

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN AND RELATING TO SENSING
 THE PASSAGE OF PHOTOGRAPHIC EMULSION CARRIERS

(71) We, AGFA-GEVAERT AKTIENGESELLSCHAFT, a body corporate recognised under the laws of the Federal Republic of Germany, of
 5 Leverkusen, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and
 10 by the following statement:—

The invention relates to apparatus for and a method of sensing the passage of photographic emulsion carriers, especially
 15 sheet films. The invention relates especially to the control of apparatus for replenishing photographic processing fluid.

It has previously been proposed to provide apparatus for sensing the passage of
 20 carriers, wherein the apparatus has at least one set of carrier rollers for supporting the carriers, and switches arranged for sensing the runthrough of the carriers, the feel levers of the
 25 switches slipping into a recess of a counter-pressure plate in the inoperative position, and trailing on the film surface when in the operative position. For less sensitive films such sensing devices may still be used, but
 30 the exposures of the prints to light and damage to their surfaces encountered with these devices is unacceptable in the case of highly sensitive X-ray films. It has also been
 35 proposed to provide sets of rollers wherein their relative movement during the run-through of an emulsion carrier has been sensed by means of an extremely finely
 40 adjusted switch in order to obtain information about the run-through of the emulsion carrier. This method is, however, very expensive.

A problem facing the Applicants was to produce an apparatus for sensing the passage of emulsion carriers that permitted the passing emulsion carriers to be sensed
 45 without being damaged.

The invention provides apparatus for sensing the passage of photographic

emulsion carriers comprising, a support for the carriers, a flap arranged in the path
 50 of the carriers and pivotably mounted about an axis parallel to the plane of the carriers as they pass through and perpendicular to their direction of movement, the flap being arranged to be deflected by
 55 the moving carriers to such an extent that the carriers are guided between the flap and the support, and the flap being so shaped that, in operation, the flap touches the carriers at an edge or edges only as they pass
 60 through, and means for sensing the position of the flap to sense the passage of the carriers.

The invention also provides a method of sensing the passage of photographic
 65 emulsion carriers wherein the carriers are sensed by means of a flap arranged in the path of the carriers and pivotably mounted about an axis parallel to the plane of the carriers as they pass through and perpendicular to their direction of movement,
 70 the carriers deflecting the flap to such an extent that the carriers are guided between the flap and a support for the carriers, the flap being so shaped that the flap touches the carriers at an edge or edges only as they
 75 pass through, and the position of the flap being sensed to sense the passage of the carriers.

When an emulsion carrier passes through, the flap is deflected in the direction of
 80 transport by the leading parts of the emulsion carriers so that the path for the emulsion carriers is cleared. Due to the movement of the flap, the sensing means for sensing the position of the flap is actuated,
 85 so that the information about the presence of a carrier can be detected by a relatively large deflection and therefore by sensing devices of large-scale tolerance such as electric switches, magnetic or photo-electric
 90 measuring instruments.

Advantageously, the edge of the flap that is to be contacted by the leading parts of the carriers is, in its undeflected position, in-

clined to the plane of the carriers at an inclination of at least 2° in such a way that the flap makes contact with the emulsion carriers only on lateral edges thereof. Preferably, the edge of the flap that is to be contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an angle of at least 2° on both sides of the flap in such a way that the flap contacts both lateral edges of each carrier as they pass through.

Advantageously, the flap is so arranged that the carriers lift the flap against the force of gravity as the carriers pass through.

Advantageously, the flap consists of a thin piece of sheet metal and the edge that is to be contacted by the leading parts of the carriers is bent for stiffening purposes in the direction of movement of the carriers.

The invention also provides apparatus for and a method of the treatment of photographic emulsion carriers which includes apparatus for, and a method of, respectively, sensing the passage of photographic emulsion carriers as hereinbefore defined. The sensing apparatus may control the addition of processing fluid to replenish the various baths.

Apparatus for and a method of the treatment of photographic emulsion carriers including apparatus for and a method of sensing the passage of the carriers will now be described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 shows the sensing apparatus in position to receive a carrier; and

Figure 2 shows a side elevation of the treatment apparatus with the sensing apparatus according to Figure 1.

Referring to Figure 1, the reference numeral 1 denotes a flap made of thin aluminium sheet, preferably 0.3 mm thick, which is pivotally mounted by lateral stub shafts 1a, 1b in pivot plates 2a, 2b, the latter being fixed firmly to the apparatus. The axis about which the flap 1 pivots is parallel to the plane of the emulsion carriers as they pass through and perpendicular to the direction in which they pass through. The position of the stub shafts, 1a, 1b relative to the centre of gravity of the flap has been so chosen that under the effect of the force of gravity, the flap moves into the inoperative position illustrated in Figure 2 with relatively little restoring moment. To stiffen the flap it is bent forward at its upper edge.

In the inoperative position the lower edge of the flap 1 is inclined to the plane of the emulsion carriers as they pass through, at an inclination of at least 2° (exaggerated in the drawing). In the described embodiment, the lower edge of the flap 1d, 1e is so inclined on both sides, in such a way that the flap increases in height (as seen in Figure 2) from

the middle to the edge. The lower edge of the flap 1 is likewise bent for stiffening purposes, but in the opposite direction to the bend on the upper edge of the flap, that is, in the direction of movement of the carriers.

In addition, an extension in the form of a screen 1c is fixed to the flap for the purpose of being sensed, in this case by entering a light barrier formed by a lamp 3 and a photo-receiver 4. In the inoperative (that is, undeflected) position the highest point of the lower edge of the flap lies slightly above a bearing surface 5 for supporting the emulsion carriers which are to be fed through. Depending on the rigidity the angles of inclination of the edges 1e and 1d may be altered. For example, in the case of softer films, the inclination may be increased, for example, to 5° .

In Figure 2 there is illustrated, in addition to the sensing apparatus of Figure 1, a feed-in section of a photographic developing apparatus with automatic roller transport. The bearing surface 5 has a recess 5a into which the flap 1 pivots in the inoperative position. In front of the nip between a first set of carrier rollers 6, 7, a guide surface 5b is provided, which guides the downwardly bent leading edges of particularly flexible emulsion carriers through the flap to the nip of the rollers 6, 7. Behind this nip there are arranged guide elements 8, which guide the carriers (for example, sheet film 13) to further sets of carrier rollers 9, 10, 11, 12 and so on, inside a first treatment tank.

The apparatus shown in Figures 1 and 2 is operated as follows.

A sheet film 13 which is to be introduced into the apparatus is laid upon the bearing surface 5 roughly centrally with respect to the flap 1 and fed into the treatment apparatus. In doing this the leading edge of the sheet film comes up against the flap 1 lying in its inoperative position as shown in Figure 1, and, as a result of continued forward movement, the sheet film displaces the flap in an anti-clockwise direction, until the flap leaves the way clear for the film to pass through. As a result of this the leading edge of the sheet film is first of all in contact with the flap over a relatively large length and, as the inclination of the flap increases, the contact surface is reduced, until, finally, as a result of being fed in centrally to the flap, the leading edge makes contact with the flap at two points only, namely, the two corners. When the film is fed in eccentrically (that is, at an inclination to its direction of movement) it makes contact with the flap at only one point, whereby a slight straightening movement is exerted on the film.

When the leading edge of the emulsion carrier 13 has passed under the flap 1, the

flap is kept in its deflected position and the two inclined edges 1d, 1e on the under side of the flap contact only the lateral edges of the film. Damage to the emulsion itself is therefore prevented.

The movement which the flap has made during this process is fairly considerable, so that the sensing can be effected in many different ways and with a generous tolerance. In Figure 2 a diaphragm type screen 1c is employed, which in the course of its pivoting movement screens the photo-receivers 4 and 4a in succession against their respective light sources.

In this way a clear and unambiguous signal is produced whenever the deflection of the flap exceeds a certain minimum value. Since when the emulsion carrier is fed into the sensing device centrally, the magnitude of the deflection of the flap is dependent on the width of the emulsion carrier, it is possible for a signal to be produced for the length and a signal to be produced for the width of the emulsion carrier simultaneously on this single sensing apparatus. The embodiment illustrated represents a relatively approximate arrangement using two light barriers, since the photoreceiver 4a is screened only by means of a much bigger deflection of the flap than that required to screen the receiver 4.

After the trailing edge of the emulsion carrier has passed through, the flap is released and returns to its initial position. The signal consequently reverts to its initial value, so that the duration of the signal is a measure of the length of the emulsion carrier which has just passed through.

This signal about the length, and possibly about the width, of the emulsion carrier may serve in known manner to control the addition of treating fluid into the treatment tank. In the case of a sensing carried out in two stages a second dosing pump, for example, may be connected into circuit or a larger outlet may be employed, or the treating fluid may be added in varying strengths according to varying widths of carrier.

Other means than the photoelectric light barriers shown in the Figures may be employed for sensing the position of the flap. Firstly, a mechanical switch can be employed without difficulty; such a switch may be kept in the open position by means of a connecting linkage on the flap, for as long as the flap is deflected. Further, other possibilities exist for sensing the position of the flap without contacting it. A particularly suitable device for this purpose is an inductive margin scanner having an oscillatory circuit containing an inductance, which is variable by means of a platelet of magnetised material fixed onto the flap and

which is advanced towards the oscillatory circuit. It is therefore sufficient for there to be on the lateral edge of the flap a piece of soft iron which when the flap is deflected is swung out of the range of the magnetic field of the inductance in the oscillatory circuit. This produces the necessary signal by the detuning of the tuning circuit. Several inductances of different oscillatory circuits may be arranged one behind the other in this region, so that in this case as well a signal may be produced for the magnitude of the flap deflection and thus for the width of the emulsion carrier which is in the process of running through. Alternatively, sensing means which operates magnetically only, or inductively only, may be used.

The measurement of the width of the carrier can be carried out if desired by using a flap the lower edge of which is inclined on one side only, that is, the lower edge of which is straight and inclined to the plane of the emulsion carriers as they pass through along its entire length. With such an arrangement the film is always laid on that side on which the edge of the flap projects out above the bearing surface. An arrangement identical to that shown in Figure 1 except that the length 1d is horizontal and not inclined would also work for film of greater width than the length 1d.

WHAT WE CLAIM IS:—

1. Apparatus for sensing the passage of photographic emulsion carriers comprising a support for the carriers, a flap arranged in the path of the carriers and pivotably mounted about an axis parallel to the plane of the carriers as they pass through and perpendicular to their direction of movement, the flap being arranged to be deflected by the moving carriers to such an extent that the carriers are guided between the flap and the support, and the flap being so shaped that, in operation, the flap touches the carriers at an edge or edges only as they pass through, and means for sensing the position of the flap to sense the passage of the carriers.

2. Apparatus as claimed in claim 1, in which the edge of the flap that is to be contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an inclination of at least 2° in such a way that the flap makes contact with the emulsion carriers only on lateral edges thereof.

3. Apparatus as claimed in claim 2, in which the edge of the flap that is to be contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an angle of at least 2° on both sides of the flap in such a way that the flap contacts both

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flap is kept in its deflected position and the two inclined edges 1d, 1e on the under side of the flap contact only the lateral edges of the film. Damage to the emulsion itself is therefore prevented.

The movement which the flap has made during this process is fairly considerable, so that the sensing can be effected in many different ways and with a generous tolerance. In Figure 2 a diaphragm type screen 1c is employed, which in the course of its pivoting movement screens the photo-receivers 4 and 4a in succession against their respective light sources.

In this way a clear and unambiguous signal is produced whenever the deflection of the flap exceeds a certain minimum value. Since when the emulsion carrier is fed into the sensing device centrally, the magnitude of the deflection of the flap is dependent on the width of the emulsion carrier, it is possible for a signal to be produced for the length and a signal to be produced for the width of the emulsion carrier simultaneously on this single sensing apparatus. The embodiment illustrated represents a relatively approximate arrangement using two light barriers, since the photoreceiver 4a is screened only by means of a much bigger deflection of the flap than that required to screen the receiver 4.

After the trailing edge of the emulsion carrier has passed through, the flap is released and returns to its initial position. The signal consequently reverts to its initial value, so that the duration of the signal is a measure of the length of the emulsion carrier which has just passed through.

This signal about the length, and possibly about the width, of the emulsion carrier may serve in known manner to control the addition of treating fluid into the treatment tank. In the case of a sensing carried out in two stages a second dosing pump, for example, may be connected into circuit or a larger outlet may be employed, or the treating fluid may be added in varying strengths according to varying widths of carrier.

Other means than the photoelectric light barriers shown in the Figures may be employed for sensing the position of the flap. Firstly, a mechanical switch can be employed without difficulty; such a switch may be kept in the open position by means of a connecting linkage on the flap, for as long as the flap is deflected. Further, other possibilities exist for sensing the position of the flap without contacting it. A particularly suitable device for this purpose is an inductive margin scanner having an oscillatory circuit containing an inductance, which is variable by means of a platelet of magnetised material fixed onto the flap and

which is advanced towards the oscillatory circuit. It is therefore sufficient for there to be on the lateral edge of the flap a piece of soft iron which when the flap is deflected is swung out of the range of the magnetic field of the inductance in the oscillatory circuit. This produces the necessary signal by the detuning of the tuning circuit. Several inductances of different oscillatory circuits may be arranged one behind the other in this region, so that in this case as well a signal may be produced for the magnitude of the flap deflection and thus for the width of the emulsion carrier which is in the process of running through. Alternatively, sensing means which operates magnetically only, or inductively only, may be used.

The measurement of the width of the carrier can be carried out if desired by using a flap the lower edge of which is inclined on one side only, that is, the lower edge of which is straight and inclined to the plane of the emulsion carriers as they pass through along its entire length. With such an arrangement the film is always laid on that side on which the edge of the flap projects out above the bearing surface. An arrangement identical to that shown in Figure 1 except that the length 1d is horizontal and not inclined would also work for film of greater width than the length 1d.

WHAT WE CLAIM IS:—

1. Apparatus for sensing the passage of photographic emulsion carriers comprising a support for the carriers, a flap arranged in the path of the carriers and pivotably mounted about an axis parallel to the plane of the carriers as they pass through and perpendicular to their direction of movement, the flap being arranged to be deflected by the moving carriers to such an extent that the carriers are guided between the flap and the support, and the flap being so shaped that, in operation, the flap touches the carriers at an edge or edges only as they pass through, and means for sensing the position of the flap to sense the passage of the carriers.

2. Apparatus as claimed in claim 1, in which the edge of the flap that is to be contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an inclination of at least 2° in such a way that the flap makes contact with the emulsion carriers only on lateral edges thereof.

3. Apparatus as claimed in claim 2, in which the edge of the flap that is to be contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an angle of at least 2° on both sides of the flap in such a way that the flap contacts both



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lateral edges of each carrier as they pass through.

4. Apparatus as claimed in any one of claims 1 to 3, in which the flap is so arranged that the carriers lift the flap against the force of gravity as the carriers pass through.

5. Apparatus as claimed in claim 4, in which the highest point of the lower edge of the flap lies slightly above the support for the carriers when the flap is in an undeflected position.

6. Apparatus as claimed in any one of claims 1 to 5, in which the flap consists of a thin piece of sheet metal and the edge that is to be contacted by the leading parts of the carriers is bent for stiffening purposes in the direction of movement of the carriers.

7. Apparatus as claimed in any one of claims 1 to 6, in which the sensing means is arranged to operate inductively, magnetically, mechanically or photo-electrically.

8. Apparatus as claimed in claim 7, in which the sensing means is an inductive margin scanner having an oscillatory circuit containing an inductance, and the inductance of the oscillatory circuit is variable by means of a platelet of magnetic material secured to the flap and movable away from the oscillatory circuit when the flap moves.

9. Apparatus as claimed in any one of claims 1 to 8, in which the flap is so shaped that carriers of different widths are responsible for deflecting the flap means by different amounts, and the sensing means comprises two or more sensing devices arranged to respond when the flap is deflected by different widths of carrier.

10. Apparatus for sensing the passage of photographic emulsion carriers substantially as hereinbefore described with reference to, and as shown in, Figures 1 and 2 of the accompanying drawings.

11. Apparatus for the treatment of photographic emulsion carriers which includes apparatus for sensing the passage of photographic emulsion carriers as claimed in any one of claims 1 to 10.

12. Apparatus as claimed in claim 11, wherein there is provided apparatus for replenishing photographic emulsion processing fluid controlled by the sensing apparatus.

13. Apparatus as claimed in claim 12, wherein the sensing apparatus is arranged to control the addition of varying strengths of processing fluid according to varying widths of carrier.

14. A method of sensing the passage of photographic emulsion carriers wherein the carriers are sensed by means of a flap arranged in the path of the carriers and pivotably mounted about an axis parallel to the plane of the carriers as they pass through and perpendicular to their direction of

movement, the carriers deflecting the flap to such an extent that the carriers are guided between the flap and a support for the carriers, the flap being so shaped that the flap touches the carriers at an edge or edges only as they pass through, and the position of the flap being sensed to sense the passage of the carriers.

15. A method as claimed in claim 14, in which the edge of the flap that is contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an inclination of at least 2° so that the flap makes contact with the emulsion carriers only on lateral edges thereof.

16. A method as claimed in claim 14, in which the edge of the flap that is contacted by the leading parts of the carriers is, in its undeflected position, inclined to the plane of the carriers at an angle of at least 2° on both sides of the flap so that the flap contacts both lateral edges of each carrier as they pass through.

17. A method as claimed in any one of claims 14 to 16, in which the flap is lifted by the carriers against the force of gravity as the carriers pass through.

18. A method as claimed in claim 17, in which the highest point of the lower edge of the flap lies slightly above the support for the carriers when the flap is in an undeflected position.

19. A method as claimed in any one of claims 14 to 18, in which the flap consists of a thin piece of sheet metal and the edge that is contacted by the leading parts of the carriers is bent for stiffening purposes in the direction of movement of the carriers.

20. A method as claimed in any one of claims 14 to 19, in which the sensing means operates inductively, magnetically, mechanically or photo-electrically.

21. A method as claimed in claim 20, in which the sensing means is an inductive margin scanner having an oscillatory circuit containing an inductance, and the inductance of the oscillatory circuit is variable by means of a platelet of magnetic material secured to the flap and movable away from the oscillatory circuit when the flap moves.

22. A method as claimed in any one of claims 14 to 21, in which the flap is so shaped that carriers of different widths are responsible for deflecting the flap means by different amounts, and the sensing means comprises two or more sensing devices arranged to respond when the flap is deflected by different widths of carrier.

23. A method of sensing the passage of photographic emulsion carriers substantially as hereinbefore described with reference to the accompanying drawings.

24. A method of treating photographic



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emulsion carriers which includes the step of sensing the passage of photographic emulsion carriers as claimed in any one of claims 14 to 23.

- 5 25. A method as claimed in claim 24, wherein photographic emulsion processing fluid is replenished under the control of the sensing apparatus.
- 26. A method as claimed in claim 25,

wherein the sensing apparatus controls the addition of varying strengths of processing fluid according to varying widths of carrier. 10

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