May 24, 1966 M. E. PHILLIPS, JR., ETAL 3,252,671

METHOD OF SPLICING CIGARETTE PAPER

Original Filed June 14, 1961 4 Sheets-Sheet 1

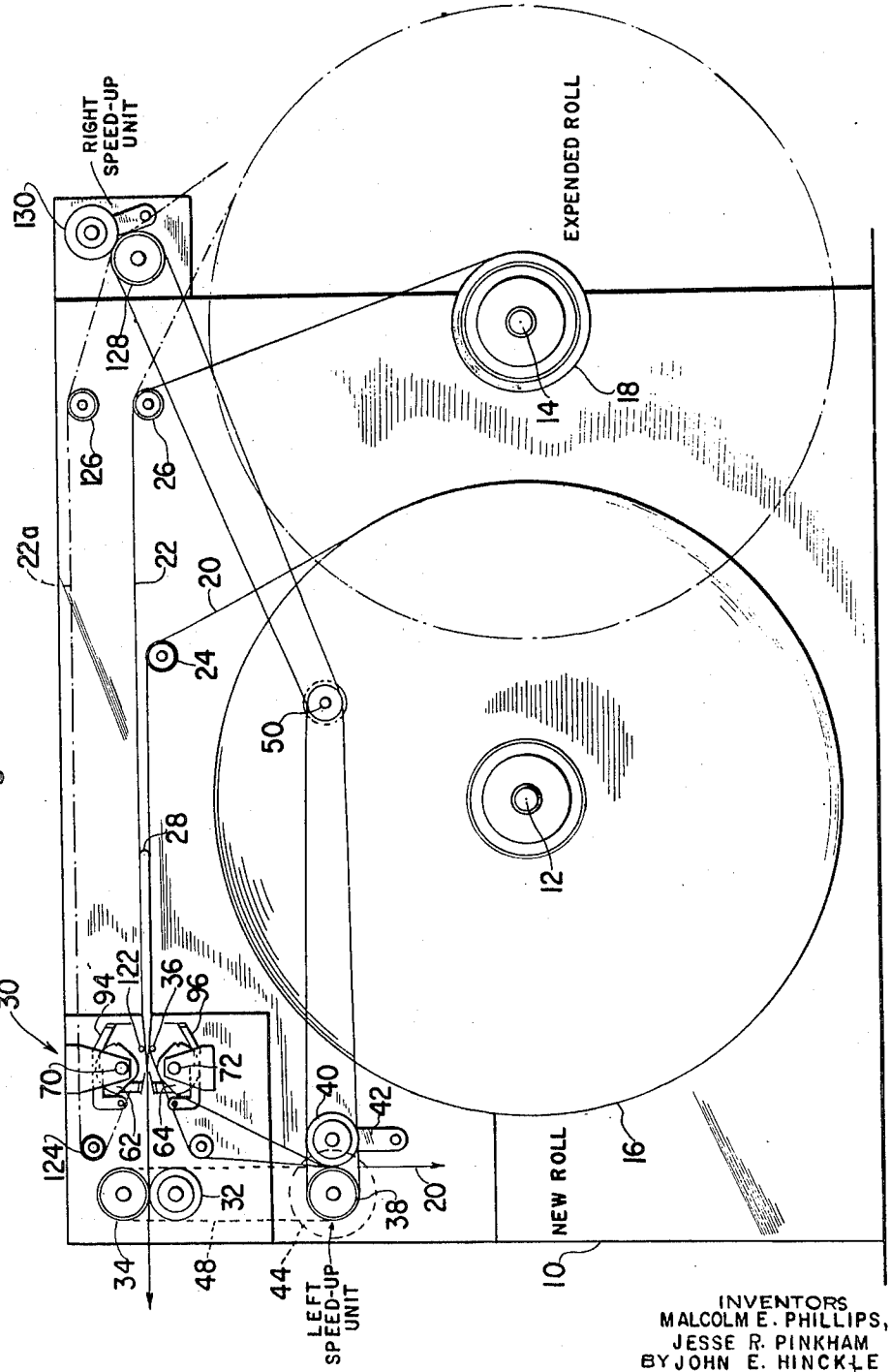


fig.1

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fig.2

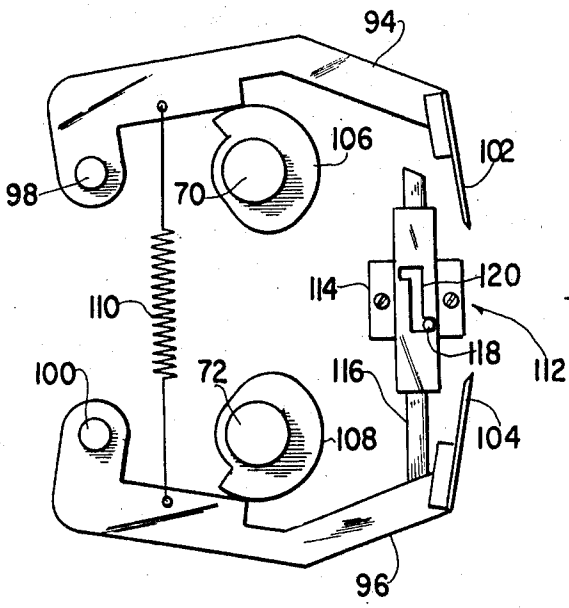
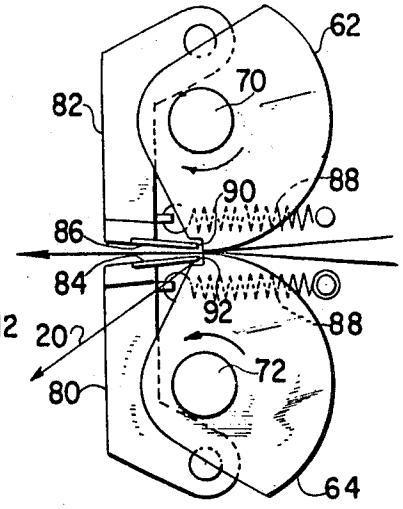


fig.3



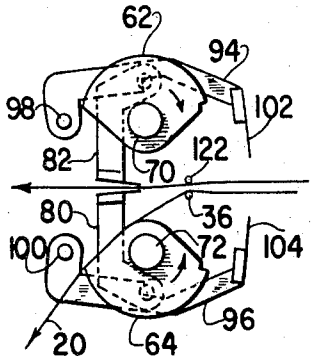


fig.4

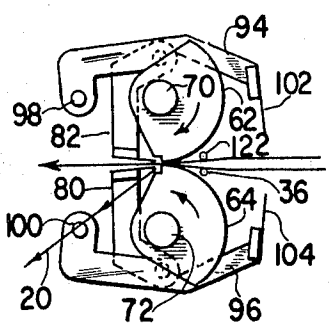


fig.5

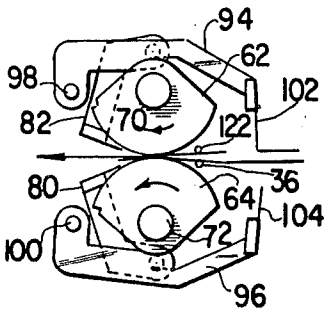


fig.6

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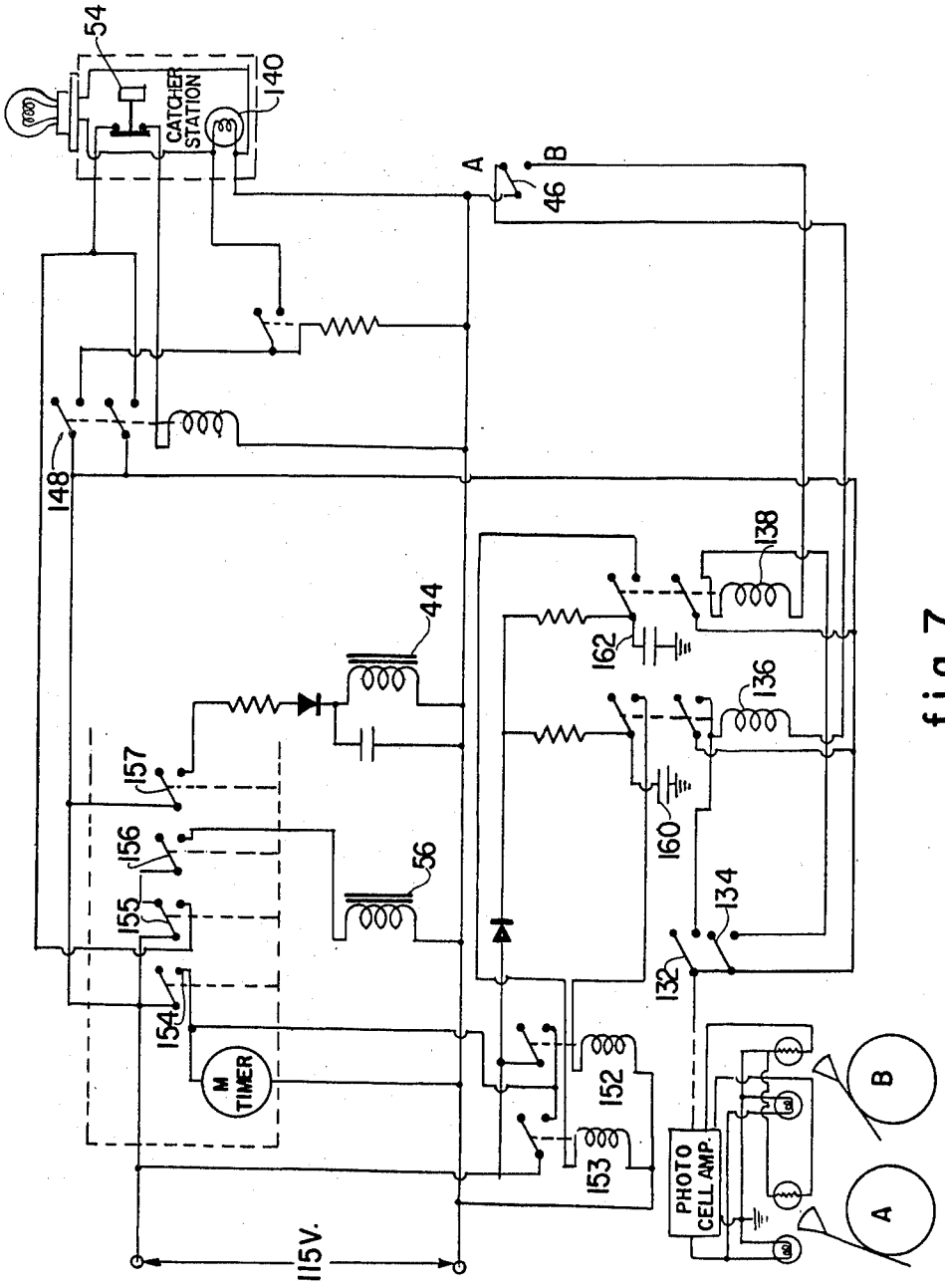


fig. 7

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Original Filed June 14, 1961 4 Sheets-Sheet 4

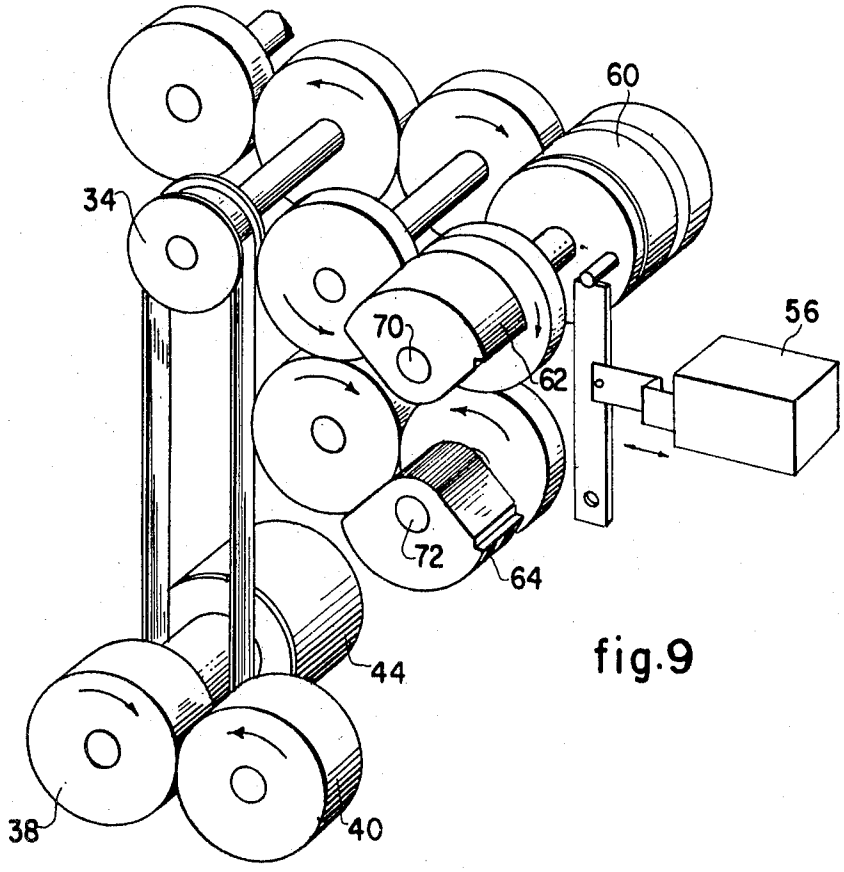


fig.9

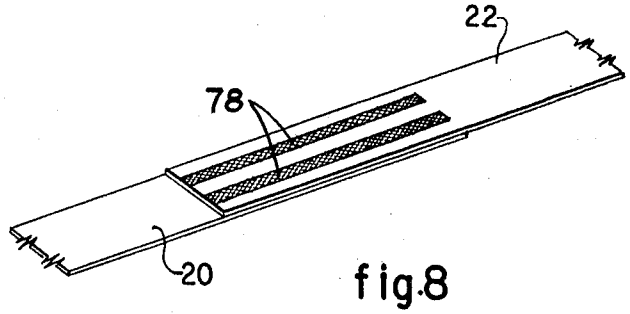


fig.8

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3,252,671

METHOD OF SPLICING CIGARETTE PAPER

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Continuation of application Ser. No. 117,182, June 14, 1961, now Patent No. 3,089,661, dated May 14, 1963. This application Aug. 21, 1962, Ser. No. 227,621
4 Claims. (Cl. 242—58.1)

This application is a continuation of our application, Serial No. 117,182, which was filed June 14, 1961, now U.S. Patent 3,089,661, which was granted May 14, 1963, and claim is made to all the equitable and legal benefits derivable therefrom.

This invention relates to a paper web splicing method and mechanism with particular emphasis upon satisfying the requirements of cigarette making machines of the continuous rod type. It is advantageous in a machine of this kind to splice the leading end of a web from a fresh reel onto the trailing end of the web from an expiring reel without stopping or slowing down the cigarette making machine.

The invention has for its principal object the provision of a simple, compact, fast acting and efficient method and splicer which, while of broader utility, is especially suitable for use in cigarette machines.

Cigarette paper is soft and compressible enough so that superposed webs can be dependably united by the simple expedient of pressing a multiplicity of minute areas of the webs together under strong pressure. If accelerated evenly and not too fast, a reel can be pulled quickly up to operating speed without exposing the web to rupturing tension.

It is a feature of the invention that the web from the fresh reel, threaded into position to confront the active web, is pulled under limited tension up to the speed of the active web, and is then, with the webs traveling in near unison, automatically united with the active web by the mere application of rolling pressure.

It is a further feature that the leading end of the fresh web which has been used up in drawing the fresh web reel up to speed, and the unused trailing end of the expiring web are automatically cut off immediately adjacent the joint formed by the webs so that all danger of their fouling the cigarette making mechanism is avoided.

It is a further significant feature that, two stationary reel mounts are provided, and that splicing and trimming mechanisms are so contrived that the speed-up and splice can be effected with equal facility and efficiency regardless of which mount carries the expiring web and which the fresh web.

Other objects and features of the invention will appear as the description of the particular embodiment selected to illustrate the invention progresses. In the accompanying drawings, which form a part of this specification, like characters of reference have been applied to corresponding parts throughout the several views which make up the drawings.

In the drawings which form part of this specification,

FIGURE 1 is a view in side elevation of a portion of a cigarette making machine which has incorporated in it novel speed-up, splicing and trimming mechanism illustrative of the invention;

FIGURE 2 is a detail view in side elevation of cut-off knives for the expiring web and the control means therefor;

FIG. 3 is a fragmentary detail view in side elevation showing the splicing sectors in operation; and

FIGURES 4, 5 and 6 are sequence diagrammatic views of the splicing and trimming unit showing how the webs are united to one another and then have their surplus ends trimmed off; and

FIGURE 7 is an electrical diagram showing signal and control circuits which are associated with, and form part of, the web splicing mechanism;

FIGURE 8 is a fragmentary view illustrating a typical splice; and

FIGURE 9 is a gear train diagram showing the one revolution clutch and magnetic clutch.

As is best seen in FIGURE 1, the illustrative machine comprises a frame plate 10 on which nearly all of the mechanism directly related to the invention is carried. The frame plate supports two shafts 12 and 14 which serve as mounts for reels 16 and 18, of cigarette paper. As illustrated, the reel 16 supplies the fresh web 20 while the reel 14 supplies the expiring web 22. The mounts 12 and 14 are fixed in position, being located in proximity to one another. The webs 20 and 22 are led respectively, over guide rods 24 and 26, and extend leftward together in juxtaposed relation with the fresh web 20 being the lower web and the expiring web 22 being the upper web.

The webs 20 and 22 respectively pass below and above an anvil 28 which, as will be explained later, is used in cutting away the trailing end of the expiring web immediately after the splice has been effected. After passing the anvil 28 the web 22 continues straight through a pressure splicing and trimming unit 30 to a feed couple 32, 34 which normally runs at a constant speed to deliver the active web, in this case the web 22, to the cigarette making instrumentalities of a cigarette making machine of the endless rod type.

The fresh lower web 20, however, after passing guide rod 36, is diverted downward to pass through a feed couple 38, 40. This couple comprises a driven roller 38 and an idler pressure roller 40, the latter roller being normally spring biased to press the web 20 against the roller 38 but being carried by a rockable arm 42 so that it can be separated from the roller 38 for easy threading.

The function of the feed couple 38, 40, is to start up the web 20 from a state of rest and to accelerate it smoothly to the operating speed of the web 22. The roller 38 is normally idle, but it is adapted to be driven through a commercial magnetic clutch 44 connected to feed couple 34, 32 by belt 48 or if desired, roller 38 could be driven by a separate electric motor.

A photoelectric sensing device actuates a repeat cycle timer. This timer causes switches 154, 155, 156 and 157 (shown in FIGURE 7), to close in a desired sequence and for a desired period of time. As soon as the timer starts, switch 157 closes and energizes the magnetic clutch 44, thus transmitting power from the shaft of roller 34 to feed couple 38, 40 and from 38, 40 to 128, 130 through idler shaft 50. After approximately two seconds, the time for the new web 20 to approximate the speed of the old web 22, the timer causes switch 156 to close thereby energizing a solenoid winding 56 (FIGURE 7) and tripping a one revolution clutch through which normally idle splicing sectors 62 and 64 are caused to turn through exactly one complete revolution at the speed of the webs. A commercial one revolution clutch 60, as shown in FIGURE 9, comprises a driving member (not shown) which is normally driven from the shaft of the roller 34 at the rotary speed of said shaft. The driving member is engageable by a normally idle clutch member (not shown) which is keyed on the shaft 70 of the splicing sector 62. The shaft 70 is connected to drive the shaft 72 of the sector 64 in a one to one ratio through gearing (not shown). When the clutch member is engaged, the sector 62 on the shaft 70 is caused to travel clockwise at a peripheral speed equal to or greater than the linear speed of the webs 20 and 22, and the sector 64 on the shaft 72 is caused to travel counterclockwise at the same peripheral speed.

The sector **62** has a smooth face, but the sector **64** has a knurled face. As the active surfaces of **62** and **64** come opposite one another, they press the webs forcibly together, causing a pressure splice to be effected, as illustrated in the areas **78** of FIGURE 8. By a pressure splice is meant, one in which no adhesive is used but the welding together of a multiplicity of minute areas of the two webs is effected entirely by pressure. The pressure splice effected is a rolling pressure splice because the web engaging surfaces of the sectors are rolling along in engagement with the paper at the speed of the paper.

The action of the splicing and trimming unit is well illustrated in FIGURES 4, 5 and 6, while details of structure are brought out more clearly in FIGURES 2 and 3.

As seen in FIGURE 3, arms **80** and **82**, carrying blades **84** and **86**, are normally held in engagement with the shafts **72** and **70**, respectively, by tension coil springs **88**. Both blades, in their normal positions, clear the path of the expiring web **22** but the web **20** extends downward toward the feed couple **38**, **40** in proximity to the blade **84**. As the sectors **62** and **64** reach the condition illustrated in FIGURE 3, the blades **86** and **84** are received in notches **90** and **92** of the sectors **62** and **64**. The web **20** becomes tautly stretched across the notch **92**, being gripped at one side of the notch by the sectors and wrapping around the opposite corner of the notch. As the sectors continue to turn, they strike forcibly against the blades **84** and **86**, driving them backward to positions like those in which they are illustrated in FIGURE 6. The blade **84** is thus caused to sever the web **20** by rupturing the web, but the corresponding action of the blade **86** is without effect because both webs are disposed beyond its field of action. The leading end of the fresh web **20** which has been used up in getting th web up to the speed of the web **22**, is thus trimmed off immediately adjacent to the splice as the formation of the splice begins.

Arms **94** and **96**, pivoted at **98** and **100**, carry knives **102** and **104** for selective cooperation with the anvil **28**. The function of these knives is to trim away the trailing end of the expiring web. The arms **94** and **96** ride on cams **106** and **108**, which are fast on the shafts **70** and **72**. The arms are drawn toward one another and toward the cams by a tension coil spring **110** which extends between the arms. As will be seen in FIGURE 2, the arm **94** is free to swing downward when the hump of the cam **106** comes opposite the notch of the arm and in FIGURE 6 it will be seen that the arm has been swung down, causing the knife **102** in conjunction with the anvil **28** to trim away the trailing end of the expiring web.

The arm **96** is not free to operate as shown in FIGURE 2, because it is obstructed by a manual selector device **112**. Each time that a splice is formed, one of the knives **102** or **104** should be free to act under cam control and the other should be restrained against operation. The arm **96** is shown as restrained by the manual selector **112** in FIGURE 2 because operation of the knife **104** would result in severance of the lower, fresh web, thereby undoing the benefit of the splice which is being formed. When the upper web is to be the fresh web the manual selector **112** is set in advance to obstruct the frame **94** and to leave the arm **96** free for operation.

The manual selector may consist of a stationary guide bracket **114** and a stop bar **116** which is slidable therein. The bar **116** includes a detaining arm and handle **118** which extends out through a slot **120** of the guide bracket **114**. The handle **118** may be caught in a lower side extension of the slot **120** when it is desired to obstruct operation of the arm **96** and in an upper side extension of the same slot when it is desired to obstruct operation of the arm **94**.

The feed couple **38**, **40** can only be used for speeding up the fresh web when the fresh web is supported on the mount **12** and is the lower of the two webs in their juxtaposed relation. When the expiring web is on the mount **12**, the fresh web reel is necessarily placed on the mount **14**, and the fresh web then becomes the upper web. In this situation the lower, expiring web, extends straight through to the feed couple **32**, **34** and the upper web is diverted upward after passing beneath guide rod **122**. The upper web is led around a guide rod **124** and over a guide rod **126** to a feed couple **128**, **130**. The feed couple **128**, **130** is like the couple **38**, **40**, and is similarly constantly connected for driving through the magnetic clutch **44**.

When the fresh web is trained as indicated by the broken line **22***a*, the blade **86** will be effective to trim off the leading end of the fresh web and the blade **84**, though active as before, will be ineffective. As has been indicated, the manual selector in this case would be set in advance to suppress the action of the upper knife **102** and to leave the lower knife **104** free to cut away the trailing end from the lower, expiring web.

In FIGURE 7, details of the electrical means through which the splicer is controlled are shown diagrammatically. Switches **132** and **134** are controlled, respectively, from reels **16**, and **18** by a photoelectric system being rendered active when a flag is removed from between the light source and the photocell by the near expiration of the web of the associated reel. At a predetermined point, near the expiration of a reel, one of the flags falls and the photoelectric system causes one of the switches, say **132**, to close momentarily. When switch **132** closes, holding circuit **136** closes provided switch **46** is closed to the "A" side. Switch **46** is a manual selector switch which the operator sets when he places a new reel of paper on the reel mounts. When circuit **136** closes capacitor **160** discharges, this charge being of a determined value and time duration sufficient to cause circuit **152** to close and allow the repeat cycle timer to start. The first switch **154** on the timer closes thereby allowing the timer to continue through its cycle. Since circuit **136** is closed and the capacitor **160** cannot build up another charge until it is opened, circuit **152** will not be able to operate again until switch **46** is opened. Opening of switch **46** causes holding circuit **136** to open and allows capacitor **160** to recharge. Switches **154**, **155**, **156** and **157** are operated by cams on a shaft which is driven by the timer motor. This arrangement allows the switches to operate for the desired duration and sequence. As noted previously, switch **154** closes to keep the timer operative through its cycle of one revolution. At the same time switch **154** closes, switch **157** closes and energizes a magnetic clutch coupling **44** which transfers power to feed couples **38**, **40** and **128**, **130**. A resistor ahead of the clutch allows it to engage gradually. Switches **155** and **156** are arranged in series so that the time both are closed will be very small. The cams on the timer are arranged in series so that the time both are closed will be very small. The cams on the timer are arranged so switches **155** and **156** are both closed approximately 1½ to 2 seconds after switch **157** closes. When both **155** and **156** are closed they energize a solenoid **56** which releases the clutch, enabling it to make one revolution, and they also energize holding circuit **148**. When **148** is closed it energizes a fifteen second thermal delay relay and after a fifteen second interval the thermal relay causes a buzzer **140** to become operative.

The buzzer **140** alerts the operator at the catcher station to be on the lookout for two defective cigarettes which are, in part at least, double wrapped because of the splice. When the two defective cigarettes have been removed, the catcher operator manually opens a switch **54** which is in series circuit with the buzzer **140**. This stops the buzzer **140** and de-energizes winding **148**. At this point all of the circuit elements have been returned to their original or normal conditions except that the actuator of switch **46** remains in an abnormal, inoperable condition. With the mounting of a fresh reel on the mount **14** in place of the used up reel **18** this disability is overcome.

When the fresh reel is placed on mount **14**, the reel **16** will have had its diameter reduced quite substantially. At that time the web from the newly placed reel is threaded through the splicing unit and the feed couple **128, 130** and the manual selector **112** is reset to prevent operation of the arm **94** while freeing the arm **96** for operation under the control of the cam **108.**

While a certain preferred embodiment of the invention has been illustrated and described in detail, it is to be understood that changes may be made therein and the invention embodied in other structures. It is not, therefore, the intention to limit the patent to the specific construction illustrated, but to cover the invention broadly in whatever form its principles may be utilized.

What is claimed is:

1. The method of effecting a splice between expiring and fresh paper webs, each of which may be mounted on one or another of two spindles spaced one from another in unchanging relationship, which method comprises, continuously driving the expiring web at a uniform operating speed, smoothly accelerating the fresh web from a state of rest to approximately the operating speed of the expiring web at a rate of acceleration which is sufficiently restricted to avoid rupture of said web, and then rolling a pressure splice of predetermined length.

2. The method of effecting a splice between expiring and fresh paper webs, each of which may be mounted on one or another of two spindles spaced one from another in unchanging relationship, which method comprises, continuously driving the expiring web at a uniform operating speed, smoothly accelerating the fresh web from a state of rest to approximately the operating speed of the expiring web at a rate of acceleration which is sufficiently restricted to avoid rupture of said web, and then rolling a pressure splice of predetermined length. and, during splicing, trimming away the leading end of the traveling fresh web and the trailing end of the traveling expiring web.

3. The method of effecting a splice between an expiring paper web, mounted on either one of two spindles spaced one from another in unchanging relationship and a fresh paper web mounted on the other one of said same two spindles, which method comprises, driving the expiring web at a uniform operating speed, smoothly accelerating the fresh web, from a state of rest to approximately the operating speed of the expiring web, at a rate of acceleration which is sufficiently restricted to avoid rupture of the fresh web, then rolling a pressure splice of predetermined length, and, during splicing selectively trimming away the leading end of the traveling fresh web and the trailing end of the traveling expiring web.

4. The method of effecting a splice between an expiring paper web, mounted on either one of a first and a second individual spindle at a first and a second time, respectively, and a fresh paper web mounted on the other one of said first and said second spindles at said first and said second time, respectively, said spindles spaced one from another in unchanging relationship, said expiring web having its supply run superposing the supply run of said fresh web at a first time and underlying it at a second time, which method comprises driving the expiring web at a uniform operating speed, smoothly accelerating the fresh web, from a state of rest to approximately the operating speed of the expiring web, at a rate of acceleration which is sufficiently restricted to avoid rupture of the fresh web, then rolling a pressure splice of predetermined length and during splicing selectively trimming the leading end of the fresh web and the trailing end of the expiring web, to tend to minimize difficulties otherwise attributable to untrimmed ends.

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