Oct. 16, 1962 W. LIMBERGER 3,058,409

APPARATUS FOR MAKING COPIES

Filed July 13, 1959 3 Sheets-Sheet 1

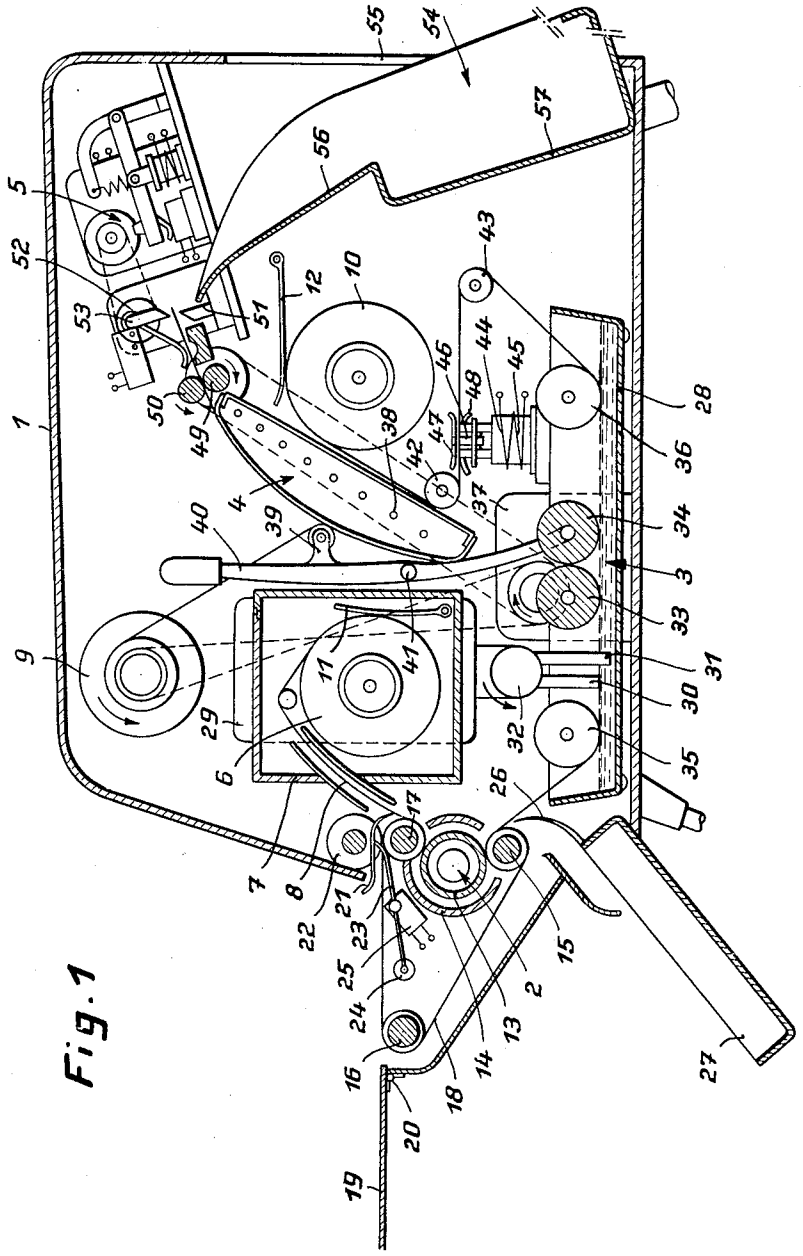


Fig. 1

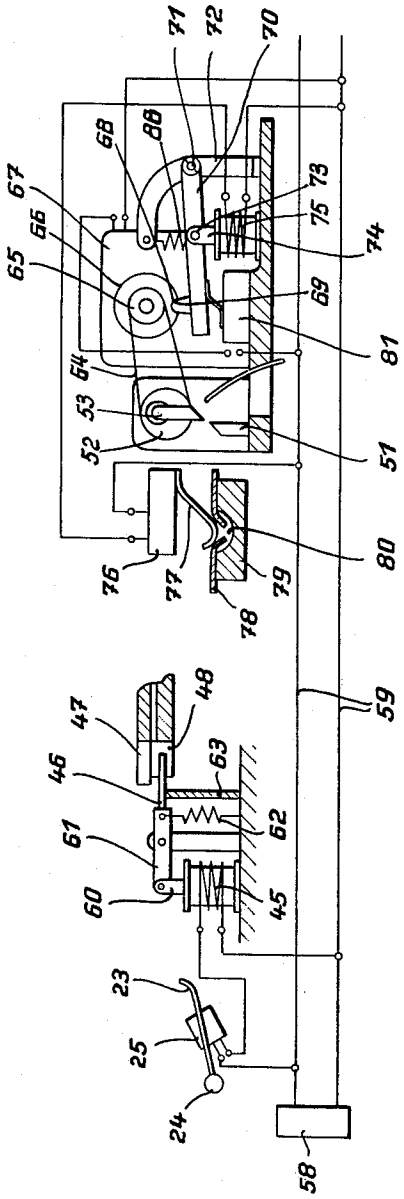
INVENTOR:
Walter Limberger
BY:
Beaman & Beaman
attys

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Fig. 2



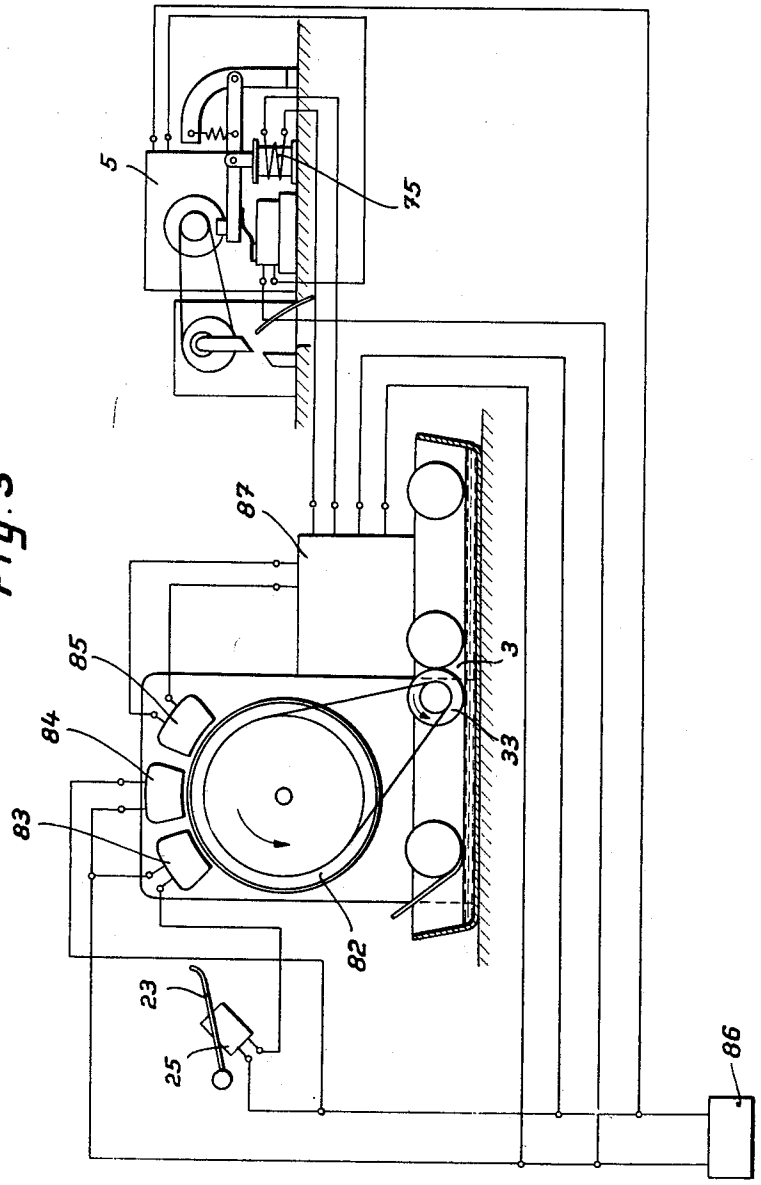
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attys

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Fig. 3



INVENTOR:
Walter Limberger
BY:
Beaman & Beaman
attys

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3,058,409

APPARATUS FOR MAKING COPIES

Walter Limberger, Hamburg, Germany, assignor to Lumoprint Zindler K.G., Hamburg, Germany

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Claims priority, application Germany Aug. 16, 1958
5 Claims. (Cl. 95—75)

The invention concerns apparatus for making copies using band-shaped layer carriers which may be stored for instance in the form of rolls, a cutting device being provided for cutting one layer carrier. This cutting device preferably cuts the positive layer carrier.

It has already been proposed to arrange in a surface developing device storage rolls for band-shaped positive and negative layer carriers. In this proposed embodiment, the positive layer carrier is again wound around a roll after the developing action. It is therefore not possible to obtain separate images of different copies in a continuous operation, except when the positive layer carrier is taken off the roll and is always cut in accordance with the images by means of scissors. Such a process abolishes the advantages inherent in the automatic developing process, because additional working costs arise.

A fully automatic developing process including cutting the positive paper encounters difficulties because of the different sizes of the originals. Up to now it has not been possible to control a cutting device automatically in such a manner that the positive layer carrier is cut off in accordance with the size of the original or the size of the image exposed thereon, respectively.

The invention provides an automatic apparatus which overcomes the above difficulties. In doing so, it must be considered that the invention is not limited to cutting the positive layer carrier as far as the cutting device is concerned, but that also a corresponding cutting of the negative layer carriers may take place, in order to then treat the cut negative layer carriers as sheet material.

In accordance with the invention, the beginning and end of the original—in a special embodiment of the invention, for instance, also of the image exposed on the negative layer carrier—are sensed and by this sensing movement of a mechanical arrangement and/or signals of an electric arrangement are used for marking the layer carrier to be cut or a synchronously running storage, and these markings are again sensed and used for the actuation of the cutting device.

As markings, changes in the surface of the layer carrier such as by stamping or by application of paint are provided. In advantageous embodiments, the invention also provides changes to the layer carrier in the form of cuts or perforations. When a synchronously running storage is used, immediate changes to the layer carrier are avoided. A magnet drum, for instance, may serve as storage element, preferably a magnetizable endless band or a wire of that kind which has associated with it writing, reading and deleting heads. The sensing may be carried out mechanically or optically, the signals or movements resulting from the sensing being utilized for the control of the cutting device.

The apparatus for making copies according to the invention preferably comprises a sensing device for the original which generates movements and/or electrical signals of a controlling member; mechanically and/or electrically operable means for marking the layer carrier or a synchronously running storage; and a device for sensing these markings and actuating the cutting device.

In accordance with an advantageous embodiment of the invention, a switch is arranged, the switching arm of which being designed as a lever and projecting into the guide path of the original, in order to control electrical

impulses, for instance, of a mechanic marking member having a lifting magnet at the guide path of the positive layer carrier. The marking member lies in the way of the positive layer carrier in front of the developing device and spaced therefrom by a distance which corresponds to the distance of the negative layer carrier from the developing device on its way thereto at the moment of marking. In an advantageous embodiment, the lifting magnet carries a special double-edged knife. In accordance with another embodiment a punching device, for instance, in the form of a stamp is provided, said stamp co-operating with a profilated counter-plate situated at that side of the layer carrier which is opposite the stamp. According to another embodiment, a device for applying paint is arranged, for instance in the form of a height-adjustable paint roll which is pressed against the layer carrier running over a guide plate in an impulse-like manner.

For sensing the marking, in dependence upon the kind of the markings either mechanical or optical sensing devices are arranged. In accordance with an advantageous embodiment, a senser which is designed as a switching arm is arranged which is elastically pressed to the through-passing layer carrier and is deflected when a deformed layer carrier or a layer carrier having an opening is passing though. According to an advantageous embodiment, the controlling impulse is released by guiding the layer carrier over a guiding surface provided with a basin-like deepening into which the switching arm may deviate when an opening passes through, for instance a hole in the layer carrier serving as a marking.

In accordance with an especially advantageous embodiment, the invention provides a magnet storage for the control of the cutting device. This magnet storage may be designed, for instance, as an endless wire loop rotating at a speed which is synchronized to that of the layer carrier, the loop being dimensioned with respect to the rotating speed in such a manner that an actuation of the cutting device always takes place at that moment when that part of the positive layer carrier arrives at the cutting device which corresponds to the marking spot. This embodiment offers the advantage that no changes are necessary to be made to the layer carrier. There is furthermore the advantage of an easy adjustability, because writing and reading heads may be easily adjusted along the rotating wire loop. This embodiment is especially suitable in connection with a cutting device which for instance owing to a cam disc being used to control the knife, allows a time minimum between two cuts. Here it is possible, by suitable displacement of the reading head, to carry out only one cut for two markings lying relatively close to one another on the storage, placing this cut in the middle between two exposed images.

The device according to the invention further comprises a surface developing device known per se having a pressure roller pair arranged above the center of the bath container and each one guide roller at the entry side of the bath container which are provided exclusively as guiding means. Preferably, one pressure roller of the pressure roller pair is removable and the device for removing this pressure roller is connected to a device which serves to lower the bath container in a manner known per se.

Furthermore, a known drying device is provided to be arranged in the apparatus, which for instance may be rigidly designed in the form of a heating plate. According to a special feature of the invention, the positive layer carrier and the negative layer carrier are guided lying side-by-side at least over a portion of the heating device, in order to accelerate the diffusion process.

According to another advantageous embodiment, in the

exposure device belts are provided for pressing and guiding the original constituting a supporting table, one portion of these belts being always guided over a horizontal distance in front of or above the exposure device. Here, the belts are especially of a material, for instance a fabric, which by lying close to and moving away from the exposure drum made, for instance, of transparent synthetic substance or glass, receives an electostatic charge, by which some holding effect is ensured when feeding the original. This electrostatic holding effect is especially advantageous if very thin originals are processed.

In accordance with a special embodiment that part of the guiding belts serving as supporting table may be covered by means of a flap which when open forms a table and is situated adjacent the belt portions serving as a support.

Further advantages and features of the invention will be seen from the following specification of an example of embodiment which is shown in the drawing.

In the drawing:

FIG. 1 is a schematic sectional side view of the apparatus,

FIG. 2 is an example of embodiment showing the production and sensing of markings in dependence upon the passage of the original,

FIG. 3 is another example of embodiment for the control of the cutting device, using a storage device.

Referring now to FIG. 1, the basic structure of the apparatus is described. Within a housing **1**, an exposure device **2**, a developing device **3**, a drying device **4**, and a cutting device **5** are arranged. Furthermore, a supply roll **6** of the negative paper is arranged in a lighttight manner in a case **7** having an exit slot **8** with curved side walls. Above the case **7**, a roller **9** for rolling the exposed negative layer carrier is provided. The positive layer carrier is stored on a roller **10**. The rollers **6** and **10** are engaged by elastic braking elements **11**, **12** arranged with the aid of a spring not shown, in order to ensure a tense running of the layer carriers.

The exposure device **2** consists of a drum **13**, made, for instance, of a transparent synthetic substance, in which the exposure device is arranged, the light intensity of which is regulated by compensating resistors in a known manner. The drum **13** is freely pivotable and arranged within a screening **14** surrounding it. The exposure device further comprises three rollers **15**, **16**, **17**, above which several belts **18** are running made for instance of a material capable of being twisted, preferably of wool or the like. The parallel movement of the belts is automatically controlled in a known manner by means of annular beads on the roller **16**. The belts preferably consist of a material which is electrostatically charged by touching the drum and parting from the drum.

The rollers **16**, **17** are arranged above the drum **13** in such a manner that the portion of the belts running between them lies in a horizontal plane. This portion of the belts serves as a supporting table, whereby as a result of the electrostatic charging of the belts a releasable holding of the original to the holding means is achieved. In the illustrated example of embodiment, the supporting surface formed by the belts is elongated by a table **19** which is hinged to the housing as at **20** and when in closed position covers the belts between the rollers **16** and **17**. By this, the apparatus is protected against dust.

Above the belts, between the rollers **16** and **17**, there is an insert slot, which in upward direction is defined by a special guiding surface **21**. This guiding surface is formed by several parallel guiding rods between which rollers **22** run, said rollers pressing the original being on the belts to the roller **17**.

At least between two rollers, a pivotable arm **23** projects into the giude path of the original between the container **18** and the guiding surface **21**. This arm is designed as a double-armed lever the end of which averted from the feed guide of the original being provided with a counter weight **24** and kept under the influence of a spring in such a manner, that the other end is deflected into the feed guide of the original. This lever is fastened to the actuating member of a snapping switch **25** in such a manner, that a deflection of the arm **23** by an original causes an actuation of the switch, and a re-deflection of the lever after the original has passed through causes another actuation of the switch. At the end of the exposure device, behind the roller **15**, a stripper **26** is arranged in order to separate the original from the negative layer carrier which travels on into the developing device **3**. The stripper **26** at the same time serves as a guiding device, in order to guide the downward dropping original into the depositing container which is opened in oblique upward direction. This container is situated at the front side of the apparatus beneath the supporting table, so that it may be easily reached from the operating side.

The developing device consists of a bath container **28** in which the level of the liquid is accurately controlled by means of a so-called chicken watering device known per se. The chicken watering device includes a container **29** which is closed on all its sides and is open to the liquid in the container only through two tubes **30**, **31**. One of these tubes **30** terminates accurately at the liquid level, while the other tube **31** projects into the liquid level and preferably ends in a sump arranged below the bottom. The container **29** is arranged at a turret **32** which, when the tubes **30**, **31** are rigidly arranged enables a deviation of the container **29** out of the illustrated position by 180° in downward direction. By this, the container **29** may at the same time be used as a tipper for discharging the container.

It is pointed out that in a special embodiment the container **28** may be arranged on a device automatically lowering the container **28** in dependence upon the movement of a controlling member still to be described. Simultaneously with the lowering movement, the liquid container **29** is deviated by 90° so that also the container **28** is emptied.

For guiding the layer carriers accurately on the level of the bath liquid in such a manner, that only that side which carries the layer and faces the bath liquid is wetted, a pressure roller pair consisting of rollers **33**, **34** and a guide roller **35**, **36** at each entry end of the container are employed. The guide rollers **35**, **36** are, for instance, rotating freely on rigidly adjusted axes. Owing to the use of band-shaped layer carriers, further guide elements may be omitted.

The pressure rollers **33**, **34** are driven over a drive assembly which is schematically indicated at **37**.

Above the pressure rollers **33**, **34**, there is situated a heating device **4**, which in the embodiment shown is designed as a plate having a vaulted surface over which the layer carriers are running. Within this heating device, for instance, heating elements as at **38** are arranged.

A special feature of the described device lies in the fact that the positive and negative layer carriers are transported together over the heating device with their layers lying side-by-side, whereby the diffusion is substantially accelerated. The drying distance which is covered by the layer carriers lying side-by-side must be exactly dimensioned with respect to the heating output as well as the wetting of the layer carriers, because too much drying might cause the layer carriers to stick together. In the embodiment shown, a deviation roller **39** is arranged lying close to the heating plate. Over this roller, the negative layer carrier is deviated, distracted and guided to the coiling roll **9**. Preferably, the arrangement of the roller **39** is adjustable in order to be able to select the distance over which the layer carriers are to be guided lying side-by-side over the heating plate.

In the illustrated embodiment the roller **39** is arranged at a lever **40** which may be arrested in different positions and which is pivotably arranged in the housing as

at 41, carrying at its bottom end the pressure roller 34. By actuation of the lever 40, the roller 39 is lifted from the heating plate and at the same time the pressure roller 34 is lifted from the roller 33. This offers the advantage that when the machine is stopped at a moment when images to be developed are within the apparatus detrimental influences are avoided, because the diffusion is interrupted by lifting the pressure rollers at the place of compression, a drying of the layer carriers lying side-by-side likewise being avoided because the roller 39 is lifted. Advantageously, the device for lowering the container 28 which is not shown in the drawing, and the means for tipping the container 29 are coupled with the lever 40 so that a movement of the lever into that position in which the roller 34 is lifted, is accompanied by a lowering and emptying of the container 28.

The positive layer carrier is distracted from the roller 10 and fed to the guide roller 36 in the developing bath via guiding rollers 42, 43. Between the rollers 42, 43, there is a marking arrangement 44 which in general consists of a lifting magnet 45, the ram of which carries the marking tool 46. Within the reach of the marking tool, the positive layer carrier is guided between two guiding surfaces 47, 48, which in case of necessity may be provided with an opening or slots to allow the tool to pass through. The distance of the marking device 44 from the spot on the roller 36 where the positive layer carrier enters the developing bath equals the distance between the entry spot of the negative layer carrier on roller 35 into the developing bath and that spot of the negative layer carrier at which the original just entering the apparatus meets the negative layer carrier.

Behind the drying device 4, over which the positive layer carrier is running, a transport roller pair 49, 50 is arranged. The transport roller pair is driven by the driving motor 37 for the pressure roller pair, by means of a rope or a belt shown in dotted lines. By this driving motor, at the same time the storage roller 9 for the negative sheet of paper likewise by means of the rope or belt shown in dotted lines.

Behind the transport roller pair, the cutting device 5 is arranged. The cutting device 5 comprises a stationary knife 51 and a knife 53 which is movable, for instance, by means of the eccentric 52. For the control of the cutting device means are provided which will be described in more detail in connection with FIG. 2.

Behind the knives 51 and 53, an exit trough 54 is arranged, which is accessible through a slot 55 in the housing. This exit trough has a guiding surface 56 with a depositing pocket 57 there below out of which the cut copies may be taken.

When the apparatus is in operation, the original is fed over the table 19. The drive for the through-pass of the layer carrier has either been switched on beforehand or is started in dependence upon a sensing switch in the guide path of the original. It is, for instance, possible to provide a pressure switch below the horizontal portion of the belts 18 which automatically starts the drive when the original is placed thereon. Positive and negative layer carriers are drawn off their respective supply rolls 6, 10 in such a manner that the side facing the layer is wetted by the liquid in the developing device. Upon the entry of the original, an impulse is generated by the switch 25 which is utilized for exciting the magnet 45 so that simultaneously a marking is produced on the positive layer carrier. This marking then starts the operation of the cutting device in a manner still to be described.

This step may be seen more clearly from FIG. 2. In this figure, similar reference numerals are used for similar impulses of FIG. 1. The electrical arrangement provided to transmit the impulse comprises a circuit 59 lying at a potential source 58. This circuit has connected to it the switch 25. The electromagnet 45 is series-connected to this switch. Thus, when the switch 25 is adjustable, the electromagnet 45 is excited by which action the anchor 60 is pulled downwardly and the tool 46 designed as double cutting knife is pushed or fulcrumed in slots in the guide surfaces 47 and 48 in upward direction up to a point where it lies above the path of the positive layer carrier between the two guiding surfaces. In the position shown in FIG. 2 the electromagnet 45 is not energized. The tool 46 is pivotally fastened to the anchor 60 via a double-armed lever 61. A spring 62 engages the levers 61, which spring pulls the knife 46 downwardly and the anchor 60 upwardly into operating position. The end position is limited by a stop 63. It is pointed out that the knife 46 extends only over an edge portion of the layer carrier. The knife is laterally guided in slots in the guiding surfaces 47, 48. The guiding surfaces ensure that the layer carrier cannot deviate during the performance of a cut or a stamping.

As the lever 23 is pivoted when an original is introduced and remains so until the whole of the original has passed over the lever 23, the movement of the knife resulting from the closing of the switch performs a cut corresponding to the leading edge, and the movement of the knife resulting from an opening action of the switch performs a cut corresponding to the trailing edge of the original.

At the right hand side of FIG. 2, the mechanical sensing device and the cutting device are shown.

The eccentric shaft 52 carrying the movable knife 53, is driven via rope 64 by means of a pulley 65 which is torsion-resistantly connected to a cam disc 66 coupled with a driving motor in the housing 67. The cam disc has a cut 68 with a cam 69 extending into it which cam is fastened to a rocking lever 70. The rocking lever is fastened to a carrier 72 as at 71. The anchor 74 of an electromagnet 75 is pivotally fastened as at 73 in such a manner that when the electromagnet is energized the lever 70 is pivoted in such a way that the cam 69 is lifted off the cam disc 66. A spring 88 engages the rocking lever 70 pulling the latter to the cam disc 66, the force of the spring being overcome when the electromagnet 75 is energized by the pulling force of the electromagnet.

The winding of the electromagnet 75 lies in series with a snap switch 76 the switching element of which being connected to a sensing arm 77. The sensing arm 77 presses the edge of the positive layer carrier 78 provided with markings. The positive layer carrier passes over a guide surface 79 at that spot of the sensing arm 77 in which a basinlike recess 80 is provided. If there is a cut in the edge of the positive layer carrier, the sensing arm 77 presses downwardly into the recess 80. By the pivoting movement, the switching member of the snap switch 76 is moved and the energization of the magnet 75 started. By this the cam 69 is lifted off the cam disc 66. This movement closes an additional switch 81 in the drive circuit of the motor in the housing 67, so that the cam disc rotates.

Meanwhile, the layer carrier 78 with its spot showing the cut has left the reach of the sensing arm 77 so that the latter may be brought again into the lifted position and the snap switch 76 may be opened. The energization of the magnet 75 is interrupted and the arm 70 carrying the cam 69 is pulled to the cam disc by the spring 88. Only when the latter has completed one rotation, the cam may again enter the opening 68, the switch 81 being simultaneously opened as a result of the lifting movement of the arm 70 and the driving motor for the cam disc 66 being switched off.

It will be seen that as a result of the rotation of the cam disc over the wheel 65 and the belt drive 64 the eccentric disc 52 is turned 360°, thus causing the knife 53 to perform a reciprocating movement.

FIG. 3 shows another embodiment of the control of the cutting device 5. In this figure, for releasing the

marking action again the snap switch **25** with the arm **23**, the developing device **3** and the cutting device **5** are provided.

Driven in dependence upon the drive of the pressure roller **33**, is a magnet drum **82** or a magnetizable endless wire guided on a circular path, respectively. Associated with this wire are three heads, i.e. one writing head **83**, one deleting head **84** and one reading head **85**. The writing head **83** is series-connected to the switch **25**. This switch lies close to a voltage source **86**. The deleting head **84** is at all times connected to this voltage source deleting all information when the drum **82** is rotating after they have been read by the reading head **85**.

The reading head **85** passes read impulses on to an amplifier **87**, which is likewise connected to this voltage source **86**. These impulses in their amplified condition are passed on to the lifting magnet **75** of the cutting device **5**. The cutting device **5** works in the way just described.

The driving speed of the drum **82** or the wire arranged on the drum, respectively, is such that the impulse generated by the writing head **83** upon the entrance of the leading edge of the original is then received by the reading head **85** when the front edge of the image developed on the positive layer carrier enters the cutting device **5**. The switch **25** is a so-called snap switch which always creates an impulse whenever the arm **23** is deflected so that one impulse is created when the arm is pressed downwardly and another one when the arm is lifted after the passage of the original. By this, the necessary impulses for actuating the cutting device at the beginning and at the end of the developed image are created. The use of a magnet storage for the marking action has substantial advantages on the one hand because an easy adjustment by adjusting the reading head is possible and on the other hand because the positive layer carrier is not influenced by the marking action. Another advantage arises especially in connection with a control of the cutting device by means of a rotating cam disc. The rotating cam disc **66** allows for the performance of a cut only at predetermined minimum spaces which correspond to the rotation time of the cam disc. Impulses received during this time, that means during the rotation time of the cam disc, cannot release the cutting device. Under consideration of the fact that the switch **25** automatically delivers an impulse on the passage of the trailing end and upon entry of the following original although both originals are lying relatively closely to one another, the reading head **85** may be arranged in such a manner that this impulse of the cutting device **5** is passed on to the cutting device **5** in such a manner that the cut is performed exactly between the two developed images. By this a margin remains between the two images which in many cases may be desirable because it facilitates the handling of the images. When working to this principle it is, however, necessary to insert the originals always at a certain distance but this will cause no difficulties when using the special feeding device with the electrostatically energized belts **18** because in this process on the one hand a scale may be applied to the belts for indicating the exact spaces and, on the other hand, a spacing of the originals is predetermined on the belts by means of their being electrostatically energized, so that the properly disposed originals also maintain their position prior to entering the rollers **22** and **17**.

It is pointed out that instead of the cutting device **5** also a winding roller for the positive layer carrier may be arranged which, concerning its arrangement and drive may correspond to the winding roller **9** for the negative layer carrier.

What I claim is:

1. A device for making copies from an original sheet and transferring the image thereof to a strip layer carrier comprising, in combination, a housing having an inlet and an outlet defined therein for the original sheet, a layer carrier outlet defined in said housing, transport means within said housing for translating said sheet and layer carrier therethrough, layer carrier supply means associated with said housing, transfer means within said housing transferring an image of said original sheet to said strip layer carrier, first fixed sensing means within said housing sensing the leading and trailing edges of said sheet, recording means operatively associated with said sensing means recording the sensing of said leading and trailing edges, layer carrier severing means adjacent said carrier outlet operatively associated with said layer carrier after the original sheet image has been transferred thereto and second fixed sensing means operatively associated with said recording means and severing means to actuate said severing means upon sensing a signal from said recording means.

2. A device for making copies as in claim 1 wherein said recording means includes a portion of the layer carrier itself and a layer carrier marking device operatively associated with said layer carrier actuated by said first sensing means.

3. A device for making copies as in claim 1 wherein said recording means includes a movable magnetic recording member within said housing driven in synchronism with said transport means, pick up, recording and erasure heads operatively associated with said magnetic recording member, said recording head being operatively interconnected with said first sensing means, said pick up head constituting said second sensing means.

4. A device for making copies as in claim 3 wherein said pick up head is adjustably supported relative to said magnetic recording member.

5. A device for making copies as in claim 1 wherein said recording means includes a portion of the layer carrier itself and a marking member adapted to slit the edge of said layer carrier upon actuation by said first sensing means, said second sensing means including a feeler engaging the edge of said layer carrier immediately ahead of said severing means adapted to be deflected upon engaging said slit.

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