Aug. 27, 1968 R. POUPIN 3,398,911

MOVING WEB SPLICING APPARATUS

Filed April 11, 1966 7 Sheets-Sheet 1

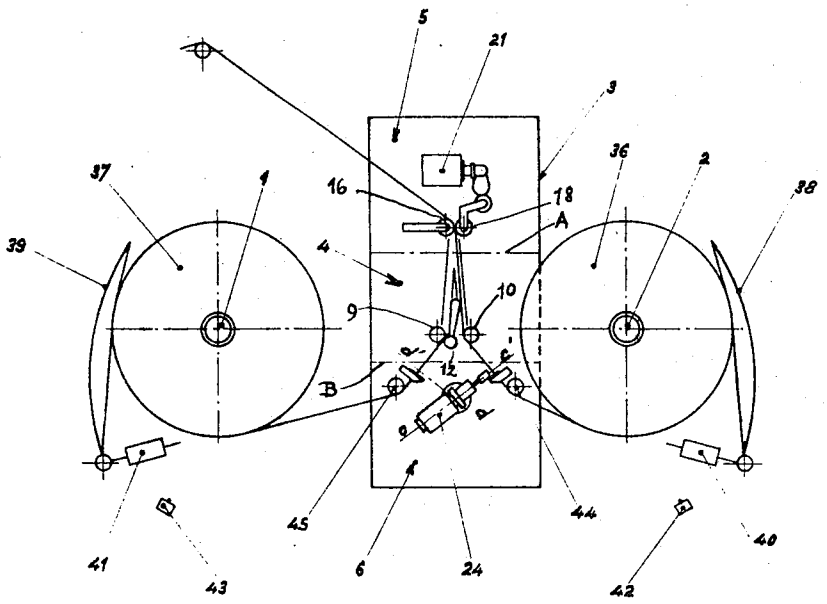

Fig.1

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MOVING WEB SPLICING APPARATUS

Filed April 11, 1966 7 Sheets-Sheet 2

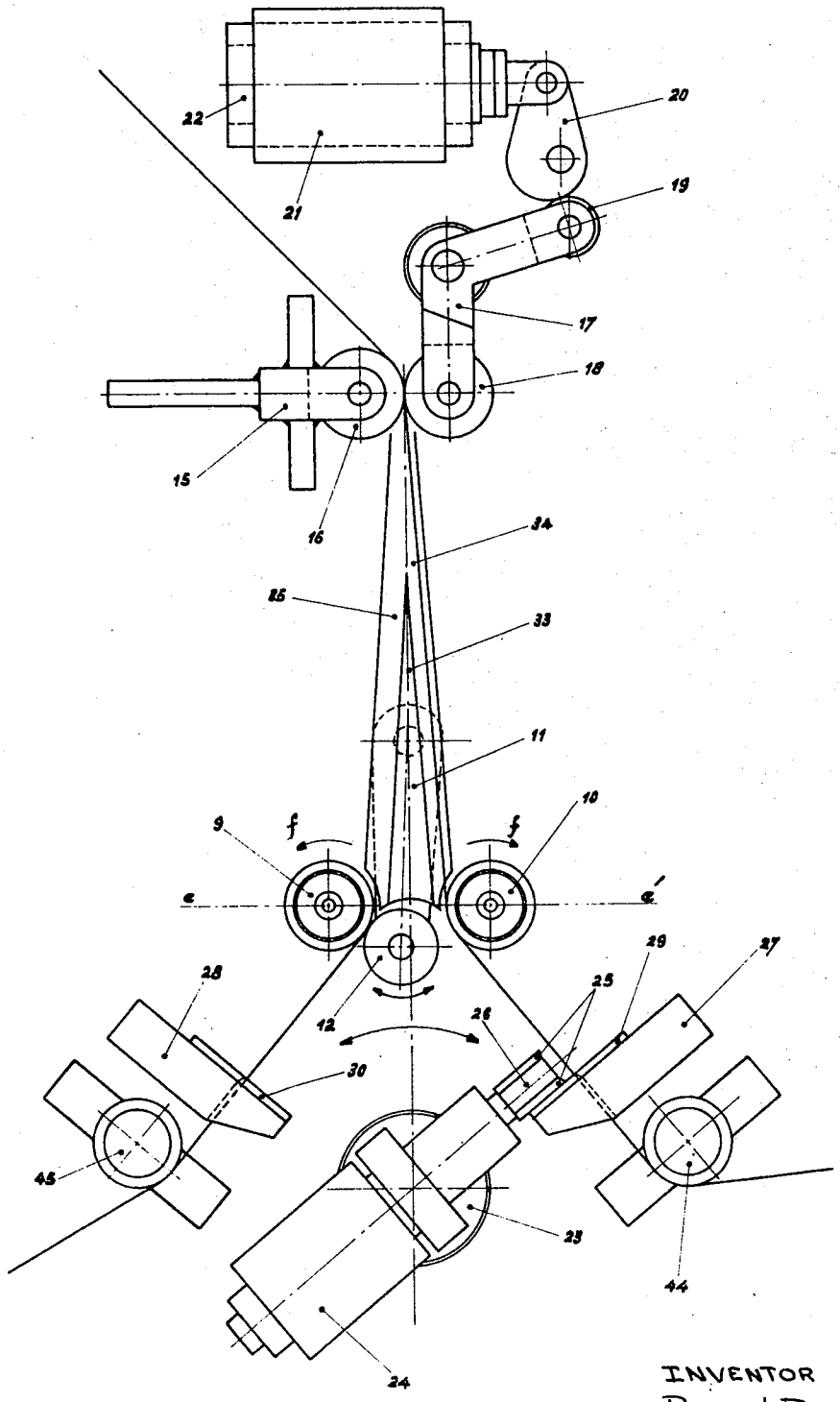

Fig.2

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MOVING WEB SPLICING APPARATUS

Filed April 11, 1966 7 Sheets-Sheet 3

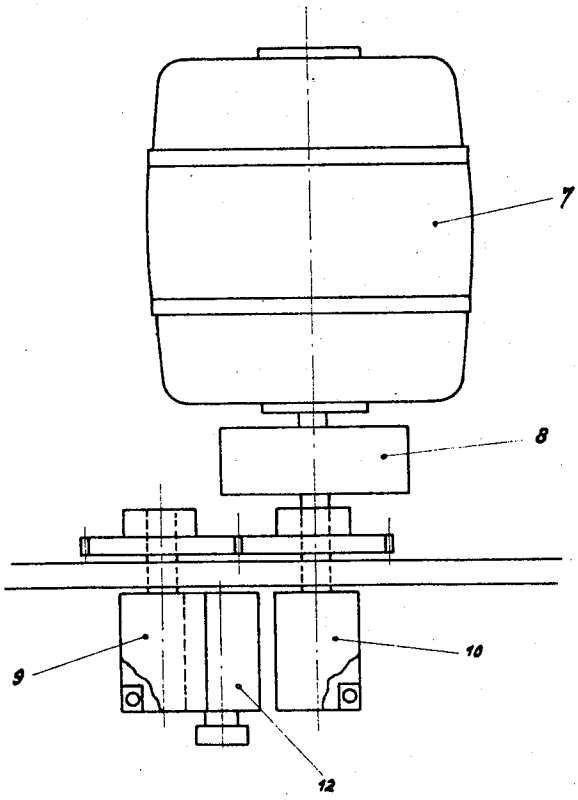

Fig.3

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MOVING WEB SPLICING APPARATUS

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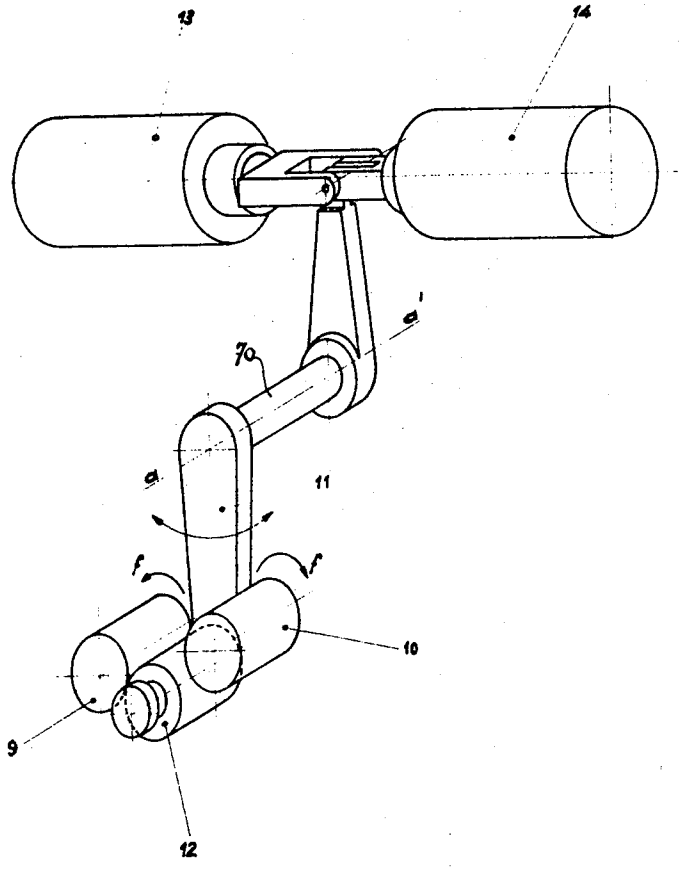

Fig. 4

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MOVING WEB SPLICING APPARATUS

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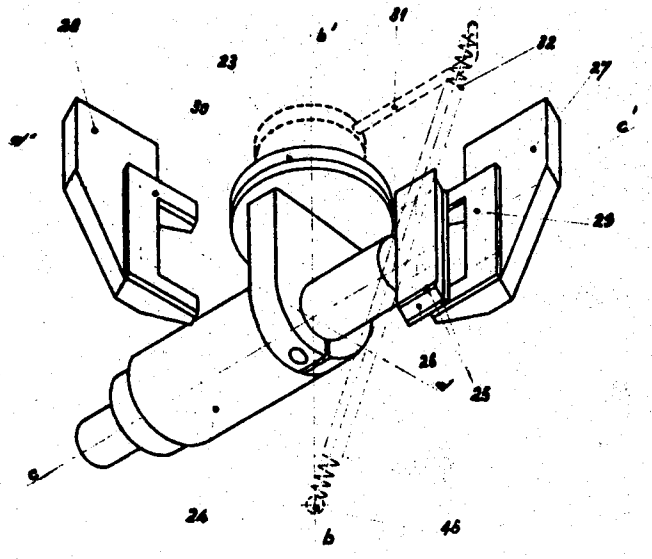

Fig.5

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MOVING WEB SPLICING APPARATUS

Filed April 11, 1966 7 Sheets-Sheet 6

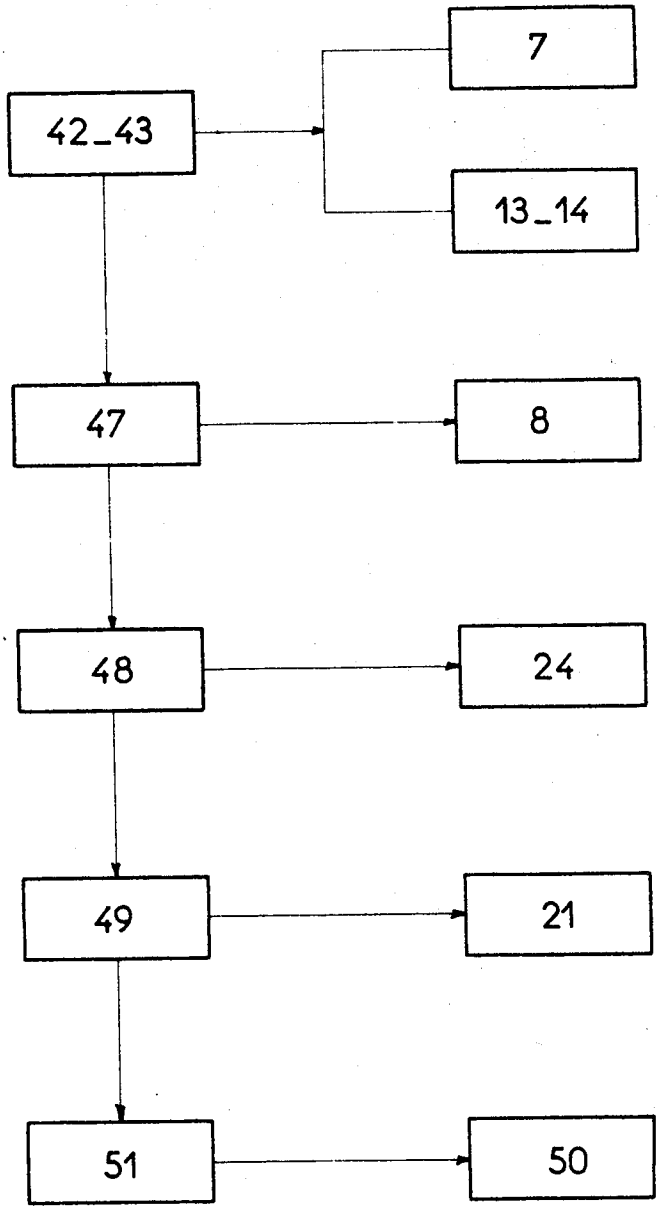

Fig. 6

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MOVING WEB SPLICING APPARATUS

Filed April 11, 1966 7 Sheets-Sheet 7

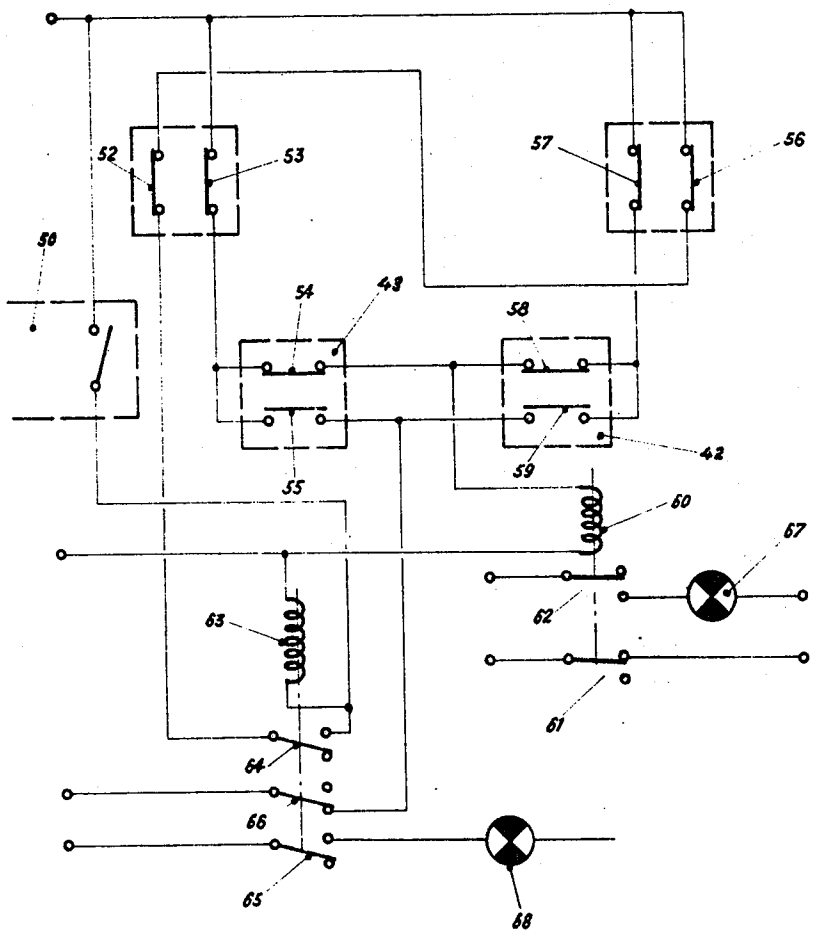

Fig. 7

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Patented Aug. 27, 1968

3,398,911

MOVING WEB SPLICING APPARATUS

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Claims priority, application France, Apr. 9, 1965, 12,645
9 Claims. (Cl. 242—58.4)

ABSTRACT OF THE DISCLOSURE

A device for splicing the end of the web of an expiring roll to the starting end of the web of a new roll while the webs are moving. Two pulleys for holding the starting end of the new roll and a pivoting pressure roller between the pulleys, a coupling on the pulleys for driving them so that they serve also for setting the new web in motion while the expiring web is running, and further guiding the moving web.

This invention relates to a device for joining sheets of a material which is delivered from bobbins or reels for subsequent feeding to a machine without entatiling the need to stop said machine. The invention is mainly directed to a machine for forming cigarettes from a continuous rod and supplied with a continuous strip of wrapping paper or like material, wherein the fresh bobbin or reel of sheet material is joined to the moving sheet as this latter is delivered from a feed bobbin.

It is known to mount two stationary feed bobbins and to put them in service in alternate sequence, the beginning of the new bobbin being joined to the end of the empty bobbin. It is also known to allow the end of the sheet or strip of the new bobbin to rest in readiness on a pulley, whilst a second pulley which will perform the same function during the following operation is employed during this time for the purpose of guiding the sheet which is in process of delivery.

In order to prevent any danger of breaks in the material, the initial feed motion or so-called "starting" of the fresh sheet or strip must be carried out with a constant acceleration which is sufficient to ensure that the new bobbin is driven in rotation at a speed which is close to that of the previous bobbin.

In known systems, the initial feed motion or "starting" is carried out either in traction as a result of close contact between the two strips or as a result of friction exerted on the bobbin itself. These modes of operation meet practical requirements only to an inadequate extent, more especially when the strips employed consist of thin material which does not have high resistance to traction, or tensile strength.

It is also known to join the two strips by causing them to pass together between a knurled roller and a flexible backing roller, both rollers being positively driven and controlled in such manner as to bring the rollers close together at the moment of double transfer of the strips during the time which is necessary for the joining operation.

All the systems referred to above comprise a cutting unit for separating the abandoned portion of the previous strip upstream of the junction point.

All the moving parts are usually set in motion mechanically by means of a unit for monitoring the strip which is in service when this latter has reached a reserve which is small as possible and having a predetermined value. In certain designs, the moving parts are set in motion by means of pulses produced by electric cells.

The present invention relates to a system of this type

for joining a new roll of sheet material wound on a bobbin to a moving sheet which is being delivered from a feed bobbin, said system being controlled by a pulse as a function of the extent of unwinding of said moving sheet but so designed as to form a uniform assembly which can be transferred as a complete unit from one machine to the other and needs only to be coupled therewith by means of support members and connected to the control units and, if necessary to the general controls of the machine.

To this end, the device in accordance with the invention which is of the type comprising two stationary bobbin supports, pulleys or rollers having stationary axes and over which are conveyed respectively the strips fed from both bobbins, one of said strips being an unused strip and in readiness for winding-off and the other strip being in process of winding-off, means for cooperating in alternate sequence with either one or the other of said pulleys, so as to hold the end of the stand-by strip, means for cooperating with said pulleys in alternate sequence so as to exert a tractive effort on the end of the stand-by strip and thus to effect the starting of said strip, means for joining the two strips together and means for cutting one of said two strips in alternate sequence, said device being further characterized in that the two holding and starting pulleys are mounted in adjacent relation and located upstream of the joining means or in other words between said joining means and the bobbins, said pulleys being so designed that each pulley serves alternately after starting and joining as a guide member for the purpose of guiding the strip which is in process of winding-off.

In a particularly advantageous form of embodiment, the two holding pulleys are mounted to rotate freely and are associated with means for setting said pulleys in rotation in the opposite direction, and a pressure roller is mounted to rotate freely on a shaft which is located between the two pulleys and which is adapted to pivot in such a manner as to apply said roller against either one or the other of said pulleys and thus to ensure both the holding of the strip and the initial feed motion of the stand-by strip on the pulley against which the pressure roller is applied.

The system in accordance with the invention makes it possible to adopt a perfectly symmetrical arrangement which is both readily accessible and easy to put into operation, wherein the joining means can be located at the apex of an isosceles triangle, the base of which is formed by the two holding and starting pulleys, the axis of the pressure roller being movable on each side of the plane of symmetry which passes through the apex of said triangle.

The joining means can consist of a knurled roller which is freely rotatable and flexible backing roller which is also freely rotatable, said rollers being so disposed relatively to each other that both rollers rotate continuously under the action of the moving strip and are capable of being applied against each other with a sufficient pressure by means of a control unit, for example under the action of the time-control pulse which is produced by the control unit.

Provision can be made for means which guide the strips between the holding and starting pulleys and the joining means and which can consist of a passageway so shaped as to converge from the pulleys towards the joining means and comprising a central dividing wall so arranged that the passageways thus formed ensure a rectilineal path of progression of the strips.

The cutting means are preferably mounted upstream of the holding and starting pulleys, that is to say between these latter and the bobbins, and they can consist of a single pivotally mounted knife, ledger-plate blocks which can be placed on the path of both strips and against which

the single knife can be pivotally brought to bear in alternate sequence.

Said single knife can consist of two parallel cutting blades disposed on each side of a spacer member which is rigidly fixed to the blade-holder block.

One form of embodiment of the device in accordance with the invention is shown in the accompanying drawings which are given solely by way of example and not in any sense by way of limitation, and in which:

FIG. 1 is a general diagram in side elevation;

FIG. 2 is a partial view on a larger scale of the assembly which is shown in FIG. 1;

FIG. 3 is a detail view in plan and in partial cross-section along the line *e–e'* of FIG. 2;

FIG. 4 is a detail view in perspective showing that portion of the device which is located between the two chain-dotted lines A and B and which is designated by the reference **4** in FIG. 1;

FIG. 5 is a detail view in perspective showing the cutting units which are located below the chain-dotted line B in FIG. 1 and which are designated by the reference **6** in that figure;

FIG. 6 is an electrical diagram of the circuit for controlling the different elements of the device; and

FIG. 7 is an electrical diagram of the safety and indicating circuits.

The device which is illustrated is intended to effect the starting, joining and cutting of the paper strip which is wound on bobbins **36** and **37**, said bobbins being carried respectively by spindles **1** and **2**. In the drawings, the bobbin **36** is shown as being in service and the bobbin **37** is in readiness. Against these bobbins are applied the brakes **38** and **39** which are fitted with balance weights **40** and **41** so designed as to actuate micro-switches **42** and **43**. The complete device forms an independent unit and is mounted on a base-plate **3**.

The device is divided into three sub-assemblies which are separated in FIG. 1 by two chain-dotted lines A and B, namely the starting sub-assembly **4**, the joining sub-assembly **5** and the cutting sub-assembly **6**.

The starting sub-assembly **4** (as shown in FIGS. 1, 3 and 4) is composed of a motor **7** and clutch unit **8** for driving in alternate sequence the hubs of the rollers **9** and **10** in the respective directions of the arrows *f* (as shown in FIG. 1) by means of free wheels mounted inside said rollers so as to provide a coupling between the hubs and the external ring-gears.

An elbowed lever **11** is pivoted about the axis *a–a'* (as shown in FIG. 4) by virtue of a crank-pin **70** which is rotatably mounted in a bearing of the base-plate **3**. The top end of said lever which is located at the rear is coupled by means of a double yoke to two electromagnets **13** and **14**. The lower end of said lever which is located in front is fitted with a rubber roller **12** which is mounted to rotate freely on its spindle and placed in contact alternately with the rollers **9** and **10**.

The joining sub-assembly consists of a stationary support **15**, a knurled roller **16** which is mounted to rotate freely on said support and pivotally mounted lever **17**. Said lever is fitted at one end with a plastic-covered backing roller **18** which is also mounted to rotate freely on its spindle and at the other end with a ball-bearing **19** which is maintained in contact with the cam **20**. Said cam is actuated by the electromagnet **21** which is secured to the base-plate by means of a support **22** in slightly oscillating relation thereto in order that the core of the electromagnet should always be centered within the coil.

An upward-motion passageway is placed between the starter unit and the joining unit. Said passageway has a central dividing wall **33** and forms two guides **34** and **35** which convey the moving sheets up to the joining rollers. This arrangement makes it possible to prevent the action of electrostatic charges which might otherwise cause the free end of the strip to adhere to one of the walls of a single passageway.

The cutting sub-assembly **6** (as shown in FIGS. 2 and 5) consists of the support **23** of the electromagnet **24** which is of the thrust type and pivoted about the axis *b–b'* (as shown in FIG. 5), knives **25** which are fixed to the moving core of the electromagnet **24** by means of a spacer member **26**, two symmetrical blocks **27** and **28** which support the ledger-plates **29** and **30**, the arm **31** which is placed behind the base-plate **3** and rigidly fixed to the pivotal support **23** so as to provide a moving point of attachment for one end of the spring **32**, the other end of which is attached at **46** to the base-plate **3**. This mode of assembly ensures correct pressure between the knife and ledger-plate and additionally prevents the pivotal assembly from taking up positions other than the stable positions which correspond to the work positions of the knives. Moreover, a micro-switch which is not shown in the drawings and which is also located behind the base-plate makes it possible to reverse an electric drive when the knife takes up either of its two positions.

Finally, the unit for detecting the level of paper on the bobbins is constituted by the brakes **38** and **39** which are continuously in contact with the paper. The free end of the rod of the balance weights **40** and **41** actuates at the end of travel the micro-switches **42** and **43** which close the general control circuit.

The control circuit referred to comprises one power relay per controlled unit (motor, clutch unit, electromagnets) and four time-controlled elements **47**, **48**, **49** and **51** which are intended to displace in time the action of a certain number of the said controlled units.

The base-plate of the device additionally carries the two guide rollers **44** and **45** which are equidistant from the cutter block.

The complete assembly of safety circuits and circuits for indicating errors of operation or incomplete operations, as shown in FIG. 7, is controlled by the bobbin-level detector, namely by the brakes **38** and **39** which, depending on their positions, accordingly actuate the different contacts.

The said contacts are symmetrical in the case of each brake and are arranged as follows in the case of the brake **39**:

(1) The contacts **52** and **53**, which are in the closed position when the brake **39** has been placed against the new bobbin **37** and in the open position when the brake **39** has not been applied against said bobbin **37** as a result of an oversight.

(2) The contacts **54** and **55**, as shown in FIG. 7, in which the contact **54** is closed as long as the bobbin is not empty, whereas the contact **55** is open in the same condition. The contacts are reversed as soon as the strip level on the bobbin reaches an insufficient value.

So far as concerns the brake **38** and its bobbin **36**, the corresponding contacts are the contacts **56** and **57** on the one hand and the contacts **58** and **59** on the other hand.

The set of contacts **54** and **55** constitutes the control unit **43** of FIG. 6, and the set of contacts **58** and **59** constitutes the control unit **42** of FIG. 6.

The control operation which is performed by means of the system **42–43** is obtained as a result of the closure of the contact **55** or of the contact **59** whilst the respective contacts **54** and **58** in that case open.

The relay **60** can be energized either by the contact **54** or by the contact **58**, in which case the contact **62** is opened and the visual indicator **67** is not lighted up, the contact **61** being closed. Said contact **61** produces the stoppage of the machine when in the open position.

The contact **50** is normally in the open position and closes only for a brief moment on completion of the joining operation.

The relay **63** is intended to be self-supplied until the moment when the brake of the completely unwound bobbin has been lifted.

The device which is illustrated operates as follows:

The paper strip of the bobbin **37** is placed in the stand-by position with the brake **39** in contact with the paper.

The free end of the strip which is passed beneath the roller **45** is lightly clamped between the rollers **9** and **12** by virtue of the low voltage of the starter electromagnet **14**.

The paper strip of the bobbin **36** is in service; it passes successively over the rollers **44**, **10** and **16** and continues on its route through the machine.

The freely mounted starter roller **10** defines with the roller **44** a stable path which passes through the ledger-plate **29** and in front of the knives **25**. The roller **18** of the joining unit is caused to rotate as a result of light frictional contact of the paper strip.

When the bobbin **36** approaches its end, the brake **38** which is still in contact with the paper has fallen lower and the end of the balance weight **40** reaches the micro-switch **42**, thus actuating this latter.

At this moment, a pulse is delivered by one of the contacts **42–43**. In accordance with FIG. 6, the starter motor **7** is set in motion and one of the starter electromagnets **13–14** is supplied with normal voltage, with the result that the rollers **9** and **12** exert a more powerful clamping action on the paper strip.

After a certain time which permits the motor **7** to run up to its normal speed by virtue of a timing relay **47**, the clutch unit **8** of the starter is operated in such a manner that the roller **9** begins to rotate and conveys the stand-by strip through the upward-motion passageway **35** towards the rollers **16** and **18** of the joining unit.

The rate of unwinding of the bobbin **37** increases progressively.

At the end of a further time delay which is obtained as a result of the action of the timing relay **48**, the strip-cutting electromagnet **24** is supplied with current; the knife **25** which is thrust forward slides rapidly over the ledger-plate **29** and cuts off the old strip.

Another timing relay **49** serves to energize the electromagnet **21** of the joining unit so as to actuate the cam **20** which accordingly moves and bears on the ball-bearing **19** of the lever **17** which performs a pivotal motion and brings the backing roller **18** into closer contact with the knurled roller **16**. The new strip which has reached this level is joined to the old strip as a result of the effect of a plurality of junction points.

After a further time-delay produced by a timing relay **51**, the different elements receive a pulse via the contact **50** which causes said elements to return to the position which they had previously occupied.

Thereupon, the operator must remove the empty bobbin **36** and replace this latter by a fresh bobbin without omitting to place the brake **38** in contact with the paper. The operator then inserts the end of the new bobbin beneath the roller **44**, through the ledger-plate **29** and beneath the roller **10**, then causes the cutter block to perform a pivotal motion so as to bring it into position *ded'* (as shown in FIG. 1). The reversing micro-switch which is located behind the cutter block cuts off the low-voltage supply to the electromagnet **14** and supplies current to the electromagnet **13** at the same voltage; the lever **11** then pivots andt he roller **12** accordingly maintains the new paper strip applied against the roller **10**.

It is then advisable to remove the portion of paper strip which may project downstream of said two rollers.

The operation of the safety circuit is as follows:

When the machine manufactures cigarettes in accordance with FIG. 1, the contacts **55** and **59** are open and the contacts **52, 53, 54, 56, 57, 58** are closed. The relay **60** which is then energized closes the circuit **61** for stopping the machine and opens the circuit **62** of the visual indicator **67**.

The relay **63** which is in the rest position opens the contacts **64** and **65** and closes the contact **66**.

When the reserve of paper of the bobbin **36** becomes insufficient, the contact **58** opens (and the coil of relay **60** can be energized only by way of the contacts **53, 54**) and the contact **59** closes, thus effecting the different joining operations by way of the contacts **57, 59, 66**.

At the end of the cycle, the switch unit **50** momentarily energizes the relay **63** which is self-supplied via the contacts **64, 52, 56** and opens the contacts **66**, thereby preventing the initiation of another joining cycle and closes the contact **65** which warns the operator by means of the visual indicator that a bobbin has to be changed.

(a) *The operator omits to change an empty bobbin 36*

In this case, since the relay **63** remains energized and the contact **66** remains open, it is no longer possible to operate the joining unit. Moreover, when the bobbin **37** has also been completely unwound, the contact **54** opens and cuts off the supply to the relay **60**; the machine is accordingly brought to a stop by means of the contact **61** and the operator is informed of this stoppage by the visual indicator **67** which is energized by means of the contact **62**.

(b) *The operator omits to apply the brake 38 against the new bobbin 36*

In this case, the contacts **56** and **57** which are open cut off the self-supply of the relay **63** which accordingly closes the contact **66** but opens one of the supply branches of the relay **60**.

As soon as the bobbin **37** is unwound, the contact **54** opens the other branch and the relay **60** is deenergized, thus stopping the machine by opening the contact **61** and delivering a warning by means of the indicators **62–67**.

It will be readily understood that the invention is not limited to the constructional details which have been illustrated or described herein solely by way of example. Accordingly, it follows in particular that the rollers **9** and **10** can be driven directly from the machine to which the paper strip is conveyed, in which case the motor **7** is dispensed with and constant acceleration is obtained by such means as a friction coupling or powder-type electromagnetic coupler, that the roller **12** could be coupled directly to the control units **13** and **14** and move between the members **9** and **10** within a suitably disposed elongated slot.

What I claim is:

1. A device for joining a new web of sheet material wound on a reel to a moving web which is being unwound from a feed reel, particularly for joining of sheets of a wrapping material in machines for forming cigarettes from a continuous rod of tobacco; comprising two stationary reel supports, means joining said two webs together, means for cutting one of said two webs in alternate sequence, two pulleys mounted in adjacent relation to one another and located upstream of said joining means between said joining means and said reels, said joining means cooperating in alternate sequence with either one or the other of said pulleys for holding the end of said new web when said other web is in the process of unwinding, and for exerting a tractive effort on said new end thereby effecting the starting of said new web, each of said pulleys being constructed for serving alternately after starting and joining of said webs as a guide member for guiding the web which is then actually unwinding.

2. A device according to claim **1**, said joining means comprising a freely rotatable knurled roller, a freely rotatable flexible backing roller, and a control unit, said rollers being disposed relatively to each other in such manner that both rollers rotate continuously under the action of said moving web and are capable of being applied against each other with a sufficient pressure applied by said control unit.

3. A device according to claim **1** further comprising means for guiding said webs between said holding and starting pulleys and said joining means.

4. A device according to claim **1** said cutting means comprising a single pivotally mounted knife, said cutting means being mounted upstream of said holding and starting pulleys between said pulleys and said reels.

5. A device according to claim **1** said two holding

pulleys being mounted to rotate freely, means associated with said pulley for setting said pulleys in rotation in opposite directions, and a pressure roller mounted to rotate freely on a shaft which is located between said two pulleys and which is adapted to pivot in such a manner as to apply said roller against either one or the other of said pulleys for both the holding of said new web and the initial feed motion of said new web on the pulley against which said pressure roller is applied.

6. A device according to claim 5, said joining means being located at the apex of an isosceles triangle, the base of which being formed by said two holding and starting pulleys, the axis of said pressure roller being movable on each side of the plane of symmetry which passes through said apex of said triangle.

7. A device according to claim 3, said guiding means comprising a passageway converging from said pulleys towards said joining means and a central dividing wall in said passageway for forming a rectilineal path of progression of said webs in said divided passageway.

8. A device according to claim 4, and ledger-plate blocks placed on the path of both webs and said single knife being pivotally mounted to bear on said blocks in alternate sequence.

9. A device according to claim 8, said single knife comprising two parallel cutting blades, a spacer member between said blades and a blade-holder block for rigidly holding said spacer.

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