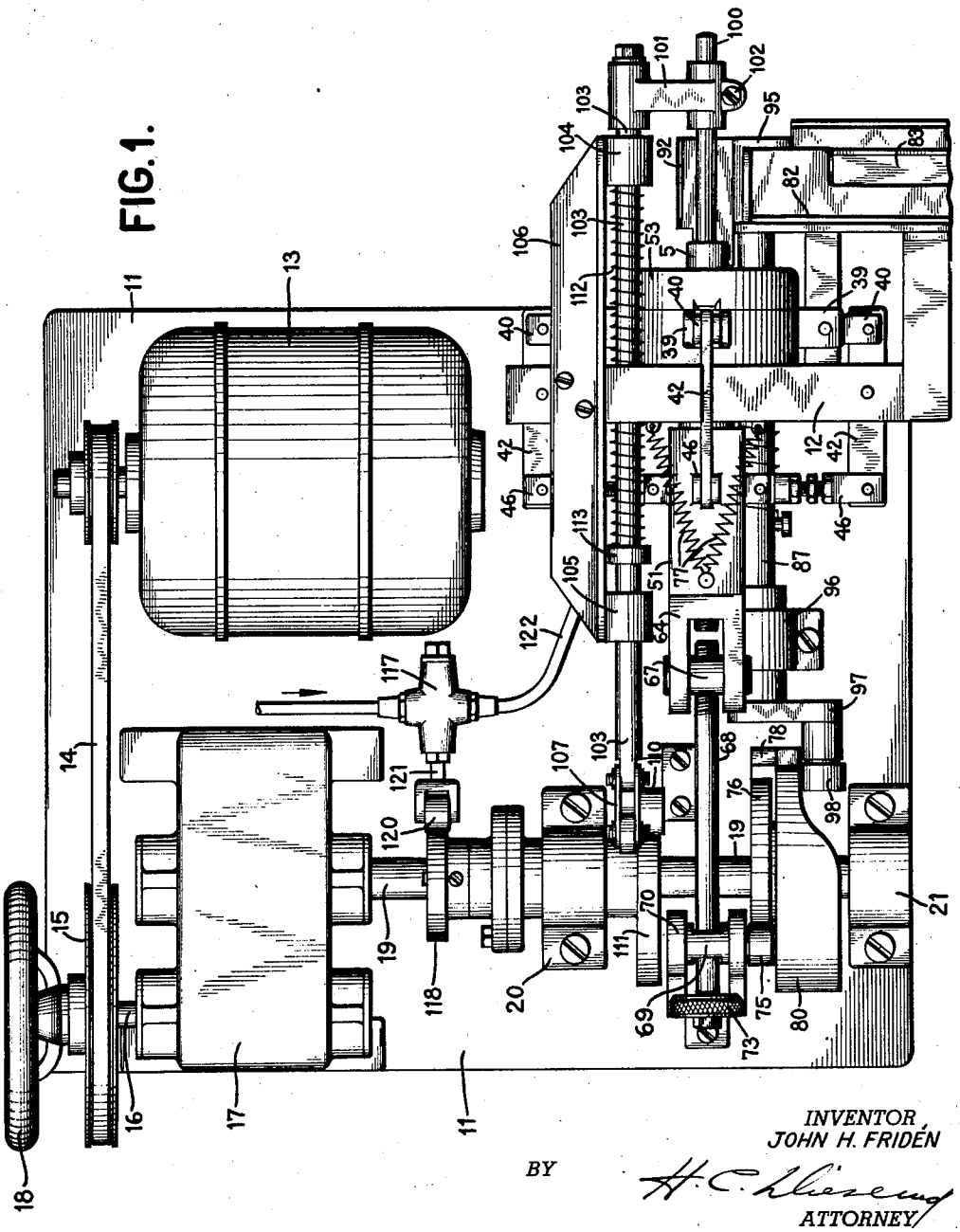
May 25, 1943. J. H. FRIDÉN 2,320,272

NOTCHING MACHINE AND METHOD

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FIG. 1.



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NOTCHING MACHINE AND METHOD

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FIG. 2.

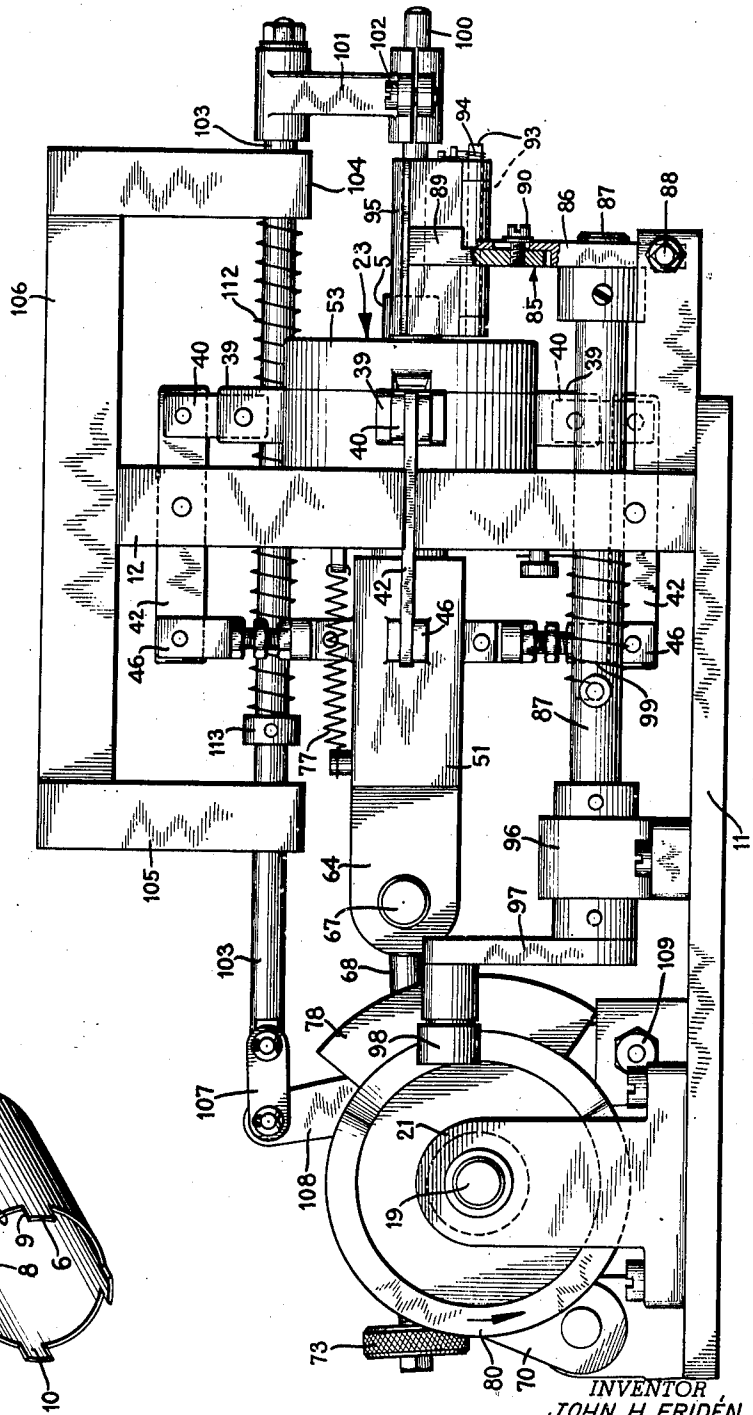
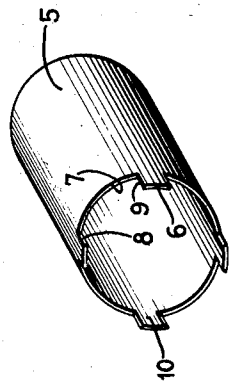


FIG. 3.



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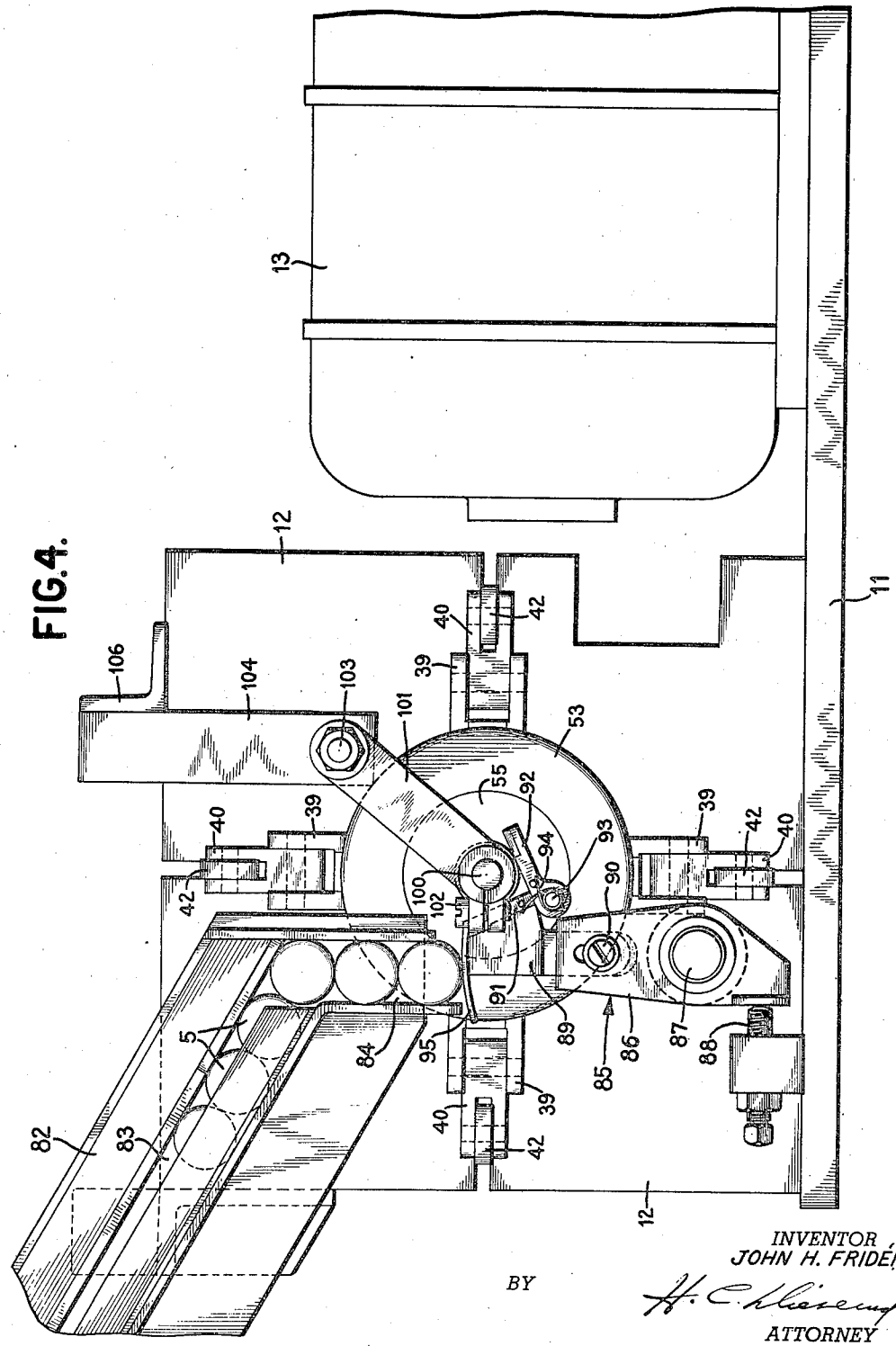
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FIG.4.



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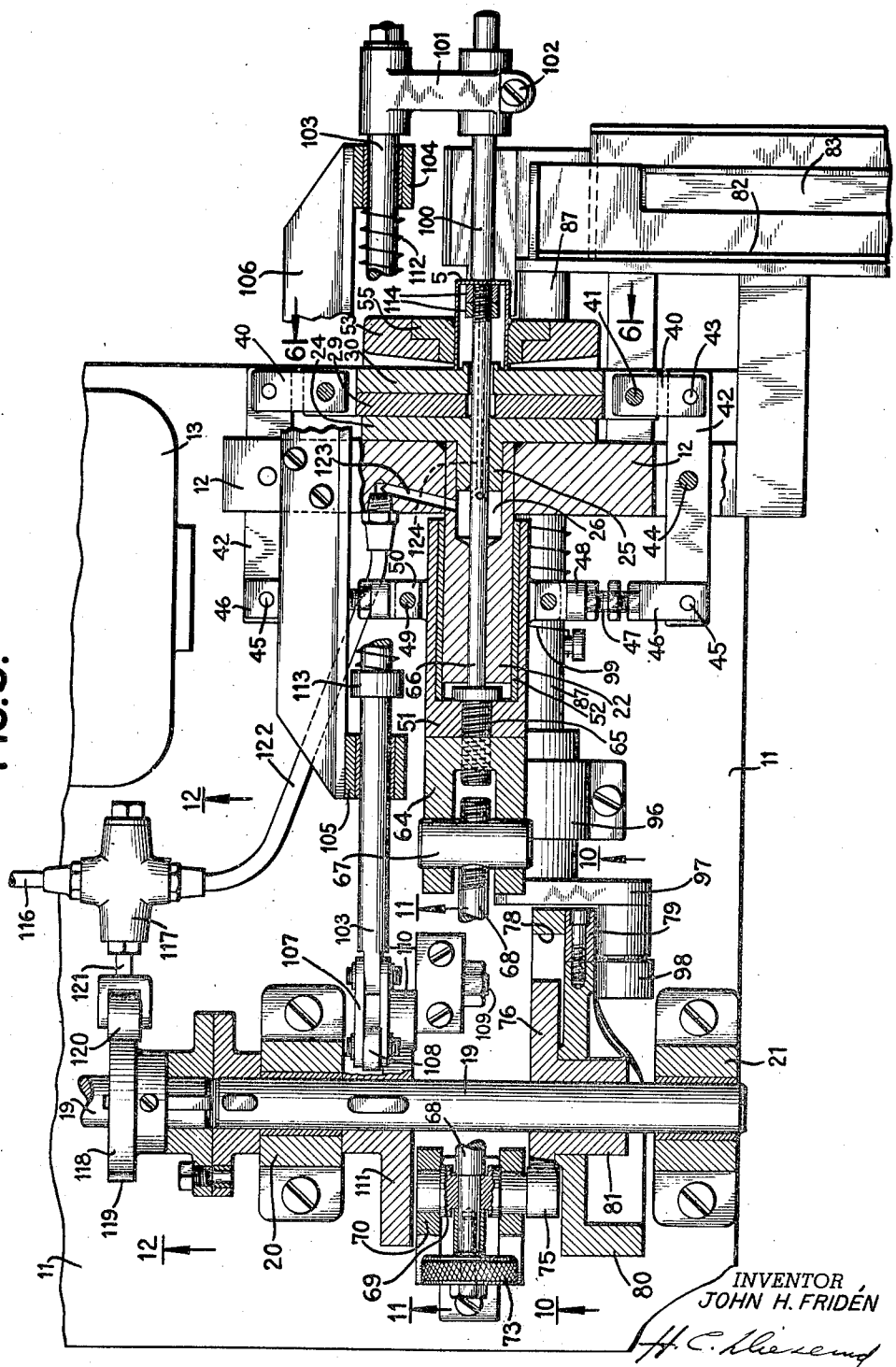
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FIG.5.



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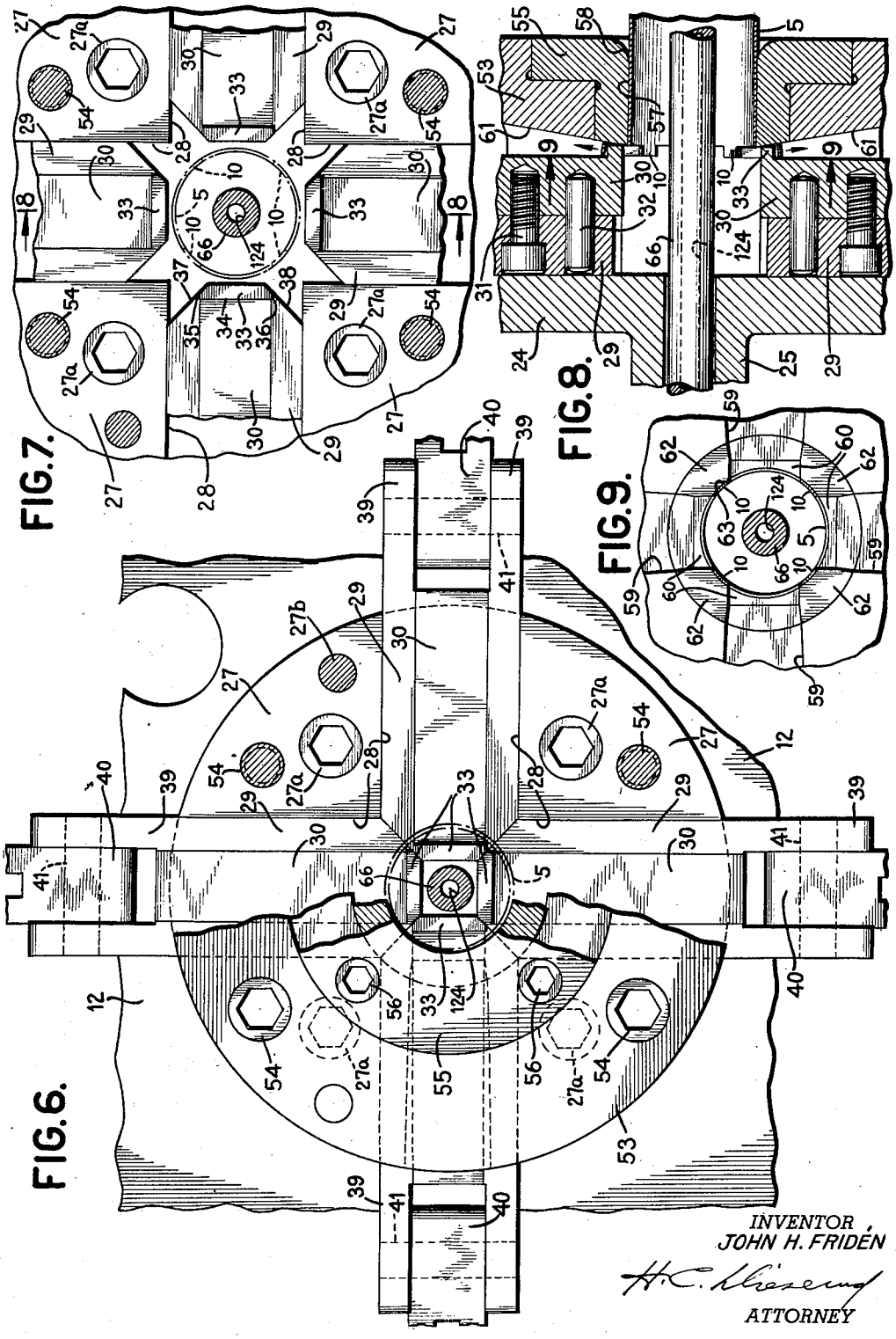


FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

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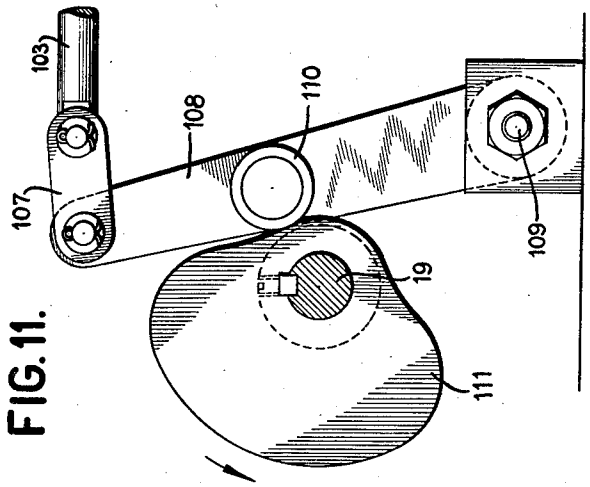


FIG. 11.

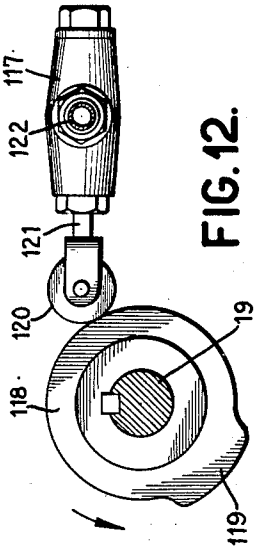


FIG. 12.

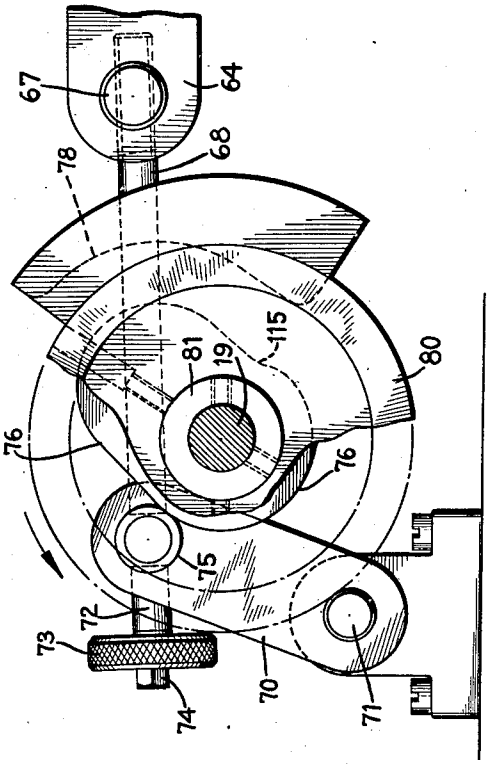


FIG. 10.

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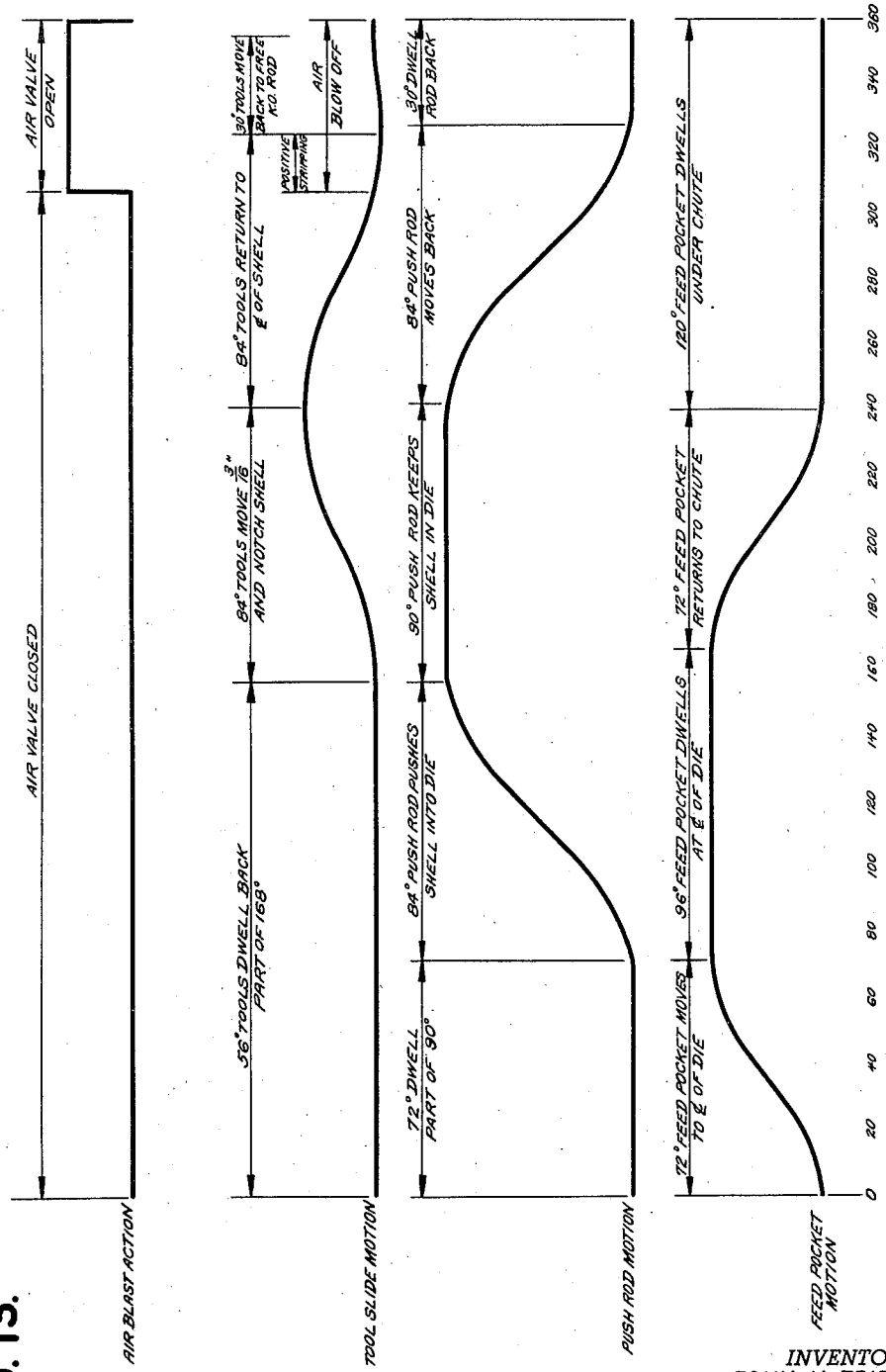


FIG. 13.

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Patented May 25, 1943 2,320,272

UNITED STATES PATENT OFFICE

2,320,272

NOTCHING MACHINE AND METHOD

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Application January 21, 1942, Serial No. 427,583

20 Claims. (Cl. 164—47)

This invention relates to an improved machine for notching the edge of a cylindrical cup or the like and to an improved method involved in its operation.

In the production of containers of various sorts, especially those formed of metal, it is desirable, at times, to provide a cup-like member or shell with a series of projections at one, or both, of its ends which are bent over in the assembly of certain parts, either to attach the cup or shell to another member, or to retain a closure for the end of the cup, or for some other similar purpose. The present invention is particularly suited for the formation of such projections by removing the intermediate portions of the wall of the cup between the desired projections in a single, rapid operation.

A primary object of the invention has been to provide an improved method and simple, durable and effective means for notching the edges of cups and the like and for automatically feeding the cups to the notching means and removing them therefrom.

A feature of the invention is the provision of a series of cutting elements capable of being simultaneously operated to shear the desired portions from the periphery of the open end of a cup. The cutting elements are arranged to operate from the interior of the cup outwardly. This minimizes the distortion of the wall of the cup and insures a clean cutting action all around.

Another feature is the provision of simple but reliable means for automatically feeding the cups into proper registry with the cutting elements and for ejecting the cups after the notching operation has been completed.

While the invention is capable of wide use on containers, cups, or shells of either large or small size and formed of any suitable material which may be subjected to a shearing action, it is particularly applicable to the notching of cups of relatively small diameter and formed of extrudable metals such as zinc, copper, aluminum, tin or the like, or alloys having similar properties.

Other objects, features and advantages of the invention will appear from the detailed description of an illustrative form of the same which will now be given in conjunction with the accompanying drawings, in which:

Fig. 1 is a plan view of the improved machine.

Fig. 2 is a side elevation of the machine, several parts at the right being broken away to disclose their connection.

Fig. 3 is a perspective view of a cup as it appears after a notching operation on the improved machine.

Fig. 4 is an enlarged front elevation of a portion of the machine.

Fig. 5 is an enlarged view partly in plan and partly in section through portions of the machine along certain principal center lines.

Fig. 6 is a further enlarged view partly in elevation and partly in section, as indicated by the line 6—6 in Fig. 5, showing the die and the cutting elements and their slides.

Fig. 7 is a similarly enlarged detail view, in elevation, showing the inner ends of the cutting elements and their slides and the adjacent portion of the guide block, the slides being in their outwardly shifted positions.

Fig. 8 is a sectional view along the line 8—8 of Fig. 7.

Fig. 9 is a detail view showing a portion of the inner side of the die and die holder along the line 9—9 of Fig. 8.

Fig. 10 is a vertical section, along the line 10—10 of Fig. 3, showing the cam members for operating the cutting elements.

Fig. 11 is a vertical section, along the line 11—11 of Fig. 5, showing a pusher control cam.

Fig. 12 is a detail view, in section along the line 12—12 of Fig. 5, showing a control cam for an air line, and

Fig. 13 is a chart indicating the relative timing of various cams embodied in the machine.

Referring now to the drawings, there is shown in Fig. 3 a cup 5 which the illustrative machine is particularly adapted to produce. This cup may be of any suitable material, preferably an extrudable metal, such as zinc, copper, aluminum, tin or the like. The cup illustrated is provided with an integral base closing one end. After extrusion from a slug of the desired metal and prior to introduction into the improved machine for the notching operation, its open end is trimmed to length so that it presents a regular, annular rim in the plane of the edge 6 which is a predetermined distance from the bottom of the cup. By the operation of the improved machine, a series of notches (four in the illustrative machine) is formed at the open end of the cup by removing metal from the rim along the edges 7, 8 and 9 at four distinct points, leaving a series of projections 10. In this form the cup is suited, for example, for use as a shell or casing for an electrical condenser.

Referring now particularly to Figs. 1, 2, 4 and 5, the machine is provided with a base 11 having connected therewith an upright standard 12,

which may suitably be in the form of a relatively thick, substantially square plate. A motor 13 suitably secured to the base is connected by a belt 14 with a pulley 15 secured to a shaft 16 of a speed reducing unit 17. The latter may be of any suitable construction; it may, if desired, be of the Reeves variable type. A hand wheel 18, secured to the outer end of the shaft 16, permits manual operation of the parts whenever desired to effect the necessary adjustments. The output side of the speed reducer is connected with a shaft 19 which is the main drive shaft of the improved machine and is suitably mounted in bearings 20 and 21.

The upright standard or plate 12 is provided with a central aperture to receive the forward end of a cylindrical support 22 which extends rearwardly toward the main shaft 19. A die and cutting unit 23 is axially alined with the member 22. This unit is formed in several parts and includes a main base member 24 having, adjacent its center, a rearwardly extending hub or sleeve 25 which fits snugly within a recess 26 in the forward end of the cylindrical support 22. As an integral part of the base member 24 a series of four segmental portions 27 is provided (see Figs. 6 and 7) these extending forwardly from the main part of the base and providing between them a series of four channels 28 extending radially from the center of the base member. A series of screws 27*a* passing through the portions 27 of the base member serves to secure the latter to the vertical support 12. Dowel pins 27*b* may also be provided for properly locating the base member on the support.

Within each of the channels 28 a tool-carrying slide 29 is provided. These slides are of channel formation and are adapted to receive cutting elements 30 formed of a high grade cutting steel. Screws 31 and dowel pins 32 may be provided for securing the cutting elements to the slides. At its inner end each of the cuttings elements is provided with a cutting projection 33 which extends out of the plane of the main body of the cutting element. This cutting projection is formed with cutting edges 34, 35 and 36 adapted to shear the three sides of a notch, as indicated in Fig. 3. The inner ends of the slides 29 and the cutting elements 30 are mitered to provide edges 37 and 38 which are brought together when the slides are in their innermost positions, as indicated in Fig. 6. The slides are shown in their outer or separated positions in Fig. 7.

For the purpose of shifting the slides between the two positions indicated in Figs. 6 and 7, each is forked at its outer end to provide a pair of ears 39 adapted to receive between them the end of a link 40 pivotally connected with the slide by a pin 41. The outer end of each link 40 is forked to straddle a lever 42 with which the link is connected by means of a pin 43. Lever 42 is pivoted upon a fixed pin 44 carried by the vertical standard 12 and at its opposite end is connected by a pin 45 with a yoke 46. The latter is connected through a screw-threaded link 47 with a second yoke 48 attached by a pin 49 to an ear 50 projecting radially from a sleeve 51 slidably carried by the cylindrical support 22. If desired, a bushing 52 may be provided between the members 22 and 51. Member 47 is formed with lefthand threads at one end and righthand threads at the other, so as to vary the effective length of this link, which connects the ear 50 with the end of the lever 42, upon simple turning of the member 47. It will be understood that each of the slides 29 is connected in a similar way with the sleeve 51. By proper adjustment of the parts, it may be insured that the inner ends of the slides and their cutting elements will cooperate properly when they are shifted inwardly in the manner to be explained.

The forward portion of the unit 23 consists of a die holder 53 which is secured to the rest of the unit by a series of screws 54. At the center of the die holder there is a die 55 secured to the holder by a series of screws 56. This die has a radially extending flange portion fitting within an annular recess in the front face of the die holder and an axially extending central portion having a central opening 57 therethrough adapted to snugly receive the cups 5 which are to be notched by the machine. The forward end of the opening 57 is provided with a curved surface 58 adapted to facilitate the introduction of the cups. Both the die and its holder are provided with a series of radially extending grooves 59 alined with the slides 30. The inner ends 60 of these grooves are formed with substantially parallel sides and are of just sufficient width and depth to snugly receive the portions 33 of the cutting elements. Beyond the portions 60 the grooves are widened somewhat to facilitate the removal of the scrap formed in the notching operation. For this purpose the bottom wall 61 of each groove (Fig. 8) may be inclined outwardly, as shown. Between the several grooves the die is provided with segmental portions 62, the inner edges 63 of which lend support to the wall of the cup between the notches, i. e., in the region of the projections 10. Thus, the edges 35 and 36 of the cutting elements produce their shearing action in cooperation with the end edges of the surfaces 63. The cutting edges 34 of the cutting elements cooperate with the arcuate edges, shown in Fig. 9, at the inner ends of the bottoms of the portions 60 of the channels in the die. This shearing action takes place as the cutting elements are shifted from their Fig. 6 to their Fig. 7 positions. It will be understood that before the cutting elements are so shifted, a cup will be introduced into the die with its forward edge in the path of the projections 33, in a manner to be later explained.

Operation of the slides 29 to produce the cutting action is brought about by shifting the sleeve 51 to the left in Fig. 5. This movement of the sleeve will rock the series of levers 42 and will cause the slides to shift outwardly as described. Movement of the sleeve 51 in this manner is brought about in the following way: A yoke member 64 is attached to the end of the sleeve by means of a screw 65 formed at the end of a long rod 66. The screw 65 turns freely in an opening in the end wall of the sleeve 51 but is screw-threaded into the member 64. The screw is simply tightened until a collar 65*a* is brought against the end wall of the sleeve 51 and the latter is clamped firmly between this collar and the member 64. A pin 67 is rockably mounted in openings in the two branches of the yoke member 64 and has a transversely extending screw-threaded opening adapted to receive the screw-threaded end of a rod 68 which, at its opposite end, extends through an opening in a pin 69 carried by a pair of arms 70 pivotally mounted on a stud 71 carried by the main frame (Figs. 5 and 10). The rod 68 is held in fixed relation to the pin 69 by the collar extension 72 of a knurled wheel 73. A screw 74, having threaded engagement with a hole in the end of the rod 68 and passing through

an aperture in the knurled wheel 73, may serve to hold the latter in assembled relation on the rod. The arrangement may be such that sufficient clearance is provided between the flat sides of the pin 69 and the shoulder on the rod 68 and the end of collar 73 to permit the rod to be freely rotated by the knurled wheel; or, if desired, loosening of the screw 74 may be required to enable rotation of the knurled wheel and the rod. By turning the rod 68 in this manner, the distance between the axes of the pins 67 and 69 may be varied slightly and thus vary the normal positions of the associated parts.

At the end of the pin 69, which extends beyond one of the arms 70, there is mounted a roller 75 cooperating with the periphery of a cam 76. The roller may be held against the cam by suitable spring means, such as the pair of springs 77 (Figs. 1 and 2), connected at one end with the sleeve 51 and at the other with the vertical support 12. To insure positive action of the cam, and prevent possible sticking of the parts, a segment 78 complementary to a portion of the cam 76, and arranged to provide therewith a raceway for the roller 75, is secured to a segmental extension 79 attached by screws or the like to the periphery of a face cam 80. This face cam is mounted upon, and secured for rotation with, a hub 81 of the cam 76.

The containers 5 to be notched upon the operation of the improved machine are automatically fed into the openings of the die 55. For this purpose the containers may be supplied either automatically or by hand, to a magazine 82 secured to the upright support 12. This magazine may be provided with an inclined channel or runway 83 terminating in a vertical channel 84 adjacent the die unit. At the lower end of the channel 84 the containers may be delivered to a carrier 85 adapted to be rocked between a receiving position below the channel and a delivery position in which the container is alined with the die opening. The carrier may consist of an arm 86 secured to a rock shaft 87 mounted in suitable bearings on the base. A set screw 88 cooperating with a downward extension of the arm 86 limits the clockwise movement of the arm (Fig. 4) and by proper adjustment insures correct alinement of the container with the die opening. At the upper end of the arm 86 there is mounted a member 89 which is secured to the arm by a screw 90 cooperating with an elongated radial slot in the arm. This permits longitudinal adjustment of the member 89 so that the container may be properly alined with the die opening. A V-shaped pocket or trough is formed on the member 89 by the inclined surface of a flat part 91 formed integral with the member 89 and a similar flat surface on a part 92 mounted in hinged relation to the part 91 by means of a pin 93. A spring 94 coiled about the pin 93 and cooperating with pins on the parts 91 and 92 serves normally to hold the parts in a position to form a trough having its surfaces at an angle of about 90°. The arrangement is such, however, that the carrier 85 may be shifted from the position indicated in Fig. 4 to a position in which the trough is directly beneath the channel 84 even though a push rod, to be later described, may be in the path of the part 92. The latter will simply be rocked against the action of the spring 94 and will be restored by this spring as soon as the part 92 clears the push rod. A portion 95 at the top of the member 89 and extending laterally from the upper edge of the part 91 is curved about the axis of the rock shaft 87 and serves to retain the containers in the channel 84 when the carrier is in the position indicated in Fig. 4.

The rock shaft 87 may be journaled in the vertical support 12 and in a bearing 96 carried by the base member. Rearwardly of the bearing 96 the shaft carries an arm 97 extending upwardly and having a roller 98 mounted on a stud at its upper end in the path of the arm of the face cam 80. Roller 98 may be held against the cam by means of a spring 99.

For introducing the containers into the die opening from the trough of the carrier 85, a push rod 100 may be provided. This is carried by a split sleeve formed at one end of an arm 101. The position of the push rod in the sleeve may be appropriately adjusted, and the rod then held in desired position by a clamping screw 102. Arm 101 is secured to the end of a rod 103 slidably mounted in bearings 104 and 105 carried by a cross member 106 on the vertical support 12. The rearward or inner end of the rod 103 is connected by a pair of links 107 with an arm 108 pivotally attached at 109 to a portion of the frame. A roller 110 carried by the arm cooperates with the periphery of a cam 111 and is held against this cam by means of a spring 112 acting between the bearing 104 and a collar 113 secured to the rod 102.

Ejection of the containers from the die, after the notching operation, is initiated by means of the rod extension 66. The forward end of this extension may be screw-threaded and provided with a pair of nuts 114 adapted to engage the inner surface of the bottom of the cup. The nuts 114 may be adjusted slightly to vary the position of the outer cup-engaging surface. Referring to Fig. 10, it will be seen that the cam 76 has a slight depression 115 just in advance of the long dwell. When the roller 75 reaches the depression 115, the rod 68, and hence the rod extension 66, will be given a slight additional outward movement, beyond the position indicated in Fig. 5, and this serves to partially eject the cup from the die. Immediately thereafter the rod is restored to the position indicated in Fig. 5 and held there by the long dwell of the cam 75.

As the container is partially ejected from the die, or loosened, in the manner explained, it is completely removed by a blast of air which throws it forwardly, clear of the die, and permits it to drop into a chute or receptacle suitably positioned. The blast of air for this purpose may be delivered from any suitable source through a line 116 to a valve 117 which may be operated by a cam 118 secured to the shaft 19. Cam 118 has a bump or high portion 119 adapted to engage a roller 120 mounted upon a slidable valve stem 121. As the valve is opened by the sliding of stem 121, air is admitted to a line 122 from which it is led by passage 123, in the support 12, into the inner end of the cavity 26 within the cylindrical support 22. From this cavity the air passes through suitable apertures in the rod extension 66 into a passage 124 extending to the forward end of the rod extension where the air blast is permitted to operate against the base of the cup for the purpose specified. If desired, in lieu of the passage 124, sufficient clearance may be provided around the extension 66 for the flow of the air into the cup.

The operation of the machine is believed to be clear from the foregoing. It will be understood that the machine, when set in operation by a suitable switch (not shown) for controlling the

motor 13, operates continuously and repeats a given cycle in which a series of cups will be introduced successively into the die, notched, and then ejected from the die. Assuming that at a given instant in the operation of the machine the parts are in the positions indicated in Figs. 1, 2, 4 and 5, it will be seen by particular reference to Fig. 13 that the parts will then be at the point in the cycle indicated as about 160° from the beginning of the cycle. The V trough or feed pocket of the carrier will have been shifted to carry the new container into line with the die opening and the push rod 100 will have just completed its operation for introducing the container into the die. The carrier 85 may at this time commence its return to the position in which the trough is beneath the channel 84, this movement being permitted by the hinge action of the part 92 of the carrier. At the same time the cam 76 and its cooperating segment 78 will operate the rod 60 and the sleeve 51 to cause the series of tool slides to be shifted outwardly, thus producing the notching operation. The push rod during this operation serves to retain the cup within the die. After the notching has been completed, during about 80° of the cycle, the sleeve 51 is returned toward the right (Fig. 5) and thus forces the cutter slides inwardly toward the positions indicated in Fig. 5. At the same time the push rod 100 will be retracted. Toward the end of this operation the end of the stem 66 will engage the bottom of the container, due to depression 115 in cam 76, and positively move the cup outwardly a slight distance, thus loosening it. As this stripping operation commences, the air valve 117 will be operated and it will be held open for some 50° of the cycle to insure blowing of the container out of the die and into a suitable receptacle. The rod 66 will immediately be retracted slightly to the position indicated in Fig. 5, where it is ready to correctly position the next container. The feed pocket is now shifted from beneath the channel 84 to the position in line with the die opening and the push rod is operated to introduce the new container into the die opening. This completes the cycle of the machine.

While an illustrative embodiment of the invention has been described in considerable detail, it will be understood that various changes may be made in the several steps of the method and in the construction and arrangement of the various parts of the machine without departing from the general principles and scope of the invention.

I claim:

1. In a machine of the class described a plurality of at least three radially shiftable, symmetrically arranged slides, each of said slides having means projecting from a surface thereof provided with cutting edges, said means on said plurality of slides being brought close together when said slides are in their radially inward position, means for presenting the open end of a member to be notched around said means when the latter are in their inward positions, means disposed around the open end of said member providing cutting edges arranged to cooperate with said first mentioned cutting edges, and means for simultaneously shifting said slides radially outward to produce a shearing action between the cooperating cutting edges.

2. In a machine of the class described a plurality of radially shiftable slides, each of said slides having means projecting from a surface thereof provided with cutting edges, certain of said cutting edges being disposed at an angle to the plane of movement of said slides, said means on said plurality of slides being brought close together when said slides are in their radially inward position, a stationary die having a portion extending into the plane of said means and presenting cutting edges arranged to cooperate in shear with the cutting edges on said means, said die having an opening adapted to snugly receive and retain a member to be notched with its end surrounding said means when the latter are in their inward positions, and means for shifting said slides outwardly to shear portions of said member.

3. In a machine of the class described a plurality of radially shiftable slides, each of said slides having means projecting from a surface thereof provided with cutting edges, said means on said plurality of slides being brought close together when said slides are in their radially inward position, a die having a portion extending into the plane of said means and presenting cutting edges arranged to cooperate in shear with the cutting edges on said means, said die having an opening adapted to snugly receive and retain a tubular member to be notched with its end surrounding said means when the latter are in their inward positions, means for automatically introducing one of said members into said die opening upon each cycle of operation of the machine, and means for shifting said slides outwardly to shear portions of the member so introduced upon each cycle of operation of the machine.

4. In a machine of the class described a plurality of radially shiftable slides, each of said slides having means projecting from a surface thereof provided with cutting edges, said means on said plurality of slides being brought close together when said slides are in their radially inward position, a die having a portion extending into the plane of said means and presenting cutting edges arranged to cooperate in shear with the cutting edges on said means, said die having an opening adapted to snugly receive and retain a member to be notched with its end surrounding said means when the latter are in their inward positions, means for introducing one of said members into said die opening upon each cycle of operation of the machine, means for shifting said slides outwardly to shear portions of the member so introduced upon each cycle of operation of the machine, and means for ejecting each member from the die after it has been notched.

5. In a machine of the class described a die having an opening adapted to snugly receive a tubular member to be notched, a plurality of cutting elements adjacent said die shiftable in a plane into and out of axial alinement with said opening, said die and elements having cooperating cutting edges adapted to produce a shearing action, certain of said cutting edges on both said die and said cutting elements being disposed at an angle to the plane of movement of said cutting elements, means for retaining a member with its edge to be notched between said cutting elements and the surface of said die opening, and means for shifting said cutting elements relative to said die to shear portions of the edge of said member.

6. In a machine of the class described a die having an opening adapted to snugly receive a member to be notched, a plurality of cutting elements adjacent said die normally in axial aline-

ment with said opening but shiftable to positions radially beyond said opening, said die and elements having cooperating cutting edges adapted to produce a shearing action, means for automatically feeding tubular members and bringing the edge of one of said members to be notched around said elements when the latter are in axial alinement with said opening upon each cycle of operation of the machine, and means for shifting said cutting elements out of such axial alinement to shear the edge of said member upon each cycle of operation of the machine.

7. In a machine of the class described a die having an opening adapted to snugly receive a member to be notched, a plurality of cutting elements adajacent said die normally in axial alinement with said opening but shiftable to positions radially beyond said opening, said die and elements having cooperating cutting edges adapted to produce a shearing action at spaced points about the periphery of a member inserted in said die, automatic means for successively introducing a series of members to be notched into said die opening while said cutting elements are in their normal positions, means for shifting said cutting elements to effect a shearing action upon each member after it has been so introduced, and means for ejecting each member after it has been notched.

8. In a machine of the class described a die having an opening adapted to snugly receive a member to be notched, a plurality of cutting elements adjacent said die normally in axial alinement with said opening but shiftable to positions radially beyond said opening, said die and elements having cooperating cutting edges adapted to produce a shearing action, automatic means for successively introducing a series of members to be notched into said die opening while said cutting elements are in their normal positions, means for shifting said cutting elements to effect a shearing action upon each member after it has been so introduced, and means for ejecting each member after it has been notched and restoring said cutting elements.

9. In a machine of the class described a die having an opening adapted to snugly receive a member to be notched, a plurality of cutting elements adajacent said die normally in axial alinement with said opening but shiftable to positions radially beyond said opening, said die and elements having cooperating cutting edges adapted to produce a shearing action, positioning means for bringing the edge of a member to be notched around said elements when the latter are in axial alinement with said opening, operating means arranged to actuate said positioning means, and means actuated by said operating means including toggle connections adapted to be straightened after operation of said positioning means for simultaneously shifting said cutting elements out of such axial alinement to shear the edge of said member.

10. In a machine of the class described a die having an opening adapted to receive a member to be notched, a plurality of cutting elements adjacent said die and normally in axial alinement with said opening, a slide for carrying each of said elements, a reciprocable sleeve, and toggle connections from said sleeve adapted to be straightened for shifting said slides to carry said elements radially beyond said opening, said die having cutting edges arranged to cooperate with said cutting elements to effect a shearing action upon said shifting of said slides.

11. In a machine of the class described a die having a work receiving opening extending axially therethrough, a plurality of longitudinally shiftable slides at one face of said die disposed radially with respect to said opening, a cutting element mounted on each of said slides and shiftable therewith to and from a position alined with said opening, a sleeve axially alined with said opening and shiftable toward and from the same, and connections from said sleeve to each of said slides for shifting the same in unison in both directions in response to movement of said sleeve.

12. In a machine of the class described a die having a work receiving opening extending axially therethrough, a plurality of longitudinally shiftable slides at one face of said die disposed radially with respect to said opening, a cutting element mounted on each of said slides and shiftable therewith to and from a position alined with said opening, a member alined with said opening and shiftable axially with respect thereto, and connections from said member to each of said slides for positively shifting the same in both directions in unison as said member is shifted.

13. In a machine of the class described a die having an opening for receiving a tubular member to be notched, cutting elements shiftable in a plane toward and from the axis of said die, said elements having cutting edges disposed at least in part at an angle to said plane and adapted to cooperate in shear with edges on said die to notch the end of said tubular member as the cutting elements are shifted away from the axis of said die, automatic means for presenting the end of said tubular member between the cutting edges on said elements and die when the elements have been shifted toward the axis of the die, and means for shifting said cutting elements away from the die axis to notch the end of said member.

14. In a machine of the class described a die having an opening for receiving a tubular member to be notched, cutting elements shiftable toward and from the axis of said die, said elements having cutting edges adapted to cooperate in shear with edges on said die to notch the end of said tubular member as the cutting elements are shifted away from the axis of said die, means for presenting the end of said tubular member between the cutting edges on said elements and die when the elements have been shifted toward the axis of the die, means for shifting said cutting elements away from the die axis to notch the end of said member, and means for ejecting the tubular member from said die after the notching operation has been completed.

15. In a machine of the class described a die having an opening for receiving a tubular member to be notched, cutting elements shiftable toward and from the axis of said die, said elements having cutting edges adapted to cooperate in shear with edges on said die to notch the end of said tubular member as the cutting elements are shifted away from the axis of said die, means for presenting the end of said tubular member between the cutting edges on said elements and die when the elements have been shifted toward the axis of the die, and means for shifting said cutting elements away from the die axis to notch the end of said member, said means including a member reciprocable axially of said die and having a positive connection with said cutting elements for shifting the latter in both directions.

16. In a machine of the class described a die having an opening for receiving a tubular mem-

ber to be notched, cutting elements shiftable toward and from the axis of said die, said elements having cutting edges adapted to cooperate in shear with edges on said die to notch the end of said tubular member as the cutting elements are shifted away from the axis of said die, means for presenting the end of said tubular member between the cutting edges on said elements and die when the elements have been shifted toward the axis of the die, and means for shifting said cutting elements away from the die axis to notch the end of said member, said means including a member reciprocable axially of said die, said last mentioned member serving to eject the tubular member at least partially from said die upon completion of the notching operation.

17. In a machine of the class described a die having an opening for receiving a tubular member to be notched, cutting elements shiftable toward and from the axis of said die, said elements having cutting edges adapted to cooperate in shear with edges on said die to notch the end of said tubular member as the cutting elements are shifted away from the axis of said die, storage means for retaining a plurality of said tubular members, means including a shiftable trough for transferring said members successively from said storage means to a position alined with said die opening, a reciprocable push rod for introducing said tubular members from said trough in to said die opening when said trough is alined therewith, means for shifting said trough and reciprocating said push rod, said means serving to return said trough to receive another tubular member from said storage means while said push rod retains a tubular member in said die opening, said trough having a yielding portion enabling said return, and means for shifting said cutting elements to effect a notching operation as the tubular member is retained by said push rod.

18. In a machine of the class described storage means for tubular members, means for retaining said members individually in a position to be operated upon, a shiftable trough arranged to receive such members successively from said storage means and transfer the same to a position alined with said retaining means, a reciprocable member for transferring a tubular member from said trough to said retaining means, said reciprocable member acting to retain said tubular member in association with said retaining means as said member is operated upon, and means for returning said trough to its position for receiving another tubular member from said storage means while said reciprocable member acts to retain the first tubular member, said trough having a yielding portion to enable said return.

19. A method of notching the rim of a thin-walled, tubular member at spaced points which comprises externally supporting the wall of the tube at the rim intermediate the points at which notches are to be formed, and simultaneously moving a series of shearing elements outwardly from the inside of the tube through its rim at the points where the notches are to be formed and causing each of said elements to shear said wall of the tube along lines in part transverse to and in part parallel with the axis of said member.

20. A method of notching the rim of a thin-walled, tubular member which comprises supporting the rim externally in evenly spaced areas between those at which notches are to be formed, and simultaneously shearing the rim along lines at the ends of the supported areas and along lines connecting said lines at the ends of said areas, and concurrently forcing the areas thus severed in an outwardly direction.

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