United States Patent [19]

Hujer

[11] **3,793,915**

[45] **Feb. 26, 1974**

[54] **FILM CUTTING APPARATUS**

[75] Inventor: **Friedrich Hujer,** Grunwald, Germany

[73] Assignee: **Agfa-Gevaert Aktiengesellschaft,** Leverkusen, Germany

[22] Filed: **Sept. 28, 1971**

[21] Appl. No.: **184,497**

[30] **Foreign Application Priority Data**

Sept. 30, 1970 Germany 2048094

[52] **U.S. Cl.** **83/62,** 83/208, 83/210, 83/221, 83/364, 83/371

[51] **Int. Cl.** **B26d 5/24**

[58] **Field of Search** 83/62, 208, 209, 210, 364, 83/369, 371, 76, 221

[56] **References Cited**

UNITED STATES PATENTS

2,599,430	6/1952	Beuerman	83/76
3,244,863	4/1966	Paterson	83/76 X
3,175,441	3/1965	Drenning et al.	83/76

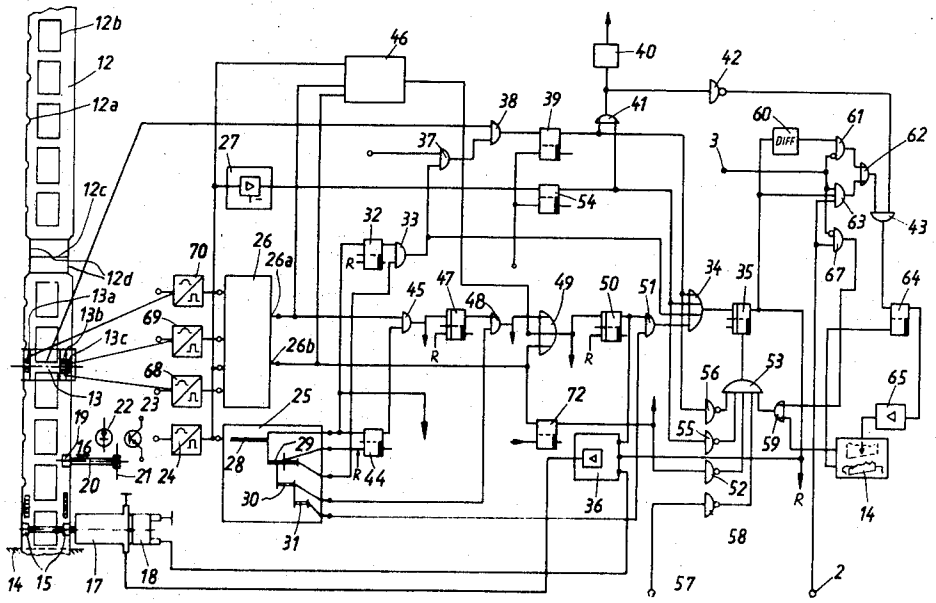
Primary Examiner—J. M. Meister

Attorney, Agent, or Firm—Michael S. Striker

[57] **ABSTRACT**

Film has first markings indicating properly exposed negatives and second markings indicating glued sections. Length of film following a previous cut is measured; following a predetermined length, passage of next first marking past a scanner causes activation of cutting means along frame line. Film transport then restarted. Sensing of second marking also initiates cutting along frame line, but no subsequent film transport.

28 Claims, 2 Drawing Figures



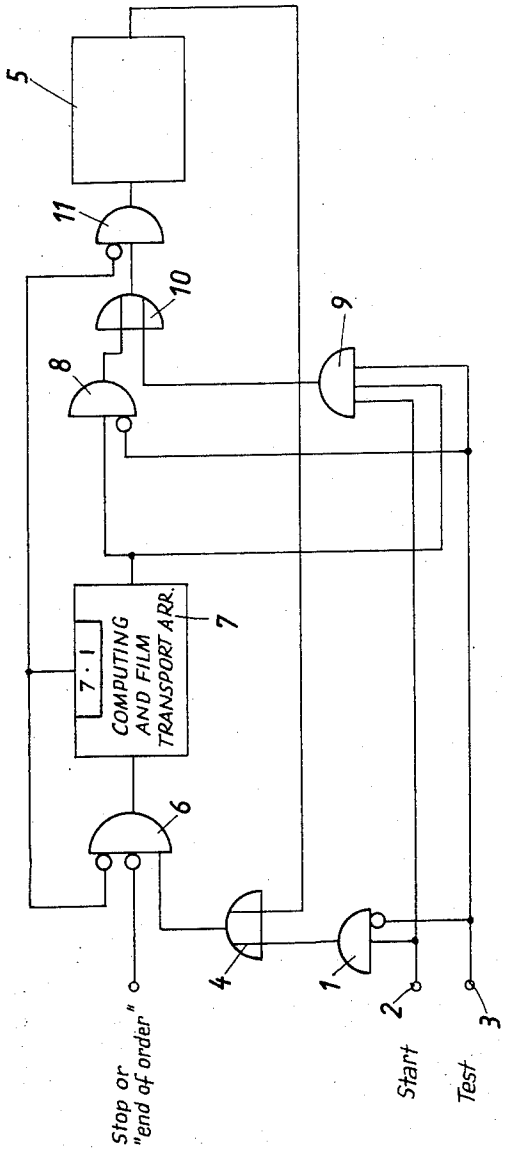


Fig. 1

INVENTOR
FRIEDRICH HUJER

BY Michael J. Striker
Attorney

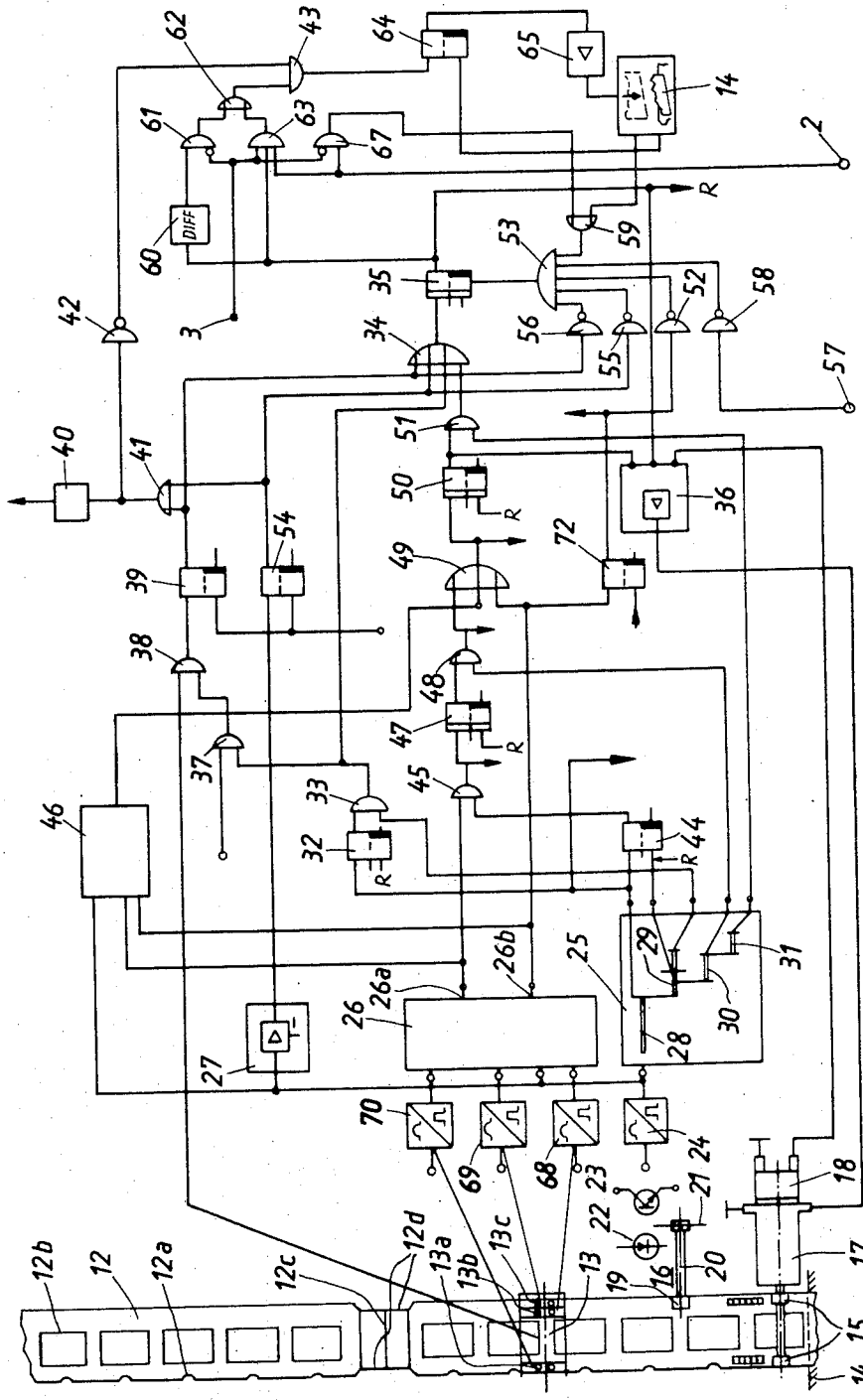


FIG 2

INVENTOR
FRIEDRICH HUJER

BY

FILM CUTTING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to apparatus for cutting elongated signal carrier means, as for example photographic film, into strips having a maximum predetermined length. The cuts are to take place at the frame lines situated between consecutive frames on the film. The frame lines are located by means of markings affixed to the film, in a predetermined spatial relationship to the frame edges. The film is transported along a predetermined path by transport means and, at a predetermined location along said predetermined path are cutting means. Both the transport and the cutting means are activated by computing means, which in turn are responsive to scanning means which scan the markings affixed to the film and to measuring means which measure the film length transported past a predetermined point along said predetermined path.

In known arrangements of the above-described type, the scanning means for scanning the film markings are physically positioned along said predetermined path at such a distance from the cutting means that a stop signal applied to the transport means from the scanning means upon scanning of a marking cause the film to stop when in the correct position relative to the cutting edge. This principle of operation has a number of substantial drawbacks. First, if the equipment is to be adjusted from one length of negative to the next, either the scanning means must be moved, or else a plurality of scanning means at different distances to the cutting edge must be provided. Further, under the above-described conditions, the film transport means are positioned at a greater distance from the cutting edge than the scanning means. This introduces a certain possibility of error, since the length of the transported film between the transport means and the cutting edge may cause waves to appear in the film which can result in measurement errors of several tenths of a millimeter.

SUMMARY OF THE INVENTION

It is an object of the present invention to furnish equipment of the above-described type, but having greater exactness in positioning the film relative to the cutting means.

The present invention therefore comprises a cutting arrangement for elongated signal carrier means having a plurality of frames, a plurality of frame lines each separating consecutive ones of said frames, and a plurality of identifying marks, each having a predetermined position relative to a corresponding one of said frames. The invention further comprises transport means for transporting said elongated signal carrier means along a predetermined path. Cutting means are arranged immediately following said transport means in the direction of motion of said elongated signal carrier means, the cutting means cutting said elongated signal carrier means at said frame lines into strips having a predetermined maximum length. The cutting means operate in response to a cutting signal. Scanning means scan said elongated signal carrier means and furnish identifying signals when scanning said identifying marks. The scanning means are arranged preceding said transport means in the direction of motion of said elongated signal carrier means. Measuring means are coupled to said elongated signal carrier means and furnish a measuring

signal corresponding to the length of said elongated signal carrier means transported past a predetermined point along said predetermined path, following receipt of a selected one of said identifying signals. Finally, computing means furnish said cutting signal as a function of said measuring and identifying signals.

By the above-described arrangement wherein the transport means are positioned just prior to the cutting edge, the film is kept under tension and is therefore not subject to changes in length because of slackness or lack of tension. Further, in the conventional arrangement, the film transport is stopped immediately upon scanning of an identifying mark. It is assumed that the scanning means is sufficiently exactly positioned that the film will have a frame line under the cutting edge when the transport comes to a final stop. In the present invention the length of film transported is actually measured until the cutting signal is generated. This allows very exact control of the film transport. Specifically, the transport may be operated at a high speed until the frame line at which the film is to be cut reaches a distance relative to the cutting edge which is equal to the distance the film will travel until the transport means reaches a final stop.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram showing the basic components of the present invention; and

FIG. 2 is a more detailed block diagram showing the interaction of the computing means with the mechanical elements of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will now be described with reference to the drawing.

FIG. 1 shows a gate **1**, having a direct input connected to a start key **2** and an inverter input connected to a test key **3**. The output of AND gate **1** is connected to an OR gate **4**, whose second input is the output of a film cutting arrangement **5**. The output of AND gate **4** is also connected with the input of an AND gate **6** which further has two inverter inputs. The first of these inverter inputs receives a stop or "end of order" signal, while the second inverter input receives a signal from an emergency stop unit **7.1** which is part of a computing and film transport unit **7**. The output of AND gate **6** is connected to the input of the film transport unit. The output of unit **7** is connected to the direct input of an AND gate **8** whose second, inverter, input is connected to a test key **3**. The output of computing and transport unit **7** is also connected to the input of an AND gate **9** whose remaining two direct inputs are connected, respectively, to the above-mentioned start and test keys. The output of AND gate **9** as well as the output of AND gate **8** are connected to the inputs of an OR gate **10** whose output is connected to the direct input of an AND gate **11**. The second input of AND gate **11** is an inverter input connected to the above-

described output of unit 7.1. The output of AND gate energizes the cutting means 5 whose output in turn is connected as mentioned above to one input of OR gate 4.

The above-described arrangement operates as follows: The film transport is energized by activation of start key 2 if no signal is present at test terminal 3 and at the inverter outputs of AND gate 6. The film continues to advance until the computing means, which will be described with reference to FIG. 2, cause the film transport to stop, on the basis of scanned identifying signals and on the basis of measured length of transported film. Upon stoppage of the film, both AND gates 8 and 9 receive a "1" signal. However, since no signal exists at test terminal 3, AND gate 9 is blocked. AND gate 8, however, is conductive and causes a signal to be applied to OR gate 10. The signal furnished by OR gate 10, in the absence of an emergency stop signal at the other terminal of AND gate 11, causes the cutting means 5 to be activated. After the cutting operation has been completed, the cutting means furnish an output signal which is applied to the second input of OR gate 4. The resulting output of OR gate 4 is transmitted through AND gate 6, the output of AND gate 6 restarting the film transport. This cycle of operation is repeated until an "end of order" signal appears at the input of AND gate 6. The operator operating the equipment must then remove the cut film strips and must reactivate the apparatus by pushing stop key 2 and extinguishing the "end of order" signal.

If, however, test key 3 was first activated and then start key 2, gate 1 is blocked. The cutting signal is then furnished via gates 9 and 10 and 11 to the cutting means 5, if the film has stopped, causing an output signal to appear at the output of unit 7. After the cutting means have operated, the film transport is reactivated via gates 4 and 6. However, gate 8 is blocked through the input at terminal 3, so that it is possible to operate the cutting means only through AND gate 9, that is by activating start key 2. It is thus seen that the film transport is automatically stopped, but under test conditions, no cutting signal is furnished to cutting means 5 until the operator decides to do so via start key 2. Thus the operator may carry out a visual inspection of the position of the film relative to the cutting means prior to activating the start key. Of course after each cut, the transport is automatically restarted and the computing means which form part of unit 7 operate under normal conditions, thereby allowing the operator to test the equipment for proper operation.

FIG. 2 is a more detailed block diagram showing the arrangement outlined in FIG. 1. The elongated signal carrier means, here a photographic film 12 has perforations 12a each of which indicates a properly exposed original (negative). The perforations 12*a* were made on the film following the development of the film by an apparatus which positions them in a determined position relative to the frame line which divides the film between consecutive ones of the frames. For example the perforations 12*a* can be affixed at the halfway point of the lengthwise edge of each properly exposed original in the direction of motion of the film transport. Further, the film, which is now to be cut into strips having a maximum predetermined length, also has junctions at which film strips, each corresponding to a particular order from a particular customer, were previously glued or pasted together. These junctions are characterized by perforations at both lengthwise film edges, which were made to prevent the glue or pasting material from contaminating the film transport. At this point it should perhaps be explained that the film which is film representing a number of separate orders from separate customers was glued together at these junctions and must now be cut into strips of a convenient size for packaging. However, in the event of a glued section, the individual order has been completed and the film must be cut at this point so that all originals of a given order may be packaged together. For example, originally a customer may have sent in a film strip comprising 20 negatives for processing. A plurality of these strips are glued together. After developing, the resulting long film strip must be cut into strips of a predetermined length (for example 3 or 4 frames) in order to allow packaging of the order for return to the customer. The customer will thus receive strips of equal length except for one end strip which may be shorter because the glued section occurred before the predetermined maximum length of the film strips into which the film was to be cut had been reached.

Scanning means are positioned along the predetermined path and are denoted by reference numeral 13 in FIG. 2. The film is pulled over these scanning means, which may comprise first, second and third scanning means namely separate scanning elements 13*a*, 13*b*, and 13*c*. It should be noted that the third scanning means are also herein referred to as additional scanning means. Each of these may comprise a light source and a photoelectric element receiving light from said source as reflected by the film. Element 13*a* generates a pulse when a perforation 12*a* passes the scanning means. Elements 13*a* and 13*c* yield a pulse when scanning a glued junction having perforations 12*b*. Scanning element 13*c* and 13*a* respectively constitute first and second scanning means. Scanning element 13*b* is not absolutely essential for the presently discussed embodiment of the invention. However, it results in greater versatility. This scanning element is for scanning perforations on the film which are affixed to each negative, whether the negative is exposed properly or improperly exposed. Such perforations are provided in some types of films for guiding the transport in the camera. If this type of film is used in conjunction with scanning element 13*b*, counter 46 which will be described below is not required.

Scanning arrangement 13 is arranged at a distance of approximately 50 mm from cutting edge 14. This distance is required so that the transport means, including transport rollers 15, and the measuring means, 16, may be positioned between the scanning means and the cutting edge. The motor driving the transport rollers 15 is a DC motor 17. The speed of the motor 17 is controlled by a tacho-generator 18, and, specifically, by comparing the output voltage of the tacho-generator to a reference voltage and energizing the motor as a function of the difference between these two voltages.

The measuring means 16 comprise a metal cylinder 19 having a very exact diameter. Cylinder 19 is taper bore mounted on a rotatably mounted shaft 20 which carries a disc 21 at its other end. A light emitting diode (LED) 22 is mounted on one side of disc 21, while a phototransistor 23 is arranged on its other side, so that each interruption of the path of light from the LED to the phototransistor results in the generation of an electrical pulse. The number of notches around the circum-

ference of disc **21** is such that a pulse is generated for each 0.2 mm of film transported.

Phototransistors **23** controls a pulse forming stage **24,** for instance a Schmitt trigger. The output of the Schmitt trigger constitutes the disc scanning signals which are furnished to the inputs of counter **25** (first counting means), a counter **26** (second counting means), and a counter **46** (third counting means). The pulses are further applied to one input of frequency comparator means **27** which will be described below. Counter **25** is a digital counter which furnishes a plurality of measuring signals, specifically, a first, second, third and fourth measuring signal, each of these measuring signals being generated after a determined count of disc scanning signals following the furnishing of the last previous measuring signal. The number of scanning signals counted between two measuring signals varies as a function of the size of the negatives in the direction of motion of the film. In FIG. **2,** the number of counts (i.e., the length of film transported) prior to the generation of the first measuring signal is denoted by **28,** that prior to the generation of the second measuring signal **29,** while the corresponding values for the third and fourth measuring signal are denoted by **30** and **31** respectively.

The film length, or, alternatively, the count on counter **25** represented by distances **28, 29, 30** and **31** may be defined as follows: The count is originally started (see FIG. **1**) with the application of a start signal at terminal **2** or with the end of the previous cutting operation. The distance **28** is arbitrarily selectable and depends on how long the maximum length of the film strips into which the film is to be cut is to be. For example this maximum predetermined length may vary between **2** and **5** originals of the 24 × 36 mm size or between **3** and **6** originals of the square format. Following the generation of the first mentioned signal, which takes place when the count **28** has been completed, the counter is reset and the count corresponding to the distance **29** commences. The distance **29** corresponds approximately to the length of an original on the film being processed. As will be described later, throughout the count **29,** namely between the generation of the first and the second measuring signal, a gate permits transmission of an exposed frame signal, that is a signal furnished by scanning element **13***a*. If such an exposed frame signal is received, prior to the furnishing of the second measuring signal, the count of the length **29** is discontinued and counting interval **30** begins. The length of this counting interval depends upon the length of a frame in the direction of motion of the film and upon the distance between the scanning means **13** and the cutting edge **14.** At the end of counting interval **30,** the third measuring signal is furnished, initiating counting interval **31.** This counting interval is used to reduce the transport velocity from a high to a low velocity. Furnishing of the fourth measuring signal at the end of counting interval **31** results in the stopping of the motor as will be further described below.

If, however, no exposed frame signal is received within counting interval **29,** the transport is stopped after an additional distance approximately equal to the distance represented by counting interval **29.** A motor stop signal is then furnished at the end of this interval. In particular, the first measuring signal is applied to one side of a flip-flop **32.** The output of flip-flop **32** is applied to one input of an AND gate **33** to which is also applied the signal furnished at the end of counting interval **29** and the additional distance mentioned above. The output of AND gate **33** is then a pulse corresponding to the pulse furnished at the end of said interval. This pulse is applied to one input of an OR gate **34** whose output in turn sets a flip-flop **35.** This output of flip-flop **35** is a motor stop signal and is applied to motor control means **36** where it causes a reference voltage to be furnished which causes an immediate stopping of motor **17.** Further, the setting of flip-flop **35** results in the resetting of a number of other flip-flops, for example flip-flop **32.** The flip-flops so reset are all indicated by an R in FIG. **2.**

The output of AND gate **33** is further applied to one input of an AND gate **37.** The other input of AND gate **37** receives a signal if it is desired to prevent the cutting of negatives which are presently designated as improperly exposed, even at the cost of an interruption of the automatic operation of the equipment. If such an interruption is not desired no signal is furnished to the other input of AND gate **37** and this AND gate is, under such circumstances, inoperative. AND gate **37** is part of the emergency stop unit **7.1** of FIG. **1.** This unit also contains ORgate **38** whose first input is the output of AND gate **37,** while the second input is a signal generated upon failure of the light source associated with the scanning means. The output of OR gate **38** sets a flip-flop **39** whose output when so set is applied to one input of an OR gate **41** whose output energizes an alarm **40,** such as, for example a blinker light. The output of OR gate **41** is also inverted via an inverter **42** whose output is applied to an AND gate **43** and prevents the activation of the cutting means under emergency stop conditions. Gate **41** is of course also part of the emergency stop unit as is a flip-flop **54** which will be discussed below.

The first measuring signal further is applied to first storage means, namely a flip-flop **54.** When set by the first measuring signal, flip-flop **54** furnishes a signal to one input of first gating means namely AND gate **45** whose other input is connected to the output **26***a* of second counting means **26,** at which is furnished the phase shifted exposed frame signal. The signal at terminal **26***a* is the pulse generated by scanning means **13***a* after a delay measured in terms of film transport length, i.e., in terms of disc scanning signals counted by counter **26.** This phase shift can be used as a means for adjusting the exact position of the place at which the film is to be cut, thereby allowing for finer adjustments than was possible by physical movement of equipment. Also of course such adjustment is simpler. The exposed frame signal is transmitted through gate **45,** reset counter **25** to start the counting interval **30** and further serves to change the state of a flip-flop **47.** In this state flip-flop **47** furnishes an input to an AND gate **48,** whose other input is the third measuring signal, namely the signal signifying the end of counting interval **30.** Thus at the end of counting interval **30** a pulse is transmitted through AND gate **48.** This pulse resets counter **25,** starting counting interval **31.** Further it is applied to an OR gate **49** whose output sets a flip-flop **50** the output of flip-flop **50** resulting from this set signal is applied to the motor control circuit **36** and causes this motor control circuit to reduce the motor speed of motor **17.**

The value of this reduced speed is such that the film transport together with the film can be stopped in a

very short time and with negligible tolerance. After the end of counting interval **31** throughout which the film transport is operating at said reduced speed, a second signal is applied to the input of an AND gate **51** at whose first input is applied the said output of flip-flop **50.** Thus, at the end of counting interval **31,** a signal is transmitted through AND gate **51,** passes through the subsequent OR gate **34** to set a flip-flop **55.** The output of flip-flop **35** is used to reset flip-flops **32, 44, 47** and **50** to their original state. Further, it serves to stop the motor by applying a signal to the motor controlled circuit which causes the reference voltage for the tacho-generator **18** to be reduced to zero so that motor **17** is braked with high torque. This causes the motor, which is in any case rotating at a very low speed, to be stopped in the shortest possible time.

Finally, the change in state of flip-flop **35** results in a potential jump at the input of a differentiating circuit **60,** thereby causing this circuit to generate a pulse which is applied to the input of an AND gate **61.** AND gate **61** has a second input, an inverter input, to which is applied a signal when the test key **3,** FIG. **1,** is depressed. Thus AND gate **51** will transmit the signal from the differentiating circuit **60** only in the absence of a test mode of operation. The output of AND gate **61** is one input to an OR gate **62** whose second input is the output of an AND gate **63.** AND gate **63** corresponds to AND gate **9** of FIG. **1** and furnishes an output in the simultaneous presence of the signal from the differentiating circuit **60,** the test program, and the start signal caused by the depression of key **2** of FIG. **1.** The output of OR gate **62** is one input to an AND gate **43** whose second input is derived from the output of OR gate **41,** described above through an inverter **42.** Thus AND gate **43** will furnish a signal only in the absence of an emergency stop signal and the presence of a signal from OR gate **62.** The output of AND gate **43** sets a flip-flop **64** whose output, via an amplifier **65,** is used to activate the cutting knife, for example by energizing a magnet controlling the motion of the knife. A feeler switch is arranged to cooperates with the knife in such a manner that when the cutting position of the knife is reached, a signal is furnished to reset flip-flp **54.** Further, a further scanning arrangement also in the form of a switch furnishes a signal when the knife returns to the rest condition following the cutting operation. This signal is furnished to one input of an OR gate **59** which, via an AND gate **53** resets flip-flop **35** which furnished the stop signal, assuming that none of the inputs of inverter gates **52, 55, 56** or **58** has an input. The resetting of flip-flop **35** causes the film transport to be restarted.

The exposed frame signal at the output of terminal **26***a* further serves to reset and restart counter **46,** the third counting means.

A pulse received at output **26***b* of counter **26,** namely a signal corresponding to a signal sensed by scanning means **13***c* (junction signal), after a phase shift by counter **26** as discussed in relation with signal **26***a*, furnishes an input to OR gate **29,** setting flip-flop **50,** thereby causing a reduction of motor speed as discussed above. At the end of counting interval **31,** the motor is stopped via signals through gates **51** and **34** also as described above. In addition, signal **26***b* serves to set a flip-flop **72** which causes a signal "end of order" (see also FIG. **1**) to be generated. Further, the output of flip-flop **72** is applied to AND gate **53** via inverter stage **52,** thereby preventing the restarting of the film transport as discussed above.

FIG. **2** also shows a frequency comparator circuit **27.** It is the function of this circuit to compare the frequency of the disc scanning signals (output of stage **24**) to the frequency corresponding to the speed of motor **17.** This may for example be accomplished by subjecting the pulse sequence at the output of stage **24** to digital-analog conversion and comparing it to the output of tacho-generator **18.** If the difference between the two values is excessive, a signal is furnished at the output of stage **27** which sets a flip-flop **54** which is part of the emergency stop arrangement **7.1** of FIG. **1.** The signal at the output of flip-flop **54** is applied to one input of an OR gate **41** whose output as described above furnishes an emergency stop signal. Further, the output of flip-flop **54** is applied to OR gate **34** causing the setting of flip-flop **35,** in turn causing the motor to stop. The film transport cannot be restarted under these conditions, since the output of flip-flop **54** via inverter **55** is applied to the input of AND gate **53.** The furnishing of the emergency stop signal of course also prevents the cutting operation via AND gate **43.**

It may be noted at this point that the remaining inputs of AND gate **53** which cause the prevention of the restarting of the transport means are an input **57** which is manually operable and is applied to AND gate **53** via an inverter **58** and the output of a flip-flop **39** which is applied to AND gate via an inverter **56.**

Further shown in FIG. **2** is a third counter **46.** This counter is reset by signals **26***a* and **26***b* and is restarted in response to signal **26***a*. It counts the output of stage **24,** namely the scanning signals. It will be noted that this counter is not started until a signal **26***a* is received. The counter thus counts the disc scanning signals, that is it measures the length of film transported following the receipt of an exposed frame signal. It continues the count until the next following signal **26***a* is received at which point it is reset and restarted. Counter **46** then emits signals at intervals corresponding to the length of a frame and, specifically, in intervals corresponding to integral multiples of the frame length. The output of counter **46** is also phase shifted by a counting interval corresponding to counting interval **30.** The output signals from counter **46** which are thus extrapolation signals signifying correct intervals between frames in cases where the original was considered not acceptable for copying, are applied to an input of OR gate **49.**

The above described arrangement operates as follows: Starting with a cutting operation, counter **25** counts the disc scanning signals furnished by stage **24.** At the end of counting interval **28** and the resulting setting of flip-flops **32** and **44** counting interval **29** begins. If an exposed frame signal is furnished with counting interval **29,** the resulting signals **26***a* are applied to first gating means **45** causing flip-flop **47** to be set thereby causing the gates **48, 49,** flip-flop **50** and gate **51,** a speed decrease and, at the end of counting interval **31** a stopping of the motor and a cutting of the film. Upon furnishing of a signal **26***b* at any time, the motor speed is reduced via gate **49,** the film transport stopped and the cutting means activated. A restarting of the film transport is prevented via gate **53** by applying a signal to the input of converter **52.**

If a signal **26***a* is missing, for example because the corresponding original is not considered fit for copying, then counter **46** furnishes signals at intervals corre-

sponding to an integral multiple of the distance from the previously received signal **26***a*. The signals cause the motor to be decreased in speed and stopped and initiate a cutting operation. This allows the equipment to proceed in automatic operation without operator interference. Additionally the cutting of an original which was considered not fit for copying is also prevented.

The test program which is initiated by the activation of test key **3** has been described briefly in relation to FIG. **1**. Depression of key **3** causes a signal to be applied to inputs of gates **61, 63** and a further gate **67** where upon depression of the test key, the cutting means are activated if the start key **2** is also depressed and if flip-flop **35** is in a position indicating that the transport has stopped. The cutting operation is accomplished through AND gate **63.** In the absence of a signal at test terminal **3,** the transport is restarted by depression of the start key through AND gate **67.** After the cutting process has been carried out by activation of the start key, the flip-flop **35** is reset through gate **53** and the film transport restarted. The same transport cycle then ensures as under normal operating conditions, but the actual cutting process is prevented by the blocking of gate **61** as long as the test mode is enforced. The cutting process in the test mode must always be initiated by depression of the start key **2.**

The above-described arrangement thus operates on the basis of sensed identifying marks and the measuring of the length of film transported past a predetermined point in order to cut the film into strips of predetermined maximum length and still prevent incorrect cutting of the originals furnished by a customer under all circumstances.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. Arrangement for cutting elongated signal carrier means having a plurality of frames separated by frame lines and a plurality of identifying marks each having a predetermined position relative to a corresponding one of said frames, at frame lines, into strips having a predetermined maximum length, comprising, in combination, transport means for transporting said elongated signal carrier means along a predetermined path; cutting means arranged immediately following said transport means in the direction of motion of said elongated signal carrier means, for cutting said elongated signal carrier means in response to a cutting signal; scanning means, arranged preceding said transport means in the direction of motion of said elongated signal carrier means, for scanning said identifying marks and furnishing identifying signals in response thereto; measuring for means furnishing measuring signals corresponding to the length of said elongated signal carrier means transported by said transport means following receipt of one of said identifying signals; and computing means connected to said measuring means, said scanning means and said cutting means for furnishing said cutting signal as a function of said measuring and scanning signals.

2. Cutting arrangement as set forth in claim **1,** wherein said transport means comprise a pair of transport rollers; further comprising driving means for driving said transport rollers under control of said computing means.

3. Cutting arrangement as set forth in claim **1,** wherein said computing means furnish said cutting signal in response to a measuring signal corresponding to the length of said elongated signal carrier means which must be transported by said transport means until the frame line corresponding to said one of said identifying signals is positioned at said cutting means.

4. Cutting arrangement as set forth in claim **3** wherein said elongated signal carrier means comprise photographic film joined at film junctions, said photographic film having properly exposed and improperly exposed frames; wherein said identifying marks comprise first identifying marks indicative of said film junctions and additional identifying marks indicative of each of said frames, regardless of exposure; and wherein said scanning means comprise first scanning means scanning said first identifying marks and furnishing junction signals in response thereto, and additional scanning means scanning said additional identifying marks and furnishing individual frame signals in response thereto.

5. In an arrangement for cutting elongated signal carrier means having a plurality of film strips joined at film junctions, each of said film strips having a plurality of frames separated by frame lines, at said frame lines into strips having a predetermined maximum length, at least one of said film strips having properly and improperly exposed frames, said film strips further having first identifying marks indicative of said film junctions and second identifying marks indicative of properly exposed frames, each of said second identifying marks having a predetermined position relative to a corresponding one of said frames, comprising, in combination, transport means for transporting said elongated signal carrier means along a predetermined path; cutting means arranged immediately following said transport means in the direction of motion of said elongated signal carrier means, for cutting said elongated signal carrier means in response to a cutting signal; first scanning means arranged preceding said transport means in the direction of motion of said elongated signal carrier means, for scanning said first identifying marks and furnishing junction signals in response thereto; second scanning means arranged preceding said transport means in the direction of motion of said elongated signal carrier means, for scanning said second identifying marks and furnishing exposed frame signals in response thereto; measuring means furnishing measuring signals corresponding to the length of said elongated signal carrier means transported by said transport means following receipt of one of said exposed frame signals; and computing means connected to said measuring means, said scanning means, and said cutting means for furnishing said cutting signal in response to a measuring signal corresponding to the length of said elongated signal carrier means which must be transported by said transport means until the frame lines corresponding to said one of said exposed frame signals is positioned at said cutting means.

6. Cutting arrangement as set forth in claim 5, wherein said measuring means comprise means positioned between said scanning means and said transport means along said predetermined path.

7. Cutting arrangement as set forth in claim 6, wherein said measuring means comprise cylinder means having a predetermined diameter; means maintaining contact between said cylinder means and said photographic film; disc means mounted for simultaneous rotation with said cylinder means, said disc means having a plurality of disc markings; and disc scanning means scanning said disc markings and furnishing disc scanning signals in response thereto.

8. Cutting arrangement as set forth in claim 7, wherein said cylinder means comprise metal cylinder means.

9. Cutting arrangement as set forth in claim 8, wherein said disc scanning means comprise photoelectric disc scanning means.

10. Cutting arrangement as set forth in claim 7, wherein said driving means comprise DC motor means; further comprising motor speed signal furnishing means furnishing a signal indicative of the speed of said DC motor means; and comparator means comparing said motor speed signal to said disc scanning signal and furnishing a comparator output signal when the frequency of said disc scanning signals differs from the frequency corresponding to said motor speed signal by more than a predetermined frequency difference.

11. Cutting arrangement as set forth in claim 10, further comprising means stopping said DC motor means in response to said comparator output signal.

12. Cutting arrangement as set forth in claim 11, further comprising alarm means responsive to said comparator output signal.

13. Cutting arrangement as set forth in claim 7, wherein said measuring means further comprise first counting means for counting said disc scanning signals and furnishing said measuring signals in response thereto.

14. Cutting arrangement as set forth in claim 13, wherein said first counting means comprise means furnishing a first measuring signal when the number of counted disc scanning signals is equal to a first predetermined number corresponding to said predetermined maximum length; and wherein said computing means comprise first gating means connected to said first counting means and said second scanning means and furnishing a first gating output signal in response to simultaneous presence of said first measuring signal and said exposed frame signal.

15. Cutting arrangement as set forth in claim 14, wherein said first counting means further comprise means furnishing a second measuring signal following the furnishing of said first measuring signal by a second predetermined number of said disc scanning signals, said second predetermined number corresponding to the length of one of said frames in the direction of motion of said film; and wherein said computing means comprise first storage means having a set and a reset state in response to, respectively, said first and second measuring signals; and wherein said gating means is responsive to the simultaneous presence of said exposed frame signal and the set state of said first storage means.

16. Cutting arrangement as set forth in claim 15, wherein said computing means further comprise logic means connected between said first storage means and said DC motor means, for furnishing a motor stop signal stopping said DC motor following receipt of said first gating output signal.

17. Cutting arrangement as set forth in claim 16, wherein said DC motor means comprise a DC motor; and motor control means connected to said DC motor for furnishing reference signals controlling said speed of said DC motor to said DC motor.

18. Cutting arrangement as set forth in claim 17, wherein said motor control means comprise means furnishing a first reference signal resulting in decreased motor speed to said motor in response to a speed reducing signal; wherein said measuring means comprise means furnishing a third measuring signal upon receipt of a predetermined third number of disc scanning signals following said first gating output signal, said third number depending upon the distance between said second scanning means and said cutting means; and wherein said logic means comprise means furnishing said speed reducing signal to said motor control means following receipt of said third measuring signal.

19. Cutting arrangement as set forth in claim 18, wherein said measuring means comprise means furnishing a fourth measuring signal following receipt of a fourth predetermined number of said disc scanning signals following furnishing of said third measuring signal; and wherein said logic means comprises means furnishing said motor stop signal in response to said fourth measuring signal.

20. Cutting arrangement as set forth in claim 19, wherein said computing means further comprise additional logic means connected to said logic means for furnishing said cutting signal in response to said motor stop signal.

21. Cutting arrangement as set forth in claim 20, wherein said logic means further comprise first bistable circuit means switched from a first to a second stable state upon receipt of said motor stop signal; and wherein said additional logic means comprise differentiating means connected to said first bistable circuit means and furnishing differentiator output signal when said first bistable circuit means changes from said first to said second stable state.

22. Cutting arrangement as set forth in claim 21, wherein said cutting means comprise a knife movable between a rest and a cutting position; means furnishing a first and second knife position signal when said knife is in said rest and cutting positions respectively; further comprising transport restart gating means connected to said first bistable circuit means for resetting said first bistable circuit means upon receipt of said first knife position signal.

23. Cutting arrangement as set forth in claim 22, wherein said additional logic means comprise first additional logic gating means interconnected between said differentiator means and said cutting means, said additional logic gating means having a blocking input; further comprising test signal furnishing means furnishing a test signal to said blocking input, thereby preventing operation of said cutting means.

24. Cutting arrangement as set forth in claim 23, wherein said additional logic means comprise second additional logic gating means, for furnishing said cutting signal in the simultaneous presence of said differentiator output signal, said test signal, and a start signal;

and means furnishing said start signal under operator control.

25. Cutting arrangement as set forth in claim **24,** further comprising second counting means receiving said disc scanning signals, said junction signal and said exposed frame signal, and furnishing phase shifted junction and exposed frame signals after a predetermined count of said disc scanning signals.

26. Cutting arrangement as set forth in claim **25,** further comprising third counting means connected to the output of said second counting means and said disc scanning means, for counting said disc scanning signals, resetting and starting in response to said exposed frame signal and resetting in response to said junction signal, said third counting means furnishing a third counter output signal following receipt of a predetermined number of said disc scanning signals after receipt of one of said exposed frame signals.

27. Cutting arrangement as set forth in claim **26,** further comprising means interconnecting the output of said third counting means with said logic means, for furnishing said motor stop signal in response to said third counter output signal.

28. Arrangement for cutting elongated signal carrier means having a plurality of film strips joined at film junctions, each of said film strips having a plurality of frames separated by frame lines, at least one of said film strips having properly and improperly exposed frames, said film strips further having first identifying marks indicative of properly exposed frames, each of said second identifying marks having a predetermined position relative to a corresponding one of said frames, at frame lines, into strips having a predetermined maximum length, comprising, in combination, transport means for transporting said elongated signal carrier means along a predetermined path; cutting means arranged immediately following said transport means in the direction of motion of said elongated signal carrier means, for cutting said elongated signal carrier means in response to a cutting signal; first scanning means arranged preceding said transport means in the direction of motion of said elongated signal carrier means, for scanning said first identifying marks and furnishing junction signals in response thereto; second scanning means arranged preceding said transport means in the direction of motion of said elongated signal carrier means, for scanning said second identifying marks and furnishing exposed frame signals in response thereto; measuring means furnishing measuring signals corresponding to the length of said elongated signal carrier means transported by said transport means following receipt of one of said exposed frame signals; and computing means connected to said measuring means, said scanning means, and said cutting means for furnishing said cutting signal in response to a measuring signal corresponding to the length of said elongated signal carrier means which must be transported by said transport means until the fram line corresponding to said one of said exposed frame signals is positioned at said cutting means; and wherein said transport means comprise a pair of transport rollers, and driving means for driving said transport rollers under control of said computing means.

* * * * *