

Oct. 22, 1968

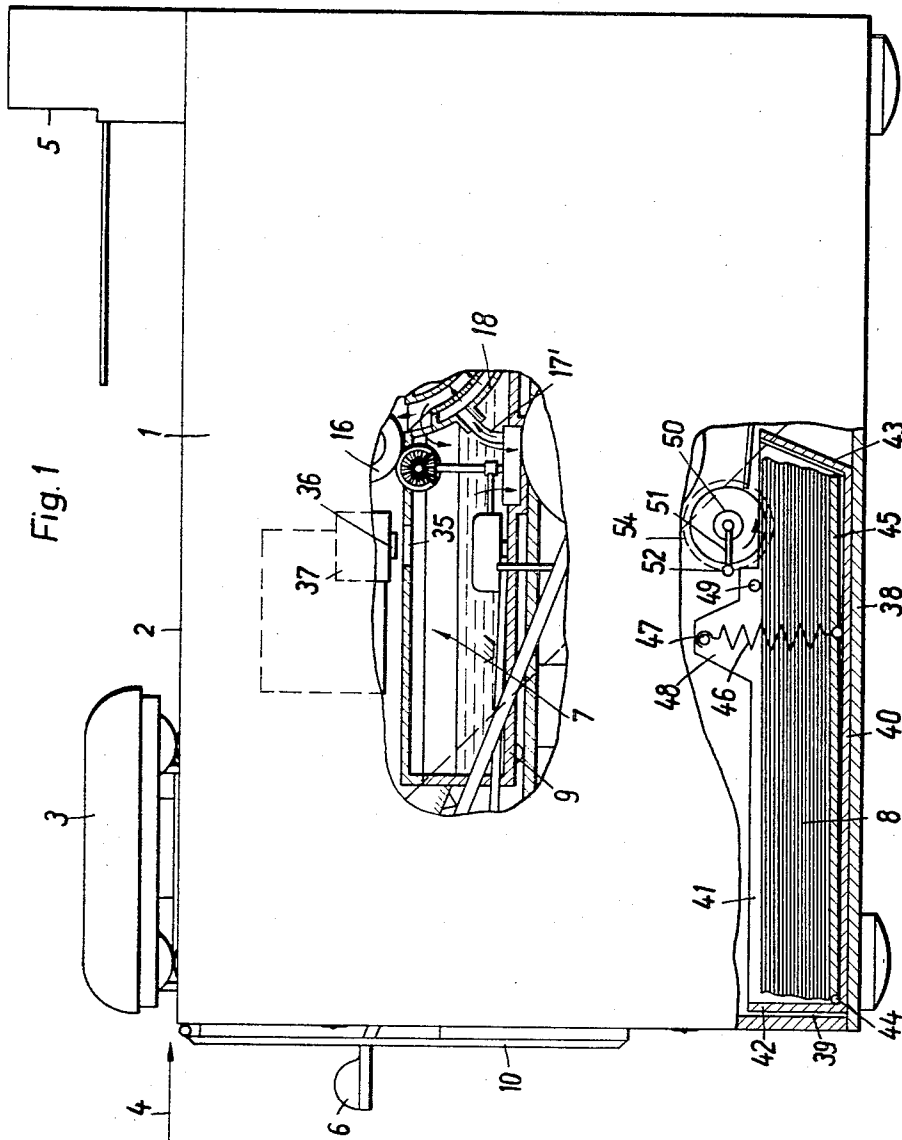
W. LIMBERGER

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APPARATUS FOR PRODUCING COPIES

Filed April 19, 1966

3 Sheets-Sheet 1



Oct. 22, 1968

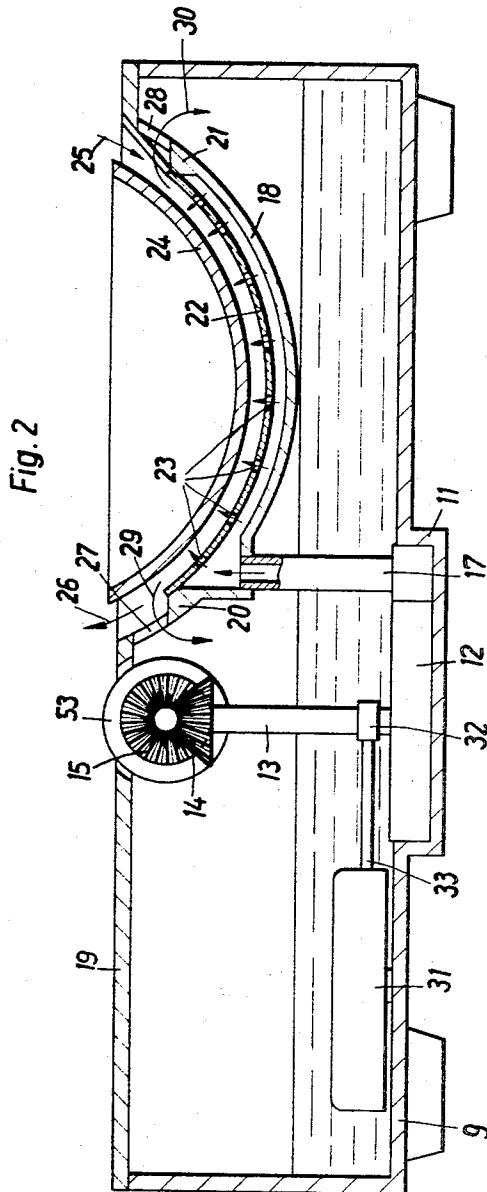
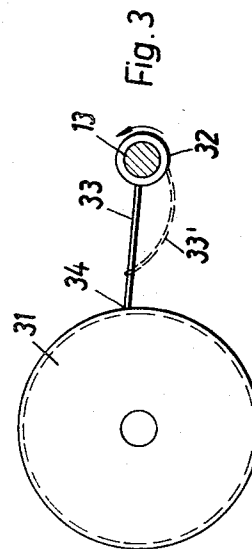
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APPARATUS FOR PRODUCING COPIES

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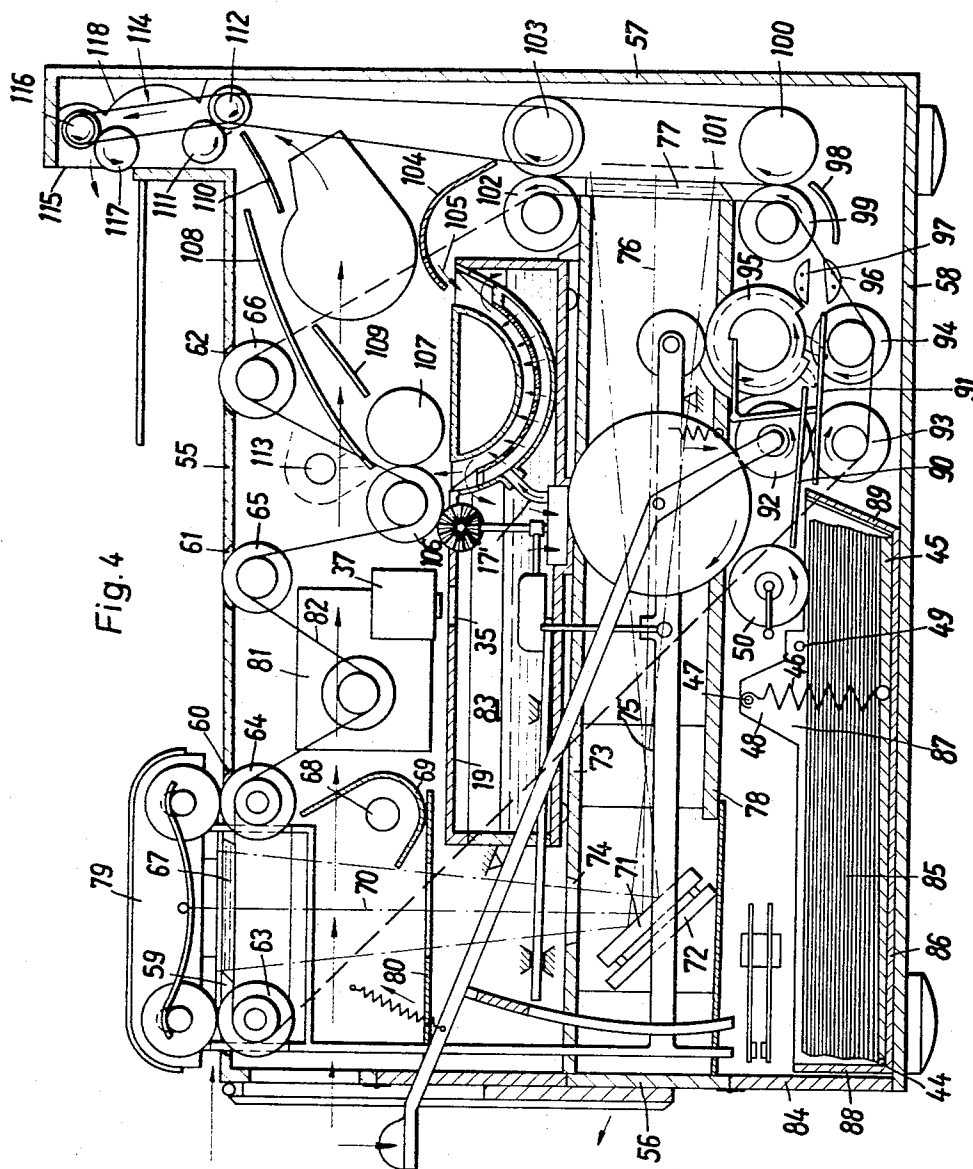
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APPARATUS FOR PRODUCING COPIES

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APPARATUS FOR PRODUCING COPIES

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5 Claims. (Cl. 118—10)

ABSTRACT OF THE DISCLOSURE

An apparatus for producing copies is provided with storage devices for developing liquid and for copying material. Each of the storage devices is provided with means for generating an acoustic signal in response to the decreasing quantity of the materials within the storage device. In a storage tank for the developing fluid, a pump having a drive means is provided for delivering the developing fluid into a developer vessel. A mallet-like member is associated with the drive means for the pump and rotates within the storage tank within the body of developing liquid. A bell or similar device is provided in the developing tank and is arranged to be contacted by the mallet as the level of liquid drops in the tank. As the liquid level drops below the bell, the sound emitted by it will change and a varying acoustic signal will be provided indicating the corresponding decrease in the liquid level. Sheets of copying material are held in a storage tray between a support plate and a transport roller for feeding individual sheets into the copying material transport system. The support plate and the roller are urged together by spring means or the like. A mallet-like member is mounted on one end of the roller and rotates with it. As the number of sheets decreases within the storage tray, the mallet begins to strike the surface of the support plate which extends beyond the sheets of copy material providing an acoustic signal indicating the decreasing quantity of sheets.

The invention relates to an apparatus for producing copies, comprising storage devices, the content of which is used up during the operation of the apparatus.

Such storage devices may be designed as storage vessels to receive the developing fluid, or as stack holders for a supply of copying material. If the developing fluid is to be stored, the vessel may be large enough to contain an excess thereof.

Known devices for producing copies comprise a developing section and a sheet feed, which may work in conjunction with an apparatus control. Moreover, such devices may also be equipped with an exposure device.

Regarding the production of copies by means of the electro-photographic method, to which a preferred embodiment of the invention relates, there are provided the necessary attachments for charging, exposing and developing the picture, for example, by burning in developer particles applied thereto, such as pigments. Also in the production of copies by the electro-photographic method, it is already known to use a liquid developer in which the pigment is dispersed. This developer may be, for example, a highly insulating oil containing pigment particles.

The present invention has the object of providing an automatic apparatus, equipped with novel and automatic devices, indicating in time that the supplies need to be replenished.

According to the invention, this object may be realized by an acoustic signal indicating the degree of charge in a storage device, wherein a revolving element is equipped with a mallet which impinges on a sounding element when

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the stored material drops below a certain minimum amount.

In a preferred embodiment of the invention, such sounding element in the developer liquid is a bell, and the mallet has the form of a resilient strip or plate, mounted on a revolving element, arranged at such a distance from the bell that the straight element impinges on the bell, whilst the element travelling through the liquid is deflected by the resistance of the liquid. In this embodiment, the bell is preferably dish-shaped, having a certain height, and during the gradual dropping of the liquid level, the liquid drops gradually below the bell, so that the sound of the bell changes as a function of the dropping liquid level, due to the gradually decreasing fluid resistance thereof. Accordingly, it is an essential feature of the invention that it achieves a tone control after the manner of the signal intensity of sound level, indicating directly to the operator the degree of charge in the tank. With pigment particles dispersed within the liquid the specific resistance of the liquid changes as a function of the enrichment in pigments so that in this case, that is to say, in the production of copies according to the electro-photographic method, also the condition of the developer fluid is indicated by the signalling device according to the invention. When the pigments have been used up to some extent, the resistance of the liquid to an element passing therethrough, drops and an acoustic signal is given.

In another embodiment of the invention in which the storage device contains a stack of sheets of copying material, associated with an intermittently actuable transport roller for removing the top sheet of the stack, the bottom sheet of which is located on a platform resiliently urged in upward direction, the roller spindle carries a mallet revolving with the roller and longer than the radius of the roller so that it impinges laterally of the stack on to the contact plate, when the height of the stack is reduced to a minimum value. Also here, a novel acoustic signal is achieved, indicating the presence of a certain amount of copying material.

The invention will be further described, with reference to embodiments shown in the drawing, indicating diagrammatically only the parts essential for the invention, whilst the other parts of the copying apparatus may be of conventional construction. In the drawing:

FIG. 1 is a side elevation of a copying apparatus with one side wall cut open to explain the parts essential to the invention;

FIG. 2 shows on an enlarged scale a detail of FIG. 1;

FIG. 3 is a top view of a part of FIG. 2, and explains different functional positions;

FIG. 4 is a side elevation of the apparatus on a more complete scale than in FIG. 1, in cross-section along different planes, and showing only the parts necessary for explaining its operation.

FIG. 1 shows the main housing 1 on the upper surface 2 of which there is a frame 3 forming part of the exposure device and adapted to receive an original in the direction of the arrow 4. Reference numeral 5 indicates the delivery slot for the copies; it should be mentioned that the sheets of copying material are stored inside the housing and supplied in the rhythm of the apparatus. The process is initiated by a lever 6 protruding from the front of the apparatus and is depressed for switching on the drive.

The individual control members and the special construction of the exposure and developing sections, and the driving and feeding means for the copying material do not form part of the invention and are not described in detail.

The present invention relates to the storage devices. The opened front wall of the housing shows two storage devices, namely a developing device 7, shown on an

enlarged scale in FIG. 2 and explained with reference thereto, and a storage device for copying material of which a stack 8 may be seen through the broken away front wall of the housing.

In the following the invention will be explained first with reference to the developing device, with special regard to FIGS. 2 and 3.

As shown in FIG. 2 the developing device has a housing 9 which can be withdrawn through a flap 10 in the front wall of the housing. This housing 9 is trough-shaped and has in its bottom a recess 11 containing a pump 12. The pump is driven by a vertical shaft 13 and a gearing 14, connected by a transmission, not shown, with a drive motor. For example, the bevel gear 15 of the gearing may have a rim cooperating with a squeeze roller 16 (FIG. 1) at the outlet of the developing section.

The suction socket of the pump 12 terminates in the lower part of the trough 9. The delivery socket 17 extends in the form of a tube upwardly and leads into a trough-shaped vessel 18 arranged in the form of a concave dish in the cover 19 of the tank 9. This vessel 18 may have, for example, a part circular cross-section. Near its ends it has lugs 20, 21 extending over its entire width and carrying a perforated plate 22, adapted in shape to the trough 18. This plate has several rows of holes 23 extending over the entire surface from the lug 20 to the lug 21 and arranged in steps, i.e. laterally offset in the direction of movement.

In spaced relationship above the plate 22 a suitably arcuate dish 24 is mounted in the side walls of the trough 18. The copying material passes through the chamber between the dish and the plate in the direction of the arrows 25, 26.

Above the lugs 20, 21, there are reflux or overflow orifices 27, 28 through which the developer fluid flows back into the tank 9 along the path of the arrows 29, 30. In the zone of the opening 28, the arcuate plate is perforated.

The developing device of FIGS. 2 and 3 provides simultaneously for an acoustic indication of the degree of charge in the tank 9. A bell 31 is mounted at the bottom of the tank 9 at a certain distance from the shaft 13. The lower part of the shaft is equipped with a fixed bush 32, on which is mounted a rod, strip or plate 33 extending radially from the shaft 13. This plate or strip 33, extending preferably vertically in cross-section, is elastic, and may be made of metal or plastic. During the rotation of the shaft 13, the resistance of the liquid in the tank causes the plate or strip 33 to bend, as indicated at 33' in FIG. 3. In this bent state, it does not make contact with the bell 31. However, when the level of the liquid in the tank drops, its resistance becomes smaller or disappears altogether, and the plate or strip 33 assumes its straight position, in which its end which may be equipped with a small hammer, contacts the bell 31, causing it to ring in consequence of the rotation of the shaft 13.

Since the bell 31 has a certain vertical dimension, the sound will change as a function of the gradual rise of the bell above the liquid level. The sound will gradually become brighter until the tank 9 is completely empty, so that a variable acoustic signal is obtained which indicates, after some experience, whether a few more copies can be made, or whether the liquid must be immediately replenished. The invention therefore provides an element operating as an acoustic liquid level indicator on a purely mechanical basis and supplying a signal changing as a function of the liquid level.

FIG. 1 shows that the cover 19 of the developing device has a hole 35 above which is arranged the delivery socket 36 of a tank 37 for developing fluid or for pigment particles. The tank may be opened by any known means, for example by a push button.

Whilst in FIG. 2 the tubular delivery pipe 17 extends rectilinearly upwardly, FIG. 1 shows a curve construction of the delivery pipe 17', which may be a hose and terminates at a lower point in the trough 18 than in FIG. 2.

At the bottom 38 of the housing 1 there is a chamber

with a drawer shaped container, accessible through a flap 39, and containing a stack 8 of sheets of copying material. The stack 8 is mounted on a slide, consisting of a base plate 40, side walls, of which the rear wall 41 is shown, and an end wall 42 serving as abutment. Within the housing is a limit stop 43 for the drawer-shaped container in the form of a wall extending obliquely upwardly and to the right, above which the sheets of copying material are detached.

The stack plate rests on a support plate 45 articulated to the base plate 40 by a joint 44. Within the zone of its front end the support plate is affected by springs on either side of the stack, as at 46. The upper ends of these springs are mounted in a support 47 located at a raised projection 48 of a side wall 41. In addition, the side walls are interconnected by a bar-shaped abutment 49 against which the top sheet of the stack is pressed when the arrangement is outside the housing.

The support plate 45 extends at least on one side beyond the stack and consists preferably of a material ringing under impact.

Several rollers are mounted in assembly walls of the housing extending parallel to the drawing. An intermittently actuatable delivery roller 50 acting on the top sheet of the stack is located above the stack 8 near its end in the centre of the housing. The lower periphery of this roller is seen to be somewhat below the abutment 49.

One end of this roller carries a radial mallet 51 whose hammer 52 protrudes beyond the periphery of the roller. The mallet may be made of elastic wire. The hammer 52 makes contact adjacent to the stack with the vertically movable support plate, when the stack has been reduced to a few sheets, that is, when the paper has been largely used up. The mentioned construction of the vertically movable hinged support plate 45 of a ring material results in acoustic signals when the stack is used up. Also here the principle of an acoustic signal is used with simple mechanical means for indicating the degree of charge of the copying material store. Of particular importance is the vertically movable support plate 45 because it is moved into the range of the hammer with the increasing consumption of sheets of copying material.

It should be pointed out that the bevel gear 15 in FIG. 2 may be directly connected with a drive motor 53. Accordingly, as shown by dotted lines in FIG. 1, the roller 50 may be provided in its axial extension with a drive motor 54.

FIG. 4 shows a more complete representation of the apparatus, but also here only the essential elements are dealt with in their mutual relation.

The automatic apparatus according to the invention has a top cover 55, a front wall 56, a rear wall 57, a base plate 58 which may be equipped with legs. The top cover 55 has holes 59, 60, 61, 62 through which guide rollers 63, 64, 65, 66, mounted in side or assembly walls, extending parallel to the drawing, protrude with a part of their periphery over the top 55 of the housing, by an amount of, for example, 1 or 2 millimeters.

The top cover 55 has between the holes 59, 60 and the guide rollers 63, 64 a transparent exposure plate 67 extending at least over the width of the copying material to be processed and over which an original is passed.

The exposure plate is irradiated from below by at least one light source 68 arranged within the housing, for example by a tubular lamp, arranged in a reflector 69 which directs the radiation towards the exposure plate 67, but is located outside the picture beam, indicated by a dash-dot line 70. This beam impinges on a deflecting mirror 71, arranged, for example, on a three-point suspension on a plate 72 fixed in the housing. The beam passes via the mirror 71 through an intermediate partition 73, having an orifice 74; this orifice has a width corresponding to the picture beam. Behind the mirror 71, there is an objective lens 75.

The exposure beam has an L-shaped configuration and passes along a horizontal path 76 to a guide surface 77,

which is also transparent in the same way as the exposure plate **67**. The substantially vertically located guide surface **77** defines a channel with the upper wall **73** and the lower wall **78**. These walls define between themselves the horizontal section of the L-shaped exposure beam towards the top and bottom between wall portions of the housing, extending parallel to the plane of the drawing and mounted on the housing walls.

As may be seen from FIG. 4 the exposure device has a special frame **79** with counter-spins located therein. The frame may be detachable and serves for guiding an original over the transparent exposure plate **67**.

The upper zone of the housing forms a space above a shutter plane **80**, shown only in part, with a motor **81** arranged thereabove, adapted to drive the revolving parts of the apparatus by means of a cable drive **82**.

The developing section **83** is located underneath this part and is shown enlarged in FIG. 2.

As may be seen from FIG. 4 the development device **83** is mounted on the partition **73**. The cover **19** has an opening **35** above which is arranged the delivery socket of a storage tank **37** for developer fluid or for pigment. The container may be opened from the outside by known means, for example by a push button.

Under the partition **78** is the chamber with a drawer shaped container, accessible through the flap **84** and adapted to hold a stack **85** for sheets of copying material (indicated at **8** in FIG. 1).

The slide for the stack **85** consists of a base plate **86** (**40** in FIG. 1), side walls of which one, **87** (**48** in FIG. 1), is shown and an end wall **88** (**42** in FIG. 1) serving as abutment for the stack. Within the housing is a stop **89** (**43** in FIG. 1) for the drawer shaped container in the form of a wall directed obliquely towards the top right and above which the sheets are detached. The stack **85** (**8** in FIG. 1) rests on the support plate **45** described in conjunction with FIG. 1.

Downstream of the storage mechanism there is a transport section, defined on the top and bottom by perforated guide faces **90** and **91**. Disk-shaped portions of rollers **92**, **93**, **94** project into these perforations. The said rollers are continuously driven in the direction indicated by the arrows, after the apparatus has been switched on. The rollers **92**, **93** run adjacently. The roller **92** is associated with a control cam roller **95**, mounted easily rotatably between the assembly walls, and carrying out certain control functions, not described in detail. The guide section formed between these parts extends through a charging device **96**, **97** in the assembly walls, equipped with corona discharge wires. The guide track is then reversed by the curved guide face **98** towards a pair of transport rollers **99**, **100**, driven in the direction of the arrows, for example by means of the belt drive **82**. This pair of transport rollers is in front of the lower end of the guide face **101**. A pair of transport rollers **102**, **103** driven in the direction indicated by the arrows, is arranged on the upper end of this guide face. A guide member **101** may extend between the rollers **100**, **103** which may be biased by spring pressure towards the guide face.

Above the contact zone between the rollers **102**, **103**, there is another curved guide member **104** for guiding the sheet of copying material towards the inlet of the developing section **83**, already described, as indicated by the arrow **105** (**25** in FIG. 2). Above the outlet of the developing section are rollers **106**, **107**, one of which is shown at **16** in FIG. 1, and the transport section extends from above these rollers between guide members **108**, **109**, **110** to driven pairs of rollers **111**, **112**. The said guide member **108** and preferably all the other guide members have perforations. They may consist of strips, wires or perforated plates. A heating radiator **113** is arranged above the guide element **108**, for example within a reflector, or with a certain direction of radiation, so that the guide section is heated.

In the zone of and above the rollers **111**, **112**, the whole

housing has a chimney-shaped projection **114** with a delivery orifice **115**, directed towards the left side. Transport rollers **116**, **117** driven in the sense indicated by the arrows are mounted in front of this delivery orifice. Between the said pairs of transport rollers **111**, **112** and **116**, **117**, respectively, there are preferably guide members **118** in the form of webs or wires, located in a vertical plane, permitting an air flow in the vertical direction and guiding the copying material towards the rollers **116**, **117**.

It may be seen that the device is intended for the processing of electro-photographic material, whilst only the parts essential for the operation have been discussed. For example, the connections for the charging station **96**, **97** to a high voltage source or the like are not shown because known means can be used for this purpose.

I claim:

1. In an apparatus for making copies on an exposed sheet of copy material with a housing containing transportation means for guiding the copying material, a storage container for the copying material arranged therein in sheets in the form of a stack, a guide track for a sheet of copying material and transportation means for carrying a sheet of copying material into the said guide track; a developing device for the copying material in the guide track, comprising: a storage tank with developing medium, consisting of the dispersion of a pigment in a liquid, an acoustic signal generator indicating the degree of charge ing material is passed, connecting and pumping means for carrying the developing medium from the storage tank into the arcuate guide, driving means for the said pumping means located at a lowest point of the storage tank, a revolving element in the said developing medium, and connected to the driving means, the arrangement of an acoustic signal generator indicating the degree of charge at least of the storage tank, said signal generator being arranged in the form of a mallet on the revolving element, the arrangement of a sound producing element within the developing medium within reach of the said mallet, wherein the end of the mallet reaches the sounding element and generates a noise when the store in the said storage tank drops below a certain minimum value.

2. A device for producing copies comprising a housing, a developing device disposed within said housing, at least one storage device disposed within said housing for holding individual sheets of copying material, guide and transport means for selectively guiding individual sheets of copying material through said developing device, said storage device comprising a stack holder for said sheets of copying material, a support plate in said stack holder for supporting the stack of sheets of copying material, said support plate arranged to extend beyond the width of the stack of sheets of copying material, a rotatably mounted transport roller disposed above said support plate and arranged to be in contacting relationship with the top sheet in the stack of sheets of copying material, drive means for intermittently driving said transport roller for displacing one sheet of copying material from said storage device at a time, spring means arranged to urge said support plate and said transport roller together, means for generating an acoustic signal indicating the quantity of copy material in said stack holder as a function of the decrease in the distance between said support plate and said roller.

3. A device for producing copies, as set forth in claim 2, wherein said means for generating an acoustic signal comprises a mallet arranged on the shaft of said transport roller, said mallet having a radius greater than the radius of said roller and disposed to rotate in a plane adjacent to and spaced from the edge of said stack of sheets of copying material, said support plate made of a material arranged to give off a sound when it is struck, whereby said mallet rotates with said transport roller and as the number of sheets in the stack decreases the mallet commences to strike the support plate and generates a sound when the level of the sheets in the stack decreases below a predetermined minimum level.

4. A device as claimed in claim 2, wherein the developing device operates with a liquid developer consisting of a dispersion of an additive in a liquid and comprising a storage tank for the liquid developer, wherein a rotatable shaft is located in the storage tank, and driving means are provided for the said shaft, a mallet in the form of an elastic strip with vertically elongated cross-section is arranged on the shaft, which strip tends to bend more or less as a function of the resistance offered by the liquid developer, and comprising further a sounding device in the liquid, having the shape of a bell, and so spaced from the shaft that it is contacted by the end of the mallet when the same is substantially straight, whilst the mallet by-passes the bell owing to its deflection caused by the comparatively high flow resistance of the liquid developer.

5. A device as claimed in claim 4 wherein the bell has a certain height and is gradually liberated as the liquid level drops, whereby the effects of the liquid on the bell are variable as a function of the liquid level in the tank, and the sound of the bell changes on impact by the mallet in consequence of the differential damping by the differential liquid level.

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