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(54) COPYING DEVICE

(71) We, OCE-VAN DER GRINTEN N.V., a limited liability company, organised and existing under the Laws of the Kingdom of the Netherlands, residing at Venlo, The Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a copying device provided with an original plate and means for transporting sheetlike originals from a position of readiness to a copying position, which means consist of a frame installed above the original plate, in which frame at least two rollers are installed, which are rotatably supported in bearings in this frame and round which a transport belt is installed, which belt has a first part which extends past and in contact with the original plate, and a second part, in the neighbourhood of which a surface is installed for lying a sheetlike original ready in such a way that an edge of an original which has been laid ready, rests in a feed nip formed by the belt and a roller co-operating externally with this, and means for driving the transport belt during certain time-intervals.

Such a device is known from the German Offenlegungsschrift 2,316,547. When with this known device books or other objects with exceptional dimensions must be placed on the original plate, the frame must be turned back. If in that case a covering device is still to be present, in order to prevent undesired light-emission, a separate covering device must be used.

According to the present invention there is provided a copying device provided with an original plate and means for transporting sheetlike originals from a position of readiness to a copying position, which means consist of a frame installed above

the original plate, in which frame at least two rollers are installed, which are rotatably supporting in bearings in this frame and round which a transport belt is installed, which belt has a first part which extends past and in contact with the original plate, and a second part, in the neighbourhood of which a surface is installed for lying a sheetlike original ready in such a way, that an edge of an original which has been laid ready, rests in a feed nip formed by the belt and a roller co-operating externally with the belt, and means for driving the transport belt during certain time-intervals, wherein the frame is connected via hinges with the copying apparatus and with the aid of these hinges can be brought into an open position in which the original plate is freely accessible, and wherein at least one supporting roller of the transport belt is displaceably supported in bearings in the frame, in such a way that in the closed position of the frame the extent of displacement depends on the thickness of an object laid down on the original plate.

Such a device enables, with one and the same auxiliary means being used, both sheetlike originals and originals with exceptional dimensions to be copied, while enabling a good contact-pressure and light-tight screening still be effected, especially with thicker originals such as books.

Other characteristics and advantages will become clear from the following description of a preferred embodiment of the invention, in which reference is made to the accompanying drawings, in which:

Figure 1 is a schematic section of a preferred embodiment of the device according to the invention;

Figure 2 is an under plan view of the device in which the belt has been partially cut away, and

Figure 3 is an electric circuit diagram showing a control circuit.

In Figure 1 the original plate of a copying apparatus is denoted with 10, which 5 copying apparatus is for instance of the electrophotographic type, in which an original is exposed overall. On the original plate 10 a device 11 for the treatment of originals is installed.

10 The device 11 comprises two parallel plates 20, between which the functional parts of the device 11 are mounted. On the sides of the plates 20 directed towards each other a first pair of bearing blocks 15 21 and a second pair of bearing blocks 22 are mounted. In each of the Figures only one of each pair is represented. In the bearing blocks 21 a roller 23 is freely rotatably mounted. Over the rollers 23 and 20 24 an endless belt 25 is installed, of which the lower part extends over the original plate 10.

The belt 25 is further tightened with the aid of freely rotatable rollers 26, 27 and 25 28, whereby the shaft of the roller 27 is taken up in elongated holes 29. The belt 25 is made of an elastic material and has a white, properly reflecting outer-surface.

A roller, cooperating with the roller 24, 30 is formed of a shaft 30 provided with freely rotatable rubber discs 31. The shaft 30 is also mounted in elongate holes, not shown, so that the rubber discs 31 press on the belt 25 and the roller 24 as a result of 35 the weight of shaft 30 and discs 31.

Above the belt 25 a feed table 32 for sheetlike originals is installed, which extends from the nip between the discs 31 and the roller 24 as far as above the roller 40 23. The feed table 32 is provided with a non-represented lateral stop. Just before the nip between the discs 31 and the roller 24 a photo-electric detecting element 33 is installed, with which the presence or 45 absence of an original on the feed table can be detected. From the detecting element 33 almost up to one edge of the original plate 10 a guide plate 34 extends about part of the circumference of the 50 roller 24.

Outside the space between the plates 20 the shaft of the roller 23 is connected with the secondary shaft of a coupling 35, on the primary shaft of which a gear 36 is 55 fixed. The gear 36 engages a gear 37 which can be driven via a reduction gearbox by an electric motor 39, (see Figure 2).

The whole of the device 11 is further provided with covering plates, which are 60 not shown in Figure 2 for the sake of clarity, but of which covering plates 40 and 41 are shown in Figure 1.

The operation of the device is as follows.

65 After the operator has placed a sheet-

like original on the feed table 32 and has pressed this original by hand into the nip between the roller 24 and the discs 31, the print switch of the copying apparatus is operated. As will be explained afterwards, 70 now also the motor 39 is started and also the coupling 35 is energised, as a result of which the original is introduced past the guide 34 onto the original plate 10 and the original is pressed on the original plate 10 75 by means of the belt 25. As soon as the leading edge of the original reaches a pre-determined position, the coupling 35 is de-energised, after which the copying cycle is started. After in a copying cycle the 80 original has been exposed for the last time, the coupling 35 is again energised, by which the original is removed and arrives in a receiving tray installed below the roller 26. If in the meantime a new original has been 85 laid ready on the feed table 32, this is automatically introduced at the same time.

In order to stop the original at the exact place desired on the original plate 10, the roller 24 makes a certain number of 90 revolutions upon each energising of the coupling 35. In the case illustrated, the roller 24 makes two revolutions, which corresponds with the distance between the nip, roller 24/discs 31, and the so-called 95 zero-point on the original plate.

The complete operation will become even clearer after the following description of the electrical control, for which reference is made to Figure 3. 100

For the control of the device 11 use is made of some signals, which are generated in the copying apparatus itself, for which reason the device 11 is electrically coupled with the copying apparatus. A first signal 105 which is generated by the copying apparatus, is the signal TM. This signal is zero, as long as the copying apparatus is not making a copying cycle. As soon as a copying cycle is started, i.e. upon operating the 110 print switch, TM becomes one, until the last copy of a copying cycle has left the copying apparatus. In practice this means, that the signal TM become one some time, for instance 0.5 seconds, before the ex- 115 posure starts, and becomes zero again some time, for instance 3 seconds, after the exposure of the last copy of a cycle has been ended.

The signal READY is one, when a new 120 original can be laid on the original plate 10. Consequently this signal becomes zero, as soon as the print switch is operated and becomes one, immediately after the exposure of the last original of a copying 125 cycle has been ended. In the circuit of Figure 3 the inverted signals of the signals TM and READY are used.

The signal $\overline{\text{TM}}$ is connected with the base of a transistor 50, of which the emitter 130

is connected via a relay coil 51 with a clamp +24V. The collector of the transistor 50 is earthed. The normally open contact 52 of the relay which includes coil 51 is connected in series with the motor 39 which in this way can be connected with an alternating current source of for instance 220V.

The signals \overline{TM} and \overline{READY} are combined in a NOR-gate 53. The detecting element 33 consists of LED and a photo-transistor, the latter being connected in a bridge circuit, which is connected with an operational amplifier 54. The output of the NOR-gate 53 is connected via an RC-circuit 69, 70 with the reset-input of a flip-flop 55, of which the set-input is connected with the output of the operational amplifier 54. The output of the operational amplifier is also connected via a delay switch consisting of a resistor 56 and a capacitor 57 to an input of a NAND-gate 54, of which the other input is connected with an output of the NOR-gate 53. Via an inverter 59 the operational amplifier 54 is also connected with one input of a NAND-gate 60, of which the other input is connected with the set-output of the flip-flop 55 via an RC-circuit 71, 72 and a monostable multivibrator 61. The monostable multivibrator 61 has a delay time which is almost equal to the time which passes between the end of the exposure phase of a copy and the delivery of that same copy by the copying apparatus. The monostable multivibrator 61 is of the type which can be reset, in which the reset-input is connected with the operational amplifier 54. The outputs of the gates 58 and 60 are combined in a NAND-gate 67 of which the output is connected with a monostable multivibrator 62, which in its turn is again connected with an amplifier 63, which is connected with the coupling 35.

In the embodiment represented the coupling 35 is a one revolution coupling, which means that after each energising the coupling makes one revolution and subsequently de-energises itself. As in the embodiment described the roller 25 must make two revolutions in order to bring an original on its place, a monostable multivibrator 62 is installed in the energising circuit of the coupling 35, which multivibrator has such a delay time, that the coupling remains energised almost during 1.5 revolution. The output of the gate 58 is connected via an inverter 64 and a resistor 65 with the base of a transistor 66, of which the emitter is earthed and the collector is connected with the printswitch of the copying apparatus, in such a way that when the transistor 66 becomes conductive, an energising of the printswitch is simulated in the control of the copying

apparatus.

When a sheetlike original is laid ready, first the detector 33 is energised, as a result of which a signal is generated in the output of the operational amplifier 54, so that the set-output of the flip-flop 55 becomes zero. However, this has no further consequences, as the monostable multivibrator 61 is triggered by rising wave-parts of a pulse. When subsequently the printswitch of the copying apparatus is operated, the signal \overline{TM} becomes zero, and the signal \overline{READY} one. When the signal \overline{TM} becomes zero, this has the consequence, that the transistor 50 becomes conductive, as a result of which the relay-coil 51 is energised, so that the contact 52 is closed and the motor 39 is energised.

In the embodiment represented it is accepted, that when operating the print-switch the signal \overline{TM} becomes zero, before

the signal \overline{READY} becomes one. If this is not the case in practice, this can be realised by incorporating a delay unit, for instance in the form of an RC-circuit, in the circuit of the signal \overline{READY} . Thus a short positive pulse is generated in the output of the gate 53 by operating the print-switch. This pulse has no influence on the signal in the set-output of the flip-flop 55, as the output signals of the gate 53 and of the amplifier 54, a short zero pulse is generated in the output of the gate 58, as a result of which a short positive pulse is generated in the output of the gate 67. By the rising wave-part of this pulse the monostable multivibrator 62 is started, and thus the coupling 35 is energised and the original is moved to the desired position on the original plate.

After the trailing edge of the original has passed the detecting element 33 the output of the amplifier 54 becomes zero, but this has no direct further consequences. The original is exposed and when the last exposure of the original is finished, the signal \overline{READY} become zero. Thus the output of the gate 53 becomes one. Through the RC-circuit 69, 70 a short, positive pulse is transmitted, so that the set output of the flip-flop 55 becomes one and the monostable multivibrator 61 is started. When no new original has been laid ready on the feed table 32, the monostable multivibrator 61 will generate a pulse with a length of about 3.5 seconds. When the output of the monostable multivibrator 61 is reset to zero, a short pulse is transmitted via the RC-circuit 71, 72, so that in the output of the gate 60 a short zero pulse is generated, which pulse starts the monostable multivibrator 62 via the gate 67, with the result that the coupling 35 is energised and the exposed original is removed.

If in the time that the original is ex-

posed, i.e. before the signal READY has been reset to zero, a new original is laid ready on the feed table 32, this has the consequence, that in the output of the amplifier 54 a signal is generated. When subsequently the exposure of the original lying on the original plate 10, is ended, the

signal READY will become zero, as a result of which a signal 1 is generated in the output of the gate 53. This signal again has no influence on the situation of the flip-flop 55, as the set input of this flip-flop still is one. However, in the same way as described above, a zero would be generated in the output of the gate 58, which zero starts the monostable multivibrator 62 via the gate 67 and consequently energises the coupling 35. In this way the processed original is transported away and at the same time the new original lying ready is introduced. At the same time a signal is generated via the gate 64 which simulates an operation of the printswitch in the copying apparatus. Thus the exposure of the new original is started automatically.

When a new original is laid ready on the feed table, after the exposure of the preceding original has already been ended, but this original has not yet been removed, the output of the amplifier 54 becomes one. As the output of the gate 53 is already one, the output of the gate 58 is consequently set to zero. It should be remarked, that the output signal of the amplifier 54 is transmitted with some delay via the RC-circuit 56, 57 in order to be sure that the original has arrived in the nip between the discs 31 and the roller 24. However, before the signal is generated in the output of the gate 58, the monostable multivibrator 61 is reset, and the resulting signal of the monostable multivibrator 61 is blocked in the gate 60 by the output signal of the amplifier 54, which output signal is generated via the gate 59. The result is, that after the expiration of the delay time caused by the RC-circuit 56, 57 the original which has been laid ready, is immediately introduced, and that also a simulation of an operation of the printswitch is generated.

When books or other thick objects have to be copied with the aid of a copying apparatus equipped with a device according to the invention, the device 11 can be turned upwards round the shaft which is parallel to the plates 20 in Fig. 2. Thereby the book or suchlike can be pressed downwards with the belt 25, during which the belt can adapt itself to the circumference

of the book or suchlike as a result of its being supported by the roller 27 in the elongated holes 29. In this case, it is desirable, that the coupling 35 cannot be energised. This is realised, since during the last treatment of a sheetlike original the output of the flip-flop 55 has become one. When copying books or suchlike element 33, the output of the flip-flop never becomes zero, so that the monostable multivibrator 61 cannot be started. It is not possible either that via the gate 58 a signal for energising the coupling 35 is generated, because no signal is generated in the output of the amplifier 54.

WHAT WE CLAIM IS:—

1. A copying device provided with an original plate and means for transporting sheetlike originals from a position of readiness to a copying position, which means consist of a frame installed above the original plate, in which frame at least two rollers are installed, which are rotatably supported in bearings in this frame and round which a transport belt is installed, which belt has a first part which extends past and in contact with the original plate, and a second part, in the neighbourhood of which a surface is installed for lying a sheetlike original ready in such a way, that an edge of an original which has been laid ready, rests in a feed nip formed by the belt and a roller cooperating externally with the belt, and means for driving the transport belt during certain time-intervals, wherein the frame is connected via hinges with the copying apparatus and with the aid of these hinges can be brought into an open position in which the original plate is freely accessible, and wherein at least one supporting roller of the transport belt is displaceably supported in bearings in the frame, in such a way that in the closed position of the frame the extent of displacement depends on the thickness of an object laid down on the original plate.

2. A device according to claim 1, in which the belt is installed round two guide rollers and is kept tensioned by means of a tension roller, the tension roller can be displaced in elongate holes in the frame, and at least one of the guide rollers is situated outside the respective edge of the original plate.

3. A device according to claim 1 or 2 in which in the neighbourhood of the feed nip a detector is installed which reacts on the presence or absence of a sheetlike original, the means for driving the belt

are initially energised by the combination of a signal emitted by the detector and a signal supplied by a starting switch of the copying apparatus.

- 5 4. A device according to claim 3 and provided with means enabling the means for driving the belt to be energised by the signal of the detector while copying is being carried out by the device.

- 10 5. A copying device bearing an original

plate and means for transporting sheet-like originals to a copying position thereon substantially as hereinbefore described with reference to the accompanying drawings.

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