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Weidman

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[54] **DUCT BOARD CUTTER**

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[52] **U.S. Cl.** **83/5,** 83/422, 83/436

[51] **Int. Cl.** **B26d 3/06**

[58] **Field of Search** ..... 83/1, 3, 4, 5, 422, 436; 144/136, 246 R, 249; 90/16

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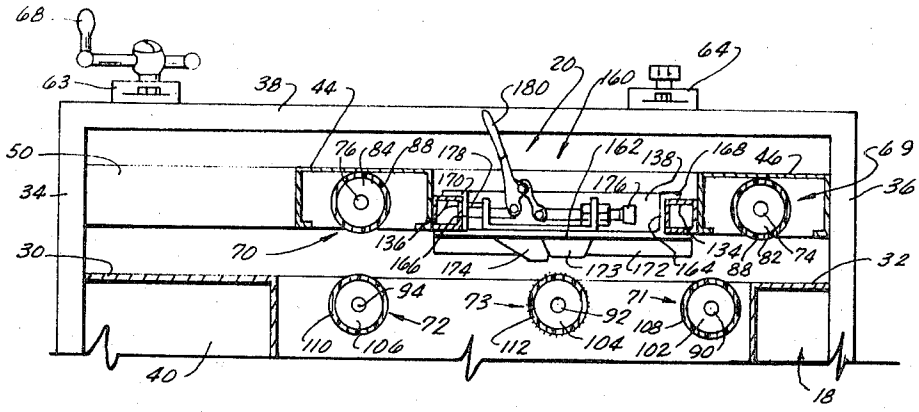
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[57] **ABSTRACT**

A machine for cutting a formation in a sheet of material has a frame having a stationary portion and a vertically movable portion. A powered apparatus is mounted with the stationary and vertically movable frame portions. It moves a sheet of material through the machine between the stationary and vertically movable portions. The vertically movable portion mounts a cutting tool for cutting a formation in the sheet of material as it is moved through the machine.

5 Claims, 7 Drawing Figures



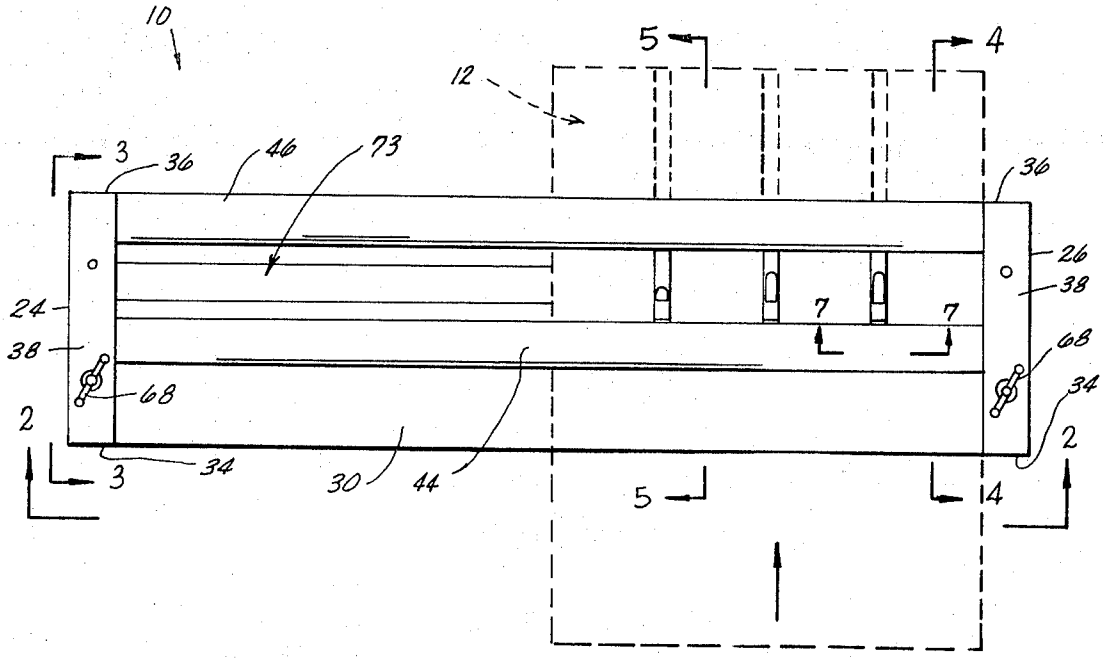

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FIG. 1

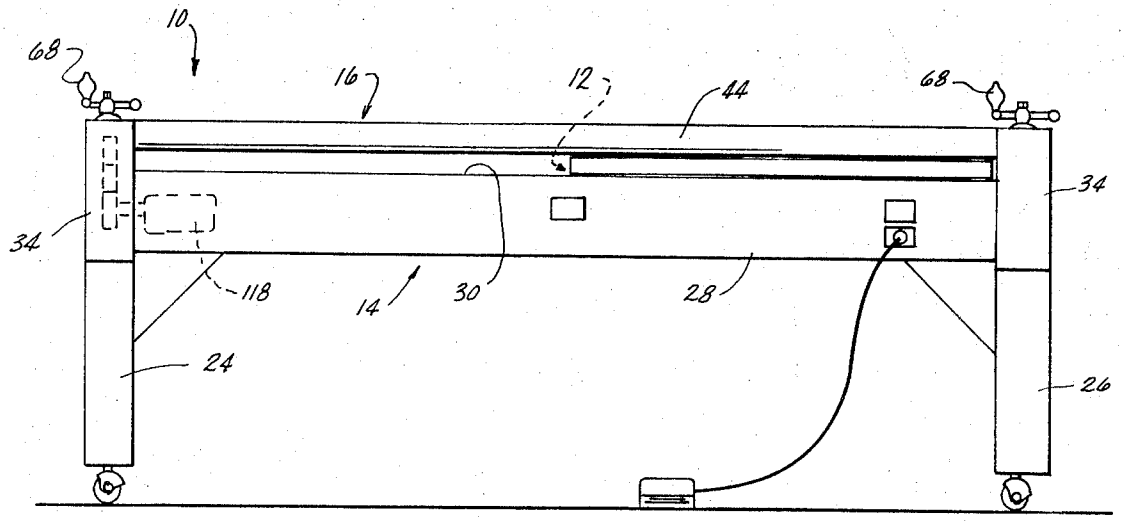

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FIG. 2

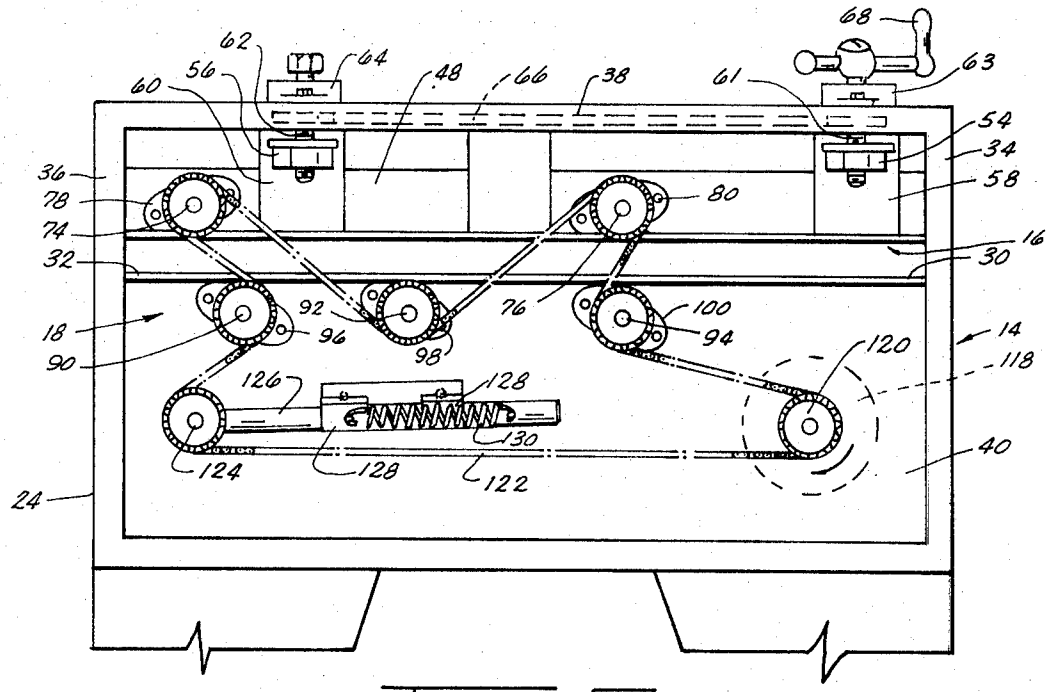


FIG. 3

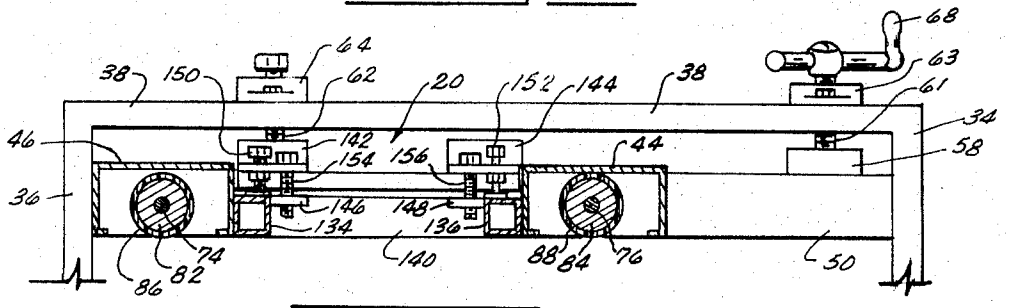


FIG. 4

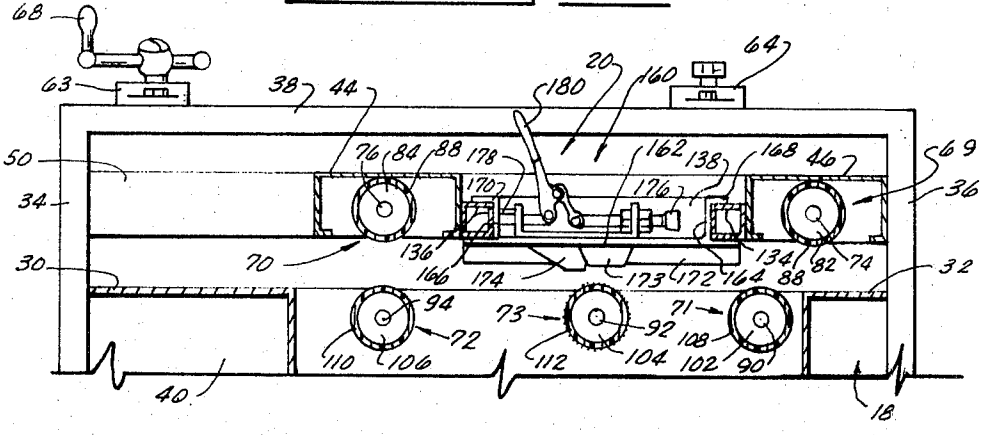


FIG. 5

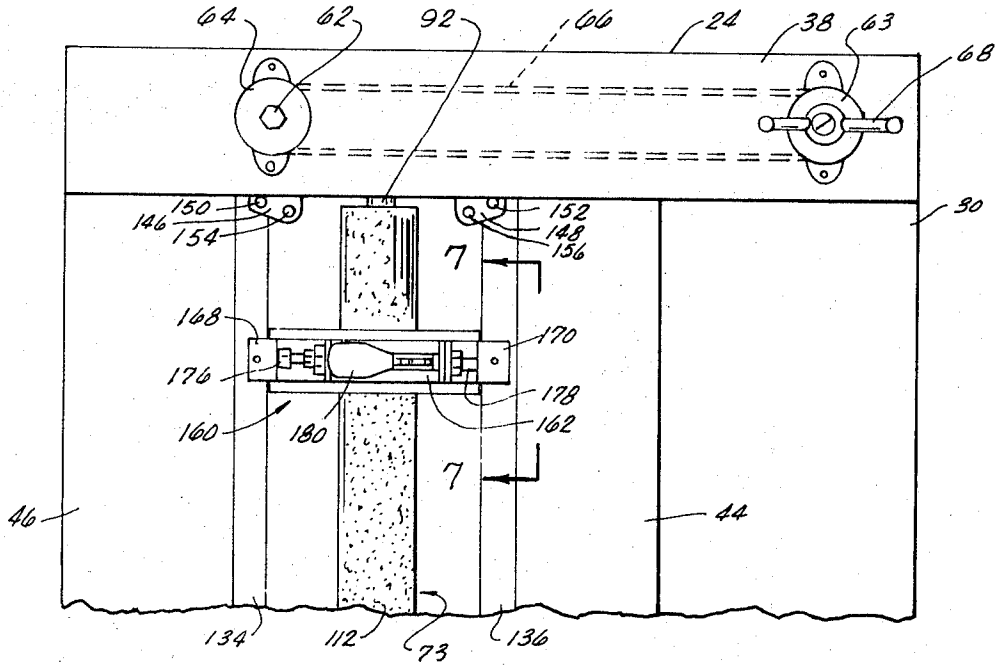

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FIG. 6

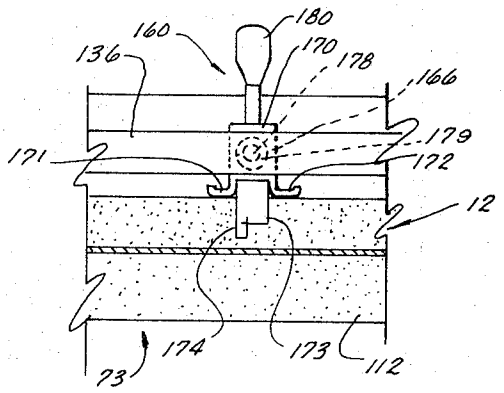

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73

FIG. 7

DUCT BOARD CUTTER

BACKGROUND OF THE INVENTION

The machine of this invention is related to machines for cutting formations in sheets of material for use in the manufacture of ventilation ducts and like structures.

Numerous types of sheet material grooving devices and machines are known in the prior art as operable to cut grooves and various other formations in sheets of material such as fiberboard and fiberglass batting for forming the sheet material into walled structures or the like. However, the prior art devices as a whole are difficult to adjust in setting up the machine for use. In use some prior art machines do not uniformly feed the material through the machine during cutting. Prior art duct former machines have the cutting tools thereof supported from a beam spanning the machine wherein the individual cutting tools are attached to the beam by bolts, clamps or the like, and must be individually adjusted for depth and spacing each time the machine is to be reset which is a difficult and time-consuming task. Duct board cutting machines are known which have multiple tool assemblies mounted on a beam with the beam being rotatable to alternately position the tools for use, however, they have the same adjustment problem as described when they are first set up and they are limited as to tool choice without resetting. In the prior art machines the cutting tool thereof is generally vertically disposed over a platform or table portion of the machine structure so that the material is cut by the tool as it is pulled over the platform or table portion of the machine structure. Additionally, in the known prior art duct board cutting machines powered rollers are positioned to contact the sheet of material to be cut from below or the underneath side thereof to move it when cutting is done on the top side of the sheet. In these machines idler rollers are positioned opposite to the powered rollers and are pressed against the sheet of material to hold it in contact with the powered rollers. In practice it has been found that this arrangement for moving the sheet of material through the duct board cutter encourages slipping of the sheet of material on the rollers relative to the cutter resulting in a non-uniform cut and encouraging the sheet of material to stick in the machine.

SUMMARY OF THE INVENTION

In one preferred specific embodiment, a duct board cutter machine includes a frame having a stationary portion and supporting a vertically movable portion and having a plurality of powered rollers mounted with the stationary frame portion and the vertically movable frame portion, the rollers used to move a sheet of material through the frame structure of the machine between the stationary portion thereof and the vertically movable portion thereof. A cutting tool is mounted with the vertically movable frame portion to in use cut formations, grooves, etc., in a sheet of material as it is moved through the machine between the rollers. A powered roller is mounted with the stationary frame portion and positioned in opposed relation to the cutting tool for supporting the sheet of material as it is cut.

One object of this invention is to provide a duct board cutter machine overcoming the aforementioned disadvantages of the prior art devices.

Another object of this invention is to provide a duct board cutter machine which is operable to cut grooves or other formations in sheets of fiberboard material, fiberglass batting material or other materials, the machine having a plurality of powered rollers on opposite sides of the sheet of material to move the sheet of material through the machine and with a powered roller positioned on a side of the sheet of material opposite to a cutting tool.

One other object of this invention is to provide a duct board cutter machine having a frame structure with a stationary portion and a vertically movable portion and having a plurality of powered rollers mounted with the stationary frame portion and the vertically movable frame portion in an opposed relation and further having a cutting tool adjustably mounted with the vertically movable frame portion and the vertically movable frame portion being adjustable in its generally vertical position relative to the stationary frame portion.

Still, another object of this invention is to provide a duct board cutter machine having an elongated frame structure with the stationary portion and a vertically movable portion mounted above the stationary portion with the ends thereof independently vertically adjustable in their relative position above the stationary portion with a plurality of pairs of powered rollers mounted in opposed relation on the vertically movable frame portion and the stationary frame portion, the rollers having a resilient surface to grip a sheet of material for moving same through the machine.

Still, one other object of this invention is to provide a duct board cutter machine having a cutting tool mount adjustably mounted in a vertically movable frame relative to a stationary portion of the frame of the machine for adjustably positioning a cutting tool for cutting, with the cutting tool being removably mountable on the cutting tool mounting frame.

Various other objects, advantages, and features of the invention will become apparent to those skilled in the art from the following discussion, taken in conjunction with the accompanying drawings, in which:

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the duct board cutter machine with a sheet of material shown in dashed lines positioned therein;

FIG. 2 is a side elevation view of the machine taken on line 2—2 of FIG. 1;

FIG. 3 is an end elevation view of the upper portion of the machine, with portions thereof shown in dashed lines for clarity, the view taken from the position of line 3-3 of FIG. 1;

FIG. 4 is a sectional view of the upper portion of the frame with the view taken on line 4—4 of FIG. 1;

FIG. 5 is a sectional view of the upper portion of the machine with the view taken on line 5—5 of FIG. 1;

FIG. 6 is a top plan view of the right-hand end portion of the machine as it is shown in FIG. 1; and

FIG. 7 is an end elevation view of a cutting tool, its mounting and a roller therebelow, the view taken on line 7—7 of FIG. 1.

The following is a discussion and description of preferred specific embodiments of the duct board cutter machine of this invention such being made with reference to the drawings, whereupon the same reference numerals are used to indicate the same or similar parts and/or structures. It is to be understood that such dis-

cussion and description is not to unduly limit the scope of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings in detail and in particular to FIGS. 1 and 2, a duct board cutter machine of this invention is indicated generally at 10 and is shown with a sheet of material, indicated at 12, therein being cut. The function of the machine 10 is to make cuts or formations in the sheet of material 12 as it is moved through the machine 10. The duct board cutter machine includes a frame structure with a stationary frame portion 14 and a vertically movable frame portion 16 and further including a plurality of powered rollers indicated generally at 18 and shown in detail in FIGS. 3–6, rotatably mounted with the stationary frame portion 14 and the vertically movable frame portion 16. A cutting tool is supported in a mount 20 which is mounted with the vertically movable frame portion 16 to in use cut formations in the sheet of material 12.

The stationary frame portion 14 is an elongated bench-like structure having uprights 24 and 26 on the ends thereof to support the horizontal center portion 28 of the frame a substantial distance above ground level on a supporting surface. The horizontal portion of the stationary frame portion 14 has horizontal table-like portions 30 and 32 on what is the inlet side of the machine and the outlet side of the machine, respectively. The uprights 24 and 26 or opposite ends of the stationary frame portion 14 extend above the horizontal portion 28 of the frame and are used for mounting the vertically movable frame portion 16. The frame ends 24 and 26 and the upper portion thereof have a box-like frame structure with sides 34 and 36 and a top member 38 connected therebetween. Structure of both ends of the frame is generally similar to that shown in FIGS. 3 and 6. Both of the frame uprights 24 and 26 have end plate members such as the end plate member 40 of upright 24 shown in FIG. 3 to mount the ends of a portion of the plurality of rollers 18 and drive system for rotating the rollers. The vertically movable frame portion 14 has a pair of elongated members 44 and 46 extending the length of the machine 10 joined by connecting members 48 and 50 on the opposite ends thereof forming a substantially generally rectangular rigid frame structure. The vertically movable frame end portions 48 and 50 mount opposite ends of a portion of the plurality of powered rollers 18 as shown in FIG. 3.

Each end of the raisable and lowerable frame portion 16 has an apparatus to raise and lower the ends thereof relative to the stationary frame portion 14. The raising and lowering apparatus is similarly constructed on both ends of the machine 10 and is shown in detail on one end portion of the machine in FIG. 3. The raising and lowering apparatus includes a pair of threaded members 54 and 56 rigidly mounted on support brackets 58 and 60 that are rigidly secured to the frame end 48 and threaded members 61 and 62 rotatably supported by mounts 63 and 64 on the stationary frame upper member 38 and threadedly engaged in the threaded members 54 and 56, respectively. A sprocket member is mounted on each of the screw members 61 and 62 and they are connected by a chain 66 for simultaneous rotation of the screw members. A hand crank 68 on the upper end of the screw member 61 is provided for rotation of both screw members simultaneously. It is to be noted that with the raising and lowering apparatus opposite ends of the vertically movable frame portion 16 can be raised and lowered independently. The screw members 61 and 62 are threaded in the same direction so that rotation of the hand crank 68 will raise and lower the ends of the vertically movable frame portion 16 in a parallel fashion.

The plurality of rollers 18 in the duct board cutter machine 10 preferably includes a pair of rollers, indicated generally at 69 and 70, rotatably mounted in the vertically movable frame portion 16 and a generally opposed pair of rollers, indicated generally at 71 and 72, mounted in the stationary frame portion 14 forming two pairs of generally opposed rollers disposed on opposite sides of the machine. Another roller, indicated generally at 73 is mounted with the stationary frame portion 14 in opposed relation to the cutting tool. Each of the rollers 69 and 70 mounted with the vertically movable frame portion 16 has a shaft extending from opposite ends thereof which is supported in mounts on the frame end members 48 and 50 as illustrated in FIG. 3 with the shafts indicated at 74 and 76 and the mounts at 78 and 80. Each of the rollers 69 and 70 has a cylindrical portion 82 and 84 with a resilient covering indicated at 86 and 88. The three powered rollers 71, 72 and 73 mounted on the stationary frame portion 14 are constructed similar to the other rollers and include shafts 90, 92 and 94 extending from their ends and supported in mounts 96, 98 and 100, respectively, and having cylindrical members 102, 104, and 106, respectively, secured to the shafts in axial alignment therewith. Rollers 71 and 72 which are in opposed relation to rollers 69 and 70 have resilient coverings 108 and 110, respectively, and the center roller 73 has a resilient covering with an abrasive surface, indicated at 112. Preferably, the resilient coatings of the plurality of powered rollers 18 is a plastic material, more preferably, a polyurethane material. The resilient and abrasive surface of the roller 73 is preferably a plastic material embedded with particulate solid material embedded therein, more preferably, the coating is a polyurethane material having sand or the like embedded in the exterior surface portion of the covering.

FIG. 3 illustrates the drive apparatus for the plurality of rollers 18. Each of the rollers' shafts 74, 76, 90, 92, and 94 has a sprocket mounted thereon connected with a chain drive to couple the rollers with a motor. The powering device includes a motor 118 mounted with the frame beneath the horizontal portion 14 of the stationary frame portion of the machine with the drive shaft thereof having a sprocket mounted thereon which mounts a chain 122 that passes around and over the sprockets mounted on the plurality of rollers 18. An idler sprocket 124 is used to keep the chain 122 taut. The idler sprocket 124 is supported on a longitudinally movable shaft 126 that is supported from the end plate 40 in sleeves 128 as shown in FIG. 3. A spring 130 connects the shaft 126 and a stationary support lug on one of the sleeves 128 to urge the shaft to an extended position, thus urge the idler sprocket 124 outward in the loop of the chain 122. The drive train 122 is looped around the sprockets of the plurality of rollers 18 so the rollers will turn in the proper direction to move a sheet of material through the space between the frame's stationary portion 14 and vertically movable portion 16. The arrow drawn near the drive sprocket 120 in FIG. 3 on the motor 118 indicates the normal direction of rotation of that sprocket and the chain 122 for moving

a sheet of material from the inlet side of the machine over the inlet table portion **30**. In examining FIG. **3** it is to be noted that vertical motion of the vertically movable frame portion **16** causes the relative spacing of the upper rollers **69** and **70** relative to the lower rollers **71**, **72** and **73** to change, and as the relative spacing changes the idler sprocket **124** is moved as the shaft **126** slides in its mount with the spring **130** maintaining proper tension in the chain **122**.

The cutting tool mount **20** includes an elongated rectangularly shaped frame structure supported on its opposite ends by the end members **48** and **50** of the vertically movable frame portion **16** and mounted such that the ends of the tool mount frame are vertically adjustable relative to the end members **48** and **50**. The tool mount frame has elongated members **134** and **136** on opposite sides thereof and end members **138** and **140** connected between the elongated side members **134** and **136** on opposite ends thereof. The cutting tool frame is mounted with the vertically movable frame portion **16** on the ends thereof and the right-hand end portion of such shown in detail in FIGS. **4** and **6**. A pair of L-shaped flanges **142** and **144** have one side secured to the stationary frame portion **14** with the other side extending over the tool mount frame **20**. A pair of spaced flanges **146** and **148** are secured to the cutting tool frame end **140**. Bolts **150** and **152** are mounted through extended sides of flanges **142** and **144**, respectively, with the end of the screw contacting the upper surface of the frame side members **134** and **136**, respectively, with the nuts being on the lower side of the extended flange sides and in contact therewith. Additional bolts **154** and **156** extend through the extended side of the flanges **142** and **144** and they are threadedly mounted in the flanges **146** and **148** on the frame side members **134** and **136**. Cooperative adjustment between bolts **150** and **154** and the bolts **152** and **156** will fix the position of the end of the cutting tool frame and provide for selective adjustment of such relative to the ends of the movable frame portion **16**. Cooperative adjustment between the pairs of bolts supporting on each end of the cutting tool mounting frame permits relative vertical adjustment of the ends of the cutting tool mounting frame and additional relative vertical adjustment of the cutting tool mounting frame side members **134** and **136**.

FIGS. **5** and **6** show in detail the structure of a cutting tool, indicated generally at **160**, supported in the cutting tool mounting frame. FIG. **5** shows the cutting tool with the latching portion thereof in a released condition and FIG. **6** shows the cutting tool **160** with the latch portion thereof in the latch position. The cutting tool **160** has a mount portion to position and support same between the cutting tool mounting frame side members **134** and **136** and a latching portion to secure the cutting tool in a fixed position in the mount. The mount portion of the cutting tool includes a horizontal member **162** with upright ends portions **164** and **166** and flange portions **168** and **170** extending from the upper end of the ends **164** and **166**. The ends **164** and **166** rest between the mount members **134** and **136** with the flanges **168** and **170** on top of the mount members **134** and **136**. A pair of opposed flanges **171** and **172** extend outwardly from the horizontal portion **162** for mounting of the cutting blades **173** and **174** as shown. FIG. **7** shows one pair of cutting blades that can be mounted with the cutting tool. Blade **173** is generally L-shaped and cuts a portion of the formation in the sheet of material. Blade **174** is generally U-shaped with one side shorter and positioned to overlap the tip of blade **173** for cutting the formation shown. Preferably the cutting blades are provided with slotted apertures so they can be adjustably mounted on the cutting tool mount portion and attached by screws or other suitable fasteners. It is to be noted that a multiplicity of blade structures other than that shown in the drawings can be attached to the cutting tool mount portion as desired for forming cuts of various shapes. The latch portion of the cutting tool has a pair of oppositely extending plungers **176** and **178** movable by a handle **180** between an extended position with the ends of the plungers **176** and **180** passing through apertures in the mount ends **164** and **166** to contact the inner sides of the support members **134** and **136** as shown in FIG. **6** and a retracted position as shown in FIG. **5**. In FIG. **7** the aperture through the mount end **166** is indicated at **179**. The plungers **176** and **178** preferably are provided with a resilient tip on the outer ends thereof. The cutting tool **160** can be positioned at any place along the frame of the tool mount **20**. Preferably a plurality of the cutting tools are made available for use in the duct board cutting machine of this invention so that multiple cuts can be made in a sheet of material in a single pass through the machine. FIG. **7** shows the cutting tool **160** in the mount illustrating the relative position of such and the roller **73**. Preferably the cutting tool **160** is set up as shown in FIG. **7** with the flanges **171** and **172** resting on the upper surface of the sheet of material **12** and the cutting blades **173** and **174** positioned therebelow.

In the use and operation of the duct board cutter machine **10** of this invention a cutting tool or a plurality of cutting tools are mounted with the vertically movable portion of the structure and they are adjustable for obtaining the proper cut desired. The overall relative position of the cutting tool in its mount is adjusted by the cooperating pairs of bolts connecting the ends of the cutting tool mounting frame with the ends of the vertically movable frame portion **16**. Overall relative position of the vertically movable frame portion **16** is accomplished by rotating the hand cranks **68** on the ends of the stationary frame portion **14** as described above. When all adjustments are complete, the drive motor **118** is operated to rotate the plurality of powered rollers **18** and a sheet of material to be cut is introduced through the inlet side of the machine on the table portion **30**. As the sheet of material moves through the machine **10** the blades of the cutting tool or tools mounted therein cut formations into the upwardly disposed portion of the sheet of material **12**, as is illustrated in FIG. **1**. The arrow on the lower portion of FIG. **1** indicates the direction of motion of the sheet of material **12** through the duct board cutter machine **10**. As the sheet of material moves through the machine it is initially contacted by the pair of opposed rollers **70** and **72** on the inlet portion of the machine and gripped by the resilient surfaces **88** and **110** of those rollers and moved by rotation of them. In the center portion of the machine as the sheet of material moves over the center roller **73** having the resilient and abrasive surface **112**, it is cut by the blades of the cutting tool or tools. The pair of opposed rollers **69** and **71** on the outlet portion of the machine grasp the sheet of material with their resilient surfaces **88** and **108**, respec-

tively, to move the sheet of material through the outlet side portion of the machine. It is to be noted that the vertical position of the vertically movable frame portion **16** is preferably adjusted so that the opposed pairs of rollers are brought into firm contact with the sheet of material to minimize slipping as the sheet of material is moved through the machine. An important feature of the duct board cutting machine **10** of this invention is that the cutting tools thereof can be rapidly changed in their position in their mounting in the machine so time necessary for adjustment of the machine in a manufacturing operation is minimal. An additional important feature is that the cutting tools can be raised and lowered relatively easy so that the machine can be used to accommodate different thicknesses of sheets of material and this adjustment can be made in a rapid fashion.

In the manufacture of the duct board cutter machine of this invention, it is obvious that the machine can be constructed by machine fabricating techniques currently used in the art to manufacture machines of the same general type. The frame structures of the machine are relatively simple in design thus making it uncomplicated to manufacture. A quantity of cutting tools can be manufactured to be used with the machine as they are usable individually or in quantity depending upon the quantity of formations to be cut in a sheet of material.

In the use and operation of the duct board cutter machine of this invention, it is seen that same provides a machine to cut formations in sheets of material such as fiberboard and fiberglass batting and other materials such as is used for forming ventilation ducts and the like. The machine will in use produce a formation or a plurality of formations or grooves in a sheet of material as it is moved through the machine. Since the machine has all the rollers thereof powered to rotate, the sheet of material is moved through the machine under the influence of these rollers and no idler rollers are included. The cutting tool portion of the machine is adapted to mount a single cutting tool or a plurality of cutting tools in a frame-like structure which is adjustable. The machine has a vertically movable frame portion with the cutting tool mount adjustably supported thereon to provide for rapid and easy adjustment of the machine for different thicknesses of material and different cutting patterns of the cutting tools.

As will become apparent from the foregoing description of the applicant's duct board cutter machine, relatively simple and inexpensive means have been provided to cut formations or grooves in sheets of material. The duct board cutter machine is economical in that it is rapidly adjustable and has only powered rollers to move the sheet of material through the machine and guide same through the machine. The duct board cutter machine is simple to use in that adjustments for the machine are uncomplicated and easily done. And additionally, the duct board cutter machine is safe to use in that the rollers thereof and cutting tools are well guarded by the structure of the machine for safety to prevent the induction of a worker's hands or clothing into the apparatus.

While the invention has been described in conjunction with preferred specific embodiments thereof, it will be understood that this description is intended to illustrate and not to limit the scope of the invention, which is defined by the following claims.

I claim:

1. A machine for forming a formation in a sheet of material, comprising:

a. a frame means having a stationary portion, a vertically movable portion and a means to move said vertically movable portion,

b. powered means mounted with said stationary portion of said frame means and said vertically movable portion thereof to move a sheet of material through said frame means between said stationary portion and said movable portion,

c. means mounted with said movable portion to removably mount a cutting tool said means to removably mount a cutting tool having an adjustable mounting means constructed and adapted to adjust the position of said cutting tool vertically relative to said vertically movable frame portion,

d. a cutting tool having a mounting means to removably mount said cutting tool with said means to mount a cutting tool, said cutting tool having when mounted a downwardly extending blade to in use cut a formation in a sheet of material as said sheet of material is moved through said machine by said means to move a sheet of material, and

e. said cutting tool mounting means has a latch means with a movable plunger constructed and adapted to in use mount said cutting tool in a fixed position with said means to mount a cutting tool.

2. The machine of claim **1**, wherein:

a. said vertically movable frame portion is supported from said stationary frame portion on an upper portion of said stationary frame portion,

b. said means to move a sheet of material has a plurality of powered rollers rotatably mounted with said stationary frame portion and said vertically movable frame portion,

c. said means to removably mount a cutting tool has a cutting tool mounting frame mounted on said vertically movable frame portion, and

d. said cutting tool has a mount portion rigidly securable to said cutting tool mounting frame.

3. The machine of claim **2**, wherein:

a. said frame means is elongated with said vertically movable frame portion mounted on opposite end portions thereof by said means to move said vertically movable frame portion,

b. said frame means has an inlet table portion on one side of said stationary frame portion for guiding sheet material into said machine and an outlet table portion on the opposite side of said stationary frame portion for guiding sheet material from said machine, and

c. said plurality of powered rollers each have a resilient covering to grip said sheet material.

4. The machine of claim **3**, wherein:

a. said plurality of powered rollers has two pairs of generally opposed rollers on opposed side portions of said frame, one roller of each of said pairs mounted with stationary frame portion and one mounted with said vertically movable frame portion, and another roller of said plurality of rollers mounted with said stationary frame portion in opposed relation to said cutting tool,

b. said roller mounted in opposed relation to said cutting tool has a resilient covering with an abrasive surface, and

c. said means to move said vertically movable frame portion has a screw member rotatably mounted in

said stationary frame portion and a threaded member mounted with said vertically movable frame portion.

5. The machine of claim 4, wherein:

a. said cutting tool mounting frame has elongated members extending substantially the length of said vertically movable frame portion, said cutting tool vertically adjustable mounting means being on end portions of said cutting tool mounting frame,

b. said cutting tool mount portion has a blade support portion mountable on said elongated cutting tool frame members and a cutting tool locking portion engagable with said elongated cutting tool frame members to rigidly secure said cutting tool in a fixed position,

c. said means to move a sheet material has a powering means connected by a chain drive means to said plurality of powered rollers to rotate same, and

d. said means to move said vertically movable portion has a pair of screw members and threaded members on opposed end portions of said frame means, said screw members being connected by a chain drive means to rotate simultaneously for raising and lowering of said opposite end portions of said vertically movable frame portion.

* * * * *