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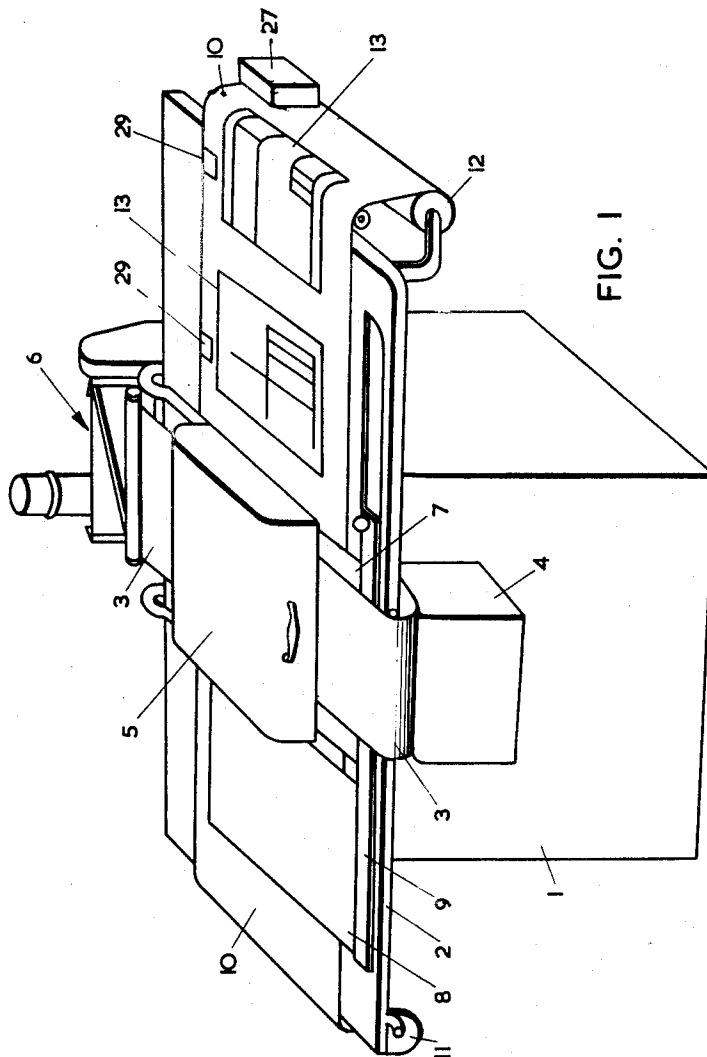
D. AMSEL ET AL

2,948,207

PHOTOGRAPHIC PRINTING APPARATUS

Filed June 18, 1958

3 Sheets-Sheet 1



INVENTORS
DONALD AMSEL
MALCOLM HARRY WRIGHT
By Hane and Nydick
ATTORNEYS

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3 Sheets-Sheet 2

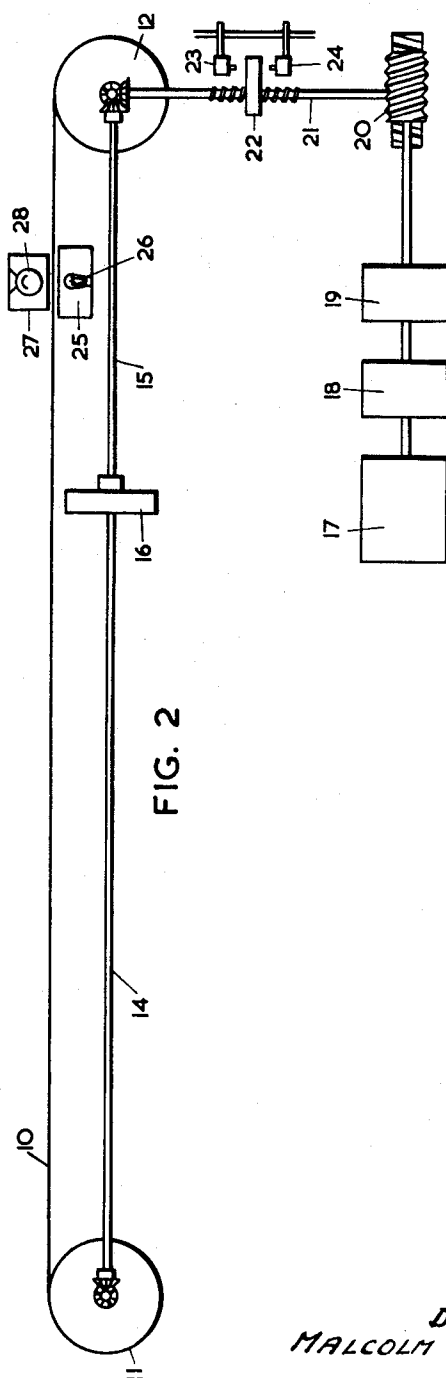


FIG. 2

INVENTORS
DONALD AMSEL
MALCOLM HARRY WRIGHT

By Hane and Nydick
ATTORNEYS

Aug. 9, 1960

D. AMSEL ET AL

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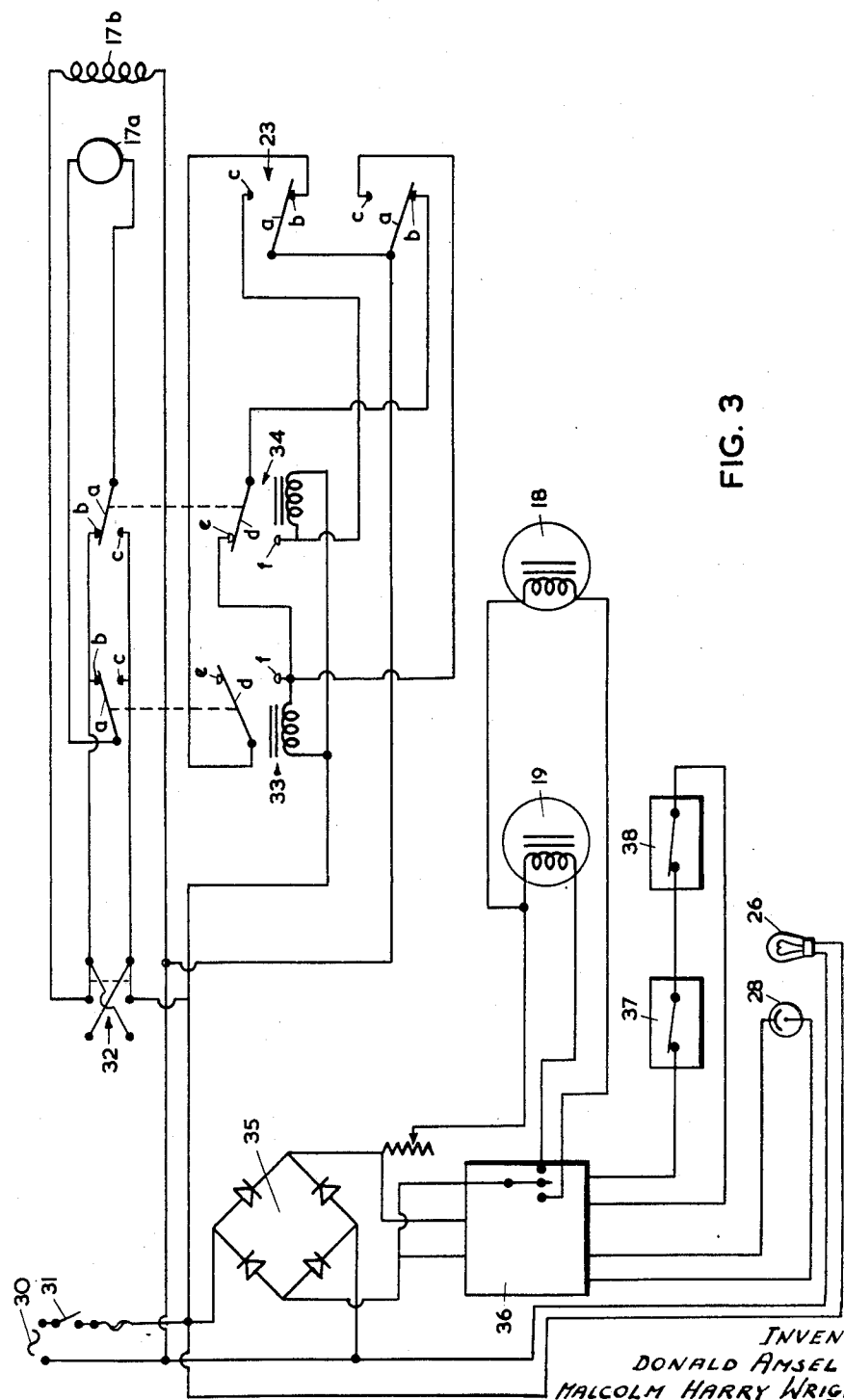


FIG. 3

INVENTORS
DONALD AMSEL
MALCOLM HARRY WRIGHT
BY *Home and Nield*
ATTORNEYS

1

2,948,207

PHOTOGRAPHIC PRINTING APPARATUS

Donald Amsel, London, and Malcolm Harry Wright, Beckenham, Kent, England, assignors to Copycat Limited, London, England

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6 Claims. (Cl. 95—75)

This invention relates to photographic printing apparatus and provides means operating, preferably automatically, to make successive prints from a negative, or other master to be copied, in superimposition or juxtaposition with each of a series of other masters. Such apparatus may be employed (for example) to prepare a series of documents relating to a particular business transaction, without the usual necessity for providing pre-printed stationery, the first mentioned master carrying the data peculiar to the transaction in question, while the masters of the series carry the standing matter appropriate to the various documents required.

The invention comprises photographic printing apparatus having a printing position, means for guiding through the printing position a web of photo-sensitive sheet material, means for locating at the printing position in superimposition with said web a first master to be copied, a band extending through the printing position and carrying at spaced intervals along its length a plurality of other masters to be copied, one of said other masters being in superimposition at the printing position with said web, and means for effecting step by step advance both of said band and of said web, whereby to locate each of said other masters in turn at the printing position for printing on to said web in conjunction with said first master, and to locate a fresh length of said web at the printing position for each such printing operation.

Apparatus in accordance with the present invention may constitute an addition to the automatically operating photographic printing apparatus described and illustrated in the complete specification of our copending application for British Letters Patent No. 27,650 of 1954 and apparatus applied in this manner is illustrated in the accompanying drawings and described below, by way of example. It will be understood, however, that the invention is not limited either to the particular printing apparatus shown in the above mentioned specification, nor to the particular form of the additional apparatus illustrated and described below.

In the accompanying drawings, Figure 1 is a simplified perspective view of the complete apparatus; Figure 2 shows separately the band carrying the said other masters to be copied and the means provided for effecting step by step advance of this band; and Figure 3 is an electrical circuit diagram of the band advancing means.

Referring to the drawings and initially to Figure 1, the apparatus illustrated includes automatically operating photographic printing apparatus as fully described in our above mentioned specification. Briefly, this apparatus comprises a cabinet 1 containing a source of printing light and having a flat table top 2. A web 3 of photo-sensitive sheet material is drawn from a supply casing 4 at the front of the cabinet and passes rearwardly across the table top, through a printing position which is located beneath an upwardly and downwardly moveable head 5. After passing through the printing position the web is received by web feeding and photographic developing

2

means indicated generally by the reference 6. Disposed on the table top at the printing position, beneath the web 3, is a holder 7 for a master to be copied. The holder 7 and a second similar holder 8 are carried by a slide 9, adjustable laterally of the table top, so that either master holder can be located at the printing position. When set in operation, the apparatus operates automatically to lower the head 5, whereby to clamp web 3 and the master at the printing position against a glass panel included in table top 2; then to expose to light for a predetermined period of time the master and the length of web in superimposition with it, whereby to effect printing; then to raise the head; then to advance the web through a predetermined distance, whereby to bring a fresh length of the web to the printing position and to develop the length of web printed upon in a previous cycle of operations. The apparatus repeats this cycle of operations a predetermined number of times and then automatically ceases to operate until restarted manually.

The additional apparatus provided in accordance with the present invention includes a wide band 10 of transparent flexible material which extends across the table top from side to side thereof, passing beneath the carrier 7 for the first master at the printing position. The band 10 is secured at its ends to a pair of feed and take-up rolls 11 and 12, disposed on opposite sides of the table top below the level thereof. Printed on or otherwise carried by the band 10 at spaced intervals along its length are a plurality of form outlines 13, constituting the other masters above referred to, each of which in turn can be located at the printing position by rotating to the appropriate extent the rolls 11, 12.

As shown in Figure 2, the shafts of rolls 11, 12 are coupled together through a pair of aligned shafts 14, 15 whose adjacent ends are connected together through a torsion spring coupling 16, the spring tending to rotate the rolls 11, 12 away from one another, so that the band 10 is always held under light tension. The shaft of the roll 12 is rotated to move the band 10 in either direction as required by a reversible electric motor 17, whose movement is transmitted to the rolls through an electromagnetically operated clutch 18, an electromagnetically operated brake 19, a worm and wheel reduction gear 20 and a shaft 21. The shaft 21 has a screw threaded portion engaged with a nut 22, the nut being held against rotation so that it is moved longitudinally of shaft 21 when the rolls are rotated to move the band 10. Nut 22 is adapted to engage and operate each of a pair of limit switches 23, 24 which are disposed on opposite sides of nut 22 and are individually adjustable in position longitudinally of shaft 21.

Disposed adjacent opposite faces of the band 10 are a housing 25 containing a light source 26 and a housing 27 containing a photo electric cell 28. The housings 25 and 27 are formed with small registering apertures by which light can be transmitted through the transparent band 10 from source 26 to photocell 28. At spaced intervals along its length, corresponding to the spacing of the form outlines 13, the band 10 carries opaque markings 29 adapted to interrupt the passage of light from source 26 to photocell 28.

As shown in Figure 3, an alternating current source 30 controlled by a manually operated switch 31 supplies the armature and field windings 17a, 17b of motor 17 through a circuit including a manually operated reversing switch 32, relays 33 and 34 and limit switches 23, 24. Each of the relays has two moving contacts a and d which respectively engage contacts b and e when the relay is deenergised and contacts c and f when the relay is energised (contact 33e having no external connection). Each of the limit switches has a moving contact a which

3

normally engages contact *b* but engages contact *c* when the switch is operated by engagement with it of nut 22. Current source 30 also supplies light source 26 and a full wave rectifier 35, the rectifier supplying energising current either to clutch 18 or to brake 19 under the control of a cold cathode relay 36. Relay 36 operates to supply current to brake 19 when no light falls on photocell 28 and switches 37 and 38 are closed, but to supply current to clutch 18 while light reaches the photocell or either of switches 37, 38 is open. Switch 37 is manually operated, while switch 38 is momentarily opened during rising movement of the head 5 (Figure 1).

In use, the band 10 is positioned so that the first of the form outlines 13 is at the printing position, one of the marks 29 being then in position to prevent light from source 26 reaching photocell 28. On closing switch 31, relay 33 is energised (by way of contacts *e* and *d* of relay 34 and contacts *a* and *b* of limit switch 24) so that its contacts *a* and *c* close and complete the circuit of motor 17. However at this time clutch 18 is not energised but current is supplied to brake 19, so that no drive is imparted to the rolls 11, 12 and band 10 is held stationary. The head 5 descends and a print is made onto web 3 from the first master in holder 7 and the other master or form outline which is then located at the printing position. When the head rises after completion of the exposure, switch 38 is momentarily opened, so that brake 19 is released and clutch 18 is engaged, motor 17 then driving rolls 11, 12 to advance the band 10. The initial movement of the band carries the mark 29 out of the path of light to the photocell 28 so that the clutch remains engaged and band 10 continues to move until the next mark 29 has been brought into position to interrupt the light to the photocell, at which time the second of the form outlines 13 has reached the printing position. Simultaneously with the movement of band 10, the web 3 has been advanced to bring a fresh length of photo-sensitive material to the printing position, this fresh length being printed from the second form outline 13 and the superimposed first master when the head 5 next descends.

The above cycle of operations is repeated for each of the form outlines 13, until rotation of shaft 21 carries nut 22 into engagement with limit switch 23, opening its contacts *a*, *b* and closing its contacts *a*, *c*. Relay 34 is accordingly energised, thereby opening relay 33, and drive motor 17 is reversed. The band 10 is accordingly again moved step by step past the printing position, but in the reverse direction, prints being made successively from each of the form outlines 13 onto successive lengths of the web 3.

Manually operated switches 32 and 37 allow the band 10 to be positioned ready for automatic operation as described above, or as may be required at any time, independently of any movement of head 5 and other parts of the apparatus described in our above mentioned specification. Momentary opening of switch 37 will cause the band to be advanced until the next mark 29 is in position to interrupt the light falling on photocell 28. Reversal of the direction of movement of the band can be effected independently of limit switches 23, 24 by reversing switch 32.

It will be appreciated that the apparatus may be employed as described above to prepare a series of documents relating to each of a series of transactions, the standing matter or form of each of the different documents required being represented by the successive markings 13 on the band 10. The matter peculiar to an individual transaction is written or printed on a sheet which is inserted in the holder 7 or 8 at the printing position, so that it is printed in superimposition with each of the forms in turn onto as many different lengths of the web 3. When the apparatus has made the preselected number of prints required to complete the documents required for one transaction, the apparatus is automatically

4

stopped. The master appropriate to that transaction is then replaced by a fresh master and the whole cycle of operations is repeated.

In another way of using the apparatus, a heading, or other matter common to a series of documents to be prepared, is carried on a sheet which is inserted in the master carrier 7 or 8 and a series of individual items (each of which is to be printed adjacent the common matter to constitute one of the required documents) is carried on the transparent flexible band 10. In such cases the individual items will usually differ from one series of documents to another and instead of marking the items on the band itself they may be marked on a sheet or sheets detachably secured to the band so as to be carried along by it. An opaque mask covering the whole printing area is inserted in the master carrier, or otherwise positioned below the web 3 of printing stock, this masking being formed with two apertures which are displaced from one another both laterally and longitudinally that is in the directions of movement of the transparent band and of the printing stock. At each printing operation, the heading (or other matter on the sheet in the master carrier) is printed through the front aperture and one of the items on the band (or the sheet attached to it) is printed through the rear aperture, the item being thus printed adjacent the print of the heading which was made during the previous exposure.

We claim:

1. Photographic printing apparatus having a printing position, means for guiding a web of photo-sensitive sheet material through said printing position, means for superimposing a first master to be copied upon said web at said printing position, a band extending through the printing position transversely of said web, said band including a plurality of longitudinally spaced-apart, other masters to be copied, said band having a plurality of longitudinally spaced-apart indicia each one correlated with one of said other masters, drive means operable in response to energization effecting longitudinal movement of said band to move one of said other masters into superimposition with said web at said printing position, said drive means in response to de-energization arresting said band, means for printing said first master and said other master located at said printing position upon said web, means responsive to the completion of each such printing operation, to advance said web whereby to bring a fresh length of said web into said printing position and to energize said drive means for said band, and sensing means located at a given position in the path of and responsive to the movement of each of said indicia past said position to de-energize said drive means.

2. Photographic printing apparatus comprising, in combination, a printing station, a web of photo-sensitive sheet material supported for guided movement through said printing station, said printing station including locating means supporting a master to be copied in superimposition with said web, a band supported for movement through said printing station in proximity with said web, a plurality of other masters carried in longitudinally spaced apart relationship by said band for individual superimposition with said web at said printing station for printing on to said web, drive means advancing each of said web and said band independently of each other, means responsive to the completion of one printing operation at said printing station to energize said drive means to effect the advance of at least one of said band and said web, a plurality of indicia carried by said band each in predetermined correlated position with each of said other masters, sensing means disposed in the path of movement of said indicia responsive to movement of one of said indicia to deenergize said band drive means to arrest continued movement of said band and to position one of said other masters correlated with said one of said indicia in printing relationship with said web and said printing station.

5

3. Photographic printing apparatus as set forth in claim 2, wherein said sensing means comprises a photoelectric cell, and said indicia comprises visible signals impressed upon said band to interrupt illumination of said cell in response to movement into the path of light transmitted thereto.

4. Photographic printing apparatus as set forth in claim 3, wherein said band is supported for movement through said printing station in a plane parallel to said web.

5. Photographic printing apparatus as set forth in claim 3, wherein said band is supported for movement through said printing station in a direction normal to the direction of movement of said web.

6. Photographic printing apparatus comprising, in combination, a printing station, a web of photo-sensitive sheet material supported for guided movement through said printing station, said printing station including a locating means supporting a master to be copied in superimposition with said web, a band supported for movement with

6

said printing station in proximity with said web, a plurality of other masters carried at longitudinally spaced apart relationship by said band for individual superimposition with said web at said printing station for printing on to said web, drive means advancing each of said web and said band independently of each other, and said drive means including means operating automatically to reverse the direction of movement of the band when the band reaches a predetermined position.

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