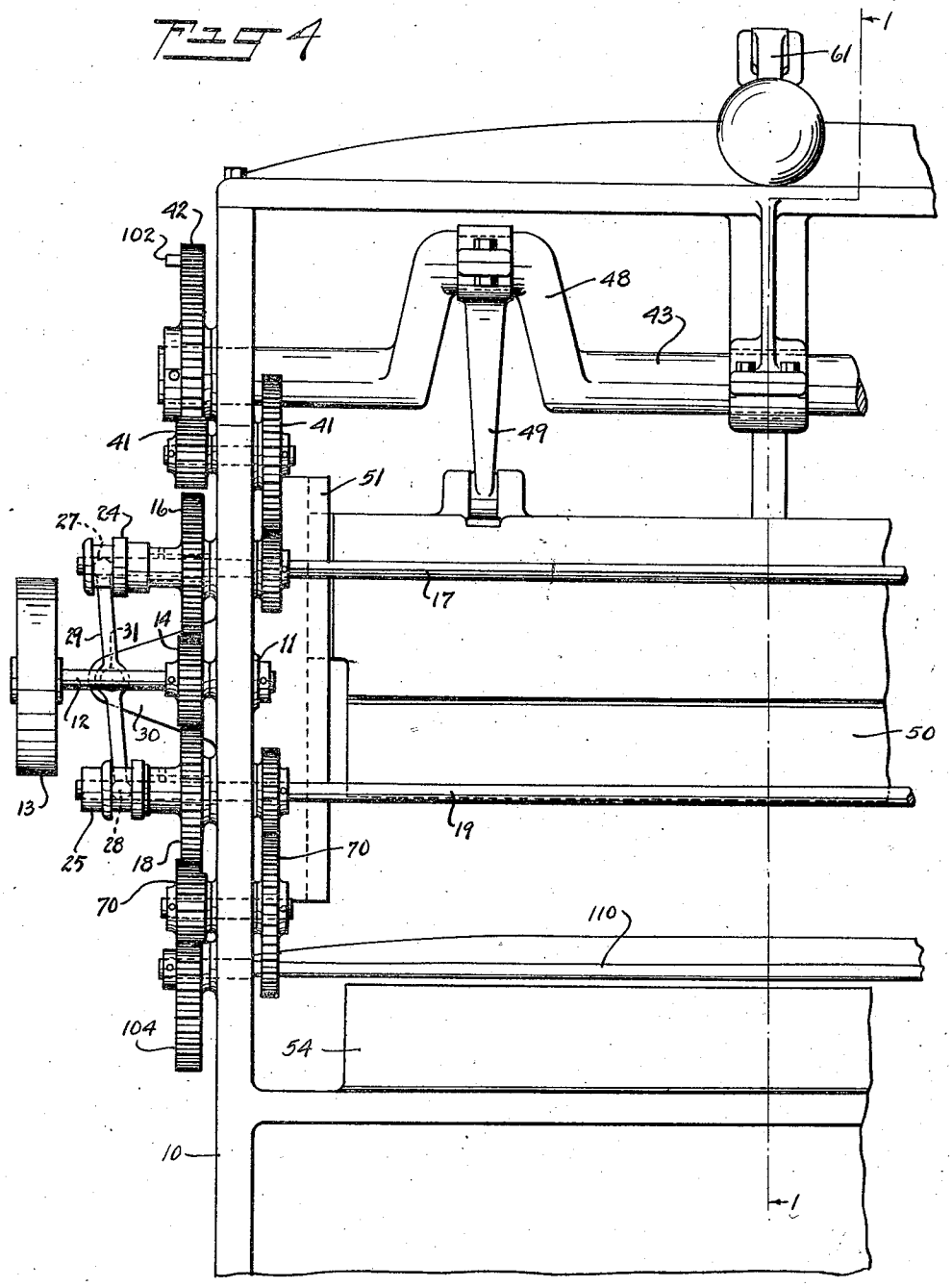
April 5, 1927. 1,623,467

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CORRUGATING MACHINE

Filed June 7, 1924 6 Sheets-Sheet 4

Fig 4



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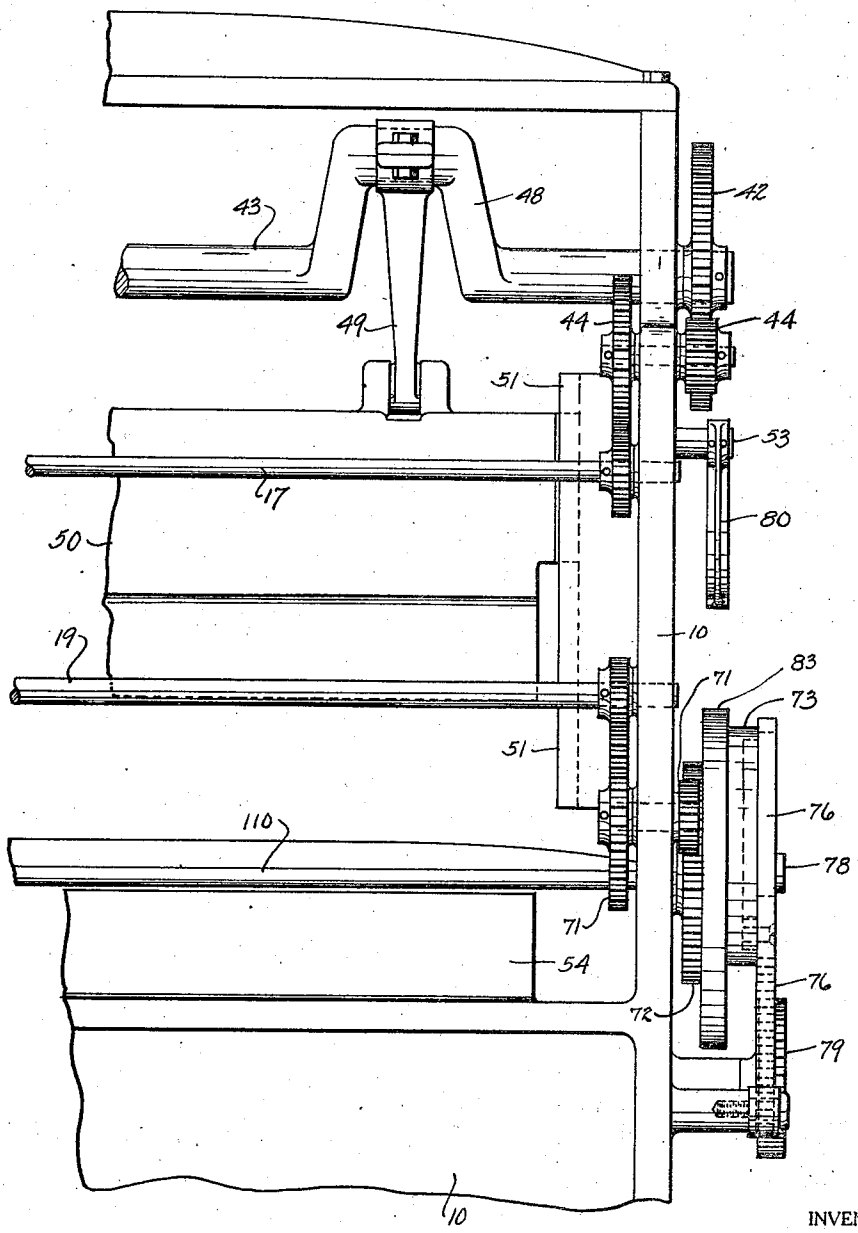
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Filed June 7, 1924 6 Sheets-Sheet 5

Fig 5



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CORRUGATING MACHINE

Filed June 7, 1924 6 Sheets-Sheet 6

Fig 6

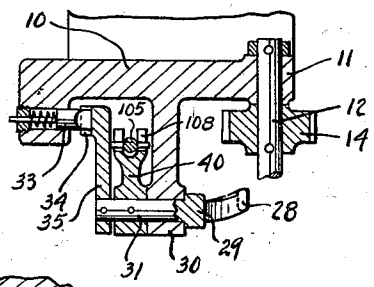


Fig 7

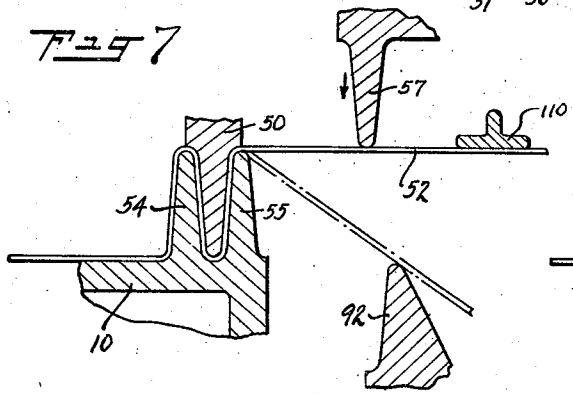


Fig 8

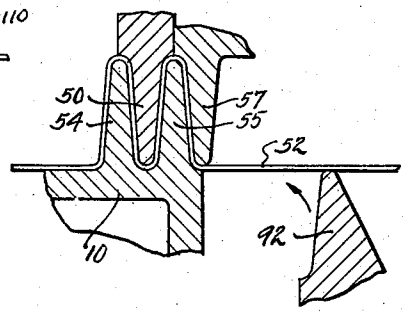


Fig 9

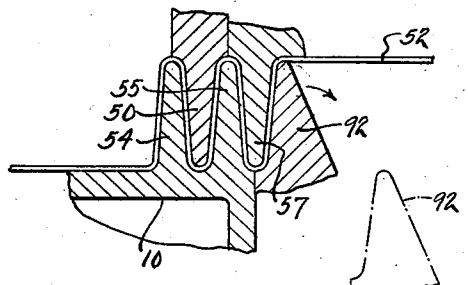
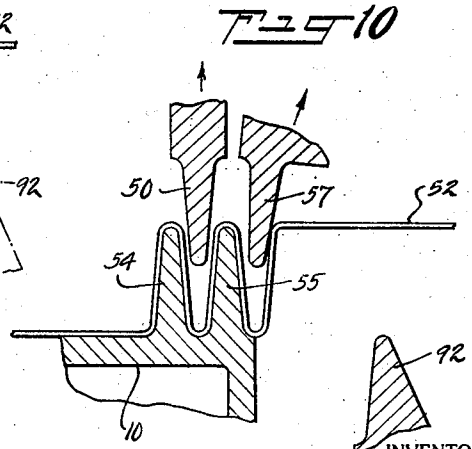


Fig 10



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UNITED STATES PATENT OFFICE.

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CORRUGATING MACHINE.

Application filed June 7, 1924. Serial No. 718,426.

This invention relates to apparatus for corrugating and particularly to a machine wherein material such as sheet metal is formed into successive corrugations between relatively movable bending dies.

One object of the invention is to provide a machine in which the corrugations are formed by bending of the metal around a die surface without stretching or distorting the metal in any way and my invention is particularly adapted to form deep corrugations in sheet metal without stretching or distorting the metal.

Another object of the invention is to provide a corrugating machine which is simple, rugged and economical in construction and operation.

Other objects and advantages will appear from the following description taken in connection with the accompanying drawing in which—

Fig. 1 is a vertical sectional view taken on the line 1—1 of Fig. 4 and shows one embodiment of my invention.

Fig. 2 is an end elevation of the machine shown in Fig. 1 taken from the left of Fig. 4.

Fig. 3 is an end elevation of the same taken from the right of Fig. 5.

Figs. 4 and 5 constitute together a side elevation of the machine shown in Fig. 1.

Fig. 6 is a detail sectional view taken on the line 6—6 of Fig. 2.

Figs. 7 to 10 are vertical sectional views of the holding and forming dies in successive positions illustrating diagrammatically the method involved in the corrugating operation.

Referring to Figs. 1 to 5, 10 represents the supporting frame of the machine. Mounted in bearings 11 in the frame 10 is a shaft 12 having secured thereto a pulley 13 adapted to be driven from a suitable source of power not shown. Secured to the shaft 12 is a pinion 14 which meshes with an upper gear wheel 16 mounted upon a shaft 17 carried by the frame 10 and with a lower gear wheel 18 mounted upon a shaft 19 likewise carried by the frame 10. Gears 16 and 18 are adapted to rotate freely on their respective shafts but may be coupled to these shafts by means of clutches 24 and 25 which are operated respectively by the end portions 27 and 28 of an oscillating member 29 mounted on a shaft 31 journaled in a bearing 30 on the frame 10. When one of the clutches is moved by the member 29 to clutch its gear wheel to the shaft the other clutch is moved to release the other gear wheel from the other shaft. A spring pressed pawl 33 adapted to engage notches 34 in a member 35 secured to the shaft 31 serves always to force one or the other of the clutches into engaging position. Oscillating member 29 is operated from an arm 40 secured to shaft 31 by means which will be more fully described hereafter.

Gear wheel 16 is adapted to operate, through reduction gearing 41, a gear 42 mounted upon one end of the shaft 43 journaled in the frame 10. Similar reduction gearing 44 operated from the shaft 17 serves to drive the other end of the shaft 43. Shaft 43 is formed with cranks 48 to which are secured by means of links 49 a reciprocating male holding die 50 adapted to be guided in guide ways 51 carried by the sides of the frame 10. Extending between the sides of the frame 10 are two upwardly directed die members 54 and 55 each of substantially the same form as the reciprocating die 50. The inner opposed faces of the die members 54 and 55 form a female die adapted to cooperate with the reciprocating male die 50 to receive and hold a previously formed corrugation of the metal sheet 52 while the operation of forming an adjacent corrugation is being performed. Pivotally secured to the outer end of the arm 56 which is secured to a shaft 53 journaled at 58 in a bracket 59 carried by the die 50, is a downwardly projecting forming die 57. Die 57 is provided with an upwardly extending arm 60 which is pivoted at its upper end to a counterweighted lever 61 pivotally mounted at 62 on the frame 10. Secured to the shaft 53 is an operating arm 80 having a bearing surface 81 adapted to be engaged by a cam 83 to move the shaft 53 and die 57 in a manner more fully to be described hereafter.

Adapted to be operated from gear 18 through reducing gearing 70 and 71 located at opposite sides of the frame 10 is a gear 72 journaled in the frame 10. Gear 72 is formed on one face with a cam 73 which is adapted to engage a roller 75 mounted upon a rack bar 76. Bar 76 is formed at its upper portion with a slot 77, adapted to receive a pin 78 projecting from the cam 73 and in alinement with the axis of the gear 72. The

rack bar 76 serves to actuate a gear 79 mounted on a shaft 90 journaled in the frame 10. Shaft 90 is provided with arms 91 which are pivotally secured to and actuate an upwardly extending forming die 92. Die 92 is provided with outwardly extending arms 94 which are pivotally secured at their outer ends to the ends of links 95. The inner ends of links 95 are secured to the shaft 96 journaled in the frame of the machine.

Secured to one end of the shaft 96 is a gear 97 adapted to be actuated from gear 79 through pinion 99. Gear wheel 72 likewise carries a cam 83 which cam is adapted to engage the arm 80 for the purpose of actuating the die 57.

On the outer face of gear 42 is a lug 102 and a similar lug 103 is carried by the gear 104 of the reducing gearing 70. Lugs 102 and 103 are adapted to move the actuating bar 105 for the clutches 24 and 25. Bar 105 is guided in its movement in suitable brackets 106 in the frame 10 and it actuates a yoke 108 carried by the arm 40 secured to the shaft 31. Assuming that the bar 105 is in the position shown in Fig. 2 of the drawing the clutch 24 will at this time serve to connect the gear 16 to the shaft 17 and the gear 42 will be rotating in a clockwise direction. This condition of operation will be maintained until the lug 102 engages the upper end of the bar 105, when this bar will be forced downwardly and the member 29 oscillated to disengage the gear 16 from the shaft 17. The spring pawl 33 will complete the motion of the member 29 in this direction to a position in which the clutch 25 secures the gear 18 to the shaft 19. Upon disengagement of the clutch 24 the gear 42 will cease to rotate, the momentum of this gear being however sufficient to cause the lug 42 to move slightly beyond the upper end of the bar 105. Upon engagement of the clutch 25 the gear 104 will begin rotating and will continue to rotate through one complete revolution at which time the lug 103 will engage the lower end of the bar 105 and oscillate the member 29 in the opposite direction which will result in a disengagement of the clutch 25 and a reengagement of the clutch 24. It will thus be seen that the gear 42 will make one complete revolution and will then stop, whereupon the gear 72 will make one complete revolution and stop; these revolutions continuing alternately during the operation of the machine.

In the operation of bending the metal 52 it will be assumed that one corrugation has been formed and this corrugation is inserted between the inner faces of the die members 54 and 55. Starting with the dies 50, 54, 55, 57 and 92 in the relative positions shown in Fig. 1, the gear 42 will be rotating in a clockwise direction as viewed in Fig. 2 and as a result of this rotation the die 50 will be forced down between the inner faces of the die members 54 and 55 into a position to hold securely the metal sheet 52. At the same time the die 57 will move downwardly with the die 50 so that the dies will occupy the relative positions shown in Fig. 7. At this time the metal 52 will be held between the die 50 and die members 54 and 55 and will extend rearwardly beneath a stop 110 mounted on the frame 10. When the parts have assumed the position shown in Fig. 7, the clutch 24 will be disengaged from the gear wheel 16 by the engagement of the lug 102 with the upper end of the rod 105 and the clutch 25 will become engaged, start to rotate the gear 42 in a clockwise direction as viewed in Fig. 2. The lower end of the arm 80 which during rotation of the shaft 43 has been moved into engagement with the reentrant portion 111 of the cam 83 will be rotated by the cam upwardly in a clockwise direction as viewed in Fig. 3. During this movement the projecting portion 112 of the cam engages the bearing surface 81 of the arm 80. The horizontal arm 56 will be rotated downwardly in a clockwise direction and will carry with it the die 57. The die by reason of its pivotal connection with the arm 60 and its connection with the balanced lever 61 will be maintained during this movement in a substantially vertical position. During this downward, curvilinear motion of the die 57 its lower point will engage the sheet of metal 52 and force the same downwardly bending the metal around the upper tip of the die member 55 to a position shown in Fig. 8 in which the sheet 52 is pressed between the outer face of the die member 55 and the adjacent face of the die 57. At the time the die 57 has reached the position shown in Fig. 8 the outer end of the arm 80 will have ridden along the engaging face of the cam until it has reached the outer cylindrical portion 114 of the cam surface. During the time that the die 57 has been bending the metal downwardly along the outer face of the die member 55 the die 92 has remained stationary for the reason that the roller 75 has been travelling over a portion 115 of the face of the cam 73 which is concentric with the axis of rotation of the gear 72. When however the die 57 has reached the position shown in Fig. 8 the portion 116 of the cam 73 will engage the roller 75 on the rack bar 76 and as a result the roller 75 will be moved away from the axis of the gear wheel 72 and with it the rack bar 76 which is in mesh with the gear 79. As the gear 79 rotates and swings the arm 91 upwardly the die 92 will be moved upwardly in a counterclockwise direction, such die remaining however in a substantially vertical position due to the parallel link connection formed by the arms 91 and

95. This movement of the die 92 will cause the metal sheet to be bent around the lower end of the die 57 to a position shown in Fig. 9, in which the metal will be clamped between the adjacent faces of the dies 57 and 92. At the time the dies assume the relative positions shown in Fig. 9 the outermost portion 116 of the cam 73 will be in engagement with the roller 75 and the roller will have been forced to its outermost position. From this time on the roller will move along the portion 117 of the cam the die 92 will be withdrawn from the metal 52 to a position shown in dotted line in Fig. 9 in which position the gear wheel 72 and 104 will have completed one revolution and gear 104 will again be in the position shown in Fig. 2. Just before assuming this position lug 103 on gear 104 will have engaged the bar 105 to shift the clutches 24 and 25 so as to disconnect the gear 18 from the shaft 19 and connect the gear 16 to the shaft 17. The gear 42 will then start rotating in a clockwise direction and first lift the male holding die 50 from between the inner faces of the die members 54 and 55. At the same time the die 57 will be withdrawn from the corrugation which has just been formed in the sheet 52 and when so withdrawn the counterweighted lever 61 will rotate the shaft 58, arms 80 and 56 to the position shown in Fig. 2. The positions of dies 50 and 57 as they are leaving the metal is shown in Fig. 10. When the dies 50 and 57 have been raised sufficiently the operator advances the sheet of metal by lifting the same and inserting the last formed corrugation between the die members 54 and 55. The continued rotation of the gear 42 will then again force the dies 50 and 57 downwardly and the operation above described will be repeated. Suitable controlling means may be employed to stop the machine when in a position shown in Fig. 1 to enable the operator to advance the sheet 52. However generally a sufficient time will elapse in normal operation of the machine after the lifting of the dies 50 and 57 to enable the operator to advance the sheet.

While I have shown the die 50 moved by means of cranks 48 on the shaft 43 in certain cases it may be advisable to employ cams operated from the gear instead of the cranks 48. When such cam is employed it will engage a pin or part secured to the die 50 and when the die 50 is in its lower holding position such pin or part will preferably engage a cylindrical portion of the cam which is concentric with the axis of the gear 42 so that there will be no tendency to rotate the gear 42 by reason of any upward pressure which may be exerted by the sheet 52 held in the clamping dies or by the upward reaction on the pivotal connection of the arm 80 during the time when the die 57 is bending the metal. If desired also in addition to providing a cam for operating the die 50, the die 50 may be resiliently connected to its operating means or the die members 54 and 55 may be resiliently supported on the frame so as to provide for the clamping of the sheet under a resilient pressure.

I claim:

1. A corrugating machine comprising sheet clamping die means, movable means for supporting one of the same, two dies which are relatively movable to form half of each corrugation, one of said latter dies being carried by said supporting means and movable therewith, and a die which is movable to a position to cooperate with one of said first mentioned dies to form the other half of each corrugation.

2. In a corrugating machine, clamping dies, means for moving one of the same, a die movable relatively thereto and whenever said latter means moves and adapted to cooperate therewith to form half of each corrugation and a die adapted to cooperate with said movable die to form the other half of each corrugation.

3. A corrugating machine comprising clamping means having a movable element, a stationary forming die, two movable dies operating upon opposite sides of the material to be corrugated and means whereby one of said dies is movable whenever said element moves and adapted to cooperate with said stationary die to form one side of each corrugation and the other being movable to cooperate with said first movable die to form the other side of each corrugation.

4. An automatic corrugating machine comprising power operated clamping means, power operated bending means including a die pivotally secured to and movable with said clamping means, and controlling means therefor adapted to cause the actuation of said clamping and bending means periodically and alternately.

5. A metal bending machine comprising co-operating, reciprocating and stationary clamping means, a forming die pivotally secured to said reciprocating clamping means and actuating means operative on the movement of said movable clamping means to clamping position for moving said forming die to bend the metal.

6. A metal corrugating machine comprising a stationary clamping member, a reciprocating clamping member cooperating therewith, a stationary forming die, a forming die movable with said reciprocating member and means operative on movement of said reciprocating member to clamping position for actuating said movable forming die to bend the metal about said stationary forming die.

7. A metal corrugating machine comprising a reciprocating clamping member, an arm pivoted thereto, a forming die pivotally connected to said arm, means for swinging said arm to actuate said die to form a portion of a corrugation, a second movable die for forming the remainder of said corrugation and means for moving said clamping member in one direction to clamp said metal and in the opposite direction to release said metal and to move said forming die away from the bent metal.

8. A metal corrugating machine comprising a frame, a reciprocating clamping member, an arm pivoted thereto, a forming die pivotally connected to said arm, an arm pivoted to said die and to said frame, means for swinging said arms to actuate said die to form one side of a corrugation, a movable die adapted to cooperate with said forming die for completing the corrugation, means for moving said clamping member in one direction to clamp said metal and in the opposite direction to release said metal and move said forming die out of the formed corrugations.

9. A machine for corrugating sheet material comprising means for holding the sheet, means for forming one-half of a corrugation, and means for completing said corrugation, all of said means being so arranged whereby the sheet during said corrugating operations is subjected to a bending action substantially only at the portions thereof which will be finally bent.

10. A machine for corrugating sheet material comprising dies having side faces movable laterally into close juxtaposition, means for supporting one of said dies including parallel link connections, and means for supporting the other die including a pivotal member whose pivot is reciprocable.

11. A machine for corrugating sheet material comprising a pair of dies having side faces movable laterally into close juxtaposition, means for movably supporting one of said dies, including a pivotal member, and means for reciprocating the pivotal point thereof.

12. A corrugating machine comprising cooperating dies movable toward each other from opposite sides of a sheet of metal to be corrugated, and means for moving said dies including a cam for one of said dies, and a rack and pinion for moving the other of said dies during actual corrugating of a sheet.

13. A corrugating machine comprising a movable support carrying a clamping die, a forming die pivotally supported thereby and movable therewith, and means for finally actuating said forming die after a predetermined movement thereof, including a cam and a cam follower which is movable with said support into operative relation with said cam.

14. A machine for corrugating sheet material comprising a forming die, movable and stationary supports, and means for pivotally connecting said die to both of said supports thereby to impart a predetermined movement to said forming die.

15. A machine for corrugating sheet material comprising a forming die, movable and stationary supports, means for pivotally connecting said die to both of said supports, and means for finally actuating said forming die after predetermined movement thereof, including a cam and a cam follower movable with said support, whereby said cam and follower are brought into operative relation.

16. A machine for corrugating sheet material comprising a forming die movable toward the sheet from one side thereof, a cooperating forming die movable toward the sheet from the opposite side thereof, and means for actuating said latter forming die, including links pivotally carrying said die, gears connected to said links for causing oscillation thereof, a rack having operative connection to said gears, and a cam for actuating said rack.

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