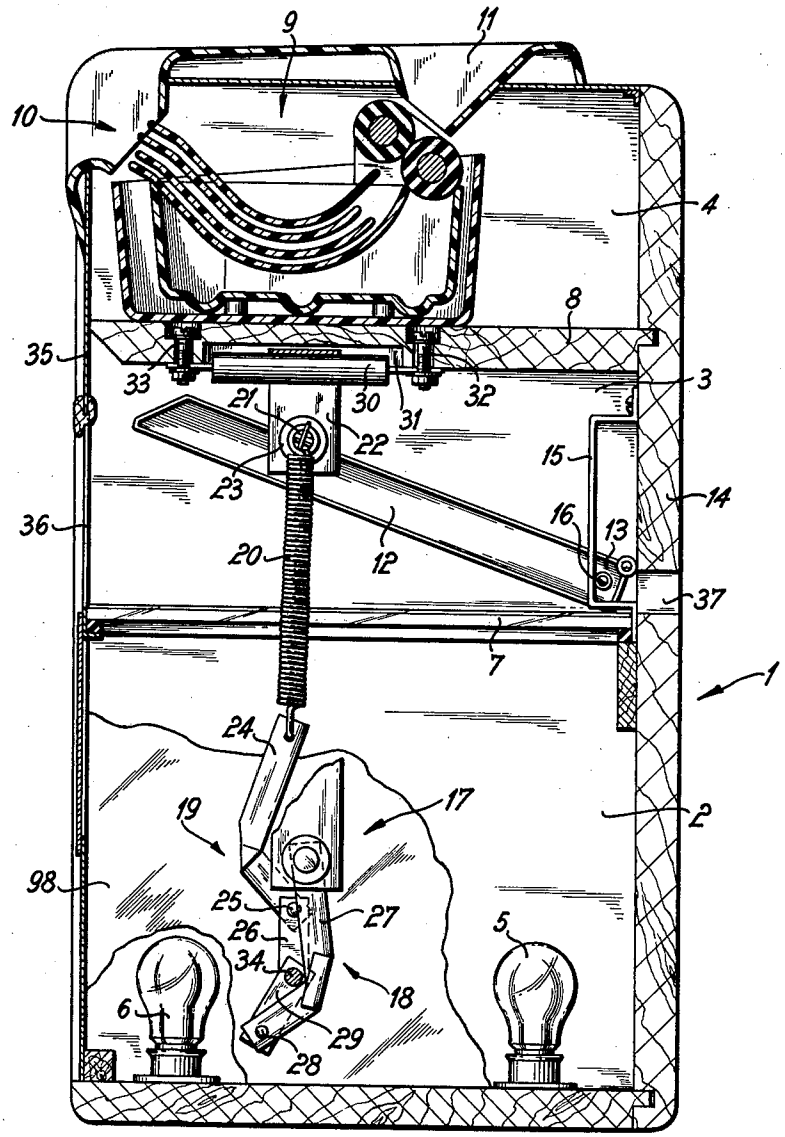
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FIG. 1



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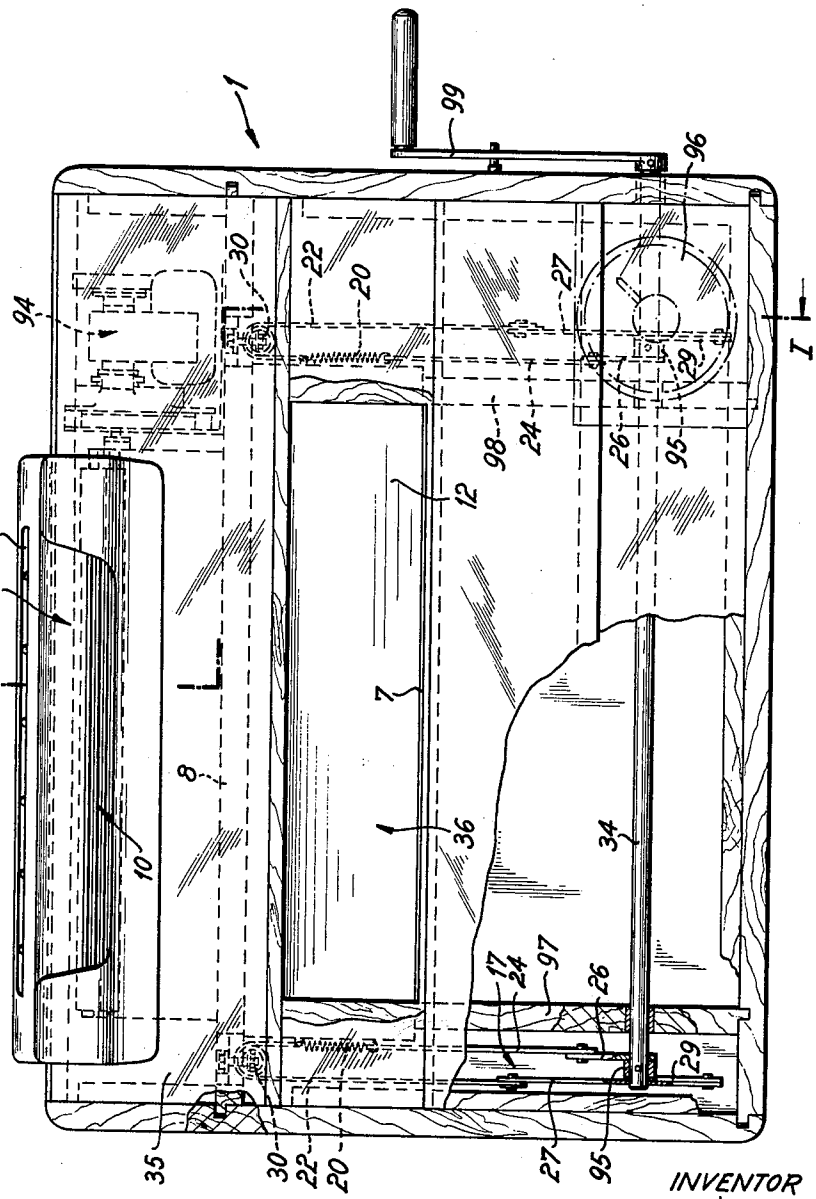


FIG. 2

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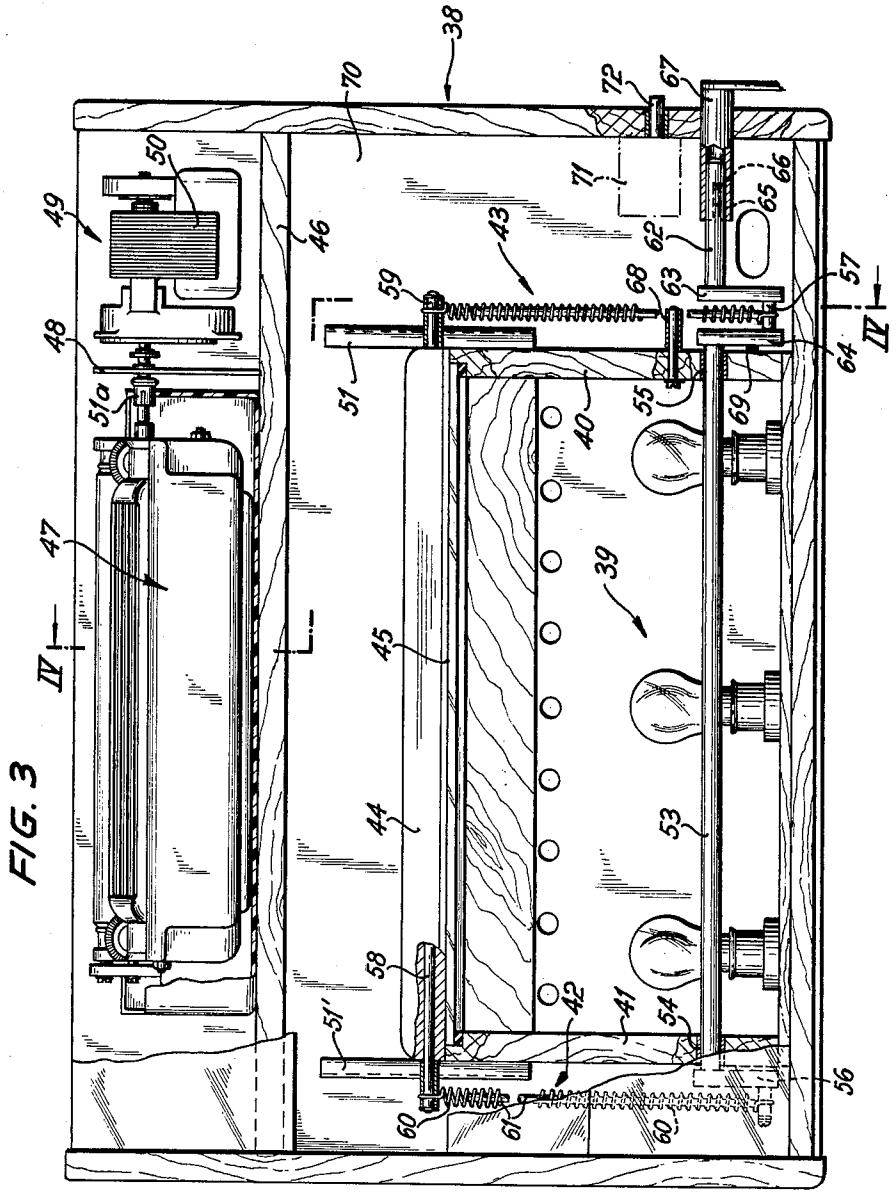


FIG. 3

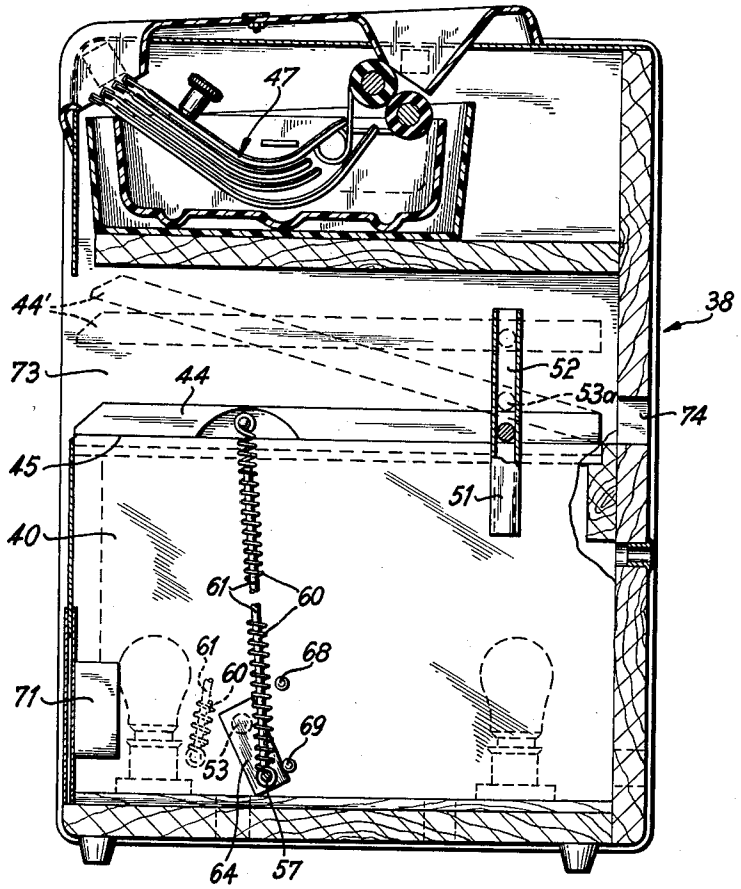
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FIG. 4



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FIG. 5

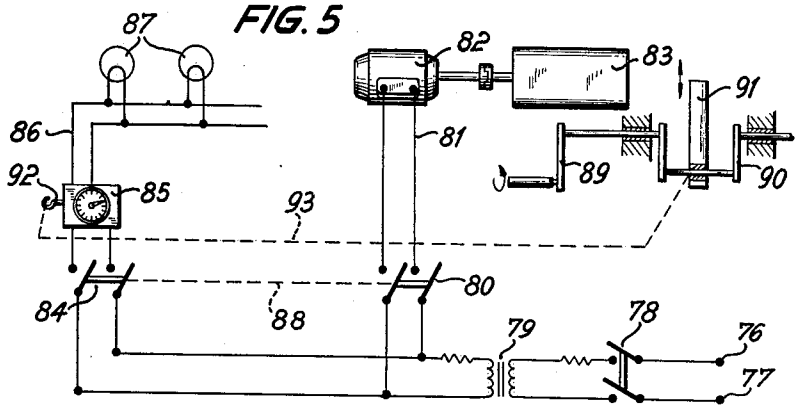
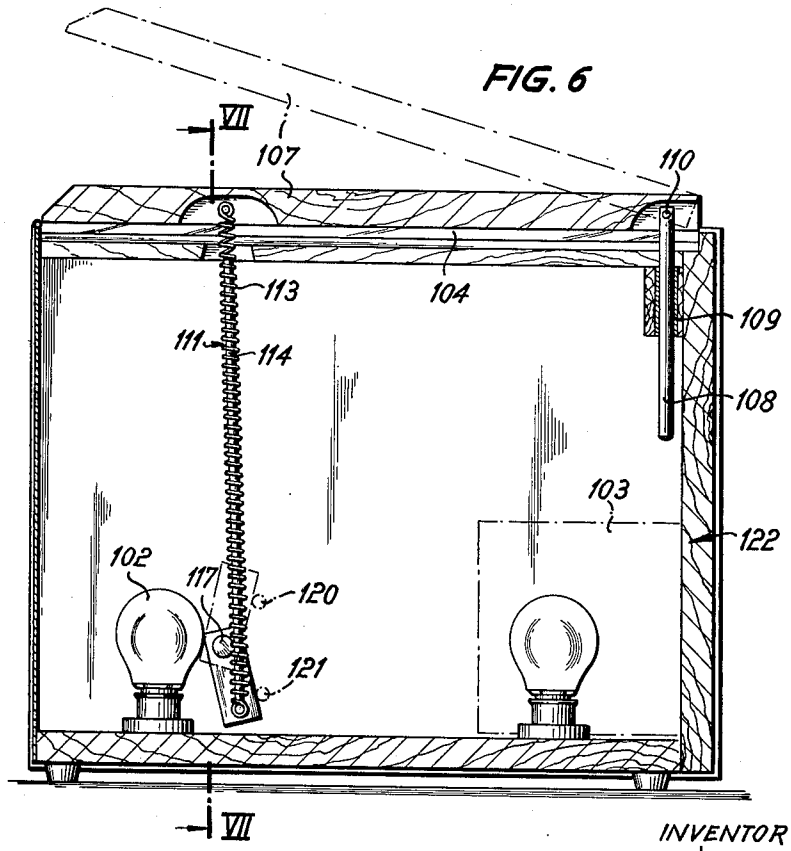


FIG. 6



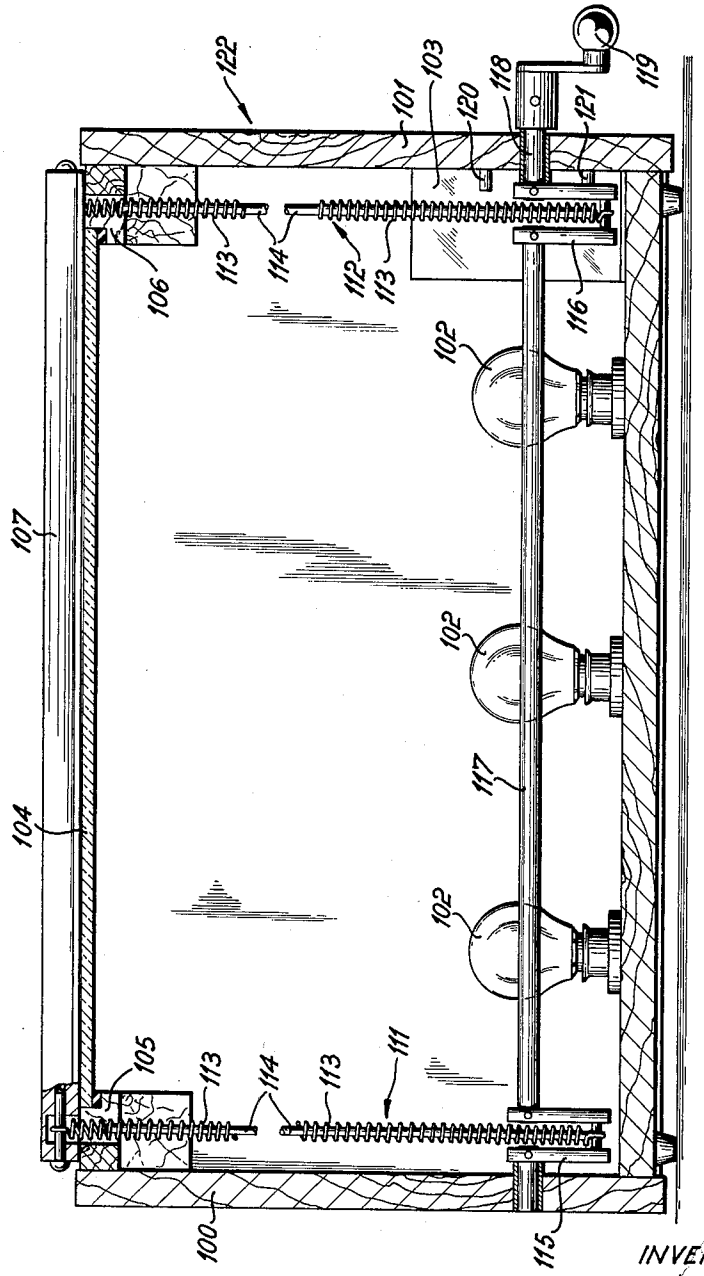
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FIG. 7



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3,076,399

COPYING DEVICES

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Filed July 21, 1960, Ser. No. 44,424
6 Claims. (Cl. 95—73)

The invention relates to a copying device comprising a surface exposure device having a transparent contact surface, a contact cover being disposed on that side of such surface which is remote from the lighting source.

In such known apparatus the contact cover is hinged along one edge and has one or more catches along the opposite edge. It is known to provide inside the cover frame a resiliently mounted contact plate which holds the original against the contact surface. Such plate has only a limited movement so that only sheet-like originals or originals of up to a predetermined reduced thickness can be used. The size of the original is also determined by the cover frame. If the original is fairly thick, adjustment must be provided, for instance, of the hinges and catch. As a rule, the known copying apparatus can be used to make copies from books only if special measures, in the form of adjustable hinges and catches, are taken or only if the contact surface is so large that it can receive the complete opened book, although even then parts of the copy may be obscure due to the fold of the open book. It is difficult to handle the known apparatus for producing a copy on a sheet, for to introduce and engage with one another the original and the negative, the cover must first be lifted, whereafter the original and negative must be placed on the contact surface, after which the catches must be operated. The provision of a lot of fittings—i.e., hinges and catches—makes the apparatus expensive. These disadvantages become very noticeable when adjustable fittings are provided. Since the cover is fixedly hinged along one edge, it is often very difficult in the known designs to ensure that the original and the film are pressed together completely uniformly.

One object of the invention is to provide an apparatus which is an improvement on the known surface exposure apparatus. Another object is to provide an apparatus which is an improvement on the known surface exposure apparatus and in which the guiding of the contact cover aligns itself automatically with the original introduced. Another object is to provide an apparatus which is an improvement on the known surface exposure apparatus and which comprises a contact cover adapted to move as a whole relatively to the contact surface and operated by means of at least one resilient member.

To this end, according to the invention, the contact cover which is movable in its entirety perpendicularly to the contact surface is guided resiliently and is pivotally articulated through the agency of spring means to one or more articulated connections, the drive of which either disengages the contact cover from the contact surface or engages such cover with such surface. A substantially free mobility of the cover is therefore provided which automatically adjusts itself to be substantially parallel with the contact surface and which is adapted in its position to the pattern and thickness of an original, even though such cover is articulated eccentrically.

According to another very advantageous feature of the invention, the linkage connection or connections comprises or comprise a spring which enables the position of the cover, when the same is in engagement with the contact surface, to be adapted to the original and which also provides the required contact pressure. These linkage connections are provided on vertically movable articulation means inside the casing. Such means can take the form of crank-like eccentrics fitted to shafts,

or for instance, lifting magnets. Advantageously, each linkage connection comprises two branches each in the form of drawing connections operative in opposite directions to one another, one branch operating by way of a reversing pulley. Two offset eccentrics or cranks are provided, each serving to operate one branch.

According to another very advantageous feature of the invention, the eccentric or eccentrics or crank or cranks is or are disposed on a shaft which is mounted on the casing of the exposure device and which preferably extends through the exposure part of the casing. Such shaft can be rotated, for instance, through the agency of a hand crank, the articulations—i.e., movement of the cover—being actuated in opposite directions by rotation of the hand crank through 180°. The invention also relates to a motor drive for the shaft comprising eccentrics or cranks, the motor drive being controlled, for instance, through the agency of a press button or limit switch or a switching roller which also controls other functions, such as the triggering of an exposure clock, the winding-up thereof and so on.

Another advantageous feature of the invention concerns an arrangement of lifting magnets in the linkages. In such a case there is no need for a control by eccentrics or cranks, since the upward movement of the cover is produced by at least two lifting magnets, springs conveniently being provided between the magnet armatures and the cover.

In one particular embodiment of the invention, the cover is guided perpendicularly to the contact surface on at least three and, for instance, four linkage connections. According to another advantageous feature, only two linkage connections are provided, each such connection being provided at opposite sides of the cover at a place offset from the centre of the sides. This provides a very advantageous way for adjustment of the cover for adaptation to an original. Where two linkage connections are used, the cover can with advantage be guided for vertical movement by way of the edge remote from the articulation places. For instance, the cover can be provided with pins or rollers running in vertical or substantially vertical guide slots which are advantageously contiguous with the cover sides so as also to provide lateral guiding.

The invention relates to a construction having considerable horizontal play in the vertical or substantially vertical guide. For instance, the rear cover edge is contiguous with the rear wall of the casing. According to a variant, guide rods are articulated to the cover sides near the edge of the cover and extend into guides on or below the contact plate. Such rods are therefore free to move vertically and provide satisfactory guiding of the contact cover which can be pivoted vertically on them. According to another very advantageous feature, the casing of the apparatus is formed with an aperture for the introduction of the original and a film, more particularly where two linkage connections are used, the aperture being located near to that edge of the cover which is near the articulation places of the connection. According to another feature of the invention, the opposite casing wall, on which the adjacent cover edge can be guided in the vertical guides, is formed above the contact surface with a slot through which some of the original can be pushed if the original is larger than the contact surface.

In combination apparatus the invention proposes the very advantageous arrangement of a developing device above the exposure device, a free space being left between the base of the developing device and the contact surface, the contact cover being guided in the manner specified in such space. In this embodiment, for instance, if linkage connections are used with two drawing branches, reversing rollers can be provided at the top of the space. Such a

construction of a combination apparatus with the arrangement and construction according to the invention of the contact cover has considerable advantages, because the cover, the position of which adapts itself to the original, can be operated with one handle, for instance, the crank for the eccentric or crankshaft, without any handling of the cover being required directly or without special steps being required to adjust the same.

Other features and advantages of the invention will become apparent from the following description of the embodiments illustrated in the accompanying drawings wherein:

FIG. 1 is a sectioned side elevation of an apparatus according to the invention;

FIG. 2 is an end elevation of the apparatus shown in FIG. 1 with part of the front wall broken away, and with internal parts of the apparatus which are disposed behind the front wall being shown in chain lines;

FIG. 3 is a front elevation of a preferred apparatus according to the invention, the front casing wall being removed and some parts being shown fragmented to make the drawing clearer;

FIG. 4 is a side elevation of the apparatus shown in FIG. 3 in section on the line IV—IV;

FIG. 5 is a circuit diagram for the driving circuit of an apparatus according to the invention;

FIG. 6 is a side elevation of another apparatus according to the invention, and

FIG. 7 is a sectional view taken along the line VII—VII of FIG. 6.

The copying device, as shown in FIGS. 1 and 2, comprises chambers 2, 3, 4 placed one above another in the casing of a combination apparatus. The bottom chamber 2 contains the exposure device, having light sources 5, 6. Advantageously, the chamber 2 also contains electrical connections and, if required, adjusting means for the light sources and a timer 96 for adjusting the duration of exposure. The chamber 2 is closed at the top by a contact surface 7 which is transparent. For reasons to be explained hereinafter, the sides of the contact surface 7 are formed with slots which extend in the plane of the drawing and through which linkage connections extend. By way of example, those walls 97, 98 of the exposure device which extend in the plane of the drawing in FIG. 1 are rebated a little towards the casing interior and away from the parallel casing walls so that narrow spaces are left on the sides.

The central chamber 3 is bounded at the top by a partition 8 on which is disposed a known developing device 9 which occupies a chamber 4. The device 9 can be releasably or non-releasably secured to the partition 8 and does not require any further description, except that it has an entry aperture 10 disposed at the top corner of the casing on the operating side, while an exit aperture 11 is disposed in the top of the casing. The electrical driving and connecting means 94 for the device 9 are separated by a wall and are disposed on the partition 8.

A contact cover 12 is guided in the chamber 3 as to be movable perpendicularly to the surface 7. The cover 12 is guided, by its end 13 which is near the casing rear wall, in a vertical guide which, in the embodiment illustrated, takes the form of a bowed member 15 disposed on the casing rear wall 14. Such a bowed member 15 is provided on each side of the cover 12. Lateral guiding of the cover 12 is ensured by the gap between the straight part of each bowed member or stirrup 15 and the wall 14. Also, the cover 12 cooperates with the stirrup 15 by means of pivots 16 which can with advantage bear rollers to ensure that the cover 12 is guided on the stirrups 15 with reduced friction. The size of the stirrups 15 is such that the rollers need not always run on the vertical straight part of the stirrups 15. If desired, the cover 12 can also be guided on the casing rear wall 14. To reduce friction, rollers can again be provided on the cover for such guidance; alternatively, the rollers disposed on the pivot 16 can be of a size and design so as to project beyond the rearward edge of the cover 12.

The cover 12 is guided at its forward part, on two sides which extend in the plane of the drawing, by one linkage connection 17 each. This connection comprises two branches 18, 19 the branch 19 comprising a spring 20 and being adapted to engage the cover 12 with the contact surface 7. The other branch 18 is adapted to raise the cover 12, for instance, into the position illustrated in the drawing. Advantageously, the two branches 18, 19 are connected to the cover 12 by a suspension pivot 21 which is secured to the cover 12 and to which the tension spring 20 of the branch 19 and belting 22 of the branch 18 are secured. By way of example, special grommets 23 are provided for fixing.

Branch 19 comprises, as well as the spring 20, an angled part 24 pivoted at 25 to an eccentric 26. The branch 18, comprising the belting 22, has a corresponding angled part 27 pivoted at 28 to an eccentric 29. The belting 22 runs over a roller 30 rotatably mounted on the sides of the chamber 3 below the partition 8, which is formed with a recess 31 in which part of the roller 30 runs, which arrangement makes for a more compact construction. The roller 30, which is mounted, for instance, by means of screws 32, 33, is of considerable length, to ensure, first, that it can be shifted without becoming jammed while the cover 12 is being moved, and, second, to allow a shifting of the pivots of the branches 18, 19 to the cover 12 or a shifting of the pivot 21. The eccentrics 26, 29 are fitted to a shaft 34 as to rotate therewith and are offset from one another by about 160°. The shaft 34 extends transversely through the exposure device or through the chamber 2 in which the exposure light sources are disposed. The shaft 34 is mounted in the side walls of the exposure device, for instance, in bushes. One end of the shaft 34 extends out of the casing 1 and is adapted to receive a crank 99 for operation of the eccentrics 26, 29. The shaft is provided with a ratchet arrangement which co-operates with corresponding ratchet elements on the casing walls to lock the shaft in position. The arrangement illustrated, wherein the eccentrics 26, 29 are offset from one another at an angle of approximately 160° and wherein the angled parts 24, 27 are bent in opposite directions to one another, leads to a dead centre arrangement such that the shaft is automatically retained in the various operating positions. More particularly, this dead centre position is controlled by the force of the spring 20 when the cover 12 is in engagement with the surface 7.

The dead centre position is adjusted by the bent parts of the angled parts 24, 27 which co-operate either with the shaft 34 itself or with a limit bush thereon. Clearly, the shaft is rotated backwards and forwards between the various operating positions, since the parts 34, 24, 27 prevent the shaft from being rotated continuously in any one direction.

The advantage of arranging the eccentrics 26, 29 as shown in FIGS. 1 and 2 is that there is no need for the shaft 34 to be bent or cranked in any way. In this arrangement, the eccentrics are disposed on a sleeve 95 which is pushed on to the shaft 34 and secured thereon, for instance, by means of a pin.

The casing front wall is provided with an entry aperture 36 through which an original and a negative emulsion base can be introduced and placed on to the contact surface 7 once the cover 12 has been raised. For this purpose the rear wall 14 is formed, near and above the contact surface 7, with a slot 37 through which, if the original is longer than the surface 7, parts of the original can be pushed when the rear cover 13 is raised automatically.

The aforesaid lateral slots in the surface 7 are adapted to receive the connections 17 where the same are mounted inside the chamber 2. If the narrow spaces are left laterally of the exposure device, the connections 17 are mounted and guided in such spaces. In the position illus-

trated in FIG. 1, the cover 12 has been raised by the branch 18 associated with the belting 22. If the shaft 34 is rotated through 180°, the branch 18 is raised, the belting 22 running over the roller 30. Simultaneously, the branch 19 draws the cover 12 on to the contact surface 7, the spring 20 being stressed. The cover, since its rear edge 13 is free to move vertically, can adapt itself in position to the shape of the original on the surface 7.

Another embodiment is illustrated in FIGS. 3 and 4 and comprises a casing 38 having an exposure device 39 which is basically the same as the exposure device illustrated in FIGS. 1 and 2 and which will therefore not be described in detail. Between the side walls 40, 41 and the casing side walls are free spaces in which linkage connections 42, 43 are adapted to operate a contact cover 44 mounted above a contact surface 45. The chamber receiving the exposure device 39 is closed at the top by a partition 46 above which is a space receiving a known developing device which may be similar to the developing device 9 shown in FIG. 1.

FIG. 3 also shows how the chamber receiving the developing device can be sub-divided by a partition 48 which separates the developing device 47 from the driving elements 49 associated with a pair of squeezing and conveying rollers of the developing device. The elements 49 comprise a motor with its reduction train, and a transformer 50. The output shaft of the reduction train extends through the partition 48 and is connected by a coupling 51*a* to the drive shaft of the pair of squeezing rollers.

The side walls 40, 41 of the exposure device comprise vertical guides 51, 51′ for the cover 44. Such guides, which also provide for the lateral guiding of the cover, are located at some distance from the rearward end of the contact surface 45 and are formed with a slot 42 in which run rollers 53*a* disposed on the sides of the cover 44. A guiding of this nature obviates any contact between the cover 44 and the casing rear wall. The vertical guides 51, 51′ are ledge-like and also provide lateral guiding of the cover 44.

As can be seen in FIG. 3, a shaft 53 is mounted in bushes 54, 55 in the side walls 40, 41 of the exposure device and extends transversely therethrough. Cranks 56, 57 are disposed on the shaft 53 outside the walls 41, 42 and serve to guide linkage connections 42, 43 secured at one of their ends to the cranks and at the other of their ends to pivots 58, 59 secured to the cover 44.

The linkage connections comprise, in the embodiments illustrated, a spring 60, the ends of which are secured to the cranks and the pivots. This spring takes the form of a helical spring and forms that branch of the connection which moves the contact cover into engagement with the contact surface. The spring 60 can also serve to disengage such cover from such surface if it is sufficiently rigid. To increase the rigidity of the springs 60, a rod 61 can be guided therein according to the embodiment illustrated. The rod 61 bears, when the spring is completely compressed, against the cranks 56, 57 and pivots 58, 59 and thus forms that branch of the linkage connections 42, 43 by which the cover 44 is raised.

A rigid tubular element could be used instead of the rod 61 to guide the spring and such element would be retained or guided on the cranks or pivots at the places where the spring is pivoted, without any particular additional steps being required for this purpose. The advantage of the arrangement shown in FIGS. 3 and 4 over that shown in FIGS. 1 and 2 is that spring length is greater, so that adjustability is improved.

The crank 57 has an extension 62 extending axially of the shaft 53. The extension 62 is disposed on the crank arm 63 which extends parallel with the crank arm 64 connected to the shaft 53. The extension 62 may extend to the outside through the side wall of the casing 38. In the embodiment illustrated, a crank 67 which is fitted by means of a connection 65, 66 comprising a recess and a projection extends out of the casing 38 so that the shaft 53 can be rotated, and the cranks 56, 57 can therefore be rotated to operate the cover 44. The operative positions of the cranks 56, 57 are determined by stops 68, 69 which are secured to the side wall 40 of the exposure device and which may consist of bushes secured by screws.

In FIG. 3, the cover 44 is shown in solid lines in the same position as in FIG. 1. The chain-line-illustrated position 44′ of the cover is the position taken up thereby when a fairly thick original is placed on the contact surface 45. It will be apparent that the cover 44′ takes up a position substantially parallel with the surface 45 but at some distance therefrom.

The chamber 70 near the exposure device is adapted to contain any electrical connecting elements which may be required and any control means required to adjust the exposure light sources. Advantageously, a timer 71 for controlling the duration of exposure is provided on the side wall of the casing 38 above the crank 67, a triggering element 72 extending outwards through a slot in the side wall in such a position above the crank 67 as to be operable, when the crank 67 is shifted, by the hand which operates the same. According to a very advantageous feature, where a crank arrangement as shown in FIG. 3 is used, the triggering element 72 is disposed below the crank 67 so that the same abuts the element 72 in its bottom position. Alternatively, the timer can be triggered by a triggering element which co-operates with the crank 67 and which is disposed inside the casing 38, or a special stop lever can be used on the shaft extension 62, to operate such triggering element.

As in the device illustrated in FIGS. 1 and 2, the embodiment illustrated in FIGS. 3 and 4 comprises an entry aperture 73 at the front and a slot 74 at the back, the aperture 73 and slot 74 corresponding respectively to the aperture 36 and slot 37 shown in FIG. 1.

A suitable driving circuit is illustrated in FIG. 5. Terminals 76, 77 are connected by a switch 78 to a primary winding of a transformer 79. A circuit 81 adapted to be made separately, for instance by a switch 80, extends from the secondary winding of the transformer 79 to a driving motor 82 of the two conveying and squeezing rollers 83 (see FIG. 1) of the developing device. Also connected to such secondary winding, for instance, through the agency of a switch 84, is an exposure timer 85 from which extend wires 86 to the exposure light sources 87. The switches 80, 84 can be interconnected for common operation as indicated at 88.

FIG. 5 diagrammatically illustrates a hand crank 89 for operating the crank shaft or the eccentric 90 to which the linkage connection 91 is pivoted. The timer triggering element 92 is connected mechanically, as indicated at 93, to the eccentric 90.

FIGS. 6 and 7 show merely an exposure device having the cover arrangement according to the invention. Such device comprises a casing 122 having side walls 100, 101. The casing receives exposure light sources 102 and a switching device 103 with electrical switching means and a timing clock. The top of the device is covered by a transparent contact plate 104 formed, near the sides of the device, with rebates 105, 106 in which the linkage connections extend.

A contact cover 107 is guided for movement above the contact plate 104. The cover 107 is articulated at its rearward end to guide rods 108 which extend in guide bushes 109 inside the casing and, with advantage, below the plate 104. The cover 107 is therefore laterally guided yet is free to move vertically, and can also be pivoted around connecting pins 110 between the cover 107 and the rods 108. This embodiment, shown in FIG. 6, has the advantage that no guide means have to be placed above the plate 104.

Near its forward edge the cover 107 is guided on two linkage connections 111, 112 which, as in the embodiment described with reference to FIGS. 3 and 4, comprise a

spring 113 and, if required, a rod 114 disposed therein. It can be gathered, more particularly from FIG. 7, that the rod 114 is shorter than the spring 113 which is stretched when the cover is in the closed position.

The bottom end of the linkage connection is articulated to cranks 115, 116 which are formed on or secured to a shaft extending transversely through the developing device. The shaft is mounted at its ends in the casing side walls 100, 101, for instance, by means of bearing bushes. One end, 118, of the shaft 117 extends out of the casing and bears a hand crank 119 by means of which the shaft 117 can be rotated into two positions determined by stops 120, 121, which may be in the form of pins extending into the inside of the device and are secured to the side wall 101.

Clearly, the stops 120, 121 are so disposed relatively to the cranks 115, 116 that the linkage connections are in a dead centre position in every operative position; in such dead centre positions the closed position, indicated in solid lines in FIG. 6, is ensured by the force of the springs 113 which draws the crank 116 against the stop 121.

The invention should not be considered as being limited to the details described and illustrated. Various details and secondary combinations can be used independently of other features and secondary combinations, falling with the scope of the accompanying claims.

I claim:

1. In a copying device, a casing having non-transparent bottom, side, and end walls, a transparent top wall in said casing, a source of light within said casing, means defining a contact plate above said transparent top wall, guide means interconnecting said contact plate and said casing and adapted to permit pivotal and substantially vertical movement of said contact plate, operating means mounted in said casing, and means connecting said operating means with said contact plate, said connecting means including a shaft rotatably mounted in said casing, a crank lever having one end secured to said shaft, a coil spring, means securing one end of said coil spring to the free end of said crank lever, means securing the other end of said coil spring to said contact plate, and stop means secured to said casing in the path of movement of said crank lever in such positions as to limit the movement of said crank lever to an angle in excess of 180°.

2. The copying device as set forth in claim 1, in which said coil spring is a tension spring, and including means associated with said tension spring to limit the contraction of said tension spring, whereby movement of said crank lever beyond said limit in the direction towards said contraction-limiting means forces the connection point between said tension spring and said contact plate away from said transparent top wall.

3. The copying device as set forth in claim 1, in which one of said stop means is disposed substantially vertically above the other stop means.

4. The copying device as set forth in claim 1, including a drive motor, and means connecting said drive motor to said shaft.

5. In a copying device, a casing having non-transparent bottom, side, and end walls, a transparent top wall in said casing, a source of light within said casing, means defining a contact plate above said transparent top wall, guide means interconnecting said contact plate and said casing and adapted to permit pivotal and substantially vertical movement of said contact plate, operating means mounted in said casing, means connecting said operating means with said contact plate, said connecting means including spring means adapted to bias said operating means towards one of two end positions of said operating means depending upon which side of a dead center position said operating means is, the first of said end positions of said operating means corresponding to a position of said contact plate in which it is maintained spaced above said transaprent top wall of the casing while the second end position of said operating means corresponds to a position of said contact plate in which it is maintained in yielding contact with copying material on said transparent top wall by said spring means, a shaft rotatably mounted in said casing, two eccentrics secured to said shaft in different angular positions, roller means rotatably mounted in said casing above said transparent top wall and spaced therefrom, a flexible strip trained over said roller means, means connecting one end of said strip to one of said eccentrics while said spring means connects the other end of said flexible strip to the other eccentric, and means connecting said contact plate to said flexible strip at a point between said roller means and said spring means.

6. The copying device as set forth in claim 5, in which said two eccentrics are angularly offset by about 160° and said means connecting said one end of the flexible strip with said one eccentric and said means connecting said spring means to said other eccentric each comprises a bent member of such shape as to establish said two end postions by engagement of said bent members with said operating means.

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