United States Patent

[11] **3,545,326**

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[54] **SWING TYPE ARBOR ATTACHMENT FOR QUICK TOOL CHANGES**
15 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **83/433,** 83/449, 83/481, 83/503; 308/61
[51] **Int. Cl.** **B26d 1/24,** B23d 19/06; F16c 35/06
[50] **Field of Search** ..... 83/481, 449, 503, 433; 90/20.5; 308/62, 61, (RB); 72/238, 239; 100/(Inquired)

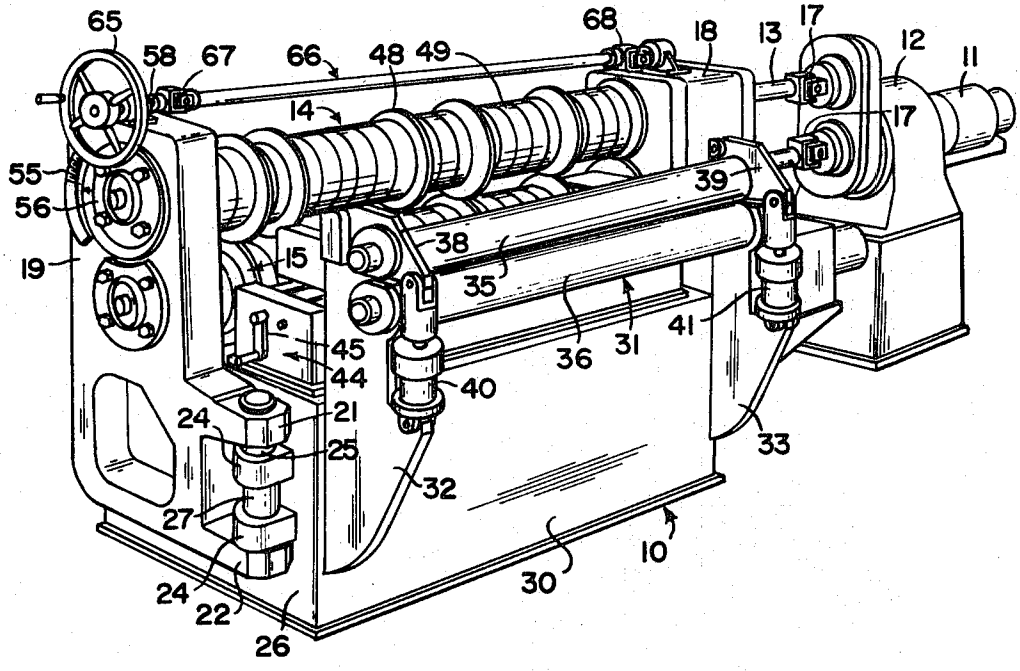
[56] **References Cited**

UNITED STATES PATENTS

2,222,051	11/1940	Tyrrell	83/481
2,307,452	1/1943	Cohen	83/503X
2,318,731	5/1943	Wood	83/481
2,511,058	6/1950	Hambelton, Sr., et al.	83/481

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ABSTRACT: The disclosure relates to an arbor rotating machine having a base and end supports extending upwardly from the base at its ends. One of the end supports comprises a hinged horizontally swinging housing while the other end support is stationary. An arbor is rotatably mounted between the supports on eccentrics for movement toward and away from the base. The arbor has one end with a self-releasing taper to fit a complementarily shaped socket on the swinging end support. Tools mounted on the arbor may be rapidly changed by swinging the hinged housing into and out of alined supporting engagement with the tapered portion of the arbor.



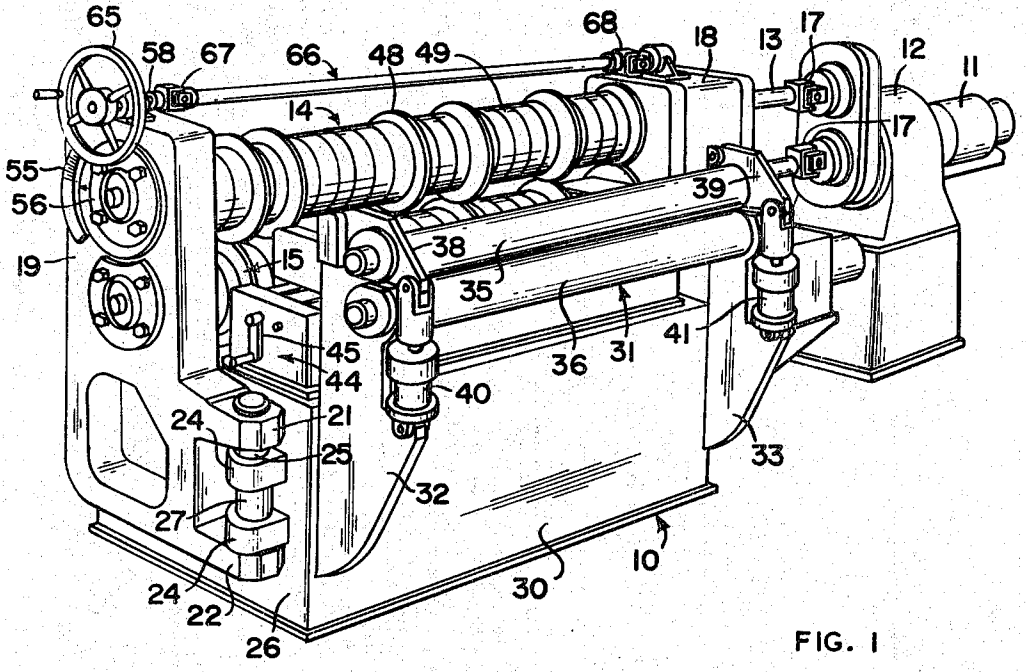


FIG. 1

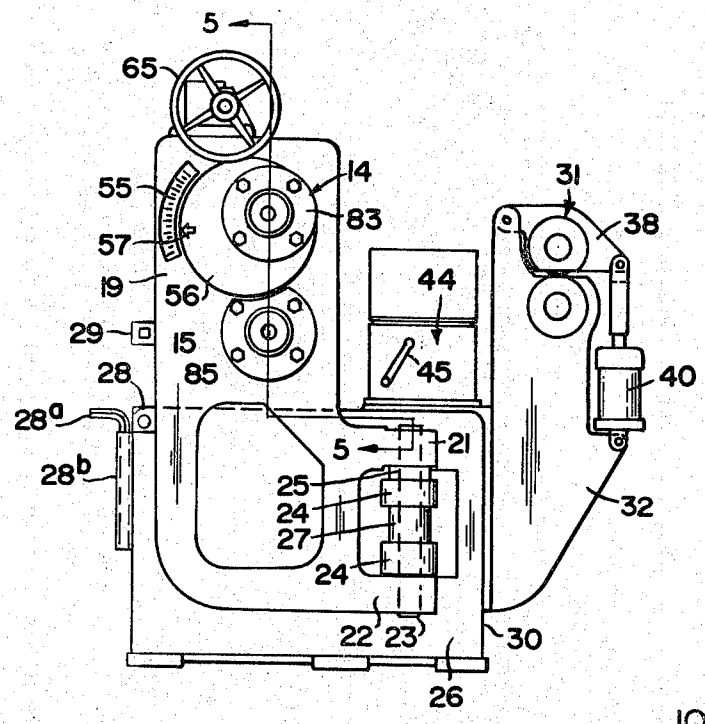


FIG. 2

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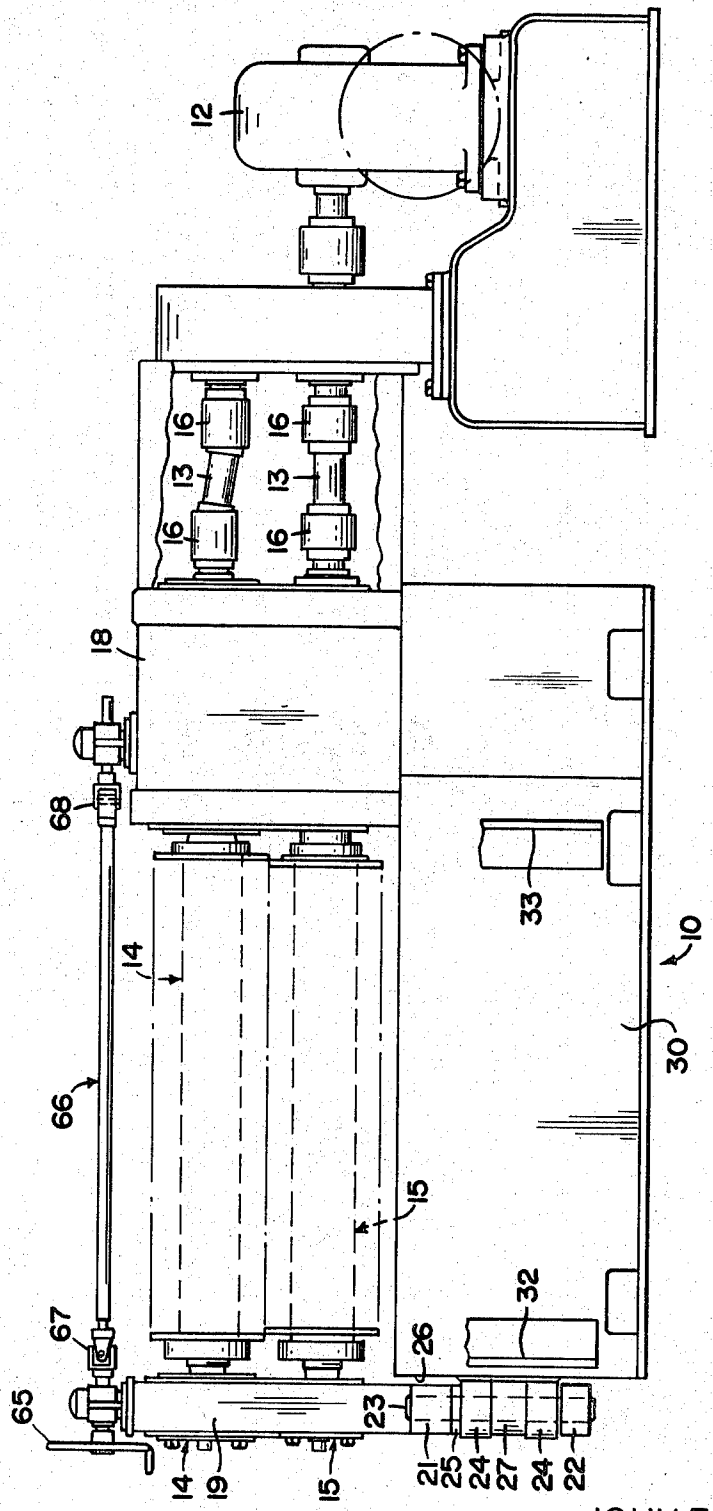


FIG. 3

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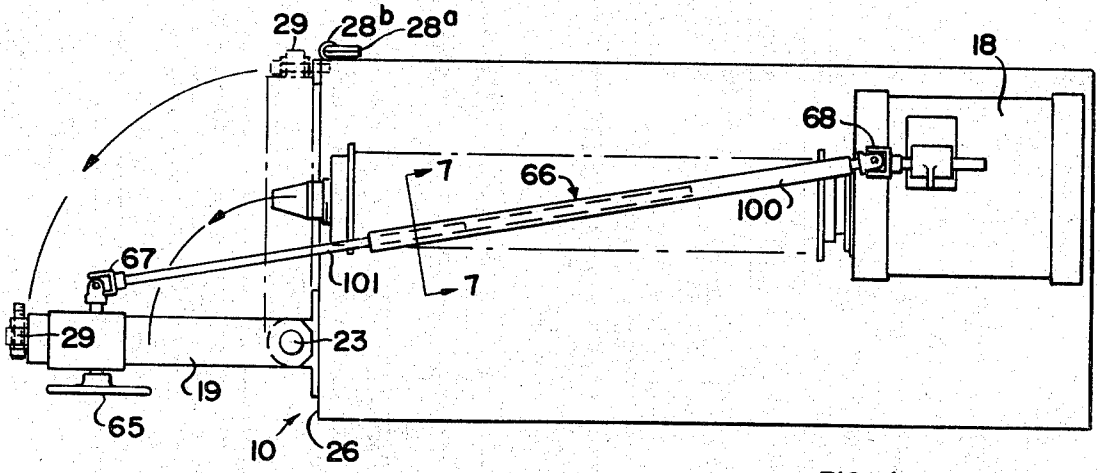


FIG. 4

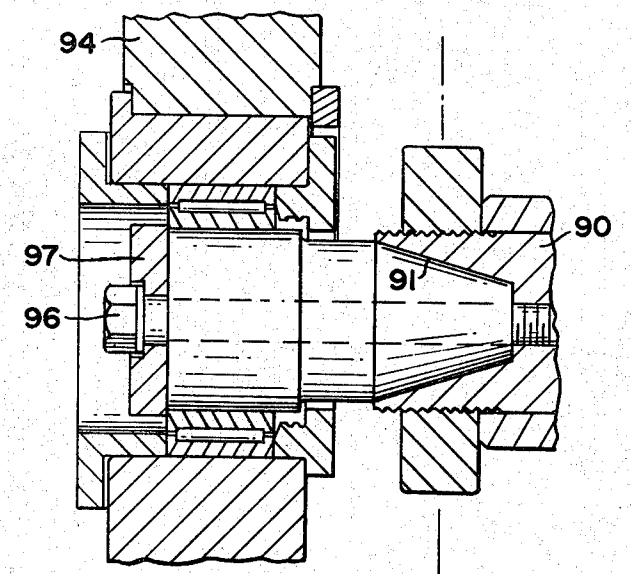


FIG. 8

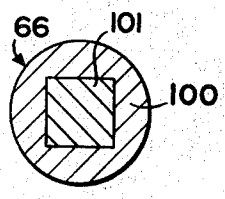


FIG. 7

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FIG. 6

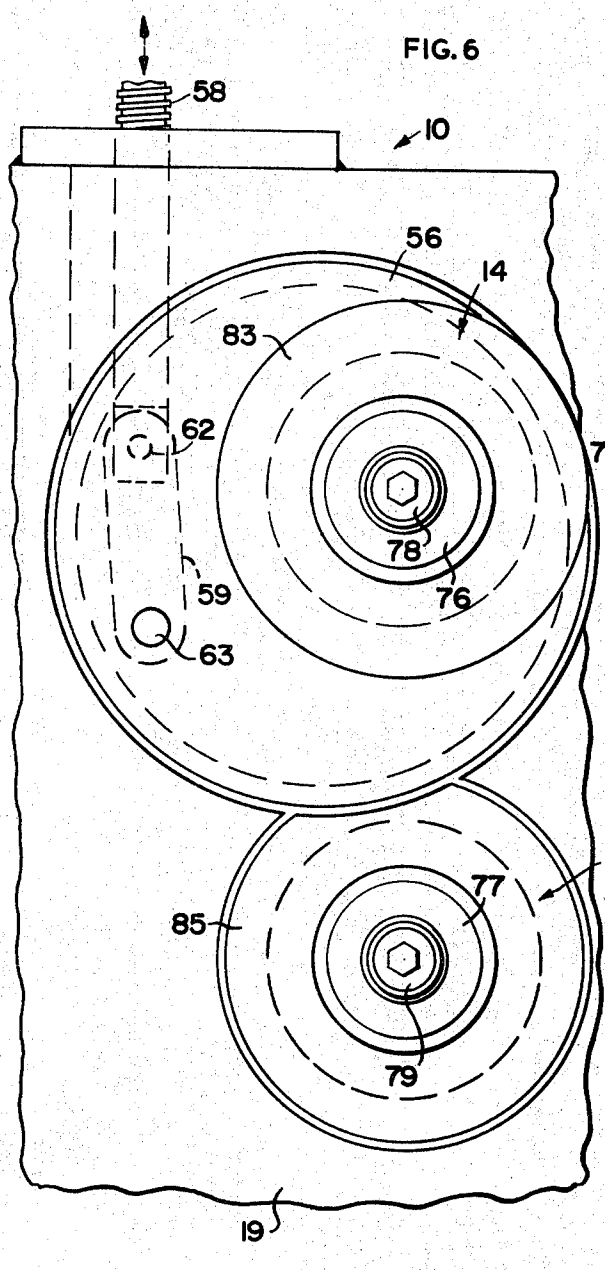
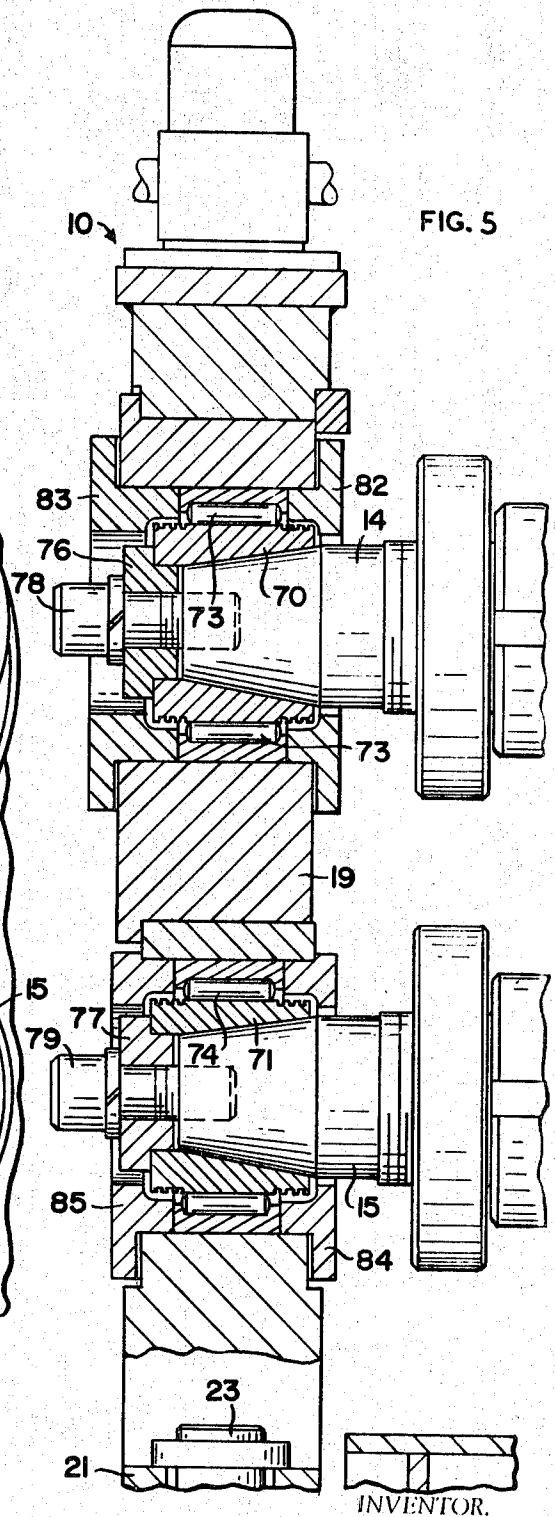


FIG. 5



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SWING TYPE ARBOR ATTACHMENT FOR QUICK TOOL CHANGES

BACKGROUND OF THE INVENTION

Coils of sheet metal, plastic, paper, etc. may be reduced in width by longitudinal cutting or slitting by slitting knives rotatably mounted on horizontal arbors. The slitting machines used in this process are naturally quite large and heavy in order to minimize distorting forces during operation. Accordingly, the end supports, between which the rotating arbors holding the slitting knives are mounted, must be of massive construction. These end supports must also provide means for raising and lowering the slitting knives to accommodate variations in thickness of the metal and diameters of the slitting knives. Pinch rolls are provided on the machine to guide and feed the steel strips into the slitter and appropriate driving means rotate the arbors and rolls.

The slitting knives are separated on each arbor by means of hollow cylindrical spacers which fit between the knives. A problem occurs when the work product requires the rearrangement or replacement of the slitting knives. One of the end supports must be completely disconnected from one end of the arbor and removed from its vicinity in order to allow the spacers and slitting knives to be removed from the arbor and replaced. Obviously, it is economically desirable to minimize the down time necessitated by the tool change.

The exact amount of work and time required for this operation depends on the type of bearing connection and the manner in which the housing releases the arbor and is moved clear for access to the spacers and slitting knives.

In prior art machines, there are two basic means for releasing an end of the arbor from the housing. The first includes simply mounting and the end support housing on tracks or rails so that the housing may move longitudinally away from the arbor. The arbor is connected to the housing by mechanical means such as bolts or clamps. There are several deficiencies in this apparatus. The tracks, in order to support the massive end support housing, must necessarily have a large, strong foundation. The massive support housing may also need a separate power driven means to move it along the track.

The tracks, its foundation and the driving means will necessarily add to the expense of the machine. Moreover, the tracks and their foundation project out from the side of the slitting machine into the work area, thus using valuable floor space and preventing the operator from being able to walk up to the end of the arbor for tool changes. Furthermore, the tracks are normally exposed to dirt and metal fragments may interfere with the sliding movement of the housing when it is disconnected from the arbor.

Another deficiency of a conventional machine is "play" in the arbor. The ends of a conventional arbor are usually cylindrical and have cylindrical bearing races. A clearance must therefore be provided between the races and the arbor to permit disassembly. This clearance reduces the inherent accuracy and stability of the machine by creating "play" which must be taken up by the load.

The process of changing the slitting knives is unnecessarily time consuming with the sliding housing. It usually entails loosening many bolts to disconnect the arbor, sliding the housing out of position, changing the knives and spacers from an awkward position, sliding the housing back in place while alining the arbor and housing bearings and securing them in connected relation. The alinement of the arbor and housing bearings is particularly difficult because the arbors normally sag slightly due to their own weight when one support housing is removed. An additional reason for arbor sag is because the arbor bearings are in bearing boxes which are positioned vertically on the housing. Clearance must be provided between the ears of the bearing box and the housing face so that it is not possible to resist more firmly the binding load of the weight of the arbor. During realinement the heavy arbors must somehow be elevated to center them in their proper axial position with the support bearings. Since these have traditionally been

cylindrical bearings, a compromise between ease of assembly and bearing tolerance has been required.

The second type of known arbor support uses both rectilinear and rotational movement to free the arbor from the support housing. These supports require hinges in series or some other apparatus which permits at least limited purely translational movement to clear a cylindrical bearing and cylindrical arbor journal. In these prior machines, the end housing could not be hinged for movement in a single arc because any initial arcuate rotation would be frustrated by a binding of the close fitting cylindrical support bearing and arbor journal.

The hinges in series or double hinge arrangements previously used have limited applicability because if the end supports or housing are very massive, as they should be, then an extremely heavy load must be held at a relatively long distance from its primary support. This is especially true if in the end support, a means to raise and lower the arbor is provided. One compromise of the prior art has been to split the supports into two double or series hinged doors, thus requiring twice the time for moving the end support into and out of engagement with the arbors when changing tools. To hinge a single massive end support in this manner with cylindrical bearings requiring initial translational movement would cause serious hinge sagging and alinement problems because of the resulting torques on the hinge arrangement.

This invention has eliminated the problems encountered by the devices utilizing tracks and series of hinges for rectilinear motion. That is, the movable end support housing of this invention is not hindered by dirt or the need for excessive floor space. It is efficient, provides easy operator access, is simple to use and vastly reduces the down time of the machines due to tool changes. In short, this invention utilizes a hinged support housing in combination with a tapered arbor journal and bearing to prevent binding. In this manner, the arbor may be released very quickly and the housing swung in one continuous arcuate path horizontally out of the area of the arbor. By mounting the door to swing horizontally, its weight is supported on the single set of hinges without producing relatively high torques. In this manner the single end support which may weigh well over one-half ton may be swung easily by one man.

SUMMARY OF THE INVENTION

This invention relates to end supports for an arbor rotating machine. The end supports are hinged to swing in one continuous arcuate path horizontally while the other end support is stationary. The arbor which holds tools such as slitting knives is rotatably suspended between the end supports and is tapered at one end to fit a complementary taper in the swinging end support. The swinging end support greatly facilitates the release and disengagement of the arbor and therefore the changing of any tools mounted thereon. Synchronized eccentric adjustment means in the end supports allow the arbor to be adjusted vertically and permits greater distance between the housing and less clearance to permit arbor motion.

FIG. 1 is a perspective view of a slitting machine embodying the swinging arbor support and eccentric arbor adjustment of this invention.

FIG. 2 is a side elevational view of FIG. 1

FIG. 3 is a front elevational view of the partially cut away slitting machine.

FIG. 4 is a plan view of the slitting machine.

FIG. 5 is a cross-sectional view taken along the line 5–5 of FIG. 2 with certain of the parts shown in full for clarity.

FIG. 6 is a fragmentary side elevational view of an end support housing and eccentric adjustment means for one of the arbors.

FIG. 7 is a cross-sectional view taken along the line 7–7 of FIG. 4.

FIG. 8 illustrates an alternate embodiment of the connection between the arbor and the support housing.

The slitting machine 10 of this invention, as illustrated in FIGS. 1 through 5, includes a motor 11 which, through appropriate power transmission means in a housing 12, turns a flexible coupling means generally designated 13 which transmits the rotary motion to arbors 14 and 15. Universal joints 17 of a drive shaft 13 may be used to transmit the rotary motion to the arbors from the power transmission means 12. The arbors 14 and 15 are supported between a stationary support housing 18 and a swinging support housing 19.

The swinging arbor support housing 19 is "L" shaped with its lower section separated in two projections or hinge knuckles 21 and 22. Both portions 21 and 22 are connected on a common hinge pin or shaft 23 with the fixed hinge brackets 24 mounted on the side 26 of the base of the machine 10. A ball thrust bearing 25 is placed between the hinge knuckle 21 and the upper bracket 24, and a spacer (not visible) is used between the lower knuckle 22 and bracket 24. A spacer 27 also separates the brackets 24.

A bracket 28 (FIG. 2) having an aperture therein holds a locking screw and is attached to the outer edge of the support housing 19. The locking screw, after passing through the bracket aperture, threadedly engages an opening at the corner of the base 26 thus securing the door housing 19 in supporting engagement with the arbors 14 and 15.

The locking screw may have any known type of head including an Allen head. An Allen wrench 28*a*, used to engage the locking screw, may be positioned in a holder 28*b* attached to the side of the machine. The Allen wrench also fits a second bracket 29. When the Allen wrench engages the second bracket 29, it extends therefrom to form a handle by which the support housing may be swung about its hinges.

As noted in FIGS. 1 and 2, at the front 30 of the base of the machine 10 is a pinch roll assembly 31 which acts to guide and drive the incoming steel sheet through the machine. The pinch roll assembly 31 includes two forwardly extending brackets 32 and 33 on which a rotatably mounted vertically fixed roller 36 is mounted. A vertically movable roller 35 is rotatably mounted in brackets 38 and 39 immediately above the brackets 32 and 33. One end of each of the brackets 38 and 39 is connected to one of a pair of pneumatic cylinders 40 and 41 which are fastened to brackets 32 and 33. When actuated, the cylinders 40 and 41 separate the rollers 35 and 36.

Side guide assembly 44 holds the incoming steel sheet in the correct lateral position. A hand crank 45 is used to adjust the width of the guide assembly through appropriate gearing which is not shown.

Slitting knives 48 and spacers 49 are mounted on the arbors 14 and 15. The spacers 49 are used to adjust the width of the space between the slitting knives 48 and, therefore, the width of the strips which pass through the machine. Scale 55 in combination with a pointer 57 indicates the vertical position of the arbor 14 relative to arbor 15.

The arbor 14 is adjustable within certain limits by means of an eccentric member, best shown in FIG. 6. The arbor 14 rotates about the center of an outer circular support 56 when actuated by means of a jack screw 58 moving a pivoted link 59 held in place by pin 62. A pin 63 fixed on circular support 56 connects link 59 to circular support 56. The jack screw 58 is duplicated at the stationary side of the support housing and both are rotated by means of a hand wheel 65 turning a connecting bar 66. The connecting bar 66 is held at either end by universal joints 67 and 68 so that it does not have to be disassembled when the door is opened, as best seen in FIG. 4.

The connecting bar 66 shown in cross section in FIG. 7 includes an outer sleeve 100 having a square hole into which a square member 101 is telescoped for longitudinal movement. In this manner, rotation of the hand wheel 65 also rotates the outer sleeve 100 and simultaneously rotates both jack screws in both support housings to adjust the arbor 14 vertically.

As best seen in FIG. 5, the tapered ends of arbors 14 and 15 are held in tapered sockets 70, 71, respectively. The sockets 70 and 71 are supported by roller bearings 73 and 74. The rollers are positioned around the periphery of the sockets so that the sockets may rotate with the arbor. Bearing holders 76 and 77 are held by bolts 78 and 79, respectively, to sockets 70 and 71. Bearing seals 82 and 83 about the arbor 14 and bearing seals 84 and 85 about the arbor 15 act as grease seals.

When it is desired to change the slitting knives 48 and the spacers 49, the two screws 78 and 79 and any other screw holding the door to the base are removed and the arbor support housing 19 is simply swung horizontally, in a single arcuate path, out of engagement with the arbors. The spacers and slitters may be then rearranged according to the operator's desire. Upon completion of the rearrangement, the door is simply swung back in place. Because of the complementary angle of the sockets 70, 71 there is an automatic registration and alinement with the arbors 14 and 15. It is then a simple matter to reinsert the bolts and replace the cover plates.

The tapers used in the invention are preferably of the "steep" or "self-releasing" type as distinguished from the self-holding type of taper. Typical tapers used have a taper of 3.50 inches per foot which corresponds to an included angle of approximately 16° 35′ 33.4″. The use of the self-releasing tapers clearly saves time and eliminates damage to the arbor and machine during the tool changing operation.

FIG. 8 shows an alternate embodiment of this invention wherein an arbor 90 has a socket 91 which has a self-releasing taper and accepts a complementary projection 93 from a swinging housing support 94. The projection 93 is held in the socket 91 by means of a screw 96 which threadedly engages the end of the arbor 90. Spacer 97 supports the head of the screw 96 and holds it in position.

For ease of description, the principles of the invention have been set forth in connection with but two illustrated embodiments. It is not my intention that the illustrated embodiments nor the terminology employed in describing them be limiting inasmuch as variations in these may be made without departing from the spirit of the invention. Rather I desire to be restricted only by the scope of the appended claims.

I claim:

1. An arbor rotating machine comprising:
a base;
end supports extending upwardly from said base at its sides, one of said supports being horizontally swingable in a single arcuate path and the other support being relatively stationary;
at least one arbor extending between said supports;
one end of said arbor rotatably mounted in said swinging support;
the other end of said arbor rotatably mounted in a stationary support; and
an outwardly tapering projection and a complementary socket therefor rotatably mounting said one end of the arbor with said swinging support.

2. The arbor rotating machine of claim 1 wherein the tapering projection and complementary socket therefor have a self-releasing taper.

3. The arbor rotating machine of claim 1 wherein means for moving said arbor vertically are provided.

4. The arbor rotating machine of claim 3 wherein the means for moving said arbor vertically includes an eccentric mounted in said support.

5. The arbor rotating machine of claim 1 wherein said one end of said arbor has the outwardly tapering end and the swinging support has the complementary socket.

6. The arbor rotating machine of claim 5 wherein said socket is supported for rotation on roller bearings in said swinging support.

7. The arbor rotating machine of claim 6 wherein a screw secures said arbor in said socket by means of an internally threaded opening at the end of said arbor and a locking screw attached to the swinging support secures the swinging support to the base.

8. A sheet metal slitting machine comprising:
a base;

supports extending upwardly from the sides of said base, one of said supports comprising a horizontally swinging end support and the other support being relatively stationary;

an arbor having spaced slitting knives thereon extending between said supports;

one end of said arbor rotatably supported in said swinging support;

the other end of said arbor rotatably mounted in said stationary support;

an outwardly tapering projection and complementary socket therefor connecting said one end of the arbor and said swinging support, the taper on said projection and said socket being such that the swinging support may rotate in a single arcuate path without previous rectilinear motion; and

means for guiding the sheet metal through the slitter.

9. The sheet metal slitting machine of claim **8** wherein the said one end of the arbor has the outwardly tapering end and the swinging support has the complementary socket.

10. The sheet metal slitting machine of claim **9** wherein said socket is supported for rotation on roller bearings in said swinging support.

11. The sheet metal slitting machine of claim **10** wherein said arbor is secured in said socket by means of a bolt which is threadedly engaged with the end of said arbor and a locking screw attached to the swinging support secures said swinging support to said base.

12. The sheet metal slitting machine of claim **11** wherein means for eccentrically moving said arbor for vertical adjustment are provided in each of said supports.

13. The sheet metal slitting machine of claim **12** wherein said means for guiding the sheet metal through the slitter include a pinch roll assembly and a side guide assembly.

14. The sheet metal slitting machine of claim **10** wherein said means for moving the arbor includes an inner circular member which rotates eccentrically about an outer circular member, a link and jack screw actuating said movement in both supports, a connecting bar between said jack screw and a hand wheel to rotate said connecting bar which is operatively connected to turn said jack screw and universal joints between said jack screws and said connecting bar.

15. A machine comprising:

a base;

supports extending upwardly from the sides of said base;

an arbor extending between said supports;

an outwardly tapering projection and complementary socket therefor connecting one end of the arbor and said support; and

means for moving one of said supports toward and away from said arbor in a single arcuate path.