United States Patent

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[54] **POWER-OPERATED CUTTER FOR FORMING LEAD STRIPS IN A PAPER WEB**
5 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **162/286,** 83/177, 83/353, 83/614, 162/193, 162/194
[51] **Int. Cl.** **B31f 5/00**
[50] **Field of Search** 162/193, 194, 255, 260, 286; 83/177, 353, 614

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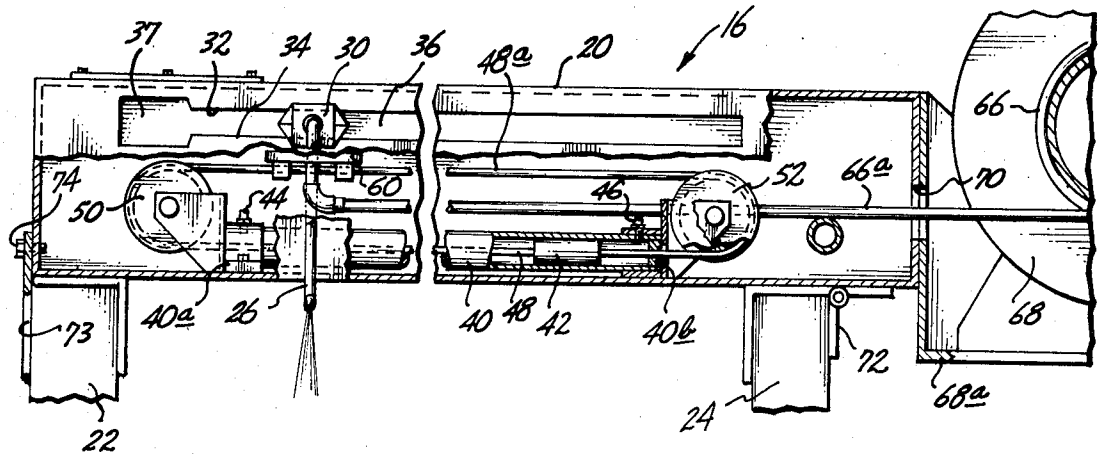
ABSTRACT: A power-operated cutter for cutting paper web being prepared in a papermaking machine. The cutter includes an elongated hollow casing extending across and adjacent the face of the paper web under preparation, and an elongated cylinder disposed within and extending along the casing. A plunger movable within the cylinder under the action of fluid under pressure introduced selectively to opposite ends of the cylinder is connected by a flexible line to a nozzle-type cutter movable along a path defined along the casing. A flexible hose extending from a hose collector disposed adjacent one end of the casing extends into the casing to a connection with the nozzle. The casing may be hingedly mounted on a support adjacent the collector, to permit it to be swung out of the way.



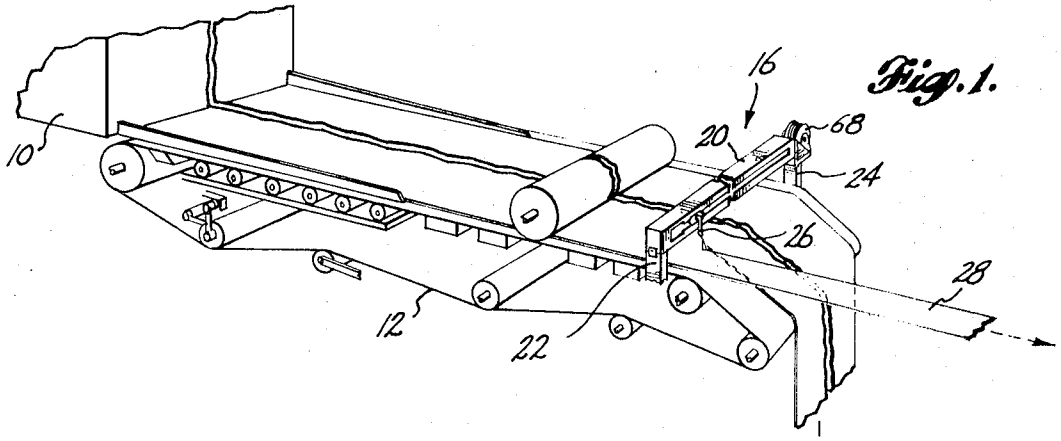


Fig. 1.

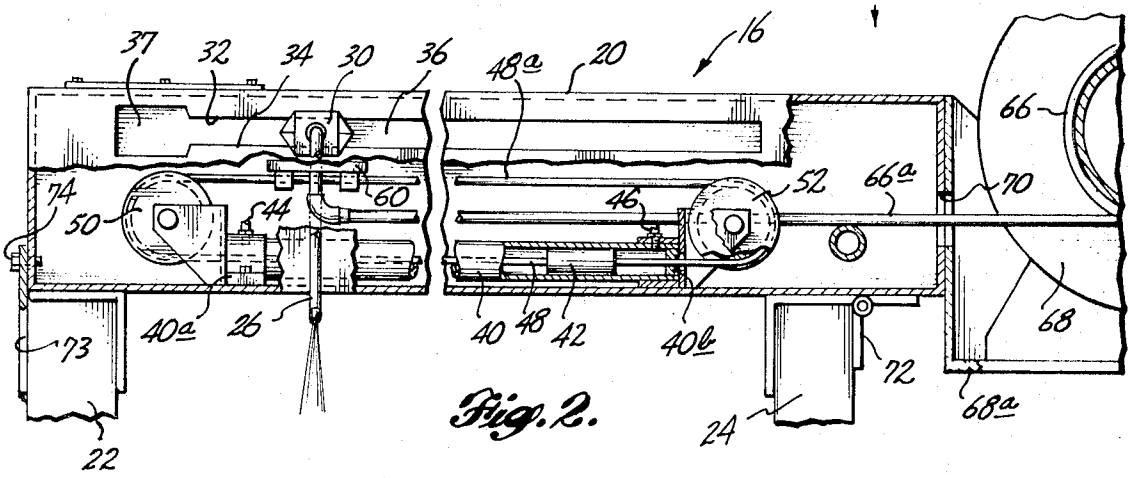


Fig. 2.

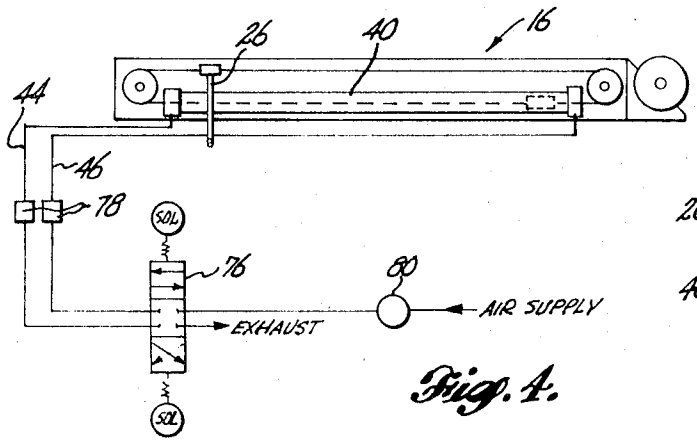
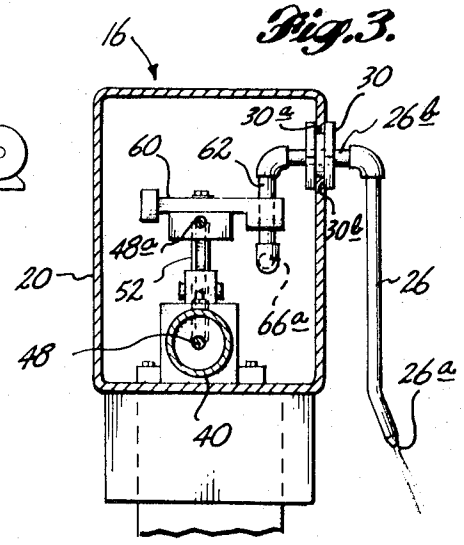


Fig. 4.

Fig. 3.



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POWER-OPERATED CUTTER FOR FORMING LEAD STRIPS IN A PAPER WEB

This invention relates to mechanism for cutting a paper web under preparation in a papermaking machine, and more particularly to such mechanism which includes power-operated means for effecting adjustments in the position of the cutting instrumentality or device in the mechanism with respect to the paper web under preparation.

Explaining a conventional papermaking machine, for purposes of illustration and not by way of limitation, such usually includes at the wet end of the machine a traveling screen upon which an aqueous slurry of wood fiber is deposited in the initial preparation of the web that ultimately forms paper. The web travels from the screen through various devices designed to remove water, compress, and otherwise process the web to convert it into a paper product. Thus, the machine may include, progressing from its wet end to its reel-up or dry end, one or more suction boxes, press sections, wet smoothers, drying cylinders dry smoothers, calender stacks, and finally a friction reel where the paper is wound up on a core. To establish properly the travel of the web through the machine, it is necessary to thread an end thereof between and around various cylinders or rolls which make up the machine, and this threading must be repeated each time there is a breaking or a parting of the web. To facilitate such threading of the web, it is usual to produce a continuous cut longitudinally adjacent one of its edges, to form a narrow strip referred to as a tail which is fed through the machine. The cutting device which produces the cut is moved across the web to widen the strip to the full width of the web, after the desired length of tail has been cut.

In the past, much of such tail cutting has been done manually with a knife, requiring the direct presence of an operator. With breaks subject to occurrence at various locations in the machine, and with an operator oftentimes not being directly adjacent the location where such cutting may be performed, this procedure has decided disadvantages. Some attempts have made to provide tail cutters which may be remotely controlled. Such tail cutters, in addition to being relatively expensive, have generally been characterized by the principal disadvantage of being difficult to maintain in operating order. Humid, relatively warm, and often chemically corrosive conditions generally are present in a papermill, which have contributed to the difficulty in obtaining reliability in operation. It should further be pointed out that a paper making machine, particularly of the type used in a modern papermill, is quite massive, having considerable width as well as length, introducing special problems in the construction of a machine which will perform the desired cutting without being excessively bulky and otherwise interfering with the operation of the papermaking machine.

A general object of this invention, therefore, is to provide a novel power-operated cutter for cutting the paper web under preparation in a papermaking machine characterized by a reliable and maintenance-free type of operation.

Specifically contemplated by the invention is cutter mechanism comprising a cutting device that projects toward the web to be cut, and an elongated cylinder with reciprocable, power-operated, remotely controlled, internal plunger for producing adjustable movement of the cutting device, the cylinder being disposed in a position extending transversely of the web and generally beside the path along which the cutting device moves for adjustment purposes. Means interconnects the plunger and cutting device whereby movement of the plunger produces powered movement of the cutting device. The cylinder, when so located, detracts little, if any, from the working space normally provided on either side of the papermaking machine.

In a specific and preferred embodiment of the invention, a flexible line with ends attached to the plunger and an intermediate expanse joining these ends disposed outside and extending longitudinally of the cylinder is employed as the means connecting the plunger to the cutting device, As envisioned by the invention, when the plunger moves the length of the cylinder, substantially the same distance movement may

be obtained in the cutting device across the paper web being processed. In this way, the maximum length of the motor instrumentality producing such movement of the cutting device may exceed only slightly the length of the path over which the cutting device moves. This is to be compared with a conventional fluid-operated ram arrangement, which has an extended length approximately twice the effective stroke of the ram.

Cutting with a fluid jet, such as a water jet, has certain advantages and such is normally performed near the wet end of the machine were the web is relatively loosely matted and easily separated with a water stream. This invention further contemplates cutter mechanism where the water to feed the nozzle producing the water jet is supplied from a hose contained in a collector adjacent one end of the cylinder earlier mentioned. A terminal expanse of this hose extends from the collector to the nozzle, and generally parallels the cylinder. The cylinder and this expanse of hose may all be contained within a hollow casing with such casing functioning to protect the various parts, and also providing a means for mounting the nozzle whereby it is movable in a path along the length of the cylinder.

When cutting with a water jet adjacent the wet end of a papermaking machine, such may advantageously be done adjacent the screen where the mat is first prepared. To permit easy repair and replacement of such screen, it may be desirable to provide a procedure for moving the cutter mechanism from a position directly adjacent the screen, whereby it is out of the way. This invention further contemplates, in a particular embodiment of the invention, a hinged mounting accommodating swinging movement of the cylinder, nozzle, and the means for guiding the nozzle as a unit, away from a position directly adjacent the web under preparation in the paper machine. This hinge mounting is located next to the collector for the hose, whereby swinging of the structure is best accomplished with minimal disruption of the hose.

It is further contemplated, according to a preferred embodiment of the invention, that the plunger be reciprocable within the cylinder utilizing air under pressure as the motive fluid. Problems of leakage are minimized with such an air pressure system. Further, the system enables accurate control of the position of the plunger from a remote location.

These and other objects and advantages are attained by the invention, described in further detail below with reference to the accompanying drawings, wherein:

FIG. 1 illustrates, in perspective, portions of the wet end of a conventional papermaking machine, and tail cutter mechanism as contemplated positioned over the paper web as such travels on the screen at this wet end;

FIG. 2 is a side view of the tail cutter mechanism with portions broken away, better to illustrate details of internal construction;

FIG. 3 is a cross-sectional view, taken along the line 3—3 in FIG. 2; and

FIG. 4 illustrates schematically a pneumatic control system for the tail cutter mechanism.

Referring now to the drawings, and first of all to FIG. 1, illustrated are portions of the wet end of a paper or papermaking machine, including a so-called breast box **10** containing a slurry of fiber and water, with such being discharged from the breast box onto the upper run of a traveling screen, shown at **12**. As is well known, a mat is prepared from the water and wood material deposited on the screen, and much of this initially introduced water is removed during the passage of the mat down the length of the screen and toward the right in FIG. 1.

The usual papermaking machine may include press sections, drying sections including drying cylinders, calender stacks, and other equipment progressing toward the dry end of the machine. This invention contemplates a cutter for cutting the paper web under preparation in the machine, such as might be used to produce a tail facilitating threading of the web through the various components of the machine. In FIG. 1, such cutter or cutter mechanism is indicated generally at **16**.

Referring now also to FIGS. 2 and 3, the cutter shown includes an elongated casing or element 20 mounted on pedestals or supports 22, 24, with the casing extending across and adjacent the upper face of the paper web under preparation in the papermaking machine. A web cutting device, more specifically a nozzle, shown at 26, projects downwardly toward the web from the casing. With the cutter as shown in FIG. 1, the nozzle is operable to direct a stream of water against the web with such cutting a tail 28 in the web adjacent the lower margin of the web in the figure. This tail is advanced through the papermaking machine, and the remainder of the web is directed downwardly where ordinarily it would be recovered for future paper manufacture.

A large papermaking machine produces a web of considerable width necessitating a casing of considerable length (20 feet not being unusual) to span the distance between pedestals 22, 24. By including the casing, considerable rigidity is obtained between these pedestals. Further, means is provided for mounting other components of the cutter, to be described, with such afforded protection by the casing.

As best seen in FIG. 3, nozzle 26 extends upwardly from nozzle opening 26*a* to a horizontal conduit portion 26*b* which is firmly held within a slide or traveler element 30. The slide, which may be made of nylon for requisite noncorrosive and gliding characteristics, has channels 30*a*, 30*b* along top and bottom margins, which slidably receive edges 32, 34 (see FIG. 2) of the causing defining a slot 36 extending longitudinally along one side of the casing. Slot 36 joins with enlargement 37, included to permit initial mounting of the slide. The slot provides a mounting for the slide (and nozzle member which it supports) and defines a path of movement for the nozzle member which substantially parallels the longitudinal axis of the casing, and extends across the web being prepared in the machine.

Suitably supported on the base of the casing, and inside it, is an elongated cylinder 40 which parallels slot 36. A piston or plunger 42 is mounted for reciprocation within the cylinder, between cylinder end walls 40*a*, 40*b*. Conduits such as the conduits partially shown in FIG. 2 at 44, 46 connect with the ends of the cylinder, for the admission and exhaust of fluid (air) under pressure to and from such ends.

An elongated flexible line 48, with ends secured to opposite ends of the piston or plunger, extends outwardly from opposite ends of the cylinder through suitable sealed openings provided in end walls 40*a*, 40*b*. Pulleys 50, 52 journaled in pulley brackets mounted at the ends of the cylinder train the line adjacent opposite ends of the cylinder, and the line between these pulleys extends in a horizontal expanse 48*a*.

Shown at 60 is a bracket which is secured to expanse 48*a* of the line. The bracket, as shown best in FIG. 3, also mounts a pipe 62 which joins with nozzle 26.

The nozzle is supplied with fluid, i.e., water, through a hose 66 including stored windings contained on a reel or collector 68, which collects or takes in and pays out hose, disposed adjacent one end of casing 20. In FIG. 2, reel 68 is shown mounted within a reel casing 68*a* which may be fixed to one end of casing 20. A suitable fluid coupling is provided adjacent the hub of this reel connecting the hose with a supply of water. End portion 66*a* of the hose extends outwardly in a horizontal expanse from the reel through an aperture 70 in the end wall of the casing, thence along the inside of the casing to a connection with pipe 62.

Considering again the mounting of casing 20 on pedestals 22, 24, the casing can be suitably fixed to the upper ends of the pedestals whereby it becomes a permanent fixture directly above the web of paper under preparation in the machine. Alternatively, and in a preferred embodiment of the invention, the casing is mounted in such a manner as to permit its being swung away from a position directly over the web, to a position spaced some distance from the web. This type of construction has the advantage of facilitating maintenance work on the papermaking machine, such as the repair or replacement of screen 12 which carries the web under the casing. In FIG. 2, it will be noted that a hinge 72 is shown hingedly connecting one end of casing 20 to pedestal 24, which accommodates upward swinging of the left end of the casing to raise the casing. An anchor bracket 73 and detachable fastener 74 are used in detachably fastening the left end of the casing to pedestal 22 with the casing in its lowered position. Suitable power-operated means (not shown) such as a winch or other device, may be used in lifting and lowering the casing.

Referring to FIG. 4, here there is illustrated schematically means whereby air under pressure may be introduced, selectively, to opposite ends of cylinder 40, with exhaust of air from the other end, to produce movement of the piston or plunger along the length of the cylinder. Such may include the usual spring-centered, four-way, solenoid-operated control valve 76, adjustable from the neutral position shown in FIG. 4 (where the conduits 44, 46 which connect with opposite ends of the cylinder are shut off) to positions to either side of this neutral position, where air is introduced either to conduit 44 or 46, with exhaust of air through the other conduit. Shown at 78 are airflow snubbers, which are adjustable for the purpose of changing the flow rate of air to and from the ends of the cylinder. A supply of air under pressure is shown at 80.

The valve controlling airflow may be manually or electrically operated. When electrically operated, no corrosion problems need be introduced by the inclusion of the necessary electrical controls, since they may be located in a protected position remote from the cutter. If desired, multiple control valves may be provided at multiple stations along the papermaking machine, to provide for greatest flexibility in operating the tail cutter.

The operation of the apparatus described should be obvious. In cutting a tail, water may be introduced to hose 66, and the nozzle advanced across the web from a position adjacent pedestal 24, to a position spaced slightly inwardly from the margin of the web adjacent pedestal 22, utilizing air under pressure admitted against one end of the plunger. Movement of the nozzle is guided by the slide or traveler element moving along slot 36. On movement of the plunger along the cylinder, a like amount of movement takes place in the expanse of line which extends between pulleys 50, 52, and as a consequence, the same movement takes place in the slide and nozzle. On the nozzle arriving at the position desired, travel is stopped by adjustment of valve 76 to its neutral position. During travel of the nozzle away from pedestal 24, hose is payed out from the reel. To return the nozzle, air under pressure is admitted against the opposite end of the plunger. With return movement of the nozzle, the reel (which is spring biased) takes in excess hose, to maintain such taut where it extends within the casing.

The cutter of the invention has particular utility in the making of tails from paper webs of considerable width. The casing described has requisite strength to support itself and the parts mounted within it with the casing spanning the distance between the pedestals on either side of the papermaking machine. The casing and cylinder overlie (or they may underlie) the web, rather than project to any distance to one side of the web in the machine, which is important since in this way the cutter minimally interferes with working space on either side of the papermaking machine. By including the flexible line as the means which connects the plunger or piston to the slide or traveler, and with the cylinder disposed beside the path of the nozzle, compactness is achieved together with a length in the path of movement for the slide and nozzle which equals substantially the length of the cylinder. Note also that with clearance problems minimized, swinging movement of the casing through its hinge mounting is made feasible.

The particular construction involved is relatively simple and is easily made with parts having requisite resistance to corrosion. The simplicity of the construction minimizes repair and maintenance, and also is important in lowering the initial cost of the equipment.

It is appreciated that variations and modifications are possible without departing from the invention.

It is claimed and desired to secure by Letters Patent:

1. A power-operated cutter for cutting a paper web prepared in a paper machine comprising an elongated hollow casing extending across and adjacent the face of a paper web under preparation in the machine, means defining an opening along one side of the casing, an elongated cylinder mounted within said casing extending across and adjacent the face of such web, a web-cutting device projecting laterally of the cylinder and toward the web, said cutting device comprising a nozzle for ejecting a stream of fluid, means mounting said device on said casing for movement in a path which substantially parallels and is alongside the cylinder, a reciprocable plunger within said cylinder and means for producing a pressure of fluid inside said cylinder on one side of said plunger whereby it is forced to move along said cylinder, means interconnecting the plunger and cutting device whereby the cutting device is moved along said path with movement of said plunger, means for supplying fluid under pressure to said nozzle comprising a hose with an expanse extending within the casing and a conduit portion extending through said opening, a support, and hinged means hinging the elongated casing on the support, said hinge means permitting swinging of the cylinder and said casing as a unit from a position adjacent the face of the paper web to a position more remote therefrom.

2. The cutter of claim 1 wherein said opening is a slot, and a slide is mounted on said slot which supports said nozzle.

3. In combination with a papermaking machine, an elongated hollow casing extending transversely and adjacent the face of a paper web under preparation in said machine, an elongated cylinder within and extending along the length of said casing, a reciprocable plunger within said cylinder and means for producing a pressure of fluid inside said cylinder on one side of said plunger whereby it is forced to move along the cylinder, means defining a slot extending along a side of the casing, a nozzle for ejecting a stream of fluid for the purpose of cutting a web mounted for movement along said slot, a flexible hose for supplying fluid under pressure connecting with the nozzle and including an expanse extending along the inside of said casing, and means including a line disposed within said casing interconnecting the plunger and nozzle whereby the nozzle is moved along said slot with movement of said plunger.

4. The combination of claim 3, which further comprises a support for at least one end of the casing supporting the casing in an elevated position, and hinged means connecting the casing to said support.

5. The combination of claim 4, which further comprises a collector for taking in and paying out the hose, and wherein said collector is mounted on one end of said casing for movement with the casing.

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