

May 14, 1963

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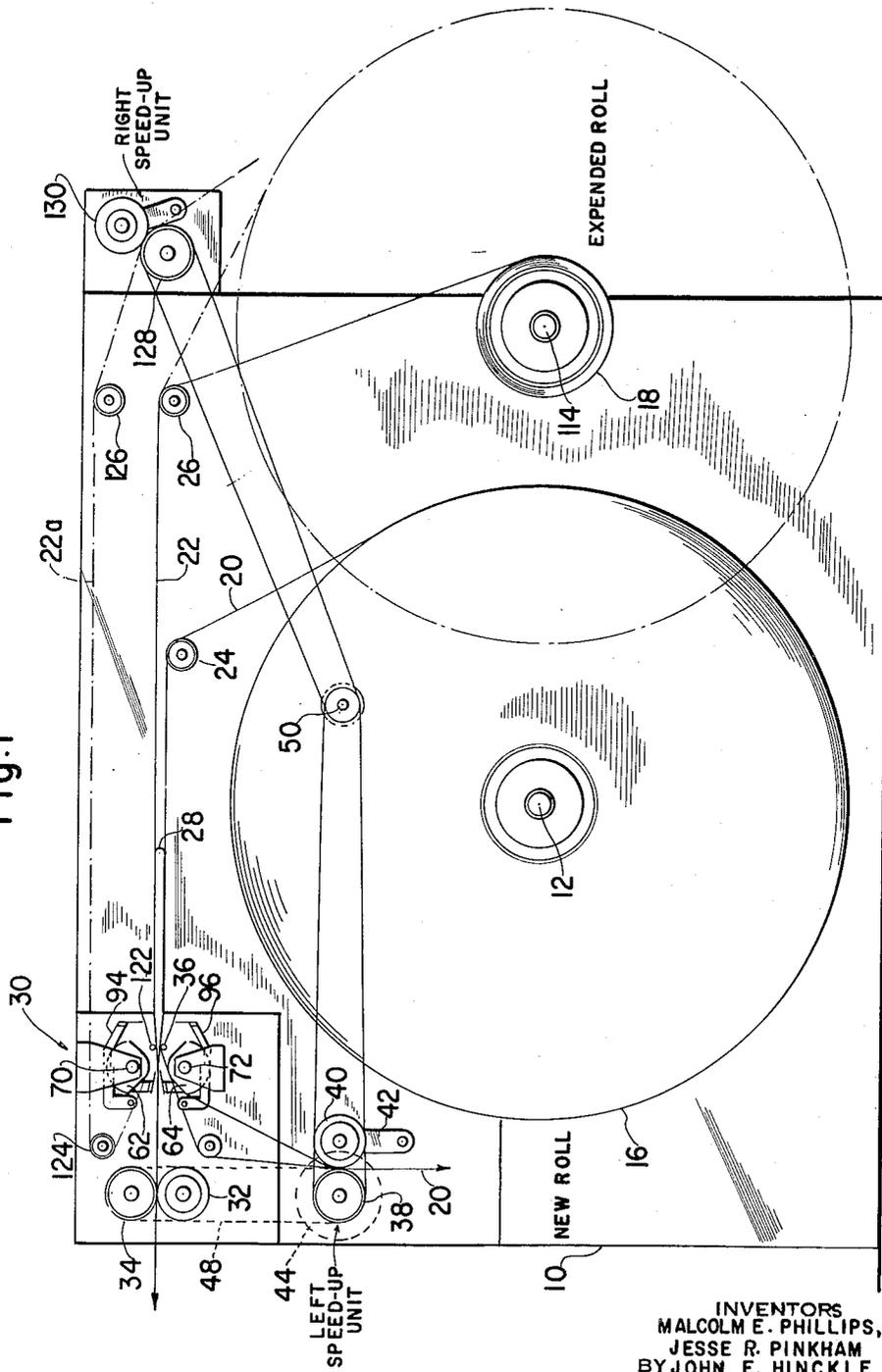
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AUTOMATIC CIGARETTE PAPER SPLICER

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4 Sheets-Sheet 1

fig. 1



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AUTOMATIC CIGARETTE PAPER SPLICER

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4 Sheets-Sheet 2

fig.2

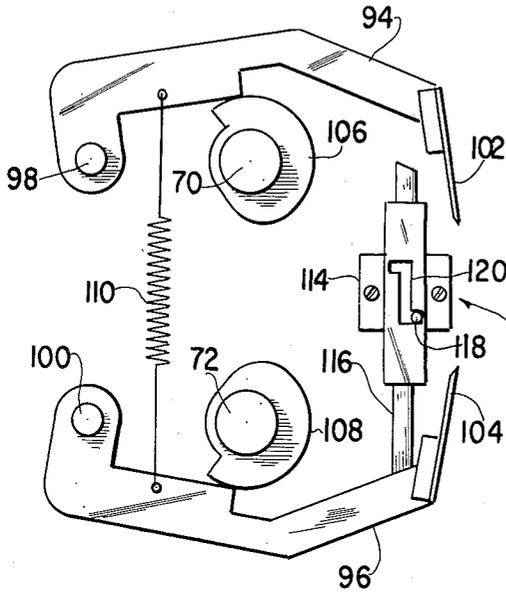


fig.3

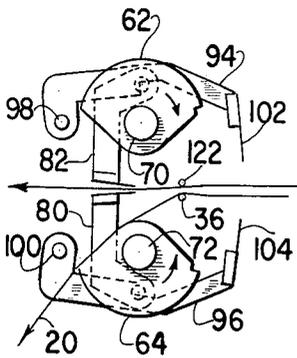
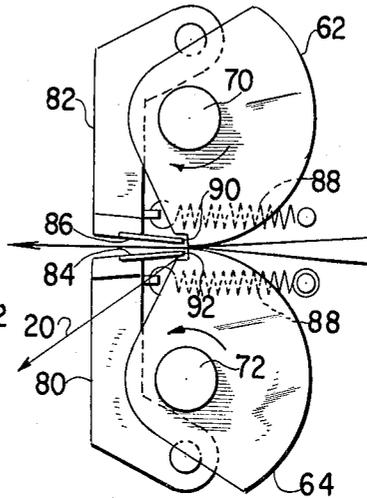


fig.4

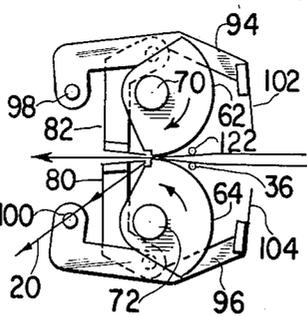


fig.5

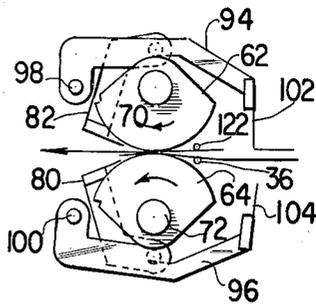


fig.6

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4 Sheets-Sheet 3

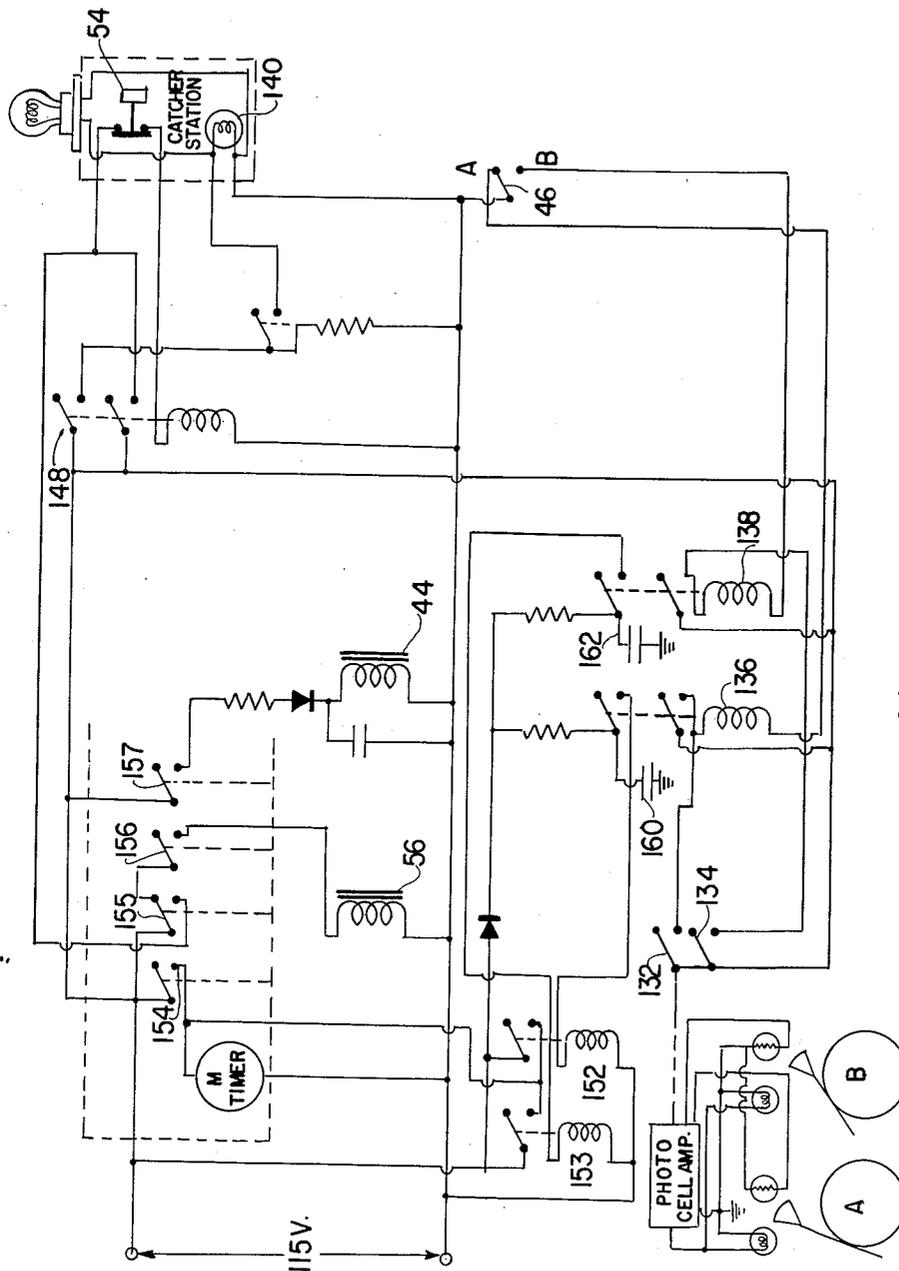


fig. 7

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4 Sheets-Sheet 4

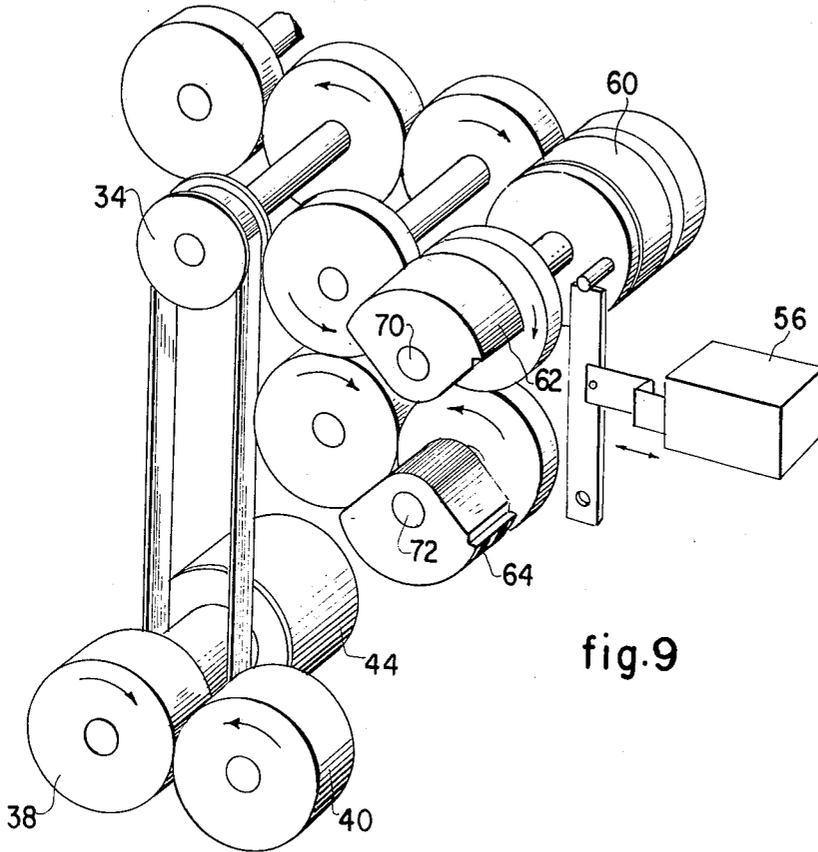


fig.9

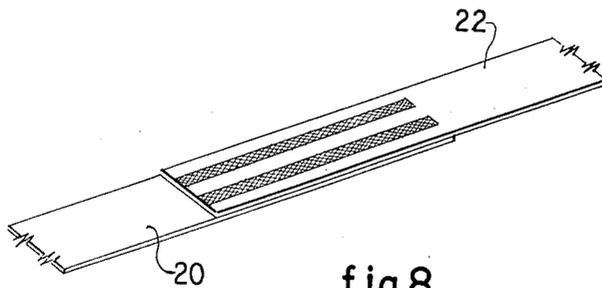


fig.8

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AUTOMATIC CIGARETTE PAPER SPLICER

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8 Claims. (Cl. 242—58.4)

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;

FIGURE 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

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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 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 photo electric 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 the 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 lead 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 22a, 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 1/2 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

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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. A web splicing mechanism comprising, in combination, a pair of reel mounts, a first feeding means for feeding an expiring web from one mount at uniform operating speed, means operable on the leading end of the fresh web for pulling the fresh web from the other mount, comprising a feed couple, a normally idle drive mechanism therefor of limited torque, means driven in unison with the first feeding means for causing said drive mechanism, when a splice is to be made, to gain speed and to accelerate the fresh web to approximately the speed of the expiring web against the inertial resistance of the fresh web reel, and a dead weight directly driven by said mechanism of sufficient mass to limit the rate of acceleration of the mechanism and thereby limit to a safe value the tension applied through the fresh web in overcoming the inertia of the fresh web reel, and means operable at the common speed of the webs, upon the attainment of near correspondence of web speeds to effect a splice by pressure alone.

2. A web splicing and trimming mechanism for cigarette making machines of the endless rod type comprising, in combination, a pair of fixed reel mounts disposed in proximity to one another, means feeding the expiring web from one mount to the cigarette making instrumentalities at uniform operating speed, means operable on the leading end of the fresh web for pulling the fresh web from the other mount up to approximately the speed of the expiring web, a pair of opposed, cooperative, normally idle, pressure splicing sectors between which the webs are threaded in juxtaposed relation, normally idle drive shafts upon which the splicing segments are made fast, one revolution clutch means operable when near correspondence of web speeds has been attained to cause the sector carrying shafts to turn the sectors through a single revolution at the speed of the webs, thereby to effect a splice by pressure alone, and trimming knives automatically responsive to operation of the one revolution clutch means to trim away the leading end of the fresh web, and the trailing end of the expiring web.

3. A web splicing and trimming mechanism for cigarette making machines of the endless rod type comprising, in combination, a pair of fixed reel mounts disposed in proximity to one another, means feeding the expiring web to the cigarette making instrumentalities at uniform operating speed, means operable on the leading end of the fresh web for pulling the fresh web up to approximately the speed of the expiring web, a pair of opposed, cooperative, normally idle, pressure splicing sectors between which the webs are threaded in juxtaposed relation, normally idle drive shafts upon which the splicing segments are made fast, one revolution clutch means operable when near correspondence of web speeds has been attained to cause the sector carrying shafts to turn the sectors through a single revolution at the speed of the webs, thereby to effect a splice by pressure alone, a trimming knife responsive to rotation of one of the sector shafts to trim away the leading end of the fresh web, and a trimming knife responsive to rotation of the other of the sector shafts to trim away the trailing end of the expiring web.

4. A web splicing and trimming mechanism for cigarette making machines of the endless rod type comprising, in combination, a pair of fixed reel mounts disposed in proximity to one another, means feeding the expiring web to the cigarette making instrumentalities at uniform operating speed, means operable on the leading end of the fresh web for pulling the fresh web up to approximately the speed of the expiring web, a pair of opposed, 75

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cooperative, normally idle, pressure welding splicing sectors between which the webs are threaded in juxtaposed relation, normally idle drive shafts upon which the splicing segments are made fast, one revolution clutch means operable when near correspondence of web speeds has been attained to cause the sector carrying shafts to turn the sectors through a single revolution at the speed of the webs; thereby to effect a splice by pressure alone, means automatically effective in response to the near attainment of the expiring web speed by the fresh web to activate the clutch means, and trimming knives automatically responsive to operation of the one revolution clutch, means to trim away the leading end of the fresh web, and the trailing end of the expiring web.

5. A web splicing and trimming mechanism for cigarette making machines of the endless rod type comprising, in combination, a pair of fixed reel mounts disposed in proximity to one another, means feeding the expiring web from a reel on either reel mount to the cigarette making instrumentalities at uniform operating speed, means alternatively operable on the leading end of the fresh web, according to the mount upon which the fresh web reel is supported, for pulling the fresh web up to approximately the speed of the expiring web, a pair of opposed, cooperative, normally idle, pressure splicing sectors between which the webs are threaded in juxtaposed relation, normally idle drive shafts upon which the splicing segments are made fast, one revolution clutch means automatically effective when near correspondence of web speeds has been attained to cause the sector carrying shafts to turn the sectors through a single revolution at the speed of the webs, thereby to effect a pressure splice, a pair of trimming knives automatically responsive to operation of the one revolution clutch means and alternatively effective to trim away the leading end of the fresh web according to the reel mount from which the fresh web is drawn, a pair of trimming knives, selectively responsive to the one revolution clutch means to trim away the trailing end of the expiring web, and a manual selector settable to cause one of the other of said expiring web trimming knives to be inoperable, according to the reel mount from which the expiring web is drawn.

6. A web splicing and trimming mechanism comprising, in combination, a pair of fixed reel mounts disposed in proximity to one another, means directing the webs from said mounts into superposed relation, means feeding the expiring web at uniform operating speed, alternative feed couples disposed at opposite sides of the common web path and selectively operable on the leading end of the fresh web according to whether the upper or the lower web is the fresh web, for pulling the fresh web up to approximately the speed of the expiring web, a pair of opposed, cooperative, normally idle, pressure splicing sectors between which the webs pass in juxtaposed relation, normally idle drive shafts upon which the splicing sectors are made fast, one revolution clutch means operable when near correspondence of web speeds has been attained to cause the sector carrying shafts to turn the sectors through a single revolution at the speed of the webs, thereby to effect a pressure splice, a pair of trimming blades automatically responsive to operation of the clutch means to trim away the leading end of the fresh web and the trailing end of the expiring web, when the expiring web is the upper web, and a pair of trimming blades automatically responsive to operation of the clutch means to trim away the leading end of the fresh web and the trailing end of the expiring web, when the expiring web is the lower web.

7. A web splicing and trimming mechanism as set forth in claim 6 in which the alternative means for trimming away the trailing end of either the upper or lower web includes a common stationary anvil disposed to lie between the webs just before they reach the pressure splicing mechanism, and cooperative knives at opposite

sides of the webs, and which further includes a manual selector settable in advance to suppress operation of one or the other of said knives.

8. A web splicing and trimming mechanism comprising, in combination, a pair of fixed reel mounts disposed in proximity to one another, means directing the webs from said mounts into superposed relation, means feeding the expiring web at uniform operating speed, alternative feed couples disposed at opposite sides of the common web path and selectively operable on the leading end of the fresh web according to whether the upper or the lower web is the fresh web, for pulling the fresh web up to approximately the speed of the expiring web, a pair of opposed, cooperative, normally idle, pressure splicing sectors between which the webs pass in juxtaposed relation, normally idle drive shafts upon which the splicing segments are made fast, one revolution clutch means operable when near correspondence of web speeds has been attained to cause the sector carrying shafts to turn the sectors through a single revolution at the speed of the webs, thereby to effect a pressure splice, two trimming blades disposed above and below the webs, respectively, each automatically responsive to the clutch means to perform a predetermined sequence of movements each time

a splice is effected, the means for feeding the expiring web always drawing the expiring web clear of the field of action of both blades, but the lower feed couple serving when the lower web is the fresh web to expose the lower web to trimming action by the lower blade, and the upper feed couple serving when the upper web is the fresh web to expose the upper web to trimming action by the upper blade.

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