April 25, 1961 S. N. SMALL 2,981,135

APPARATUS INCLUDING A SWINGING FRAME FOR INTERMITTENTLY CUTTING ELONGATED WORKPIECES

Filed June 26, 1958 2 Sheets-Sheet 1

FIG. 1

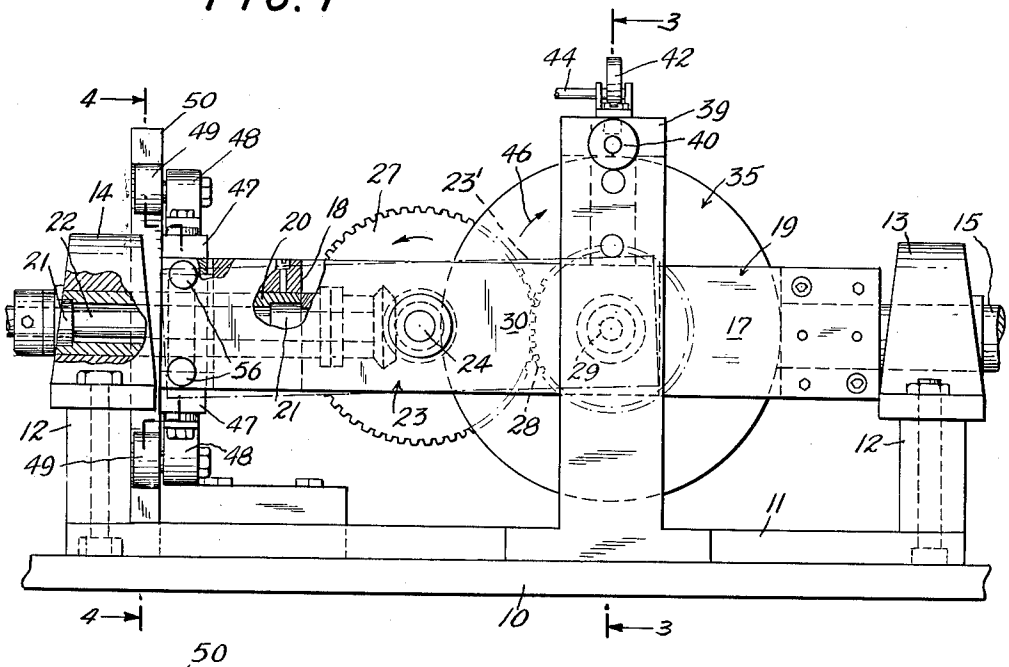
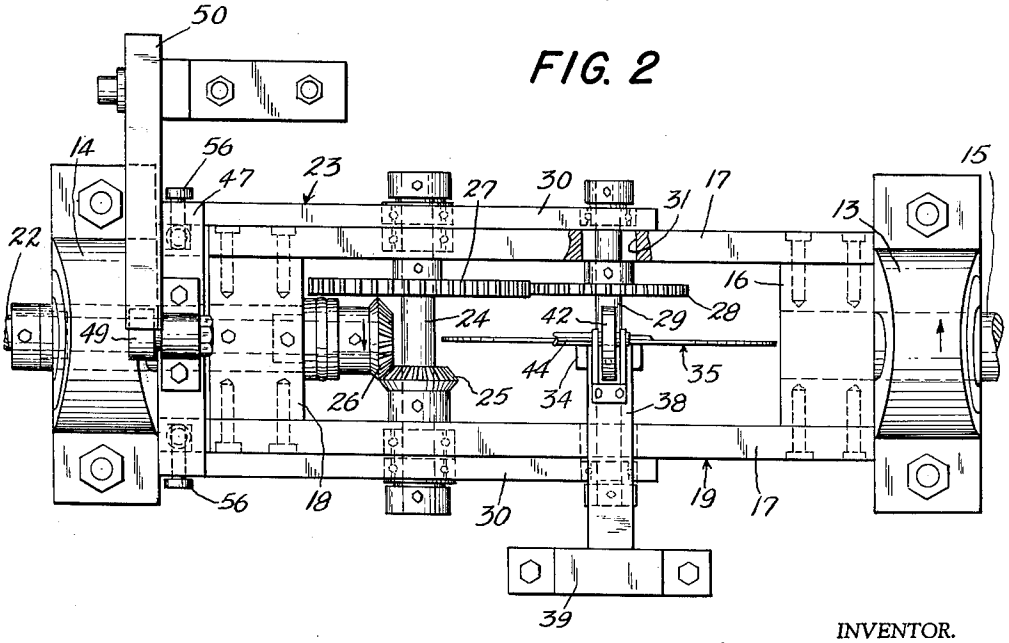


FIG. 2



INVENTOR.
SAMUEL N. SMALL

BY
Howard C. Thompson
ATTORNEY

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FIG. 3

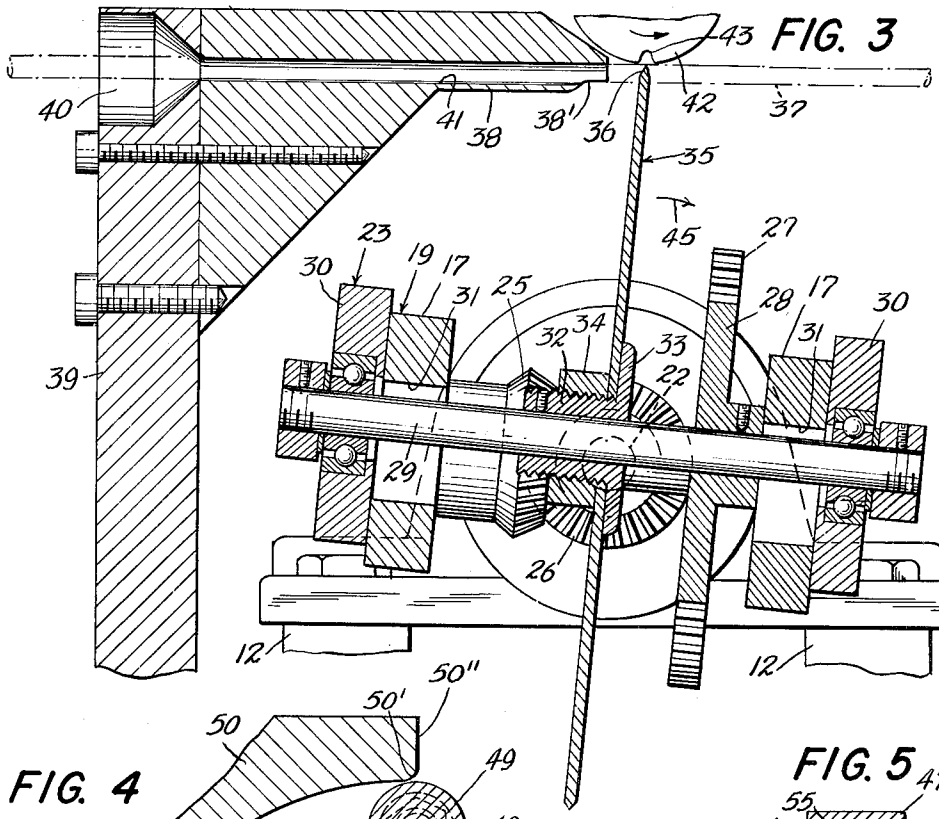


FIG. 4

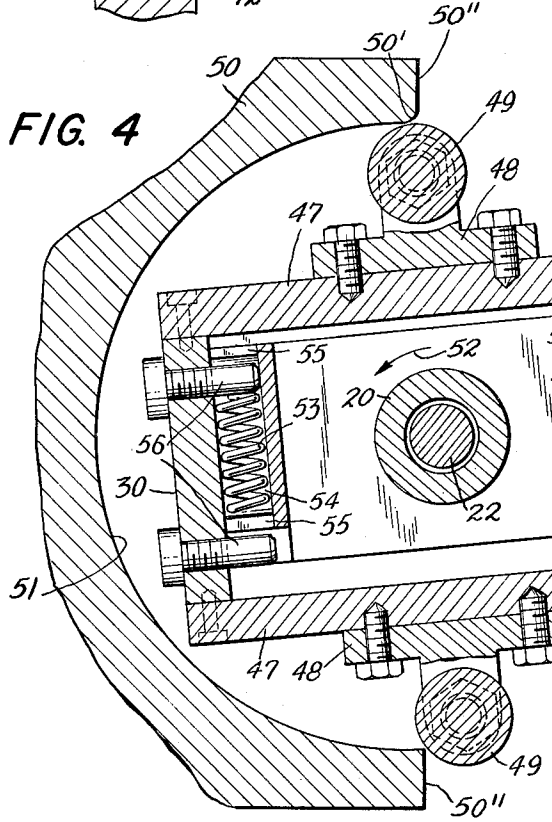
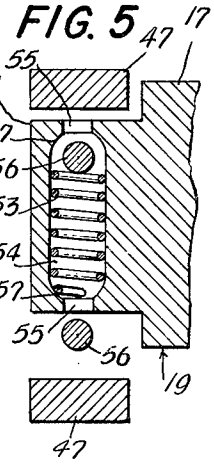


FIG. 5



INVENTOR.
SAMUEL N. SMALL
BY
Howard E. Thompson
ATTORNEY

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APPARATUS INCLUDING A SWINGING FRAME FOR INTERMITTENTLY CUTTING ELONGATED WORKPIECES

Samuel N. Small, Valley Stream, N.Y., assignor to Julius Duberstein, New York, N.Y.

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5 Claims. (Cl. 83—310)

This invention relates to a method and apparatus, wherein a cutting or forming tool is bodily rotated about an axis, while being rotated on its own axis and, wherein, means is provided for imparting reciprocating or swinging movement to the tool while passing through the two first named motions described, whereby the tool can be moved in synchronism with the feed of an elongated workpiece in the operation of cutting or forming the workpiece at predetermined spaced intervals.

More particularly, the invention deals with an apparatus of the character described employing a main rotatable frame, having end bearings with a direct drive at one end of the frame, a supplemental reciprocating or swinging frame pivotally mounted in the main frame in supporting, at one end, a rotatable tool with means operatively engaging the other end of the supplemental frame for intermittently imparting swinging or reciprocating motion thereto in movement of the tool into and out of engagement with an elongated workpiece fed through the machine.

The novel features of the invention will be best understood from the following description, when taken together with the accompanying drawing, in which certain embodiments of the invention are disclosed and, in which, the separate parts are designated by suitable reference characters in each of the views and, in which:

Fig. 1 is a side view of the machine or apparatus made according to my invention, with parts of the construction broken away and in section and indicating, in dot and dash lines, the swinging or reciprocating motion imparted to the supplemental frame of the machine.

Fig. 2 is a plan view of the structure, as shown in Fig. 1, with part of the construction broken away and in section.

Fig. 3 is an enlarged section, substantially on the line 3—3 of Fig. 1, showing only part of the construction and omitting part of the background showing, said figure illustrating, in dot and dash lines, the workpiece operated upon by the tool.

Fig. 4 is an enlarged section on the broken line 4—4 of Fig. 1, showing only part of the construction and illustrating the supplemental frame in its tilted or operative position; and

Fig. 5 is a detailed section on the line 5—5 of Fig. 4, omitting background showing.

In Fig. 1 of the drawing, 10 represents a suitable base or support, to which a plate 11 is suitably fixed and supported on end portions of the plate are pairs of upstanding members 12, in connection with which end bearings 13 and 14 are supported. The bearing 13 forms a support for a driven shaft 15, the drive for which is not shown and fixed to the shaft, inwardly of the bearing 13, is a box-shaped member 16, to opposed sides of which are secured side rails 17 which, in turn, are secured to another box-shaped member 18 at opposed ends of the rails 17. 16, 17 and 18 constitute a main rotatable frame, which will be generally identified by the reference character 19, this frame being rotated with the rotation of the shaft 15 and at a speed in synchronism with the feed of a workpiece fed through the machine, as later described.

Mounted in the box-shaped member 18, note Fig. 1, is a bearing sleeve 20, having a direct support in the bearing 14 and arranged within end portions of the sleeve 20 are needle bearings 21, forming an antifrictional support for the cutter drive shaft 22, which passes freely through or operates freely in the sleeve 20, as clearly indicated in Fig. 1 of the drawing.

From the foregoing, it will be apparent that the entire main frame 20 rotates about the axis of the drive shaft 15 and, in this operation, carries with it a supplemental more or less yoke-shaped frame, generally identified by the reference character 23. The supplemental frame 23 is mounted to swing about an axis or shaft 24, having antifrictional bearing supports in the rails 17 of the main frame, as well as similar supports in the supplemental frame 23.

Fixed to the shaft 24, within the main frame 19, is a bevelled gear 25 meshing with a corresponding gear 26 on the inner end of the shaft 22.

Also fixed to the shaft 24 is a large gear 27 meshing with a smaller gear 28 fixed to a cutter shaft 29, the latter having antifrictional bearing supports in the side members 30 of the supplemental frame 23.

It will appear, from a consideration of Figs. 2 and 3 of the drawing, that the shaft 29 operates in large apertures 31 in the rails 17 to allow for the swinging movement of the supplemental frame 23, as later described.

Adjustably fixed on the central portion of the shaft 29 is a threaded collar 32 having, at one end thereof, a circumferentially large flange 33, note Fig. 3 of the drawing, and in threaded engagement with the collar 32 is a nut 34 for securely clamping a disc-type tool 35 in position on the collar and, thus, on the shaft 29.

In illustrating one adaptation and use of my invention, the tool 35 is in the form of a cutter tool and has a circumferential cutter edge 36, as indicated in Fig. 3 of the drawing, so that, in the operation of the machine or apparatus, an elongated workpiece, indicated in dot-dash lines at 37 in Fig. 3 of the drawing, can be severed at spaced intervals, as this workpiece is fed by suitable means, not shown, through a guide and positioning nozzle 38, the nozzle being supported in connection with an upright support 39 suitably fixed to the base 10.

The support 39 has, at its upper end, a hopper-like admission aperture 40 for guidance of the workpiece into the bore 41 of the nozzle, so as to position the workpiece 37 directly at the top center of the disc 35. It is also preferred that a backup roller or forming tool 42, mounted on the nozzle 38, be arranged directly above the workpiece 37, the roller having one or more notches, as at 43, adapted to register with the tool 35 when in its operative position, as diagrammatically illustrated in Fig. 3 of the drawing. Suitable means will be provided to rotate the shaft 44 of the disc 42, note Fig. 1, to actuate the same in synchronism with the feed of the workpiece 37.

While any type or kind of workpiece can be employed, that is to say, rod, tube, strip or the like, in order to illustrate one adaptation and use of my invention, the workpiece 37 can constitute a tubular paper drinking straw or a long tube, from which these straws of predetermined lengths are formed by severing the long workpiece 37 at intervals which will define the straw lengths.

At this time, it is also pointed out that the speed of rotation of the main frame 19, together with the cutter tool 35, is again in synchronism with the feed of the workpiece 37, so that the tool 35 moves with the workpiece

in the cutting operation. In this connection, it will appear that the diagrammatic showing of Fig. 3 of the drawing would be illustrating the limit of height position of the tool 35 as the same is rotated in the direction of the arrow 45, which is the direction of rotation of the main frame 19.

Now, considering Fig. 1 of the drawing, it will also appear that, while the tool 35 is being bodily swung in the direction of the arrow 45, the tool is rotated in the direction of the arrow 46, the tool being rotated through the gearing, as previously described, the drive for which is the shaft 22.

Coupled with the ends of the rails 30 of the supplemental frame 23, adjacent the bearing 14, are upper and lower cross-straps 47, to which are secured, centrally, brackets 48 supporting antifrictional rollers 49 which operatively engage an actuating cam 50 supported on the base 10 at the side of the apparatus opposed to the mounting of the nozzle 38, as will appear from a consideration of Fig. 2 of the drawing and, in this figure, the illustration of the base 10 is omitted for simplification in the showing and this is also true of the supporting plate 11.

The cam 50 provides an eccentric cam surface 51 which is disposed at one side only of the machine, as will clearly appear from a consideration of Fig. 4 of the drawing, in which figure, the arrow 52 illustrates the direction of rotation of the main frame, as well as the supplemental frame movable therewith. The lower roller 49, as illustrated in Fig. 4 of the drawing, is shown in the position released from the cam surface 51, which has permitted the swinging supplemental frame 23 to be moved downwardly by the action of springs 53 in swinging the tool end of the supplemental frame upwardly into the position indicated in dot-dash lines at 23' in Fig. 1 of the drawing or, in other words, into the raised position, as noted clearly in Fig. 3 of the drawing. At this instant and at this instant, only, is the tool brought into operative position to form or sever the workpiece in its passage through the machine. As the lower roller 49 is released, it will appear that the upper roller 49, as shown in Fig. 4 of the drawing, is now in position to freely enter and operatively engage the cam surface 51 and the entire supplemental frame will be held in this position, until said last named roller reaches the lower position and is then released.

Considering Figs. 4 and 5 of the drawing, it will appear that the ends of the rails 17 of the main frame 19, adjacent the bearing 14, have reduced extensions 17', note Fig. 5, in outer surfaces of which are formed recesses 54, generally of the contour seen in Fig. 5, for reception of the springs 53. The upper and lower ends of the recesses are contracted and terminate in apertures or slots 55 opening through upper and lower ends of the extension 17', so as to provide passage of pins 56 into and out of the recesses 54, the pins being fixed to the rails 30, as clearly noted in Fig. 4 of the drawing.

The contracted ends 57 of the recesses 54 form seats for the springs 53 and it will, thus, appear that, when a spring has operated upon one of the pins in each pair to move the frame 23 downwardly when the lower roller 49 is released from the cam surface 51, simultaneous admission of the upper roller 49 will move the other pins of the pairs into engagement with and compress the springs 53, retaining the same in this position, until such time as the next successive roller 49 comes to the releasing position.

At this time, it will be apparent that the degree of movement required for the actuation of the tool or cutter 35 will depend entirely upon the size or cross-sectional form of the workpiece being operated upon and the nature of work performed on the workpiece. The primary movement will take place at the initial operation of the tool or cutter and, while a greater movement may be imparted to the tool or cutter, this would be compensated for by the recess 43 in the disc or roller 42.

To clearly understand the foregoing, it will appear, from a consideration of Fig. 3 of the drawing, that the lower discharge end of the nozzle 38 is cut away, as seen at 38', to clear the tool 35 as it is rotating in the direction of the arrow 45 and also to clear the frames in their rotary movement. In other words, in Fig. 3, the tool is indicated at the limit of its cutting or forming operation, but it would be free to move upwardly a greater degree than that shown in Fig. 3 in compensating for the complete swinging movement of the frame 23. The diagrammatic showing of Fig. 4 would indicate, however, the limit of swinging movement of the frame 23 with the upper roller engaging the cam surface 51, placing the spring 53 under compression, the rounded surface 50' of the cam 50 serving to guide the roller onto the cam surface 51.

It will also appear that the surfaces 50'' of the cam 50 are sufficiently offset with respect to the axis of the shaft 22 to permit the release of one roller 49, while simultaneously admitting the other roller 49 onto the cam surface 51.

It will be apparent from the foregoing description that, in the complete cycle of operation of the machine or apparatus, the part of the tool or cutter 35, appearing uppermost as the main frame is rotated in the direction of the arrow 45, will operatively engage the workpiece 37. Then, there will be the lapse of time until the tool 35 is again brought into the raised position and, at such time, a longitudinally spaced interval of the workpiece will be in the position at the discharge end of the nozzle 38 to be severed or operated upon by the tool. The speed of rotation of the frame, together with the speed of feed of the workpiece, will govern this spacing of operations performed on the workpiece. In some instances, it may be desirable to provide an intermittent feed of the workpiece in order to provide a closer spacing of the cutting or forming operations on the workpiece.

However, where speed of production is an important factor, it is desirable that the machine or apparatus be so constructed in design and operated as to perform the desired operations on the workpiece consistent with the practical feed of the workpiece through the machine.

From the foregoing, it will be apparent that, normally, the tool 30 is bodily rotated in the direction of the arrow 45 while being rotated on its axis 29 and this procedure continues, except only at the moment of the sudden release of the supplemental frame or dropping of what may be termed the rear end thereof in providing the desired lift to the forward or tool end of the supplemental frame, this supplemental frame swinging on the axis 24, as will be apparent.

For purposes of description, the terminal end of the nozzle 38 and the engagement of the disc 42 with the workpiece 37 may be said to define a forming station. In other words, it is that particular part of the apparatus where the tool is brought into engagement with and moved in synchronism with the workpiece, while the workpiece is being formed. In this connection, it is also to be understood that, in the use of the expression "form" or "forming" this is to imply any type and kind of operation performed upon the workpiece.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An apparatus for intermittently performing operations upon a continuously fed elongated workpiece along a given path, a main frame rotatable about a single axis, a supplemental frame extending the major portion of the length of and arranged outwardly of and swingably mounted in the main frame on a pivot axis arranged transversely of and supported in said main frame, a transverse shaft supported in one end portion of the supplemental frame and spaced with respect to said pivot axis, a tool fixed to said shaft, means driving said pivot axis,

means comprising gears on the pivot axis of said swinging frame and on said shaft for rotating the tool, the axis center of said tool being normally substantially in alinement with the center of the axis of rotation of the main frame, and means, at the other end portion of the swinging frame, for intermittently imparting swinging movement to the supplemental swinging frame in movement of said transverse shaft out of said alinement and in movement of the tool into said path into operative engagement with a workpiece while fed through the apparatus and immediately withdrawing the tool from the path of movement of the workpiece.

2. An apparatus as defined in claim 1, wherein the last named means includes rollers supported on the supplemental frame, and a cam operatively engaging said rollers in control of the intermittent swinging movement of the supplemental frame and spacing of operations performed upon the workpiece.

3. An apparatus as defined in claim 2, wherein said means further includes tensional means for actuating the swinging frame upon release of one of the rollers from said cam.

4. An apparatus as defined in claim 1, wherein the means driving said pivot axis comprises a shaft arranged axially of the axis of rotation of said main frame, and said last named shaft including a bevelled gear operatively engaging a bevelled gear fixed to the pivot axis of said supplemental swinging frame.

5. An apparatus of the character described, comprising a pair of spaced bearings, an elongated main frame having means at ends thereof rotatably mounted in said bearings, one of said means comprising a drive shaft

for rotating said frame, the other of said means including an elongated sleeve, a gear drive shaft freely rotatable in said sleeve, a supplemental frame extending the major portion of the length of the main frame and arranged outwardly of and swingably mounted on a pivot axis supported in said main frame intermediate and in alinement with said first named bearings, means comprising bevelled gears on the gear drive shaft and said pivot axis for rotating said pivot axis, a tool shaft normally in alinement with said drive shaft and freely rotatable in one end portion of the supplemental frame and spaced with respect to said pivot axis, means providing a drive between the pivot axis and said tool shaft, a tool fixed to the tool shaft, means for guiding an elongated workpiece fed into the machine axially of the tool shaft along a given path, and means, at the other end portion of the swinging frame, for intermittently imparting swinging movement to the supplemental swinging frame in movement of said tool shaft out of said normal alinement and in movement of the tool into said path into operative engagement with a workpiece while fed through the apparatus and immediately withdrawing the tool from said path of movement of the workpiece.

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