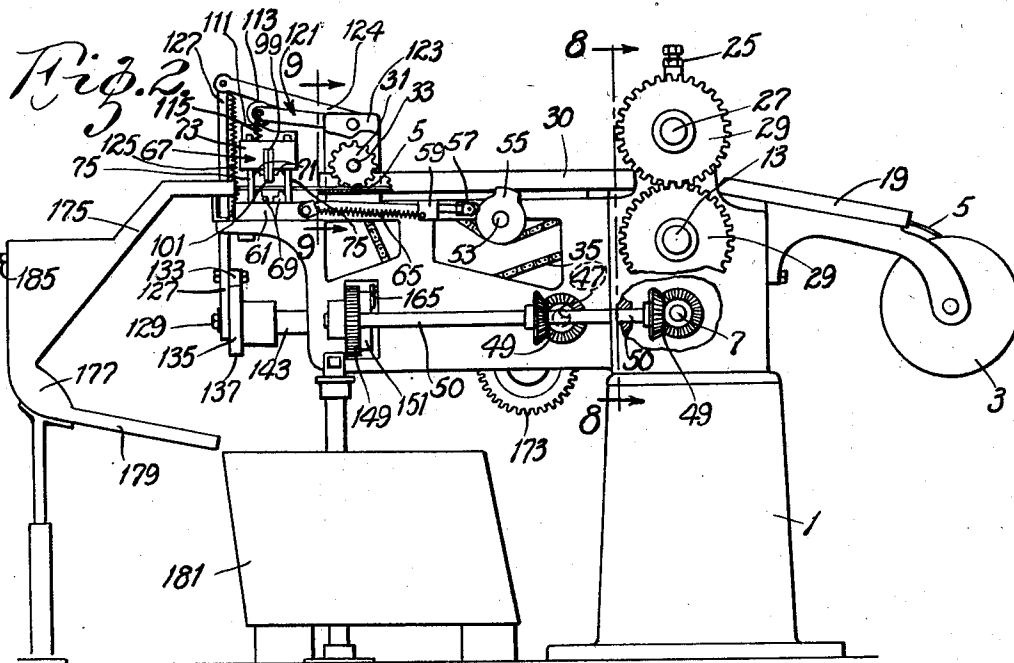


**1,849,944**

4 Sheets-Sheet 1



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March 15, 1932.

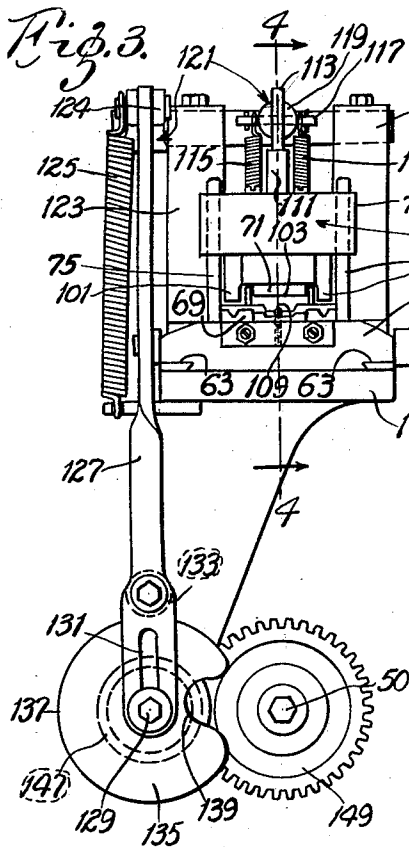
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APPARATUS FOR FORMING RADIATOR CORES

Filed Dec. 16, 1929

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March 15, 1932.

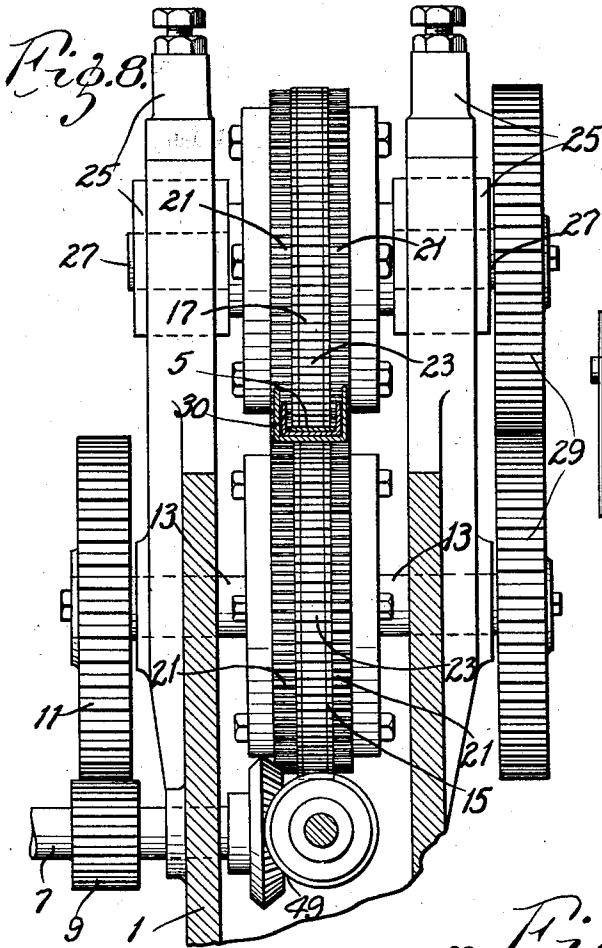
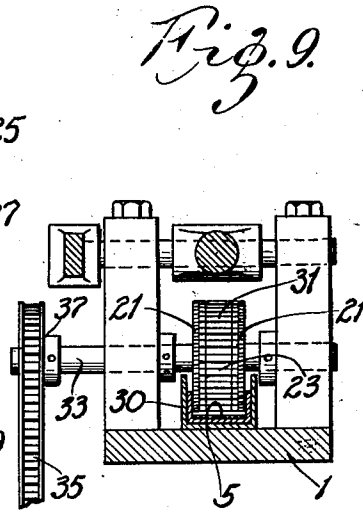
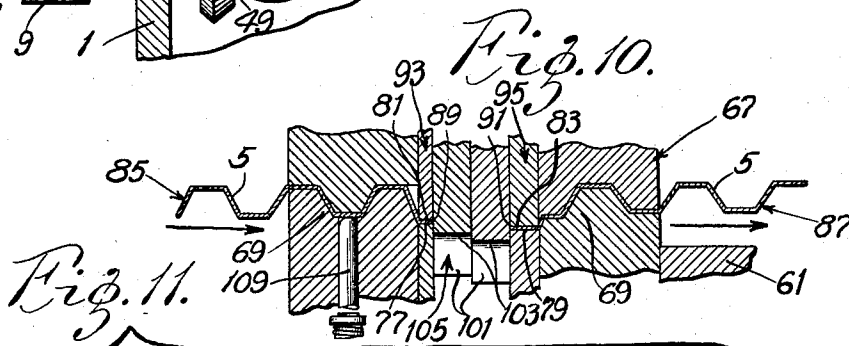
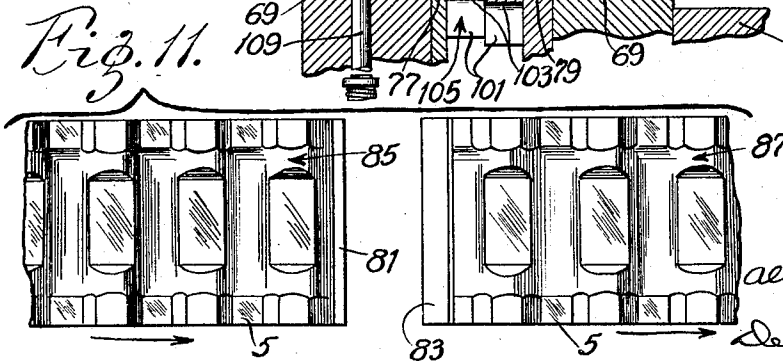
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APPARATUS FOR FORMING RADIATOR CORES

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APPARATUS FOR FORMING RADIATOR CORES

Filed Dec. 16, 1929

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*Fig. 12.*

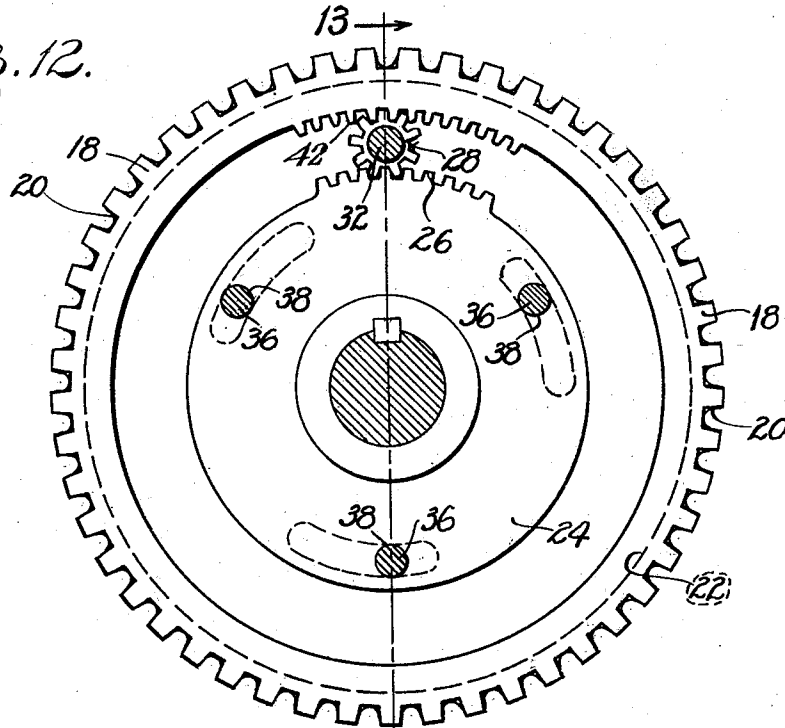
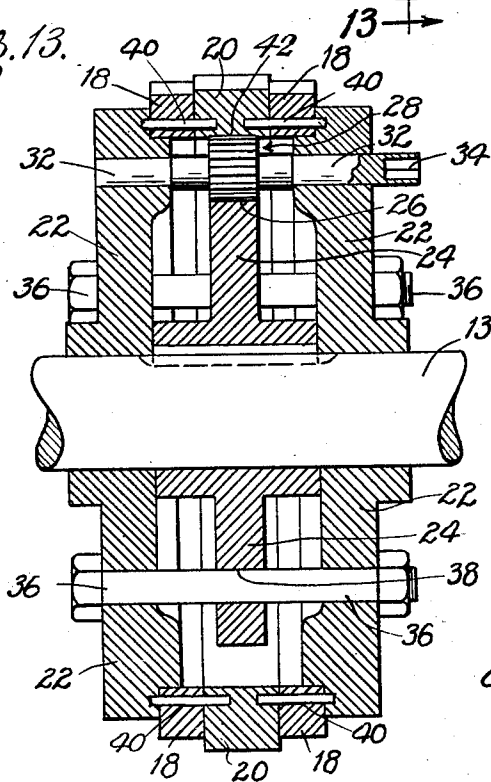


*Fig. 13.*



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# UNITED STATES PATENT OFFICE

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## APPARATUS FOR FORMING RADIATOR CORES

Application filed December 16, 1929. Serial No. 414,322.

This invention relates generally to an apparatus for forming and cutting a material, and with regard to certain more specific features, to an apparatus for forming metallic strip for automotive, airplane and like radiator cores; and with regard to certain further features, to apparatus of the class described which is fully automatic and continuous in operation.

Among the several objects of the invention may be noted the provision of improved means for continuously converting an indefinite length of plain metal strip into definite lengths of shaped elements, said elements having their surfaces and ends accurately formed to adapt them to use preferably in a radiator core assembly; the provision of a device of the class described in which the material operated upon is not subjected to unnecessary crinkling, bending or other distortion, said material being ejected continuously from the machine as distinguished from intermittent ejection; the provision of improved means for handling the product as it is ejected; and the provision of means of the class described in which there is a minimum of complication with a maximum capacity for turning out an accurate and uniform product. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structure hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a left side elevation of the assembled machine;

Fig. 2 is a right side elevation thereof;

Fig. 3 is a detail end view of a riding, forming and cut-off die, the view being taken in the direction of arrow X in Fig. 1;

Fig. 4 is a vertical longitudinal section, taken on line 4—4 of Fig. 3, showing a cut-off die in open position;

Fig. 5 is a bottom plan view of the upper die shown in Fig. 4;

Fig. 6 is a detail section of a one-revolution clutch;

Fig. 7 is a cross-section taken on line 7—7 of Fig. 1, and also on line 7—7 of Fig. 6, but in the latter case Fig. 7 shows a repositioning of parts with respect to Fig. 6;

Fig. 8 is a detail sectional view of a set of roller dies and connected gearing, the view being taken along line 8—8 of Fig. 2;

Fig. 9 is a detail of a rubber traction roll, taken on line 9—9 of Fig. 2;

Fig. 10 is an enlarged detail section of one form of cut strip which is manufactured by means of the present invention, showing fragmentarily certain cut-off die parts in cutting and forming positions alternative to the positions shown in Fig. 4;

Fig. 11 is a plan view of the cut strip shown in Fig. 10;

Fig. 12 is a detail of an index gear taken in connection with a forming roll; and

Fig. 13 is a cross-section showing parts in connection with said detail of Fig. 12, being taken on line 13—13 of Fig. 12.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Fig. 1, there is illustrated at numeral 1 a frame, supporting at its rear end a supply roll 3 of blank strip material 5. In the present embodiment of the invention the blank strip material comprises thin gage brass having a width of the order of several inches, this width being determined by the use to which the finally formed material is to be put. In the present embodiment, this width equals the depth of the radiator to be assembled from the formed pieces obtained by means of the present invention.

The frame 1 supports a main shaft 7 suitably driven from an external drive. The main shaft 7 carries a pinion 9 meshing with a gear 11, the latter driving a lower shaft 13. The shaft 13 centrally carries a lower hardened forming roll 15 which operatively cooperates with a similar upper roll 17 (Fig. 8). The blank strip 5 is drawn up to a U-

shaped incline 19, by means to be described, and feeds between said forming rolls 15, 17, to be properly shaped corresponding to the use to which it is to be subsequently put. For instance, in the present embodiment the rolls 15, 17 are cut with lateral portions 21 for providing semi-hexagonal margins on the strip and a wave form of portion 23 providing a wave form of web between said margins on the strip. The exact formation may correspond to forms now known or to forms shown in Figs. 10 and 11, and in my patent for core, No. 1,802,263, dated April 21, 1931, and in my patent for radiator core, No. 1,821,562, dated September 1, 1931.

It will be appreciated that the rolls 15, 17 are provided with suitable clearance permitting proper formation without undue wear. This clearance is adjustable as indicated at numeral 25, which numeral 25 is directed to the adjustable means for supporting the upper shaft 27 on which the roll 17 is located. Furthermore, one roll is not permitted to drive the other, but there is provided a meshed set of gears 29 between shafts 13 and 27, for providing the proper relative motion between rolls 15 and 17 (Figs. 2 and 8). From the rolls 15, 17 the strip 5 (now formed) moves forwardly through a U-shaped guide 30 to a point beneath a rubber traction roll 31, the shape of this traction roll 31 corresponding to the then shape of the formed strip. Thus the roll 31 acts upon the corrugated strip in the nature of a gear on a rack to draw and guide the strip through the machine. It will be seen from Fig. 8 that the channel 30 may be composed of a built-up section.

The shaft 33, upon which the roll 31 is supported, is rotated by means of a chain 35 co-operating with a sprocket 37 on said shaft 33. The chain 35 passes over a tension adjusting idler sprocket 39 and to a driving sprocket 41, the latter being driven through a gear train 43 from a pinion 45. The pinion 45 is mounted on a shaft 47 which in turn is driven through a bevel gear train 49 from said main shaft 7. The value of the complete trains 43, 49 is such that the peripheral speed of the roll 31 is equal to that of the forming rolls 15, 17.

The chain 35 also engages a sprocket 51 located on a cross shaft 53, the latter carrying similar cams 55, one cam being located on each side of the machine (Figs. 1 and 2). Each of these cams 55 engages a follower 57 suitably supported in a bearing 59 and reaching forwardly to couple with a lower sliding die block 61. This die block 61 is dovetailed to the frame 1 as indicated at numerals 63 in Figs. 3 and 4, the dovetails permitting sliding backward and forward the amount required by the lift of said cams 55. Return springs 65 reacting from the sliding die block 61 to the supports 59 effect a return of the

block 61 after the cam lifting operation is completed.

As illustrated in Fig. 1, the formed strip 5 advances forwardly from the rubber roll 31 and over said sliding block 61. This function is also illustrated in Figs. 3 and 4. The block 61 is stationary most of the period of operation, but during periods when the closable cut-off die or cutter 67 of which the block 61 is a part, operates, said cut-off die 67 moves forwardly as a whole at the same velocity as the strip 5, this motion being effected from said cam 55 in the manner hereinbefore described.

The cut-off die 67 is illustrated more in detail in Figs. 3 and 4 and comprises said sliding carriage or lower die 61 having raised and depressed portions 69 properly spaced to accommodate the corresponding shape which the strip 5 has received at the forming rolls 15, 17. Moving portions 71 fitting said portions 69 are resiliently carried in a vertically reciprocal die head 73, said head 73 sliding on four fixed posts 75 on the lower die 61. Resilience is effected by backing the slidable members 71 with coil springs 72. The said portions 69, 71 perform no shaping function but merely accommodate the strip shape previously effected by the rolls 15, 17.

The function of the die 67 being to cut off the strip to proper length and form proper ends thereon, the lower die block 61 is provided with flat forming surfaces 77 and 79, the latter being wider than the former. These surfaces 77, 79 are depressed an amount adapted to provide proper end shapes on the finished product, whereby a subsequent double seaming operation (not shown) may be effected between a wide rear edge 83 of a length 87 with a narrow front edge 81 of the next length 85 (see Figs. 10 and 11).

Engaging said surfaces 77, 79, respectively, are surfaces 89, 91 of resiliently mounted die members 93, 95 respectively. The die members 93, 95 are also resiliently mounted in said reciprocating head 73 being backed by springs 97 therein.

Between the members 93, 95 are rigidly mounted in the head 73 cut-off blocks 99 having sideward guide spurs 101 and cutting faces 103, the latter being behind the forming surfaces 89, 91 in the retracted position of the head 73 shown in Fig. 4, but advancing forwardly of said surfaces 89, 91 in the depressed cutting position illustrated in Fig. 10. This advance is relative, due to the resilient mounting of the edge forming members 93, 95. The guide spurs 101 and cutting surfaces 103 move into a cutting slot 105 formed in the lower die block 61.

Thus, the operation of the sliding die per se, is that from its Fig. 4 position, the upper head 67 descends on the posts 75. The lower die 61 is starting to move to the right at this time. The strip 5 is positioned over the por-

tions 69 of the lower block 61 and moving therewith at the same rate. As the head 67 descends the resilient holding members 71, 75 move against the material and force it into the shapes of the holding members 69 to hold it steady. Then the holding members 71, 75, being resiliently mounted are forced up against the reactions of their springs 72.

Next, the forming members 93, 95 have their edge-forming faces 89, 91, move down to push down what will be the edges 81, 83 of the subsequently formed lengths. These edges 81, 83 are thus pushed and formed against the lower faces or surfaces 77, 79 respectively, previously corrugated material being re-shaped during this operation.

Immediately after the last-described operation, the cut-off blocks 99 come into operation and cut out a short section of material, forcing the same through the opening 105, thus separating the material into lengths. The magnitude of lengths depends upon the timing of the machine. Fig. 4 shows how an opening 107 is formed through the frame 1, cooperating with the said opening 105 in the movable block 61 to permit the cut-off slug to pass from the machine. The action of the cams 55 are so timed that after the operation of the die 67 is completed and the die reopened, the die will return under reaction of the return springs 65, to be positioned ready for another cycle of operations. However, the strip 5 continues to feed through the machine without interruption, bending, crinkling or the like.

In Figs. 3, 4 and 10 is illustrated a spring-supported knock-out pin 109 supported in the lower die block 61 for pushing up the strip 5 from the rear half of the block 61 after operations of the die 67 thereon have ceased. As illustrated in Fig. 4 the pin supports uncut strip 5 in spaced relationship with respect to the block 61, but it will be appreciated that as the top 73 of the die 67 descends the pin will assume the position shown in Fig. 10, and when the die 67 reopens, the pin will force up the advancing edge 81 so that it will ride forwardly clear of the die corrugations. The strip in passing through the die 67 passes between the posts 75 and spurs 101.

The actuating mechanism for the top 73 of the die 67 will now be described. Fastened to the die top 73 is a translation cam 111 which is held up against a roller 113 by springs 115, this affording a lost-motion connection for holding up the whole die top 73. The springs 115 are fastened to the cross-pin 117 on which the roller 113 is mounted. Thus the top 73 is fastened to or suspended from one arm 119 of a bell-crank 121 (Fig. 3), said bell-crank 121 being borne in the brackets 123 which also support the roll shaft 33. The other sideward arm 124 of the bell-crank 121 reaches forwardly and tends to be drawn down by a tension spring 125, the lower end

of said spring 125 being held to the frame 1.

The downward pulling tendency of the spring 125 is normally overcome by an upholding link 127 fastened to the end of the arm 124 and guided for reciprocation at its lower end by a stud 129 and slot 131. The link 127 bears a roll follower 133 which rides on a cut-off cam 135, being held against said cam 135 by the action of said spring 125. Normally, the follower 133 is located on the high portion 137 of said cam 135, thereby holding the die 67 open for passage there-through of the uncut strip 5. The die 67 at this time has no translatory movement, because the cams 55 do not operate their followers 57.

When the cam 135 moves to where the follower 133 drops into a recessed portion 139 thereof, the spring 125 pulls down the bell-crank 121 to force down the top 73 of the die 67 into engagement with the lower portion 61 thereof to perform the functions hereinbefore set out. By the time that said closure of the die 67 is effected, the cams 55 operate on their followers 57 to effect translatory movement of the die. Thus the cut-off operation is effected by a die which travels with the traveling material and crowding of the strip with attendant evils is avoided.

It will be seen that the purpose of the springs 115 is not only to hold the upper part 73 of the die 67 in connection with the wheel 113 but to permit relative translatory movement forwardly of the die, without breaking the mechanical connection with the wheel 113. The translatory cam 111 has a suitably shaped face 141 against which the roller or wheel 113 contacts, this shape being such as to effect a smooth cut-off action as translation and shutting of the die 67 is effected.

In order that the cam 135 may be properly timed it is driven through a one-revolution clutch, illustrated more particularly in Figs. 1, 6 and 7. The driving mechanism for cam 135 comprises a lay shaft 143 held in a suitable bearing 145 of the frame 1. The front end of this shaft carries and drives said cam 135 and the rear end loosely carries a gear 147 which in turn is driven from a gear 149, the latter being affixed to the shaft 50 forming a part of said bevel gear train 49. Thus the gear 147 moves continuously.

As is apparent from Fig. 6, the constantly running gear 147 has a driving flange 151 which is internally notched at 153 to be engaged by a clutch dog 155, the latter being oscillably held to a driven disc 157 keyed to the lay shaft 143. It will be seen that the dog 155 can be swung, either to an engaging position or disengaging position with respect to the notch 153 and that it is normally pressed toward an engaging position by a spring 159. When in engagement, the

dog 155 provides a positive drive from the constantly rotating gear 147 to the lay shaft 143; otherwise not.

In order to delay movement of the lay shaft 143 and cam 135 over suitable timed intervals, despite continuous action of the gear 147, there is provided a trip plunger 161 normally pressed by a spring 163 to intersect the path of movement of an extended portion 165 of the dog 155. Hence when in rotating, the extension 165 of the dog 155 strikes the trip 161, the clutch is opened and the lay shaft 143 has further movement blocked, its position at that time being as shown in Fig. 3, that is, holding open the then stationary die 67.

In order to permit one revolution of the cam 135 at suitable intervals, the trip 161 is caused to be actuated by a bell-crank 167 and this in turn is intermittently actuated by a lever 169 rotatable with a pinion 171, the pinion 171 being driven from an idler gear 173 which is in connection with the said pinion 45. Thus for every revolution of the lever 169 the bell-crank 167 causes the trip 161 to free the dog 155 to close the clutch. Hence the lay shaft is driven to drive the cam 135 so that the die operations above described are effected. The die is thus closed and opened once as it makes one reciprocation. As the dog 155 passes from behind the trip 161, said trip springs back into obstructing position to disengage the clutch and hold the lay shaft 143 in position, this action taking place after one revolution of the cam 135. The trip 161 may spring back as the lever 169 passes from the end of the bell-crank 167.

From the above it will be seen that by means of one mechanical train (gears 45, 173, 171, levers 169, 167 and one-revolution clutch) the timing of operation of the die 67 is controlled and by means of another train (gears 45, 43, chain 35 and sprocket 51) its velocity of translation is controlled. Hence with the given travel of the strip 5 and die 67 variations may be made in the time at which cut-off will be had by simply changing the angular position of the lever 169. The one-revolution clutch and cam 135 operate serially.

The device operates as follows:

The blank strip 5 feeds from the supply, up the incline 19 and through the forming rolls 15, 17 where it is formed. Thence it passes in formed condition beneath the traction roll 31 which prevents the driving action of the rolls 15, 17 from crinkling up the material against the frictional retarding effect of the guide 30.

Next, the formed strip 5 passes through the die 67, which die is normally open and stationary, but which at predetermined intervals moves along with the material and simultaneously closes down on said material to form

front and rear edges thereon and also to separate a length therefrom. Thereafter the die 67 opens and returns, the uncut strip proceeding through the die as before. The cut length is ejected.

Another novel feature resides in the method of handling the cut and formed (corrugated) lengths as they are ejected from the die. They pass down an inclined chute 175 to an enclosed elbow 177 therein. Here the chute flexes back in direction by way of the elbow 177 and delivers the lengths down an incline 179 to a lozenge-shaped container 181 of width slightly wider than the product. In order to assist the product lengths around the curve at the elbow 177, a blast 183 of air is tangentially ejected into the elbow from a nozzle 185. The blast in impinging tangentially on the corrugated and then curved material materially assists delivery thereof through the chute. It also accelerates a piece away from the die and prevents interference with subsequent portions fed out.

In Figs. 12 and 13 are shown details of a preferred means for adjusting the rolls 15, 17, should it be desired to have them adjustable. Each roll 15, 17 comprises a plurality of forming pieces or peripheral portions 18 and 20. These portions are made separate in order to facilitate milling or otherwise forming the surfaces.

The outer peripheral portions 18 are carried in rotatable flanges 22 mounted on the respective shafts 13, 27. The portions 18, 20 and flanges 22 are doweled so as to be rotatable as a unit around the shaft 13 in Fig. 13.

Inside of the flanges 22 there is located an indexing member or hub 24 which is keyed to the shaft 13 and provided with a section of teeth 26 at the edge for meshing with a pinion 28, the latter pinion 28 being rotatably mounted between the sideward flanges 22. The pinion 28 in turn meshes with internal teeth 42 on the central peripheral portion 20.

The shaft 32 on which the pinion 28 is located extends sidewardly through one of the flanges 22 as indicated in Fig. 13 where it is provided with an adjusting head 34. The adjusting head 34 is adapted to receive a tool for adjusting purposes.

Passing through circularly arranged slots in the member 22 are clamping bolts 36 which also pass through holes 38 in the central hub 24.

From the above it will be seen that if the bolts 36 are loosened, that the members 18 and 20 are loosened and that this affords means whereby the pinion 28 may be turned by means of a tool applied to the head 34. This turning action causes the pinion to move around on the periphery of the hub 24 and drives the die portions 18 and 20 angularly. The hub 24 is relatively stationary.

After the adjustment has been effected, the clamping bolts 36 are again tightened.

Fig. 13 shows how the forming members 18, 20 and 22 are caused to move as a unit 5 because of the interpositioning between the same of dowels 40.

The advantage of this arrangement is that whenever a new length of strip is desired, an accurate adjustment may be effected between the shaft 13, 27 and their respective rolls whereby it is possible to have the cut-off die 67 become effective at a predetermined point, relatively to the corrugations shown in Fig. 10. Thus there is obtained a fine adjustment for effecting a correct relationship 15 between the point of cut-off by the die head 67 and the convolutions in the product.

In view of the above, it will be seen that the several objects of the invention are 20 achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

30 1. In metal forming apparatus, meshed rotary forming rolls, means for continuously moving a strip of material therebetween, said material being adapted to be formed thereby, and means intermittently movable 35 with the formed strip adapted to cut the same to predetermined lengths as it moves, said last-named means comprising a reciprocable closable cutter adapted to move with the strip and simultaneously close to cut and 40 move against the direction of movement of the strip when open.

2. In metal forming apparatus, meshed rotary forming rolls, means for continuously moving a strip of material therebetween, said 45 material being adapted to be formed thereby, a reciprocable closable die, means for guiding said strip therethrough, means for periodically driving the die with and at the speed of the strip, and means for simultaneously 50 closing the die to cut the strip to lengths.

3. In metal forming apparatus, meshed rotary forming rolls, means for continuously moving a strip of material therebetween, said 55 material being adapted to be formed thereby, a reciprocable closable die, means for guiding said strip therethrough, means for periodically driving the die with and at the speed of the strip, and means for simultaneously 60 closing the die to cut the strip to lengths and predeterminedly form front and rear edges on said lengths.

4. In metal forming apparatus, meshed rotary forming rolls, means for continuously moving a strip of material therebetween, said 65 material being adapted to be formed thereby,

a reciprocable closable die, means for guiding said strip therethrough, means for periodically driving the die with and at the speed of the strip and means for simultaneously closing the die to cut the strip to lengths, 70 a train of mechanism adapted to perform said reciprocation, another train for performing and timing said closure operation at predetermined intervals, and means in said last-named train adapted to permit varying of the 75 timing of closure without destroying said intermittent identical speed relationship between die and strip.

5. In metal forming apparatus, meshed rotary forming rolls, means for continuously moving a strip of material therebetween, said material being adapted to be formed thereby, a reciprocable closable die, means for guiding said strip therethrough, means for 80 periodically driving the die with and at the speed of the strip and means for simultaneously closing the die to cut the strip to lengths, a train of mechanism adapted to perform said reciprocation, another train for performing and timing said closure operation 85 at predetermined intervals, and means in said last-named train adapted to permit varying of the timing of closure without destroying said intermittent identical speed relationship between die and strip, said last-named means comprising an angularly adjustable lever and a one-revolution clutch operable thereby. 90

6. In apparatus of the class described, means for moving a material, reciprocable 100 cut-off means through which said material is moved, means for periodically moving said cut-off means with and at the speed of the material, automatic means for operating the cut-off means to cut while it moves with 105 the material, and means for varying the period of operation of the cut-off means independently of said material moving means.

7. Apparatus for conveying corrugated and similarly shaped material, comprising 110 a chute, means for directing said material into said chute, and an air blast directed along the line of motion of material, said blast impinging upon said corrugations or the like. 115

8. Apparatus for conveying corrugated and similarly shaped material, comprising a chute, means for directing said material into said chute, an air blast directed along the line of motion of material, said blast 120 impinging upon said corrugations or the like and being directed along at least a portion of said chute.

9. Apparatus for conveying corrugated and similarly shaped material, comprising a 125 curved chute, means for directing said material into said chute, an air blast directed along the line of motion of material and tangent to the curve of the chute, said blast impinging upon said corrugations or the like. 130

10. Apparatus for conveying corrugated and similarly shaped material, comprising a curved chute, means for directing said material into said chute, an air blast directed  
5 along the line of motion of material and tangent to the curve of the chute, said blast impinging upon said corrugations or the like, and an enclosed portion surrounding said chute at the curve for receiving and con-  
10 straining said blast.

11. In means of the class described, a reciprocable die adapted to operate periodically on material moving therethrough, said die having two blocks, one of which is guided  
15 with respect to the other, means for periodically moving the die at a rate substantially the same as that of said material, means for spacedly supporting the guided block in elevated position, said last-named means being  
20 also adapted to depress said guided block.

12. In means of the class described, a reciprocable die adapted to operate periodically on material moving therethrough, said die having two blocks, one of which is guided  
25 with respect to the other, means for periodically moving the die at a rate substantially the same as that of said material, means for spacedly supporting the guided block in elevated position, said last-named means being  
30 also adapted to depress said guided block, and a connection between the block and its supporting means serving both as a support and lost-motion connection.

13. In means of the class described, a reciprocable die adapted to operate periodically on material moving therethrough, said die having two blocks, one of which is guided  
35 with respect to the other, means for periodically moving the die at a rate substantially the same as that of said material, means for spacedly supporting the guided block in elevated position, said last-named means being  
40 also adapted to depress said guided block, a spring connection between the block and its supporting means serving both as a support and lost-motion connection, and a cam surface located between the block and its depressing means.

14. In apparatus of the class described, means for moving a material, reciprocable  
50 cut-off means through which said material is moved, means for periodically moving said cut-off means with and at the speed of the material, automatic means for operating the  
55 cut-off means to cut while it moves with the material, said last-named means including a one-revolution clutch.

15. In apparatus of the class described, means for moving a material, reciprocable  
60 cut-off means through which said material is moved, means for periodically moving said cut-off means with and at the speed of the material, spring-operated means normally tending to throw the cut-off means to cut,  
65 means timed to prevent the cutting action

operating against the action of said spring-operated means, said last-named means being adapted to release the spring-operated means at predetermined intervals.

16. In apparatus of the class described, 70 means for moving a material, reciprocable cut-off means through which said material is moved, means for periodically moving said cut-off means with and at the speed of the material, spring-operated means normally  
75 tending to throw the cut-off means to cut, means timed to prevent the cutting action operating against the action of said spring-operated means, said last-named means being adapted to release the spring-operated  
80 means at predetermined intervals and comprising a one-revolution clutch, a cam mechanism, said clutch and cam mechanism operating serially.

In testimony whereof, I have signed my  
85 name to this specification this third day of December, 1929.

ALBERT BENJAMIN MEDVILLE.

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