Feb. 21, 1967 G. CRANSKENS ETAL 3,304,849

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5 Sheets-Sheet 1

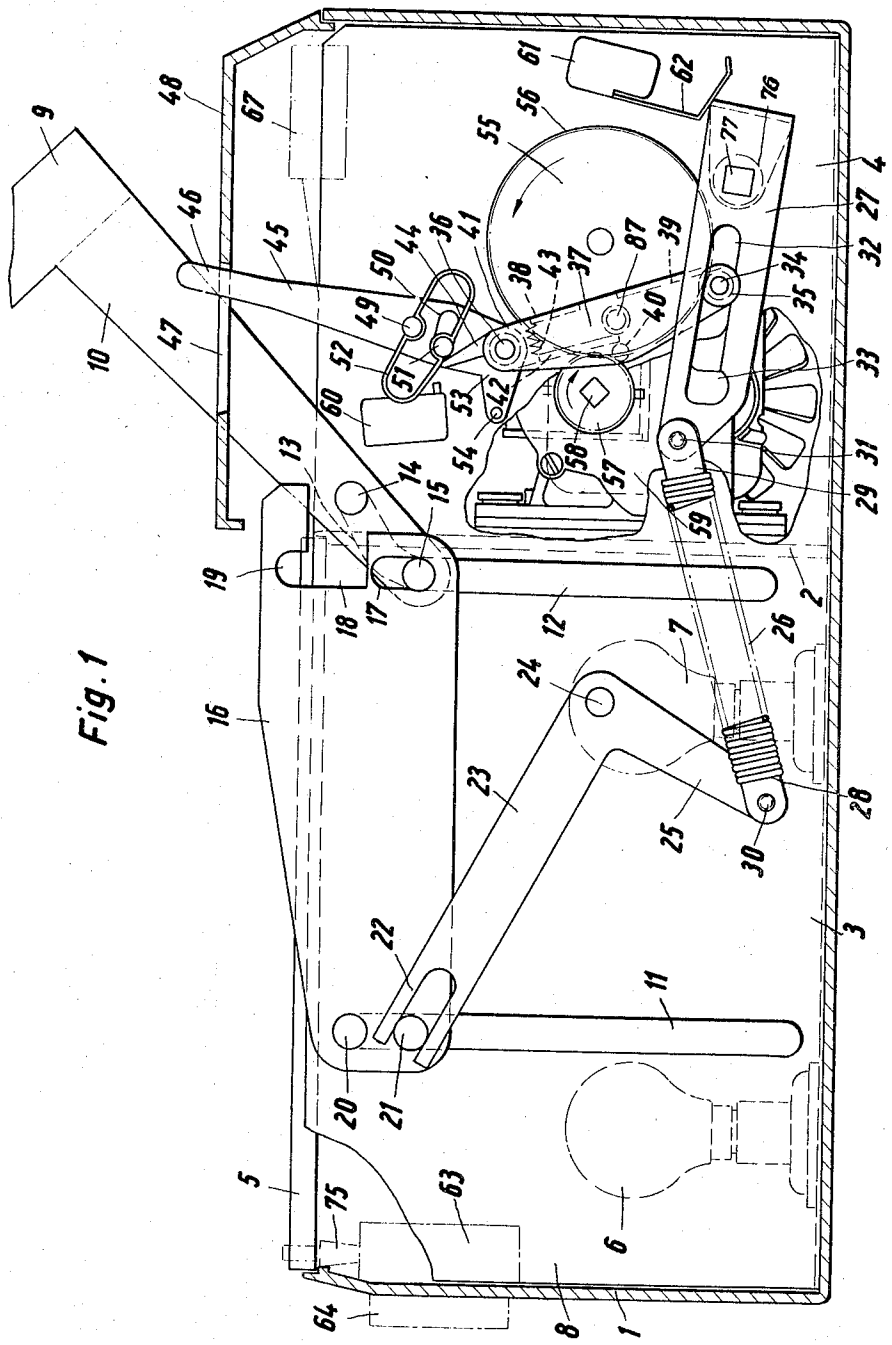

Fig. 1

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5 Sheets-Sheet 2

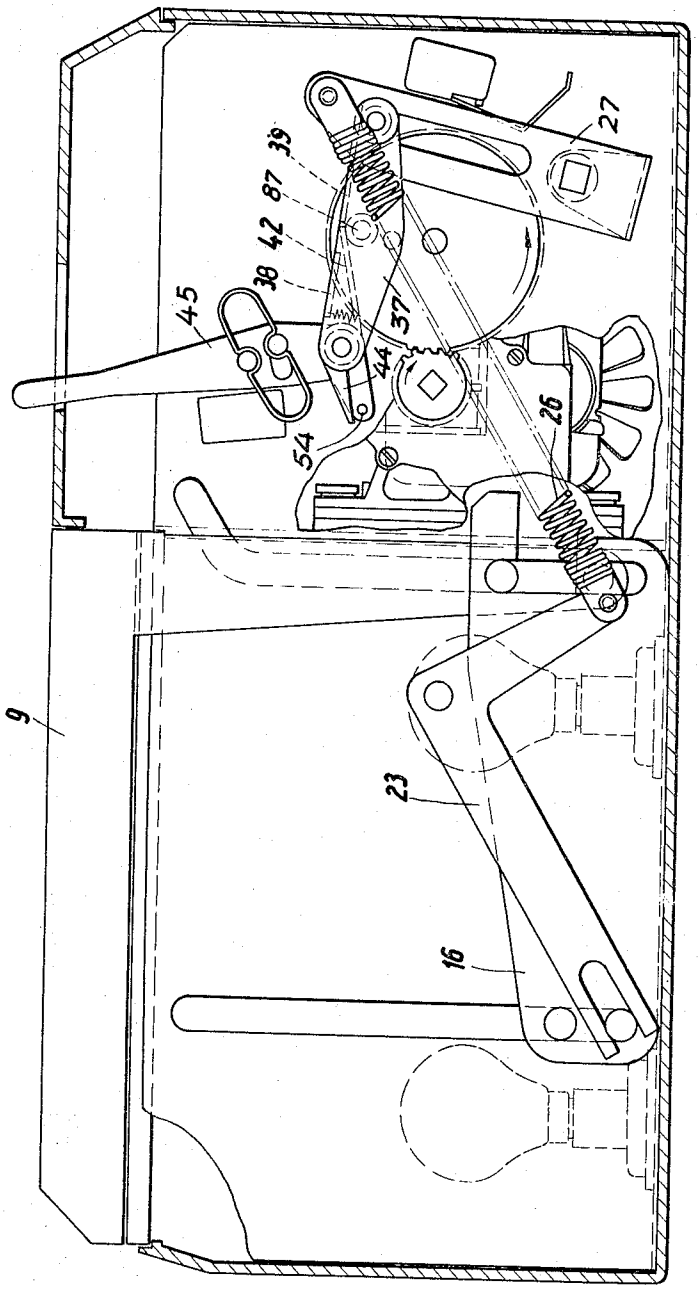

Fig. 2

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5 Sheets-Sheet 3

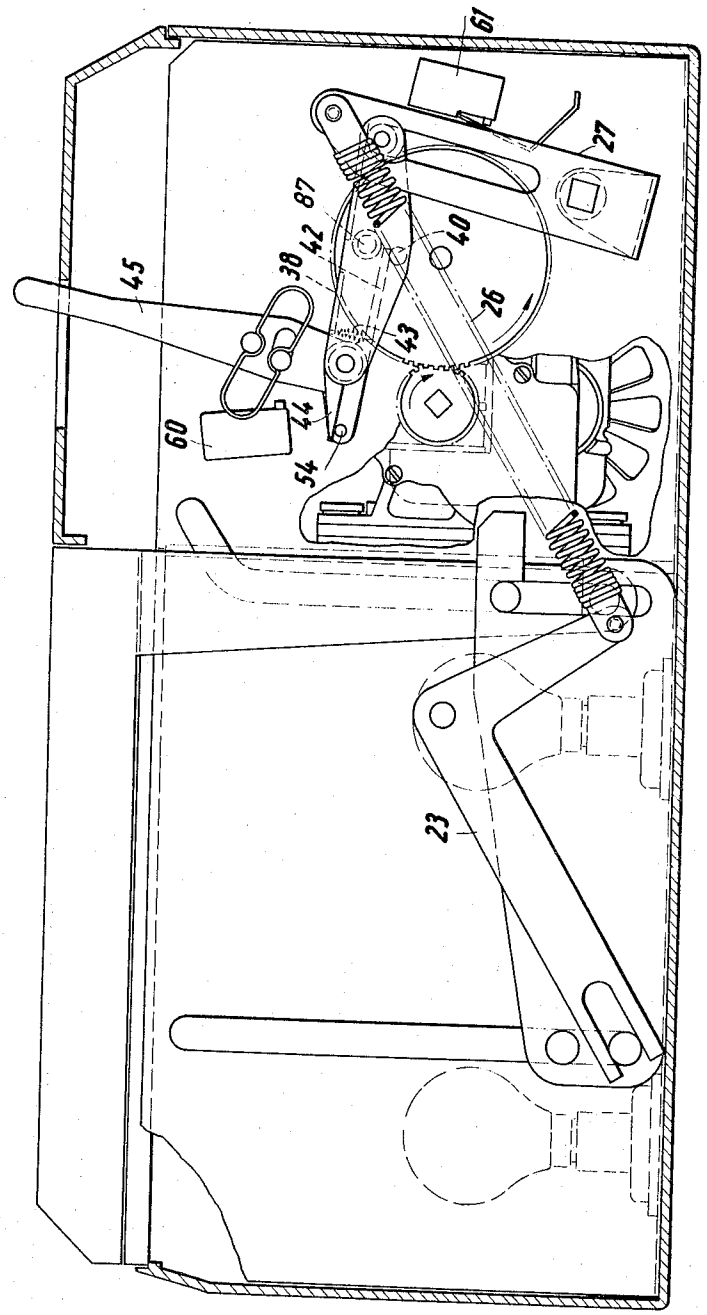

Fig. 3

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Fig. 4

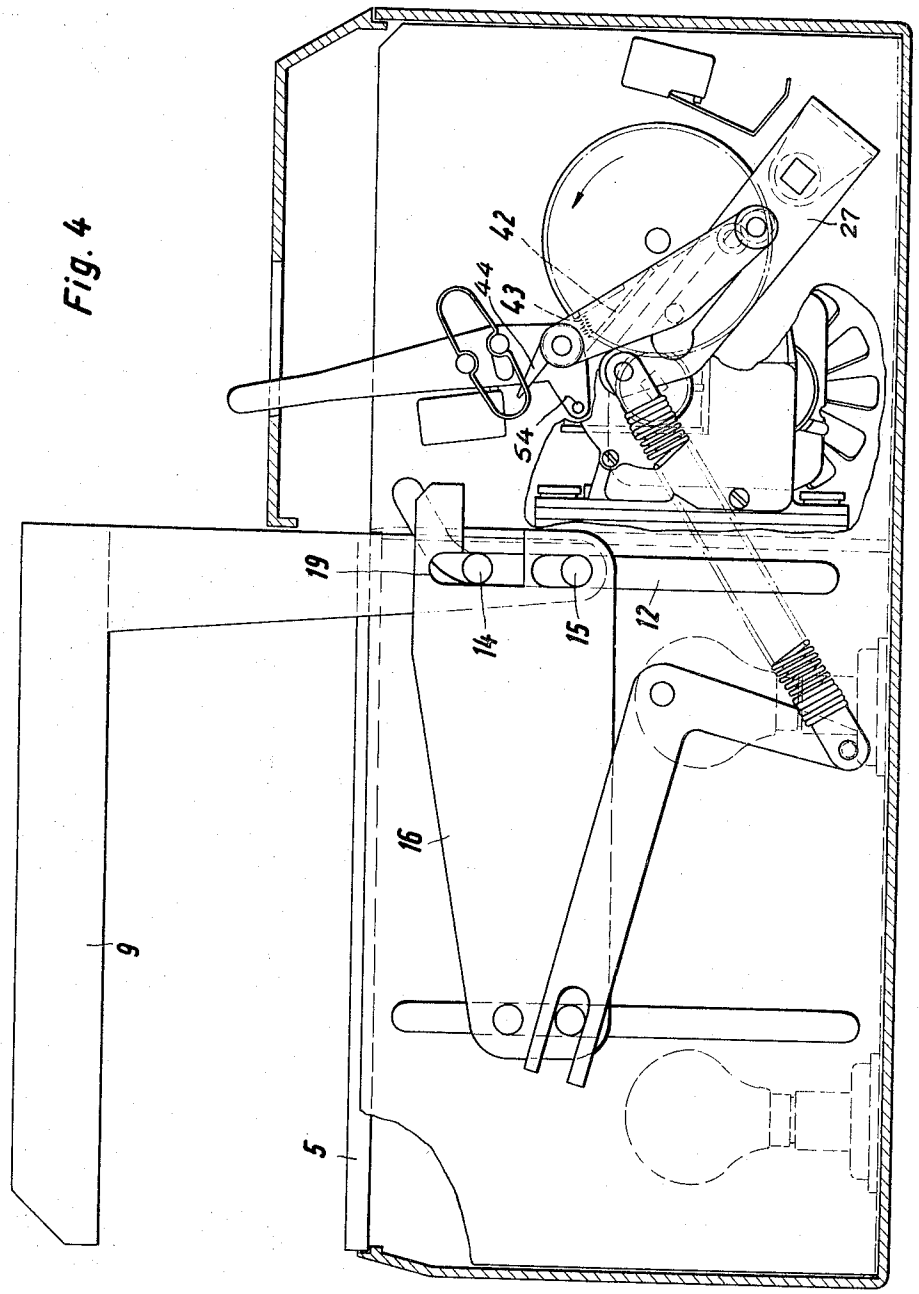

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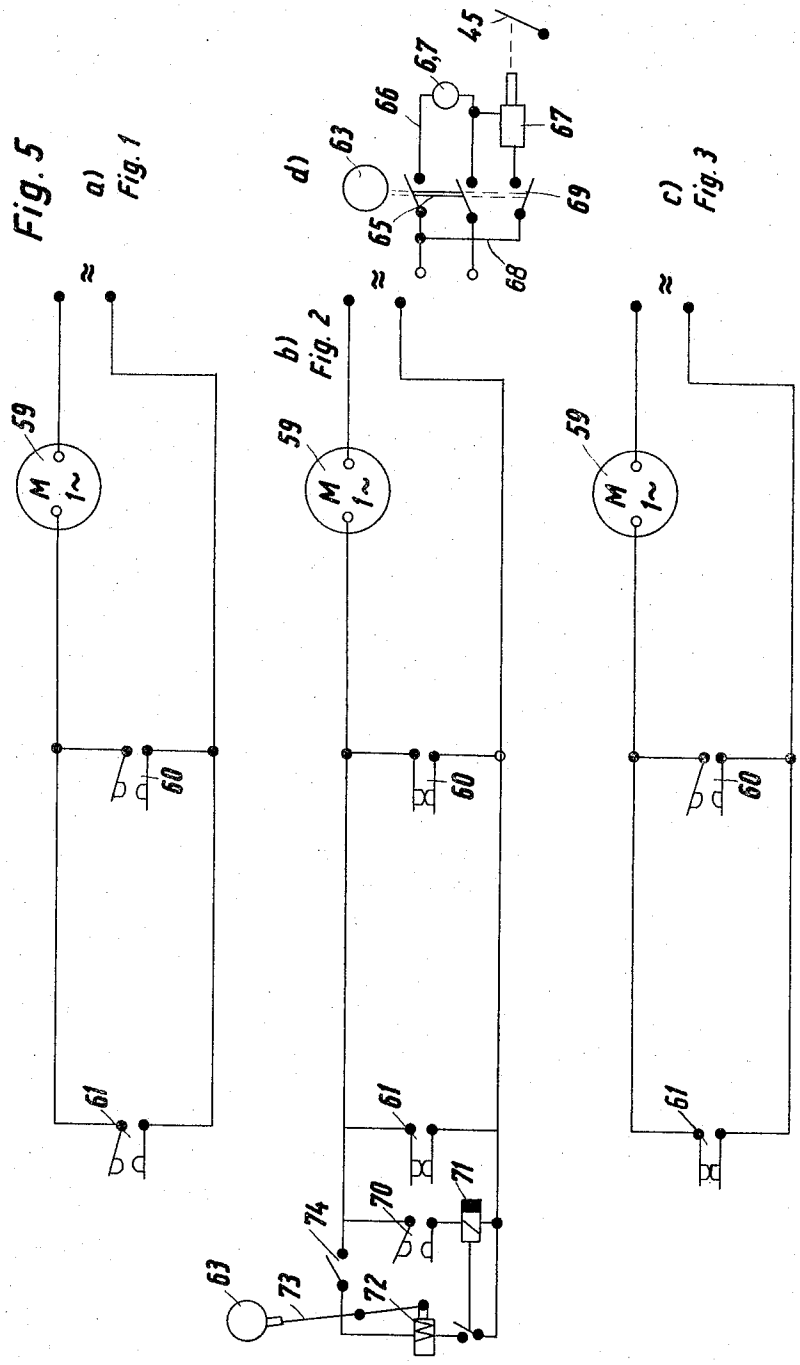
Fig. 5



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United States Patent Office 3,304,849 Patented Feb. 21, 1967

3,304,849

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Claims priority, application Germany, June 5, 1963, L 45,025
10 Claims. (Cl. 95—73)

The invention relates to a copier with a supporting surface permeable to radiation and more particularly to light, comprising on one side thereof a source of radiation such as light and on the other side a contact cover of adjustable height adapted to press against the supporting surface at least one copy sheet and an original, the apparatus further comprising resilient means for elastically pressing the contact cover against the supporting surface, taking into account the thickness of the original and/or the copy sheet.

The radiation source may be a set of thermal radiators enabling a copy to be made under the action of heat and with the use of suitable materials as known in the art.

When the sources of the radiation are light sources and the contact base is correspondingly transparent, the invention provides a so-called planar exposure device used for exposing the copy sheet which is then passed conveniently through a developer in conjunction with a receiving material, or a copier comprising such a planar developing device together with a developing device having actuatable parts such as squeeze and transport rollers and a pivoting lever for actuating a tank for the developing fluid, as well as a motor for the automatic actuation of these parts.

In known apparatus with a cover, this cover is operated by hand; then a previously preset exposure clock or a drive motor is switched on in order to effect the exposure and to actuate the moving parts of an associated developing device. It is known, for example, to release the height-adjustable contact cover in response to the action of the exposure clock by means of a magnet, allowing a transport means to become effective whereby the copy sheet is carried into the developing device.

The manual operation of the contact cover, which may be either pivotable or movable translatorily parallel to the contact supporting surface presents certain difficulties, because in this case the cover is moved or retained generally against the force of a spring tending to lift the cover. Either the cover is held by hand in its position for the duration of the exposure, which is inconvenient and tiring, or there is provided a crank drive which is self-locking in the contact position and in the lifted position by moving beyond its dead-center points. However, even this automatic movement of the contact lever is somewhat unsatisfactory even if the crank is actuated via a transmission, since it requires a certain amount of time and effort for its operation.

There are also still in use planar exposure devices in which a contact cover is lockable in position by means of clamps and the contact is made by a complex pneumatic pumping arrangement which inflates a pressure cushion. This construction is particularly wasteful from the point of view of time and effort.

The present invention has for an object the provision of a copier, and more particularly a planar copier, which no longer requires the effort heretofore needed for operating the contact cover and in which it is only necessary to operate a lever in order to move the contact cover into its operative or its inoperative position.

It is a further object of the invention to provide an apparatus with a contact cover which may be operated

with the least possible expenditure of working time and effort.

It is a further object of the invention to provide an apparatus with a contact cover which may be simply operated and wherein the contact cover adjusts itself automatically to the thickness of the original.

It is yet another object of the invention to provide a radiation apparatus with a contact cover which can be operated so easily that the operator can devote more attention to the correct insertion and contact of the copy sheets and their further treatment since he is relieved from carrying out the rather long adjustment for operating the contact cover.

According to the invention, the contact cover, movable in height, is actuated by a motor, which urges the contact cover into its contact position by means of a spring under tension and restores it, upon the actuation of an actuating lever, into an elevated position in which the motor is deenergized.

With the use of thermal developing, the invention relates to a complete copier with a stationary operational position of the copy sheet for carrying out the copying, or to a planar developing appliance having a movable member in the form of an electric drive motor.

It should be noted in this conjunction that certain special problems arise from the fact that an actuating lever, which in one of its positions also turns off the machine, cannot exclusively and directly control the drive motor because during its movement into the "Off" position the lifting of the contact cover must also be effected. This results in certain difficulties which have hitherto prevented this object from being satisfactorily realized.

Although there are already known pivotable or translatorily movable contact covers, these solutions are not quite satisfactory, because, on the one hand, with a pivotable contact cover special adjusting means are required on the articulated side for adjustment to the thickness of an original, and, on the other hand, with contact covers with translatory movements only a limited interspace was available between the contact cover and the supporting surface for introducing the original and the copy sheet.

In the case in which the contact cover moves at least prior to the contact with the supporting surface substantially parallel thereto, a preferred embodiment of the invention provides that the cover is automatically pivotable into its raised position automatically after a translatory movement way from the operating location. In this manner the advantages of both movements of the cover are combined whilst the hitherto experienced disadvantages are avoided.

According to a particularly preferred embodiment of the invention, in a copier with an exposure clock or timer for controlling the radiation sources, the exposure clock has a contact for an operating magnet for moving a lever into its Off position wherein the energization of this magnet after the lapse of the exposure time causes automatically the opening of the cover and the de-energization of the motor. In order to provide fully automatic operation, a member operated by the contact pressure of the cover is provided for switching an exposure clock. The term "exposure clock" used in this description is defined, in its wider sense, as a timing element switching the radiation sources on and off.

According to a further feature of the invention the cover is mounted on supporting levers each of which is guided by two studs in a slotted guide, bent at its upper end to enable the pivoting of the cover and comprising preferably a guide plate movable parallel to and serving as a movable support mounting for at least one stud.

The switching lever energizes, according to the invention, the motor for driving an actuating mechanism; the

motor circuit comprises two switches connected in parallel, one of which is actuatable by the switching lever; and the other is controlled by a toggle lever in the driving mechanism and breaks, after the reversal of the switching lever, the motor circuit only after the parts of the driving mechanism have been restored to the position corresponding to that of the raised cover. In this manner, the arrangement of the switching lever provides a control handle which controls automatically the necessary operational functions or stages including particularly the de-energization of a distinct driving mechanism which is located within a housing and need not necessarily be connected with the cover or with a part rigidly connected therewith.

Preferably, this driving mechanism has a motor-driven crank plate whose pin collaborates with a control lever, the mechanism further comprising at least one fixed rail and one trip lever movable relatively to the said control lever and pivotable by the switching lever into a position forming an abutment for the crank pin. This arrangement provides simple means for performing the dual function of turning the motor on for the exposure and thereafter lifting the cover, with subsequent stopping of the motor, upon a return movement of an on-and-off lever.

Preferably, the said trip lever has a lug engaging a tappet during the movement of the on-and-off or actuating lever into the off position so as to move the trip lever into a position in which it forms an abutment for the crank pin in order to return the control lever.

Conveniently, the control lever operates, via a lever arrangement translating the movement, a spring member which causes the cover to be lifted by means of a crank lever, this spring member being tensionable in order to provide the contact pressure for the cover but acting as pressure member during the last phase of the cover-opening movement.

When the copier is equipped with a developing device having a drive motor for its movable parts, the invention provides as the power source for the contact cover a coupling between this drive motor and a member of the cover-drive mechanism, specifically the said crank plate. The switching lever serves here conveniently for engaging and disengaging the coupling after switching on the appliance, or else the coupling may be automatically engaged during the switching on in order to move the contact cover into its operative position, whilst after the lapse of the exposure time the coupling may be automatically disengaged as hereinbefore described so that the contact cover is lifted off and the development can be carried out. This last solution is regarded as particularly important because only a single actuating member is required for such a combined apparatus and the apparatus is placed in readiness for the next copy by the winding up of the exposure clock which prepares the system for the motorized operation of the cover, possibly by means of a further pushbutton-type operating member.

The invention will be further described, by way of example, with reference to an embodiment shown in the accompanying drawing, representing in a diagrammatical form only those parts of a thermal copier with planar exposure device necessary for the realization of the invention, without, however, restricting the invention to this preferred embodiment.

In the drawing:

FIG. 1 shows with parts broken away, a cross-sectional side elevation of the apparatus according to the invention in its starting position;

FIG. 2 is a view corresponding to that in FIG. 1, with the contact cover in its operating position in contact with the supporting surface;

FIG. 3 is a view corresponding to that in FIG. 1, showing the apparatus in an intermediate position be-

FIG. 4 is a view corresponding to that in FIG. 1, showing an operational position for moving the contact cover into the contact position after the actuation of the switching lever and after the start of the initial movement of the contact cover; and

FIGS. *5a* to *5d* show different circuits useful for explaining the conditions of the control circuits of the apparatus.

The invention will be further explained with special reference to a planar exposure device.

This exposure device has a housing **1** subdivided by a partition **2** into an exposure chamber **3** and a drive chamber **4**. The top of the exposure chamber **3** is covered by a transparent top **5** forming a supporting surface. In the chamber **3** there are several radiation sources **6**, **7** which are switched on and off as a function of th operation of an exposure clock. The chamber **3** is closed laterally by side walls **8** extending parallel to the plane of the drawing. These side walls **8** are arranged in spaced relationship from the housing side walls, extending parallel thereto, the outer wall facing the viewer having been omitted. Between the walls **8** and the outer walls there is a guide mechanism for a contact cover **9**, mounted on lateral support arms **10**, which extend at right angles to the contact cover and terminate in the space between the outer housing walls and the intermediate walls **8**.

These intermediate walls **8** have two vertical slots **11**, **12**; the slot **12** has on its upper end an arcuately bent portion **13**, pointing to the right side in FIG. 1, by means of which a separate pivoting movement of the raised cover into the position shown in FIG. 1 is carried out.

The ends of the support arms **10** remote from the covers **9** have two pins **14**, **15** which engage in the slot **12** and are so long that they extend through corresponding orifices in a guide plate **16** forming part of a vertically slidable carriage. The pin **15** engages in an oblong cutout **17** of the guide plate **16**, extending parallel to the slot **12**, whilst an open recess **18** is provided for the pin **14** which terminates towards the top in a slot-shaped extension **19**.

On the left end of the guide plate **16** (of which there are in fact two, namely one on either side of the apparatus, together constituting the slidable carriage), there are guide pins **20**, **21**, one vertically under the other, engaging in the slot **11**. These guide pins ensure the parallel movement of the guide plate **16**. The pin **21** extends through the slot **11** and carries an extension which is embraced by the fork **22** of a bell-crank lever **23**, pivotable about a pivot **24**, mounted in the intermediate wall **8** or in the associated outer wall.

When the guide plates **16** are moved vertically downwardly by means of the slots **11**, the pin **15** is carried along after reaching the upper end of the cutout **17**. This causes the support arms **10** to pivot into the position of FIG. 4 in which the arms **10** are vertical and the contact cover **9** is parallel to the contact base **5**.

During the further movement of the guide plates **16**, the contact cover is pulled downwards against the supporting surface **5**, with a certain vertical play within the range of the cutout **17** and the undercut **19** aligned therewith. In the position of FIG. 4 the pin **14** rests under its own weight on the lower edge of the oblong cutout **17** after it has been moved by means of this hole first from its sloping position into a position parallel to the surface **5**. In addition, there may also be provided a spring between the support arms **10** and the guide plates **16**.

It may be seen from the preceding description that the guide plates **16** on both sides of the surface **5** form a moving frame for the contact cover **9** which lets this cover slide and pivot by virtue of the pin-and-slot connections **14**, **15**, **12**.

The leg **25** of the bell-crank lever **23**, remote from the fork **22**, is articulately connected through a helical

spring member is connected with elements 25, 27 by axial lugs 28, 29, bearing hinge pins 30, 31. The pivoting lever 27 is rotatable about an axis of a plastic sleeve 76 which is mounted in the intermediate wall 8, and is connected with that lever by a square 77 passing through the housing so that the pivoting levers 27 on both sides are torsionally interconnected.

The pivoting levers 27 are each provided with an axially extending slot 32 having a wider portion 33 on one end facing the hinge pin 31. In this slot there is guided a guide roller 35, rotatable about a pin 34, which is located on a control lever 37, rotatable at its other end about a pivot 36. The control lever 37 has two rigid guide rails 38, 39 along its rear edge and a stop pin 40 substantially in the central region of its front edges. A trip lever 42, provided with a hub 41 by which it is swingable about the pin 36, is pulled on the one hand by a tension spring 43 against the rail 38 and has on the other hand a stop lug 44 protruding beyond the control lever 37 so as pivot the trip lever 41 against the force of the spring 43.

About the pivot pin 36 a switching lever 45 is pivotable whose operating end 46 passes through a slot 47 out of a housing cover 48 of the drive chamber 4. This switching lever carries an abutment pin 49 having a peripheral groove. In addition, the switching lever 45 has a slot 50 curved concentrically about the pivot pin 36; a pin 51, arranged on the wall 8 and also formed with a peripheral groove, protrudes through this slot 50. A spring clip 52 stressed towards the outside is arranged between the pins 49, 51 and retained by their peripheral grooves. This spring clip determines the end positions of the switching lever 45 in the manner of toggle device. These end positions are shown in FIGURES 1 and 2 and from which it will be seen that the pin 51 is located in the bisectrix of the angle formed by the axis of the switching lever 45 in its two limiting positions.

The switching lever 45 is a crank lever with a lug 53 carrying a stop pin 54. This stop pin is so arranged as to be capable of co-operating with the stop lug 44 (FIGS. 2 and 3) so that it can displace the trip lever 42 against the force of the spring 43.

The rails 38, 39 and the trip lever 42 are arranged on the edge of the control lever 37 remote from the viewer. Near that edge there lies also a crank plate 55, rotating in the direction of the arrow (i.e., counterclockwise), with a peripheral toothing 56 mating with a pinion 57 mounted on the output shaft 58 of an electric gear motor unit 59 which can be switched on and off in any convenient manner and drives the pinion 57 and the crank plate 55. The crank plate 55 has a crank pin 87 which is associated with the rail 38, 39 and with the trip lever 42 in order to actuate the control lever 37 in accordance with its operating position.

The control circuit of the gear motor unit 59 contains two switches 60, 61 connected in parallel. Of these switches, the switch 60 is closed by the switching lever 45 when the same is moved out of its position of FIG. 1 to the left (see FIGS. 1 and 4). The switch 61 is closed when the extended switching member 62 thereof is released by the pivoting lever 27 (FIGS. 2, 3 and 4).

In FIG. 1 both switches 60 and 61 are open.

In FIG. 5, the switch contacts are designated with the same reference numerals as the switches in the other figures. The operating positions represented by FIGS. 1 to 3 are shown in diagrams (*a*), (*b*) and (*c*) in conjunction with the electric motor unit 59, the latter operating when at least one switch is closed.

When the switching lever 45 is moved out of the position of FIG. 1 into the position according to FIG. 4, the motor unit 59 is energized and the crank pin 87, being in its starting position according to FIG. 1 and retaining the trip lever 42 against the force of the spring 43, abuts against the rail 39 and pivots the control lever 37 in a counterclockwise direction. This causes the pivoting lever 27 to swing in the clockwise direction through an intermediate position according to FIG. 4. The spring 26 is tensioned and carries along the crank lever 23, the forked end 22 of which moves the guide plate 16 downwardly. In this manner, the contact cover 9 is moved into the horizontal position according to FIG. 4, by means of the pins 14, 15 and the guide slot 12, in which the pin 15 rests under the weight of the cover on the lower edge of the oblong hole 17.

During the further movement of the crank plate 55, the apparatus reaches the position shown in FIG. 2 in which the control lever 37 has been rotated through about 60° and the pivoting lever 27 through about 90°, the spring 26 being tensioned and causing the crank levers 23 to move the guide plates 16 into their lowermost position. During this movement, the pins 14, 15 move in the slot extension 19 and in the oblong hole 17, respectively, and adapt their position to the thickness of the original and copy sheets, ensuring the maintenance of an adequate contact pressure by virtue of the resilience of the spring 26.

It may also be seen that during the leftward movement of the control lever 45 from the position of FIG. 1, the switch 60 is closed so that the drive motor is energized and the drive is actuated. During the initial movement of the pivoting lever 27, the switch 61 is closed, e.g. in the position FIG. 4.

When the contact cover 9 has reached its lowest position according to FIG. 2, the control lever 37 is in a nearly horizontal position as shown in FIG. 2. Upon the disengagement of the crank pin 87 from the trip lever 42 in the intermediate position of FIG. 4, the trip lever is pulled by the spring 43 into the vicinity of rail 38. In the fully deflected position of the lever 37 (FIG. 2), the trip lever 42 is therefore in a position in which the crank pin 87 can pass underneath the trip lever 42 without thereby altering the position of the actuating mechanism and of the contact cover 9.

When the switching lever 45 is moved according to FIG. 3 in the clockwise direction to the right, the stop pin 54 carries along the stop lug 44 in a clockwise direction, causing the trip lever 42 to be lifted off the rail 38 against the force of the spring 43 and into engagement with the stop pin 40. The trip lever 42 is thus within the path of travel of the crank pin 87 which, during its further rotation in a clockwise direction from the position shown in FIG. 3, causes again the control lever 37 to pivot in a clockwise direction, thereby entraining the pivoting lever 27 in a counterclockwise direction whilst simultaneously the spring 26 is relaxed. After the detensioning of the spring the same acts as a compression member and restores the pivoting lever 23 in a clockwise direction to the position of FIG. 1 whilst the contact cover 9 is lifted.

During the return movement of the switching lever 45 according to FIG. 3 the switch 60 is opened whereas the switch 61 is opened only when the pivoting lever 27 returns into its starting position of FIG. 1 and actuates the member 62.

The preceding description explains clearly the operation of the arrangement shown in the drawing, as well as the functional relationship between the geared motor drive unit 59 and the switches 60, 61.

FIGURES 1 and 5(*d*) indicate a further solution. A timing clock 63 may have an operating member 64 mounted externally on the housing. This timing clock may be started, for example, by depressing the operating member 64, closing a switch 65 in the circuit 66 of the radiation sources 6 and 7. Naturally, this takes place after the contact cover 9 has been placed in its contact position (FIG. 2). The switching member 45 is in its left-hand position, and may be connected with a pull magnet 67. The field circuit 68 of this magnet is so connected by a delayed switch 69 with the timing clock 63 that the field circuit 68 is closed when the exposure time has lapsed, causing the operating magnet 67 to be energized and the switching member 45 to be moved back into its right-hand position

(FIG. 3). The circuit 68 may then be opened as a result of this return movement by a stop switch, not shown in the drawing.

This arrangement makes possible the automatic opening of the cover 9 after the termination of the exposure time.

Naturally, there may also be provided automatic devices for operating the clock 63, for example, upon the closure of the switch 61, such as a contact 70 shunted across the contacts for controlling the motor 59, via a time relay 71 and a working magnet 72 through a lever 73 as indicated in FIG. 5(*e*). This trigger circuit may be operated automatically through a switch 74 in response to the running down of the exposure clock 63; a parallel operation of the switch 74, on the one hand, and the switches 65 and 69, on the other hand, may be provided.

The timing clock 63 in FIG. 1 may have a vertically movable trigger lever 75 located within the path of the contact cover 9 immediately ahead of its lowest position and preferably adjacent to the supporting surface 5, for operating the clock in response to the contact pressure of the cover in order to start the exposure timing.

Having thus fully described and disclosed the invention, I claim:

1. A copying apparatus comprising a housing with a radiation-permeable wall forming a supporting surface for an original and a copy sheet; a source of radiation in said housing; a cover mounted outside said housing for movement toward and away from said supporting surface; actuating means on said housing for moving said cover from an outwardly swung open position to a closed position proximal to said supporting surface preparatorily to energization of said source; and guide means for swinging said cover from said open position into an intermediate position parallel to said supporting surface prior to movement of said cover into said closed position upon operation of said actuating means, said guide means including a wall member of said housing with a guide slot having a straight portion perpendicular to said supporting surface terminating in a bend, a carriage slidable along said guide slot, an arm on said cover having a first pin traversing said carriage and said guide slot, a second pin on said arm received in said guide slot in spaced relationship with said first pin, and link means connecting said carriage with said actuating means for moving said carriage with said first pin along the straight portion of said guide slot, said second pin entering said bend in a limiting position of said carriage for tilting said arm and swinging said cover outwardly upon a return of said cover to said open position.

2. An apparatus as defined in claim 1 wherein said carriage has an oblong cutout traversed by said first pin, said cutout registering with a friction of the straight portion of said guide slot for enabling limited relative displacement of said first pin and said slider, said carriage further having a recess for said second pin provided with an undercut in line with said oblong cutout, said second pin being receivable in said undercut upon a movement of said carriage away from said bend.

3. An apparatus as defined in claim 1 wherein said wall member has a second slot parallel to the straight portion of said side guide slot, further comprising at least one other pin on said carriage extending through said second slot for restricting said carriage to translatory motion.

4. A copying apparatus comprising a housing with a radiation-permeable wall forming a supporting surface for an original and a copy sheet; a source of radiation in said housing; a cover mounted outside said housing for movement toward and away from said supporting surface; and actuating means on said housing for moving said cover from an open position remote from said supporting surface to a closed position proximal to said supporting surface and subsequently returning said cover to said open position; said actuating means comprising a drive motor, an energization circuit for said motor including first and second switch means, an actuating element manually movable into a start position for closing said first switch means to complete said energizing circuit, a crank member coupled with said motor for continuous unidirectional rotation thereby, a control member linked with said cover and displaceable between a normal position and an off-normal position respectively corresponding to said open position and said closed position of said cover, said control member being positioned for entrainment by said crank member from said normal position to said off-normal position during a first revolution of said crank member while remaining in said off-normal position during subsequent revolutions of said crank member, said control member being operatively connected with said second switch means for closing the latter in said off-normal position to maintain said motor energized independently of said first switch means, and trip means on said control member displaceable by said actuating element into the path of said crank member upon a movement of said actuating element to a stop position whereby said control member is entrained by said crank member for a return to said normal position with consequent opening of said second switch member and de-energization of said motor.

5. An apparatus as defined in claim 4, comprising an articulated linkage connecting said control member with said cover, said linkage including a resilient link arranged to be stressed by said control member in said off-normal position thereof for elastically urging said cover against an original and copy sheet overlying said supporting surface.

6. An apparatus as defined in claim 5 wherein said linkage comprises a bell-crank lever connected with said cover and a swingable member coupled with said control member, said resilient link being anchored to said swingable member and to said bell-crank lever for alternate tensioning and compression therebetween.

7. An apparatus as defined in claim 6 wherein said control member is coupled with said second switch means through the intermediary of said swingable member.

8. An apparatus as defined in claim 4 wherein said trip means comprises a trip lever pivotally mounted on said control member, spring means tending to swing said trip lever out of the path of said crank member, and stop means on said control member limiting a displacement of said trip lever against the force of said spring means by said crank member.

9. An apparatus as defined in claim 8 wherein said actuating element comprises a toggle lever having an extension engageable with said trip lever in said start position.

10. An apparatus as defined in claim 4, further comprising an operating circuit for energizing said source of radiation in the closed position of said cover, said operating circuit including timer means for moving said actuating element to said stop position at the end of a predetermined interval following energization of that source.

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