May 29, 1956 H. H. BROOKS 2,747,666

SLITTING MACHINE HAVING TWO LATERALLY MOVABLE OUTER KNIVES AND A CENTER KNIFE MAINTAINED MIDWAY BETWEEN THE OUTER KNIVES

Original Filed March 19, 1952 4 Sheets-Sheet 1

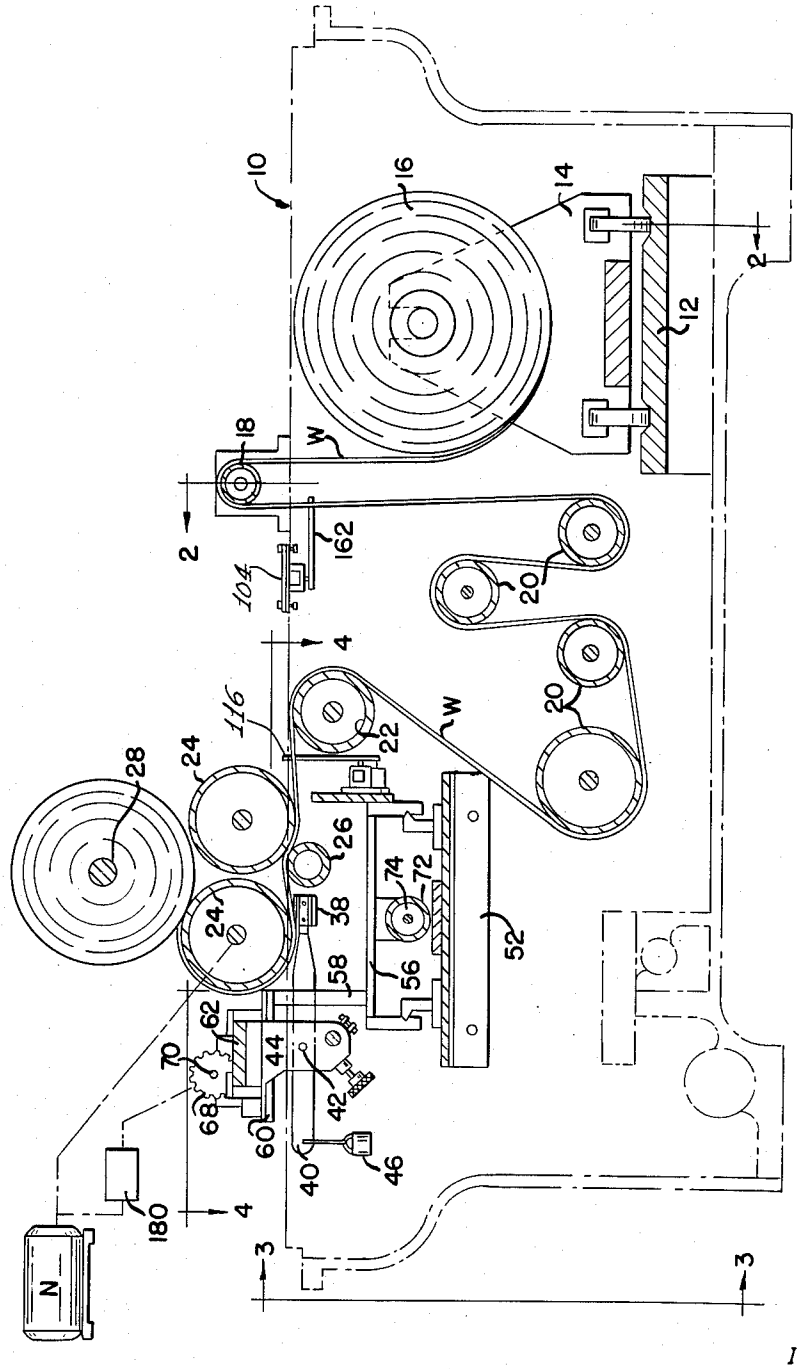



FIG-1

INVENTOR.
HAROLD H. BROOKS
BY Toulmin & Toulmin
ATTORNEYS

May 29, 1956 H. H. BROOKS 2,747,666

SLITTING MACHINE HAVING TWO LATERALLY MOVABLE OUTER KNIVES AND A CENTER KNIFE MAINTAINED MIDWAY BETWEEN THE OUTER KNIVES

Original Filed March 19, 1952 4 Sheets-Sheet 2

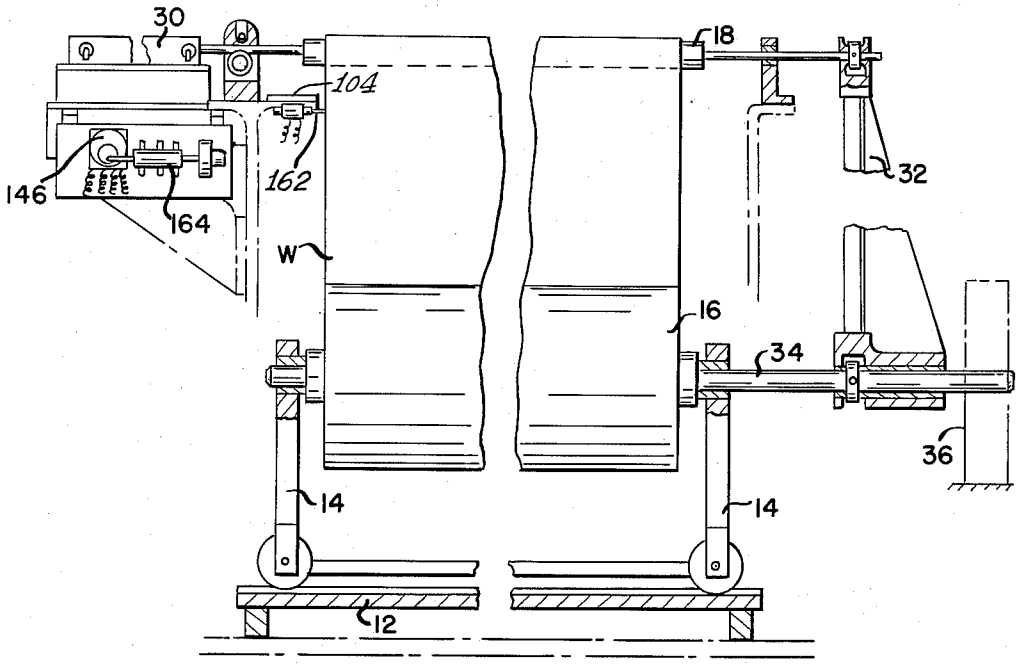



FIG-2

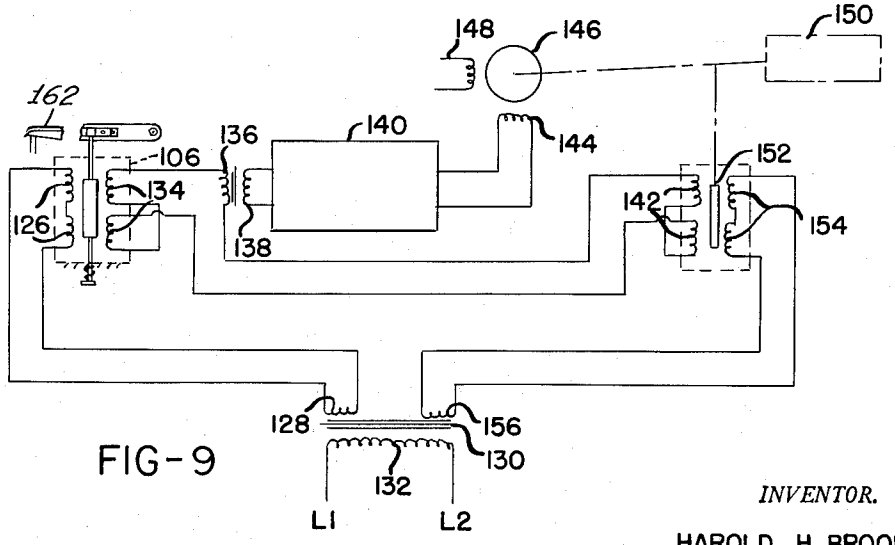



FIG-9

*INVENTOR.*

BY HAROLD H. BROOKS
Toulmin & Toulmin
ATTORNEYS

May 29, 1956 H. H. BROOKS 2,747,666

SLITTING MACHINE HAVING TWO LATERALLY MOVABLE OUTER KNIVES AND A CENTER KNIFE MAINTAINED MIDWAY BETWEEN THE OUTER KNIVES

Original Filed March 19, 1952 4 Sheets-Sheet 3

FIG-5

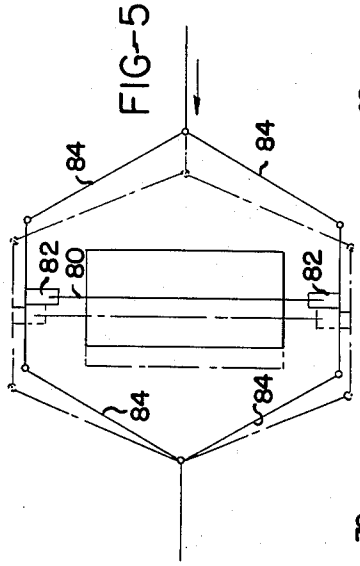



FIG-3

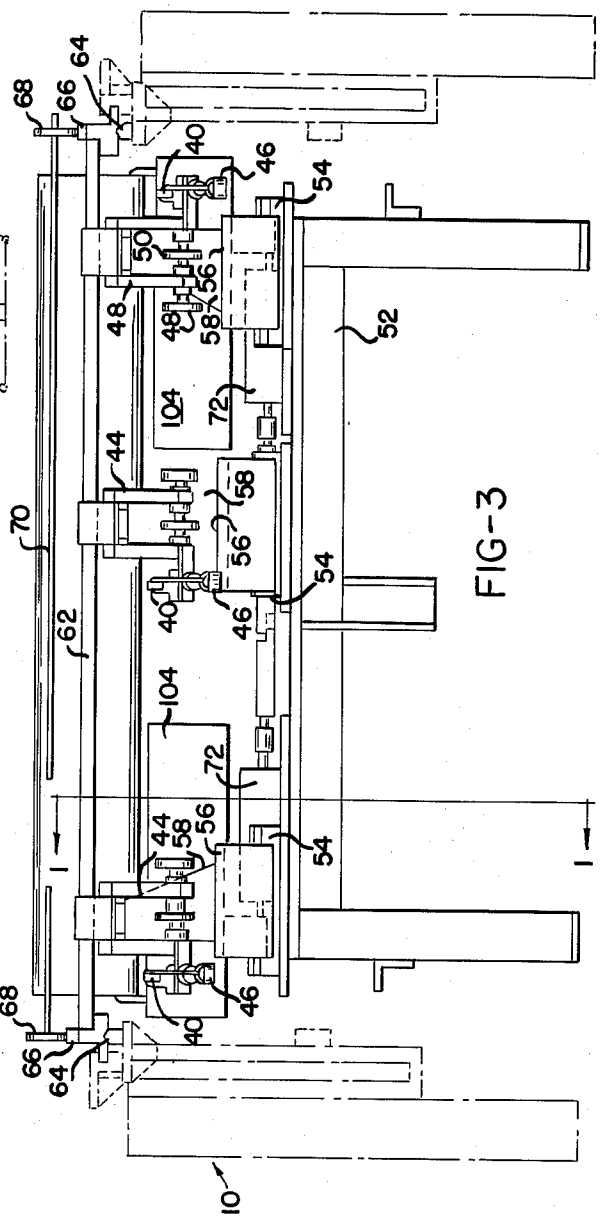
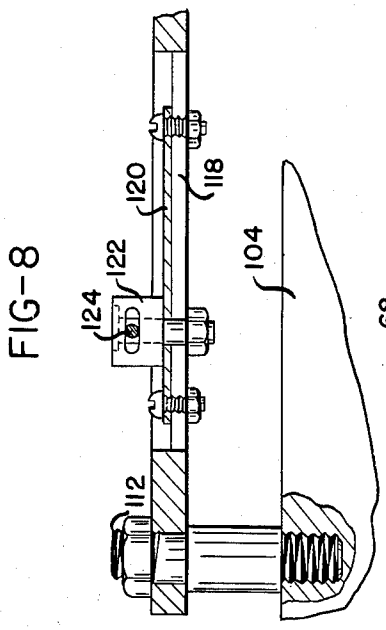



FIG-8




*INVENTOR.*
HAROLD H. BROOKS
*BY* Toulmin & Toulmin
ATTORNEYS

May 29, 1956 H. H. BROOKS 2,747,666

SLITTING MACHINE HAVING TWO LATERALLY MOVABLE OUTER KNIVES AND A CENTER KNIFE MAINTAINED MIDWAY BETWEEN THE OUTER KNIVES

Original Filed March 19, 1952. 4 Sheets-Sheet 4

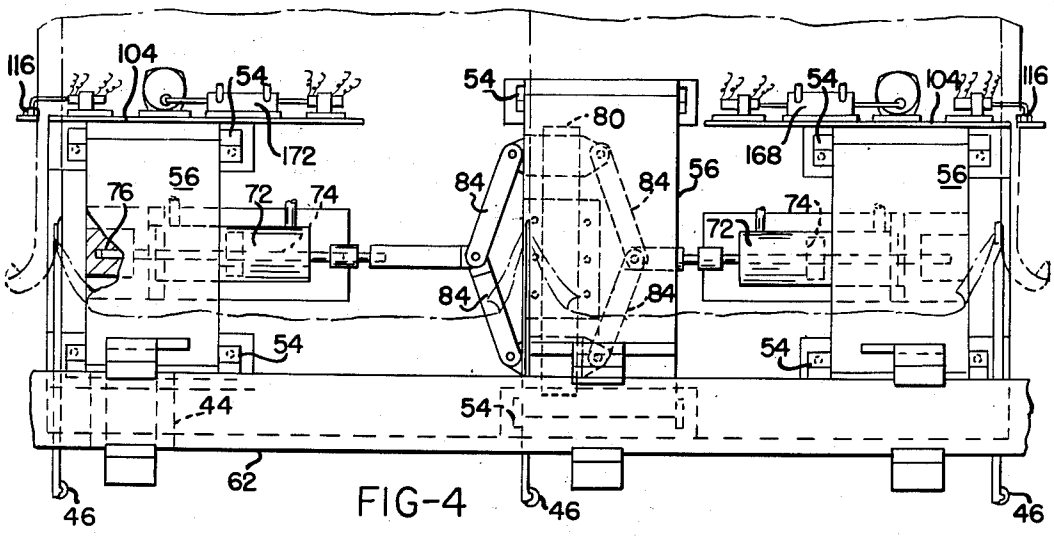



FIG-4

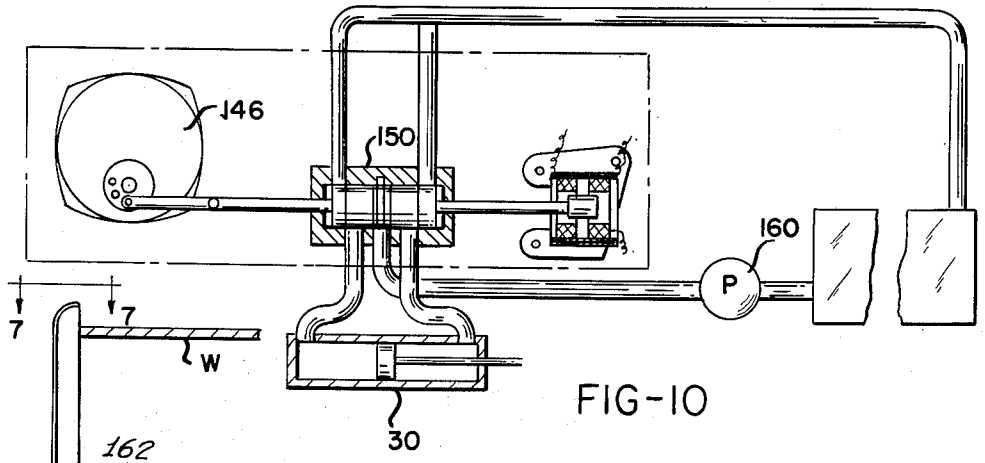



FIG-10

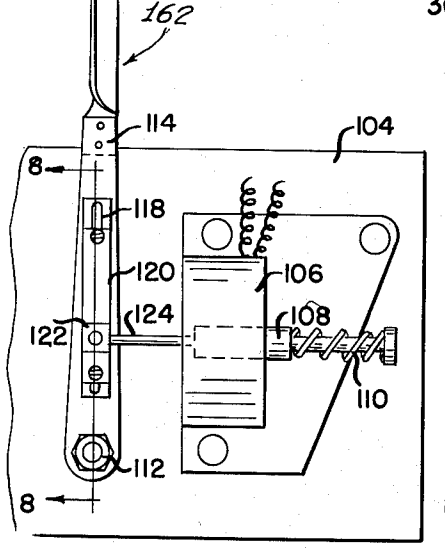



FIG-6

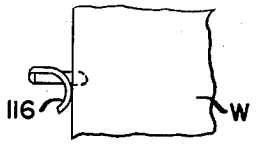



FIG-7

*INVENTOR.*
HAROLD H. BROOK.
BY Toulmin & Toulmin
ATTORNEYS

United States Patent Office 2,747,666 Patented May 29, 1956



2,747,666

# SLITTING MACHINE HAVING TWO LATERALLY MOVABLE OUTER KNIVES AND A CENTER KNIFE MAINTAINED MIDWAY BETWEEN THE OUTER KNIVES

Harold H. Brooks, Columbus, Ohio, assignor to Columbus Coated Fabrics Corporation, Columbus, Ohio, a corporation of Ohio

Original application March 19, 1952, Serial No. 277,401, now Patent No. 2,738,729, dated March 20, 1956. Divided and this application July 28, 1953, Serial No. 370,695

4 Claims. (Cl. 164—39)

This invention relates to a method and apparatus for trimming and slitting webs and is generally similar to the apparatus disclosed in my co-pending application Serial No. 245,100, filed September 5, 1951, now Patent No. 2,705,049 but is an improvement thereover.

The present application is a division of my prior application Serial No. 277,401 filed March 19, 1952, now Patent No. 2,738,729 and entitled "Method and Apparatus for Trimming and Slitting Webs."

The work member which the device according to the present invention is adapted for operating comprises an elongated web of coated fabric, particularly material for a wall covering. These webs of fabric are made up in lengths of up to 2400 yards, and heretofore have been produced in four foot widths with a trimming strip along each edge. Due to the extreme width of the strip and the necessity for exact trimming preparatory to hanging the strip, the use of this wall covering has heretofore largely been restricted to skilled persons. A substantially larger market can be opened up, however, and the hanging of the covering made easier if the product can be brought out in two foot widths and already trimmed to exact size.

With this general objective in view, the device disclosed in the co-pending application Serial No. 245,100 referred to above was developed and put into operation, and, while it accomplished an eminently satisfactory job of making a clean and sharp incision in the web, it was found to be lacking in trimming and slitting to close enough limits to insure a proper product. This fault came about because it was found that the webs of material varied somewhat in width along their lengths and any fixed trimming arrangement would thus result in a trimmed strip where the trim line did not exactly match the printed pattern.

In general, the variation in width of the web came about on account of shrinkage at certain points therealong, as, for example, in the area where two pieces of the fabric being coated were joined together. This variation in width of the strip quantitatively is a relatively minor matter, and further, the rate of variation is slight, and because of this a printed web trimmed to the proper line with reference to the pattern can always be hanged properly, due to the inherent flexibility of the material.

Having the foregoing in mind, this invention has for its primary object a method and apparatus for trimming and slitting webs of the nature described, particularly printed webs, such that the difficulties referred to above are entirely eliminated and the resulting product is always trimmed to a precise line relative to the printed pattern thereon.

Another object is the provision for a method and apparatus for trimming and slitting webs which is rapid in operation, and wherein the machine is easy to set up.

A still further object is the provision of a method and apparatus for printing a web in such a manner that it is



particularly adapted for use in a web trimming and slitting machine according to this invention.

These and other objects and advantages will become more apparent upon reference to the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a side view of a machine according to this invention with the frame of the machine indicated in dot-dash outline;

Figure 2 is a vertical section, indicated by line 2—2 on Figure 1, showing the appearance of the machine from the rear;

Figure 3 is a front elevation of the machine;

Figure 4 is a partial plan view of the machine at the cutting end thereof;

Figure 5 is a diagrammatic view showing the manner in which a pantograph arrangement forming a part of this invention operates;

Figure 6 is a plan view showing a typical feeler member forming a part of the control system of this invention;

Figure 7 is a view looking at the end of the feeler arrangement in Figure 6, and is indicated by line 7—7 on Figure 6;

Figure 8 is a section indicated by line 8—8 on Figure 6;

Figure 9 is a diagrammatic representation of the electric control circuit associated with the feeler; and

Figure 10 is a diagrammatic representation of the hydraulic system that is under the control of the feeler and its associated electric circuit.

Referring to the drawings somewhat more in detail, the machine of this invention comprises a frame, generally represented at **10**, and comprising at the one end means **12** forming tracks for supporting a carriage **14** for lateral movement in the frame. Carriage **14** is adapted for receiving a roll **16** of the material to be trimmed and slit. The web of material, represented by letter W leads from roll **16** over a first roller **18** and in edge contact with feeler **162**, and then over a plurality of idler rollers **20** distributed about the frame of the machine, and which preferably include means for maintaining a predetermined tension on the web. The web W then leads over another idler roller **22**, and then passes underneath a pair of relatively large rollers **24** and is held thereagainst by a fairly small intermediate roller **26** beneath the web. After passing over the rollers **24**, the web is wound on a suitable receiving spindle **28**.

As will be seen in Figure 2, the roller **18** is laterally shiftable in the frame of the machine, in response to lateral movement of the feeler **162**, the roller being shifted by means of the hydraulic cylinder and piston **30**. This mechanism is connected to one end of the supporting shaft for the said roller and the other end of the said shaft is connected by a bracket **32** to shaft **34** of the supply roll **16**, so that lateral shifting movements of roller **18** will be accompanied by equal lateral shifting movements of the supply roll.

In cooperation with the means associated with the rollers **20** for maintaining a predetermined tension on the web, shaft **34** may include a braking means, generally illustrated at **36**, for applying a predetermined braking effect on the said shaft.

Associated with the left-hand one of rollers **24**, as viewed in Figure 1, are a plurality of cutting blades **38** which are in the form of extra-long razor blades mounted on the ends of arms **40**, each of which is pivoted at **42** to a suitable supporting framework **44**, and so biased by a weight **46** that the cutting blade is pressed toward the roller **24**.

As will be seen in Figure 3, arms **40** are actually supported to one side of their supporting brackets **44**, and are shiftable laterally in their respective brackets by

the adjustable screw **48**, and can be clamped in position by the clamp nut **50**.

In Figures 1, 3 and 4 it will be noted that underneath rollers **24** and extending transversely in the frame of the machine is a rigid table or platform **52**. This platform **52** has fixed thereto upstanding guide rails **54** which slidably receive the slides **56**, and each of which slides is rigidly connected with an upstanding support plate **58** that has at its upper end a horizontal slide portion **60** extending leftwardly therefrom, as viewed in Figure 1.

Slide portion **60** of each of the upstanding parts **58** of the slides **56** is associated with one of the cutter knife supporting brackets **44**. The said brackets **44** are supported on the slide parts **60** for movement thereon and are likewise slidably engaged by a transverse bar **62**, so that the knife supporting brackets **44** will all slide in unison. The bar **62** is supported at each end by the rails **64** and also adjacent each end are the racks **66** engaged by the gears **68** that are interconnected by shaft **70**. The purpose of this arrangement is so that during operation of the machine shaft **70** can be rotated slowly, and this will gradually shift the cutting blades in the direction of their length, thus continuously presenting a clean and sharp cutting edge to the web being trimmed and slit, so that at all times a perfectly sharp cut is obtained.

At the same time, the brackets **44** are slidable longitudinally of the rail or bar **62** independently of each other.

Associated with the two end slides **56** are the stationarily mounted hydraulic cylinders **72** within which are mounted double acting pistons **74**, each of which has rods extending out both ends of the associated cylinder. The outer one of each of the rods is connected with the adjacent slide **56** by means of dependent block **76** thereon, as will be seen in both Figures 3 and 4. As the pistons move in the cylinders, the associated slides are thus also moved.

The center slide takes a motion different from the two end slides for the reason that the knife associated therewith must always be exactly half-way between the two outer knives. For this reason, the center slide is connected so that it takes one-half the movement of each of the end slides, and in the same sense, whereby once adjusted so its knife is midway between the two outer knives, it will remain in an exactly centered position throughout all adjusting movements of the end slides.

According to this invention, this is accomplished, and as shown diagrammatically in Fig. 5, by fixedly supporting on the underneath side of the center slide a bar or rod **80**, and on each end of which is slidable a yoke **82**. This rod is at right angles to the direction of movement of the piston **74**. Each yoke **82** is connected with the adjacent inner rod of one of the pistons **74** by a link **84**. It will be seen that the movement of either of the pistons **74** in either direction will be accompanied by a movement of the center slide in the same direction, but only half the amount.

In the preparation of the web for being operated by the web slitter and trimmer, it is printed in the usual manner, and at the time of the final printing, the web is trimmed a predetermined distance outwardly from the outer edge of the printed pattern. Thus, should shrinkage or stretching of the web occur after the printing has been applied, the trimmed outer edge will always be the same distance from the edge of the printed pattern, and thus provide a reliable guide means when the web is delivered to the trimming and slitting machine.

When the trimmed web is mounted in the trimming and slitting machine, it engages the feeler arm **162**, as shown in Figures 1 and 2 mounted in the machine frame closely adjacent laterally shiftable roller **18**. This feeler **162** is best illustrated in Figure 6, and the arrangement for operation will be seen to consist of a mounting panel **104** on which is carried a coil **106** and reciprocably mounted on coil **106** is an armature **108** biased in one direction by a spring **110**.

Pivotally mounted on plate **104** by post **112** is the rod **114** that has the arcuate feeler arm **162** bearing on the edge of the web with a light pressure, say, one-half ounce.

Adjustably mounted on the arm, as by means of slot **118**, is a plate **120** pivotally supporting a block **122** to which is connected rod **124** leading to armature **108**.

It will be apparent that movements of the web in the machine frame will be accompanied by movements of rod **114** about its pivotal support, and a corresponding adjustment of armature **108** in coil **106**.

The movement of armature **108** in coil **106** is converted into a usable electrical impulse in the manner diagrammatically illustrated in Figure 9. In this figure it will be noted that coil **106** is, in fact, a plurality of coils, with the two numbered **126** being connected in series and supplied with energy from secondary coil **128** of a transformer **130** having a primary **132** connected with power lines L1 and L2.

The amplifier output **140** is delivered to field coil **144** of reversible motor **146** having a second field coil **148** with a constant input, and the drive shaft of motor **146** is connected for adjusting a hydraulic control valve **150** and is also connected with armature **152** associated with coils **142**.

Armature **152** is also positioned to influence the serially connected coils **154** that are supplied from secondary coil **156** of transformer **130**.

At this time it will be seen that what Figure 9 illustrates is an extremely delicate electrically operated detector that controls a servo-valve and the adjustment of the servo-valve operating to restore balance in the electric circuit.

A typical arrangement of motor **146**, valve **150**, and the connected armature **152** is illustrated in Figure 10, and it will be noted that the valve **150** is connected between the hydraulic motor which it controls and a source of fluid pressure **160**. Shifting of the valve in one direction will drive the motor piston in one direction, whereas shifting of the valve in the opposite direction will drive the piston in the opposite direction, and the valve further has a neutral position wherein the piston is locked stationary.

As mentioned before, the feeler arm **162** is carried by the frame and engages the edge of the web adjacent roller **18**. The feeler operates through the highly sensitive combined electrical and hydraulic system in Figure 9 to cause the motor **146** to actuate the valve **150**. This, in turn, controls a hydraulic motor **30** (Figs. 2 and 10) for moving the roller **18** lengthwise which carries the web.

Inasmuch as the feeler arm is mounted on a bracket fixed in the frame, it will be apparent that it serves to control the position of the web in the frame, so that the edge of the web that is engaged by the feeler arm is always running in a fixed vertical plane. This locating of the web in the machine insures that the knife holders will take a minimum amount of movement in following the cutting lines and also simplifies the mounting of the roll of material to be cut in the machine.

At the cutting and slitting end of the machine, there is a first feeler arm **116** positioned to engage the right-hand edge of the web as it is viewed in Figure 4. Feeler arm **116** controls hydraulic valve **168**, which is connected to supply the cylinder **72** associated with right-hand slide **56**. This arm is pivotally mounted on any suitable stationary part of the machine so as to permit the feeler to move and follow the edge of the web.

At the left edge of the web is another feeler arm **116** that controls a hydraulic valve **172** connected with cylinder **72** associated with left-hand slide **56**. Hydraulic control valves **168** and **172** are of like construction and operation as the hydraulic control valve **150**, which is illustrated in Figure 10. Piston cylinders **72**, as shown in Figure 4, and arranged at opposite side edges of the web

are actuated in response to movement of the hydraulic control valves **168** and **172** respectively similarly as piston cylinder **30** in Figure 10. In this manner when either of the pistons **74** of the cylinder **72** are operated in response to movement of the control valve by edge feelers **116** arranged at opposite side edges of the web, the trimming knives or blades **38** are caused to move to the right or left, as seen in Figure 4. The middle slitting knife or blade which is connected to the piston cylinder **72** is shifted through the action of the link **84**, upon movement of either or both of the edge trimming knives **38**, to a position exactly one-half of the distance between the outer edge trimming knives.

From the foregoing description, it will be apparent that the device according to my invention operates as follows: a web is first run through a printing machine, and simultaneously is trimmed on its opposite edges a predetermined and fixed distance outwardly from the opposite edges of the pattern printed thereon.

The printed and roughly trimmed web is then placed in the slitting and trimming machine and threaded therethrough. As soon as the machine is started, and which is accomplished by energizing a motor N that is connected with one or both of rollers **24**, and which is also connected through a speed reducer **180** with shaft **70**, the feeler arm **162** adjacent roll **18** becomes effective for predetermining the lateral position of the web in the machine.

Thereafter feeler arms **116** at the cutting and slitting end of the machine serve to control the two outer knife carriages to maintain their knives a predetermined fixed distance inwardly from the outer edges of the web being trimmed, with the center knife occupying a precisely centered position between the outer knives and slitting the web in half.

Each of the knives can be adjusted laterally independently of the others, and the machine is thus made to conform to patterns of slightly varying width and to compensate for variations in the structure in individual knives.

In connection with the hydraulic motor actuation of the transversely movable rollers and the control of the slitting and trimming knives, this manner of actuating these elements is important because of the natural damping characteristics of this type of motor which tends to prevent hunting thereof. Where electric motors are suitable in most combinations of the general nature referred to, with the instant apparatus, it was found that hydraulic motors were much to be preferred. This application is related to application Serial Number 324,172, now U. S. Patent No. 2,728,393.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

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

1. In a machine of the character described, in combination a frame, means for passing a web through the machine and supporting the web, three spaced cutter knives engaging the web across its width, feeler means engaging the edges of the web adjacent the outer of said knives, means guided by said feelers for maintaining the adjacent knives a predetermined distance inward of the side edges of the web, and means connecting the two outer knives with the center knife and operable through guiding contact with said feelers to maintain the center knife midway between the outer knives in all positions thereof.

2. In a machine for trimming the opposite edges of a moving web and slitting the same longitudinally which comprises two laterally spaced web side slides and a laterally movable middle slide having a web-slitting knife mounted thereon, edge trimming blades mounted on each of said side slides, hydraulic motor means connected with each of said web side slides for moving the same laterally, edge feelers arranged to contact the opposite side edges of said web, said edge feelers being movable laterally so as to follow the edge of the web, and collapsible linkage means connecting the inner ends of said web side slides with said middle slide, said linkage means having a point in the region of said middle slide connected therewith which takes a movement equal to one-half the sum of the movements of the web side slides, said edge trimming blades being movable laterally in the same direction as said edge feelers a distance corresponding to the distance moved by said edge feelers.

3. In a machine for trimming the opposite edges of a moving web and slitting the same longitudinally at the middle, which comprises two laterally spaced web side slides and a laterally movable middle slide having a web-slitting knife mounted thereon, edge trimming blades mounted on each of said side slides, a hydraulic motor connected with each of said web side slides for moving said slide laterally, edge feelers arranged to contact the opposite side edges of said web, said edge feelers being movable laterally so as to follow the edge of the web, linkage means connecting the inner ends of the web side slides with said middle slide, said linkage means having a point in the region of the middle slide connected therewith that moves one-half the amount of each web side slide and in the same direction, said edge trimming blades being movable laterally in the same direction as said edge feelers a distance corresponding to the distance moved by said edge feelers, a control valve for each of said hydraulic motors for reversibly controlling the supply of fluid thereto, a reversible electric motor for shifting each valve, and an electric control circuit for each of said electric motors for controlling the operation of the same in response to lateral movement of said edge feelers.

4. In a machine for trimming the opposite edges of a moving web and slitting the same longitudinally at the middle which comprises two laterally spaced web side slides and a laterally movable middle slide having a web-slitting knife mounted thereon, edge trimming blades mounted on each of said side slides, a hydraulic motor connected with each of said web side slides for moving said slide laterally, edge feelers arranged to contact the opposite side edges of said web, said edge feelers being movable laterally so as to follow the edge of the web, linkage means connecting the inner ends of the web side slides with said middle slide, said linkage having a point in the region of the center slide connected therewith that takes one-half the movement of each of said web side slide and in the same direction, said edge trimming blades being movable laterally in the same direction as said edge feelers a distance corresponding to the distance moved by said edge feelers, a control valve for each of said hydraulic motors for reversibly controlling the supply of fluid thereto, a reversible electric motor for shifting each valve, an armature connected to each of said feelers, a differential coil about each armature, an amplifying circuit connected to each coil, a second armature movable with each valve, and a differential coil about each said second armature which is connected in the amplifying circuit of the valve.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,133,297 | Lewis | Mar. 30, 1915 |
| 1,299,335 | Hazeltine | Apr. 1, 1919 |
| 1,333,588 | Lewis | Mar. 9, 1920 |
| 1,656,755 | Palmer | Jan. 17, 1928 |
| 1,669,634 | Templeton | May 15, 1928 |
| 1,678,458 | Biggert | July 24, 1928 |
| 2,020,491 | Winters | Nov. 12, 1935 |
| 2,082,634 | Johnstone | June 1, 1937 |
| 2,088,473 | Gulliksen | July 27, 1937 |
| 2,298,685 | Davis | Oct. 13, 1942 |
| 2,681,702 | Kuenn et al. | June 22, 1954 |
| 2,696,253 | Hartman | Dec. 7, 1954 |