Sept. 21, 1965 A. H. COOPER ETAL 3,207,051

PHOTOGRAPHIC TYPE COMPOSING APPARATUS

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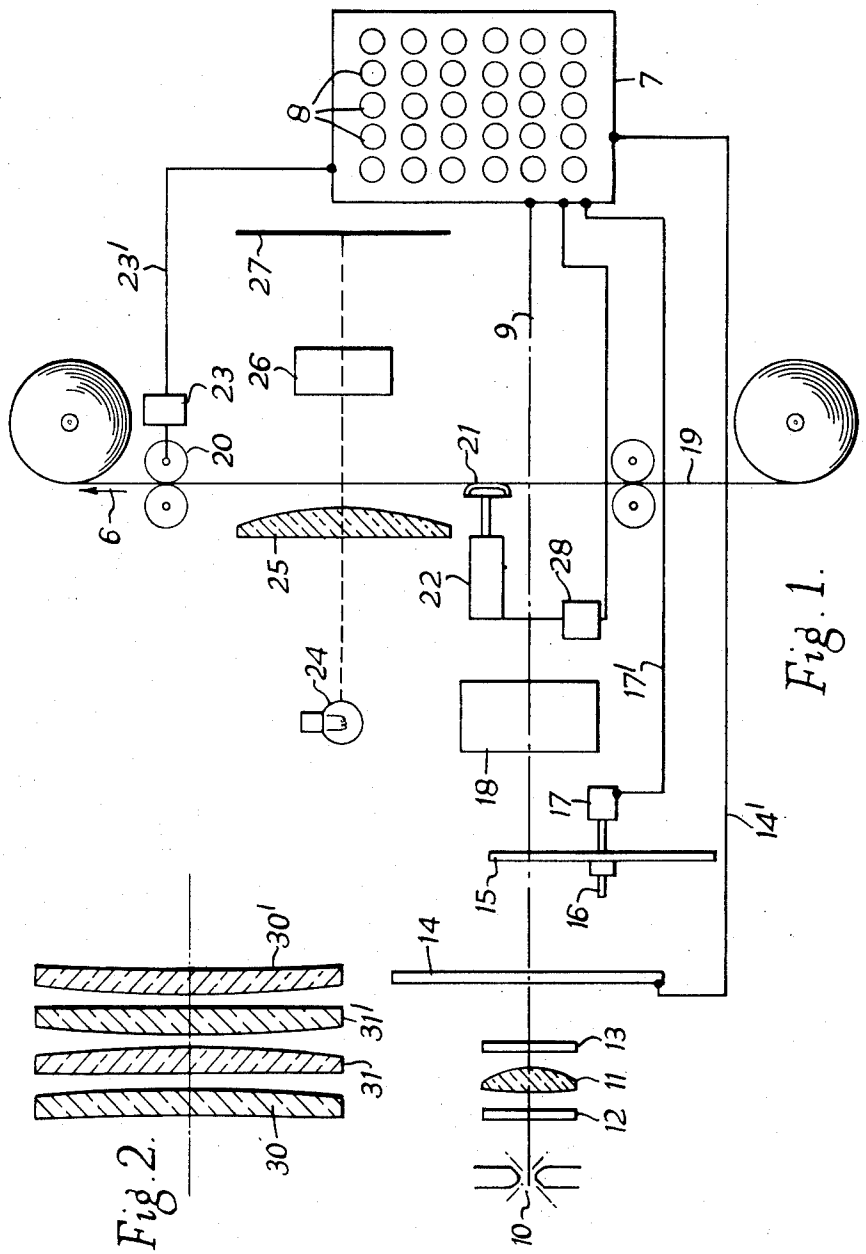

Fig. 1.

Fig. 2.

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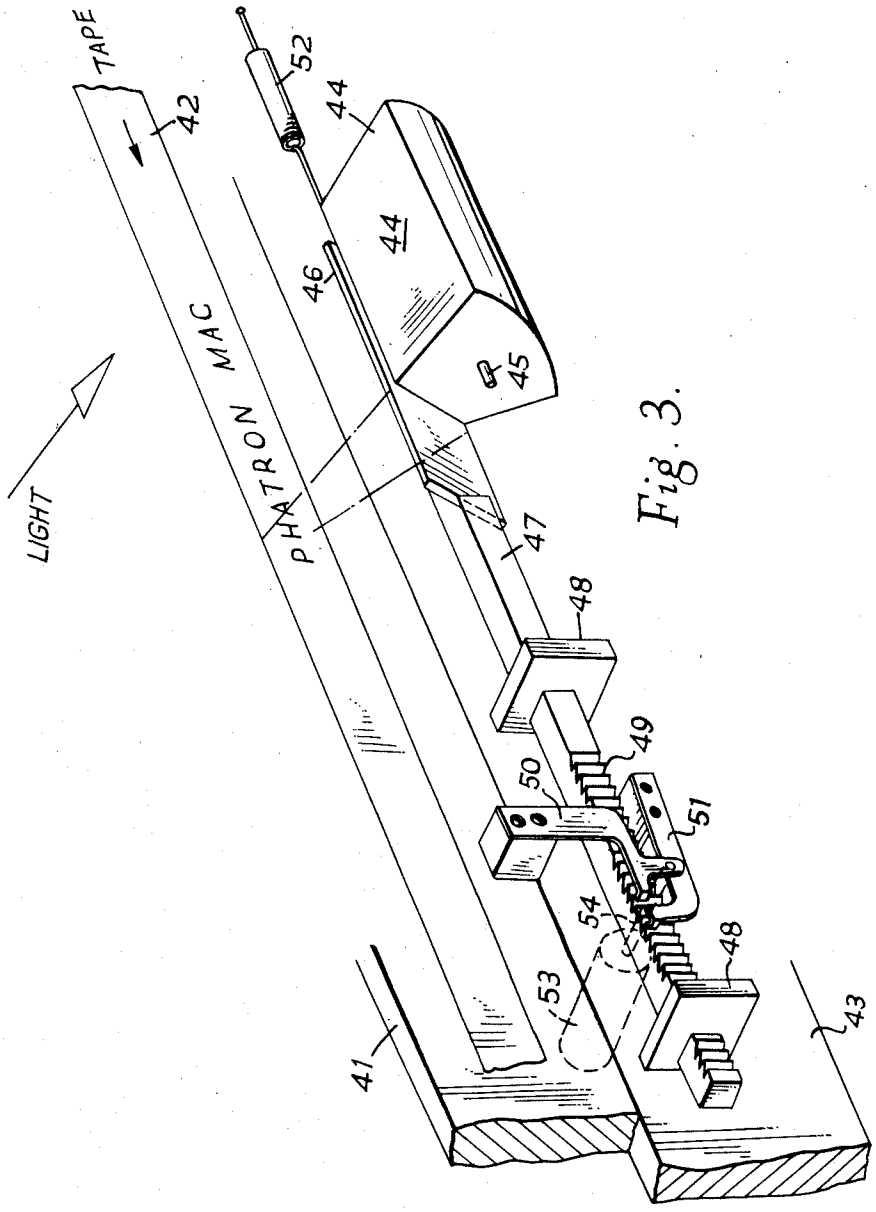

Fig. 3.

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PHOTOGRAPHIC TYPE COMPOSING APPARATUS

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1 Claim. (Cl. 95—4.5)

This application is a continuation-in-part of Serial No. 771,356 filed November 3, 1958, now abandoned.

This invention relates to photographic type composing methods and apparatus.

In photographic type composing individual characters of the matter to be composed are composed photographically on light sensitive film and the developed film or transparency is subsequently used for the production of a printing plate.

The characters may be selected by an operator by means of a keyboard mechanism. In known arrangements of this kind, it is usual for the selected characters to be displayed to the operator in the form of a typewritten copy as in the manner of a conventional typewriter. Although such a typewritten copy suffices to indicate to the operator which keys have been actuated, this copy does not give any indication as to whether the selected characters have been correctly composed on the sensitive surface bearing in mind that when a particular character is selected by means of a key a corresponding character in a font of characters assembled, for example, on a transparent plate, cylinder or disc, has to be selected automatically and then projected to a predetermined position on the sensitive surface. Thus any breakdown in the automatic selection, projection or positioning mechanism may well produce unsatisfactory results. It would be feasible to provide various automatic checking and alarm devices but such devices may not be able to deal with all the possible causes of breakdown. Furthermore, these devices would provide no means of checking the actual composed copy.

Though various proposals have been made for providing, so-to-speak, a pre-view of the selected character before it is optically projected onto the film, these again do not provide a means of checking the composed copy or of controlling the composition by visual viewing of the actual composition as composing proceeds.

In photocomposing methods and apparatus used hitherto, the light sensitive film used is the normal photographic film of the silver halide emulsion type. This film as is known has to be completely screened from light during operation, except for the elements momentarily exposed for the formation of latent images thereon, and also has to be developed under dark room conditions.

Diazotype film materials which are sensitive to ultra violet light and can be developed by heating have been known for several years. Such materials do not require dark room conditions for operation and are typified by "Kalvar" or "Kalfax" film made by the Kalvar Corporation of New Orleans, United States of America. Though the use of "Kalfax" or similar materials has been considered for photographic type composing, they have hitherto been discarded as offering no advantages.

It has now been found that this type of film, that is,

a film sensitive to ultra violet light and developable by heating, offers outstanding advantages in photographic type composing if a sufficiently high output of ultra violet light is employed for exposure so that the exposure time does not exceed $\frac{1}{10}$ of a second and is preferably of the order of $\frac{1}{20}$ of a second and the film is developed by heating substantially immediately after exposure so as to present the developed characters for viewing by the operator shortly after he selects them.

By this means, not only can matter be composed at normal typing speeds but control of the composing operation is obtained by visual observation of the actual composition. This feature is unique in photographic type composing systems.

The ultra violet sensitive materials referred to also produce transparencies of a quality suitable for the preparation of printing plates for high quality printing.

The exposed and developed tape may be used for the direct preparation of the printing plate or for the production of an intermediate film in make-up form which is subsequently transferred to the printing plate. The latter method offers further opportunities for adjustment of the make-up of the composition.

The type of film referred to may be developed by heating for from 0.4 to 2 seconds. The development may be carried out by heating in contact with a heated surface or by heating by infra red radiation or by heating with hot air.

Thus, the invention consists in an apparatus for photographic type composing in which images of characters are successively selected by the operation of a keyboard and optically projected in ultra violet light onto succeeding areas of a radiation sensitive material, sensitive to ultra violet light and developable by heating, moving into and out of an exposure area and in which the latent images thus formed are developed on the radiation sensitive material by heating substantially immediately after it moves out of the exposure area and are rendered visible image by image for viewing by the operator.

The invention also consists in photographic type composing apparatus for use with radiation sensitive material which is sensitive to ultra violet light and can be developed by heating, which apparatus comprises a keyboard by means of which characters can successively be selected and positioned in a predetermined location, an optical projection system comprising an ultra violet light source of relatively high intensity and an imaging lens system delivering a high output of ultra violet light for projecting an image of the selected character in said location onto the radiation sensitive material in the exposure area, heating means located close to the exposure area for heating the radiation sensitive material and developing and thus rendering visible latent images formed thereon and means for moving the radiation sensitive material in successive steps to the exposure area, thence to the heating means and thence to a viewing position at which it is visible to the operator whereby each developed image is presented for viewing and checking by the operator shortly after the selection thereof.

For viewing by the operator it is preferred to provide means for projecting the developed images onto a viewing screen within sight of the operator. The viewing screen should preferably be such that it accommodates at least a complete line of copy.

The invention is illustrated by way of example in the accompanying drawings in which:

FIGURE 1 illustrates schematically the general arrangement of a photocomposing machine in accordance with the invention,

FIGURE 2 shows an imaging or projection lens system which may be used with an ultra-violet light source for projection of images onto the radiation sensitive surface which in this case is provided by "Kalfax" film in the form of a strip or tape, and

FIGURE 3 illustrates a modified form of heating means for development and the control thereof.

As character matrix arrangements including means for selecting and positioning characters, shutter mechanisms and means for moving the radiation sensitive material as required, for use in photographic type composing apparatus are well known, it is considered unnecessary to describe these mechanisms in detail.

Referring to FIGURE 1, the apparatus comprises a keyboard **7**, whereby characters can be selected by manual operation of the keys **8**, a character projection system, the optical axis of which is represented by **9**, for projection of images of selected characters and comprising a high pressure mercury arc compact source lamp **10**, which may suitably be a 500 watt lamp, a condenser lens **11**, a heat absorbent glass screen **12**, a black glass filter **13** passing near ultra violet light, a character matrix unit **14**, shutter **15** and an optical imaging or projection lens system **18** (shown more fully in FIGURE 2). As is normal, a mirror or other reflector (not shown) is provided to the rear of lamp **10** to reflect light transmitted to the rear back onto the arc. The images are projected onto a "Kalfax" tape **19** which is advanced between projections in the direction of the arrow **6**.

The matrix unit **14** may be of the kind comprising a rectangular plate mounted for movement in two mutually perpendicular directions in its own plane whereby a selected character representation carried by the plate can be positioned in line with the optical axis **9**. A connection **14'** from the keyboard **7** to the matrix unit **14** represents means whereby the matrix unit **14** can be appropriately positioned in response to the selection of a character by the operator on the keyboard **7**. The shutter **15** is driven by motor **17** through shaft **16** to expose the tape to the projected image for the required interval of time, which may be $\frac{1}{20}$ of a second. The shutter operation is synchronised with the character selection operation from the keyboard through means represented by a connection **17'**.

The tape **19** is advanced by the rollers **20** the distances required corresponding to set-widths of the selected characters and to other spacings required. This is achieved in known fashion by feeding information from the keyboard **7** via a connection represented by **23'** to a computing or like-acting device **23** which controls the driving mechanism of the rollers **20**.

In operation, the arc lamp **10** is switched on, the keyboard **7** is operated to move the matrix unit **14** to bring the selected character into the position for projection in line with optical axis **9** and to actuate the shutter **15** to provide the set exposure interval for forming a latent image of the selected character on the tape **19**. As a number of characters are exposed in succession the tape **19** advances in the direction of arrow **6** until it comes into contact with a heated shoe **21**. The shoe is maintained at about 255° F. and is of such dimensions that a single character will remain in contact therewith for about two seconds at the normal speed of operation of the keyboard **7**.

The shoe **21** is carried by a solenoid **22** and is maintained in contact with the tape **19** as long as the solenoid is energised. The solenoid is kept energised by actuation of the keys of the keyboard **7** at the normal speed of operation. A time-controlled delayed action device represented by **28** is provided which acts to de-energise the solenoid **22** after a preset interval of time, should the operator for any reason cease actuating the keys of keyboard **7**, and this results in the shoe **21** being moved away from the tape **19**. The actuation of a key will reset the device **28** and will result in re-energisation of the solenoid **22** to restore shoe **21** to its operative position. This arrangement will ensure that overdeveloping or burning of the tape **19** does not take place when actuation of the keyboard ceases.

As the tape **19** carrying the developed images advances further through the apparatus, it moves into the field of a secondary optical projection system represented by a filament lamp **24**, condenser lens **25**, and a conventional imaging or projection lens system for white light indicated by **26**. This system serves to project the developed images carried by tape **19** onto a viewing screen **27** to be seen by the operator at the keyboard. The screen **27** may be a translucent strip-like screen able to accommodate at least one line of copy.

FIGURE 2 shows a suitable imaging lens system which may be used at **18** in FIGURE 1 to deliver a satisfactory output of ultra violet light from the lamp **10** to ensure an exposure time of about $\frac{1}{20}$ second. This system comprises four lenses, the outer two **30** and **30'** being convex meniscus with the concave curves outside and the inner two **31** and **31'** being plano convex with the convex curves facing each other. The lenses are 3 cms. in diameter and are made of Borosilicate Crown glass with a refractive index of about 1.530 for near ultra violet light of wave length 3655 A. units. The radii of curvature, thicknesses and distances between the lenses are set out below. This system images the matrix character at a magnification of minus 1 on the tape, the distance between the matrix and tape being approximately 20.6 cms.

Specification of U.V. Imaging System

[All dimensions are given in cms. Surfaces with positive radii are convex: those with negative radii are concave.]

Lens	30	31	31'	30'
Radii	−21.3	+7.1 ∞	+10.6 ∞	+7.1 −21.3
Thickness	0.2	0.2	0.2	0.2
Distance between lenses at nearest point	0.1	0.1	0.1	

The condenser lens **11** may be a moulded glass aspherical lens having a convex surface facing the arc and a paraboloid surface remote from the arc and dimensioned so as to image the arc on the matrix unit.

In the arrangement described and illustrated the operator is enabled to view visible images on the tape **19** within a very short time after the actuation of the keys which initiated the production of the images. Hence the operator can check the matter composed and the typewritten copy, previously used for checking purposes, can, if desired, be dispensed with. Moreover, the checking and alarm devices previously incorporated in photographic type composing machines can be largely dispensed with because if any breakdown or incorrect operation of the machine occurs the operator will be aware of it due to the absence or incorrectness of the visible images.

Referring to FIGURE 3, in the modification shown the tape advancing means comprises a movable carrier or transport bar **41** arranged to be moved from a fixed starting position during the exposure of a character and returned to this position, advancing the tape **42** the required character width dimension during the return movement which takes place after the exposure of the character. The distance which the bar **41** moves from the fixed starting position is adjusted in accordance with the width of the character which is being exposed. **43** represents the fixed frame of the apparatus.

A source of radiant heat is provided having a strip heating element **45** and a substantially parabolic reflector

44 to focus the heat rays onto the tape 42. The heat source 44, 45 is positioned adjacent the image projection area and facing the tape 42 and extends in the direction of movement of the tape. A screen 46 is provided between the tape 42 and the heat source. The rear end of this screen (i.e. the end nearest the projection area) is attached by a coiled spring 52 under tension to a pin on the fixed frame 43 of the apparatus and the front end is attached to a rod 47 which is arranged to slide in guides 48 on the fixed frame 43 of the apparatus which also carries the film transport bar 41 mentioned above. One face of the rod is formed with ratchet teeth 49 in the form of a rack and the rack is engaged by two spring pawls 50 and 51, one of which (50) is attached to the transport bar 42 and the other of which (51) is attached to the fixed frame 43 and which are positioned so as not to interfere with each other.

The ratchet teeth 49 are shaped so that the rod 47 can be moved in the sense in which the film 42 is to be moved, with the pawls 50, 51 over-riding the teeth 49, but not, when the pawls engage the teeth, in the reverse sense.

Thus the return movement of the transport bar 41 to its starting position will cause its pawl 50 in engagement with the teeth 49 on the rod 47 to take the rod with it, and during this movement the pawl 51 attached to the frame 43 will over-ride the teeth 49 of the rod 47. When the transport bar 42 moves in the reverse sense the set distance corresponding to the character width, the pawl 50 carried by it will over-ride the teeth 49 of the rod 47 which will be held in its advanced position by the pawl 51 attached to the frame 43. When commencing operation of the photocomposing apparatus the screen 46, will fully obscure the source of radiant heat (44, 45) from the tape 42 and as the tape is advanced step by step by the transport bar 41, the rod 47 and consequently the screen 46 will be moved step by step to expose an increasing area of the tape 42 to heat from the heat source. The operable length of the toothed rack 49 of the rod 47 is such that it and the screen 46 will be moved that distance which at the normal average rate of advancement of the tape 42 will expose each elemental area of the tape to heat from the heat source for the required period of time—which in the case of Kalfax tape will be approximately two seconds. When the rod 47 has moved this distance, the pawl 50 of the transport bar 51 will engage the smooth surface of the rod 47 and no further movement of the rod will be effected.

As will be appreciated from the above description the rod 47 and the screen 46 attached to it are moved to uncover the heat source against the biassing action of the coiled spring 52 attached to the rear end of the screen 46.

To prevent overheating of the tape 42, should operation of the tape advancing means be interrupted for a longer period than that required for development of the tape, a time controlled switch (not shown) is provided, which is reset on each actuation of the tape transport bar 41 and which is arranged to act after the elapse of a predetermined period, which may be the two seconds mentioned above, to make a circuit to energise a solenoid 53, which is so disposed that on energisation its armature 54 moves to disengage the pawls 50, 51 from the rack 49 on the rod 47. When this occurs the coiled spring 52 will pull the screen 46 back into the fully obscuring position. This arrangement not only ensures that overheating will not occur but also that the last latent image formed on the tape before the interruption is heated for a sufficient time for its development.

The spring arm of pawl 50 has a lip 55 overlapping the spring arm of the other pawl 51 so that the movement of the solenoid armature 54 to contact and disengage the second-mentioned pawl 51 will also cause the disengagement of the first-mentioned pawl 50.

Development may, as previously indicated, take place by exposing the film to a current of hot air and in such case a flap valve may be provided in the conduit conveying hot air for diverting the stream of hot air either to the tape or so as to by-pass the tape. This flap valve may suitably be actuated by a solenoid energised by actuation of the keys of the keyboard in a manner similar to that described in connection with the solenoid 22 carrying the heating shoe 21 shown in FIGURE 1.

As previously stated "Kalfax" is the trade name of a radiation sensitive material produced by the Kalvar Corporation of New Orleans, Louisiana, United States of America. It is sensitive only to light in the near ultra violet region of the spectrum and does not require darkroom conditions for operation. With a suitable projection system exposure periods of from about $\frac{1}{10}$ to $\frac{1}{20}$ second can be used. "Kalfax" can be developed by heating to 255° F. for from 0.4 to 2 seconds, for example as described above or by passing around a heated roll. Alternatively, radiant heat may be used for development. Development should follow immediately after exposure and the developed film may then be used for viewing.

"Kalfax" or "Kalvar" photographic film comprises a light-sensitive emulsion coated on a transparent base e.g. a "Mylar" base. (Mylar is a Registered Trade Mark.) The emulsion is said to consist of a sensitizer, which may be a diazo material and which undergoes photo-decomposition to yield volatile products or gases, dispersed in a polymeric vehicle which can be relaxed by heat. After irradiation and the subsequent application of heat for development, a developed visible image in the form of radiation scattering centres is formed in the light struck or irradiated area of the film.

We claim:

Photographic type-composing apparatus for forming composed copy as a visible line of text on a continuous strip, which comprises:

(a) a character matrix unit,

(b) a manually operated keyboard for successively selecting characters from said character matrix unit and locating the selected characters in turn at a projection station,

(c) an optical projection system operating in synchronism with the operation of said keyboard comprising an ultra-violet light source of relatively high intensity and an imaging lens system delivering a high output of ultra-violet light, for projecting an image of the selected character located at said projection station,

(d) an exposure station at which the projected images of the characters are received,

(e) a continuous strip of ultra-violet light sensitive material developable by heating, arranged to pass through the exposure station to receive the said projected images whereby there is formed in said strip latent images of the projected characters,

(f) a developing station adjacent the exposure station and through which the said continuous strip is arranged to pass on leaving the exposure station and which comprises heating means for developing said latent images to form in said strip visible images of the projected characters,

(g) actuating means for rendering the said heating means operative controlled by operation of said keyboard comprising a delayed action device which on cessation of operation of the keyboard comes into action to cut off the heating means after a predetermined time interval,

(h) a viewing station adjacent the exposure station and through which the said strip is arranged to pass on leaving the developing station, and

(i) drive means controlled by the operation of said keyboard for successively advancing the said strip through the exposure station, through the developing station and through the viewing station so that each developed image is presented at the viewing station for viewing and checking by the operator

shortly after the selection of said keyboard of the corresponding character.

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