SPECIFICATION

Improvements in and relating to electrostatic copying apparatus

This invention relates to electrostatic copying apparatus, and especially to such apparatus having a device for fusing toner powder onto a final copy support, in which device the toner powder is brought to its melting temperature by intensive irradiation over a short period with a flash lamp arranged in a reflector housing facing the area of the copy support on which an image is to be fixed.

Apparatus of this kind for so-called flash fixing are described in DE-AS 1 063 029, DE-OS 1 597 898 and DE-OS 1 908 827. It has been found that in apparatus of this kind it is not possible to achieve a sufficiently rapid fixing sequence for some types of copying apparatus by using correspondingly high-energy flash lamps without severe ozone formation in the air surrounding the flash lamp. Intensive flash irradiation can also result in decomposition of the toner powder, which consists of a relatively complex plastics material, to yield volatile substances. Both phenomena may lead, if the flash intensity is increased above a certain level, to unacceptable pollution of the environment because ozone in high concentrations is damaging to health, and toner vapour irritates at least the mucous membranes. It is an object of the present invention to provide a flash fixing device having a high flash intensity, which device is not hazardous to the environment.

The invention provides electrostatic copying apparatus including an image-fixing device for fusing toner powder onto a final copy support, in which the toner powder is brought to its melting temperature by intensive irradiation over a short period with a flash lamp, that is of a type known *per se* which produces very little ozone and, is provided with a filter to reduce emission of ultraviolet radiation, arranged in a reflector housing wherein in use a stream of cooling air is passed through the interior of the reflector and then through an active carbon filter, and the stream of filtered cooling air is mixed with a further air stream having a higher rate of flow than the air stream from the toner-fixing device before it emerges into the outside air.

In this arrangement, the formation of ozone in the area surrounding the flash lamp is greatly reduced even with a high-energy flash and toner vapours formed as a result of the intensive irradiation are filtered out of the air stream coming from the lamp before it emerges into the outside air.

The mixed air stream is preferably directed at least slightly downwards at its outlet from the apparatus, advantageously by deflector plates provided at the outlet. The further air stream may comprise air which has passed through an electronics compartment of the apparatus. This prevents the relatively hot air stream coming from the flash lamp, which has been constricted by the air filter and is therefore slow-moving and of relatively low volume, from leaving the apparatus directly. Owing to its high temperature and low flow rate it would rise immediately on leaving the cooling air vents and enter the respiratory organs of the operator undiluted by the shortest route in the form of a coherent vapour. Under these circumstances, even small residual quantities of harmful air impurities could still cause irritation, whereas a stream of cooling air that has been mixed with a cool air stream of higher volume and speed can easily be deflected in any desired direction by, for example, a louvred outlet grating and can first be blown downwards where it causes least harm. By the time the air stream that has been deflected downwards, mixed with cool air and swirled in the surrounding air rises again, it is so diluted that it can no longer cause any irritation even if it originally contained fairly large admixed amounts of harmful components.

The use as the reflector surrounding the flash lamp of a reflector of a type known *per se* that distributes the radiation of the flash lamp evenly over the whole area of the record support onto which an image is to be fixed also helps to increase the fixing speed that can be obtained without harmful side effects because, owing to the more uniform heating of the image, the average intensity of irradiation can be increased without the local maximum intensity becoming any higher than is normal.

Copying apparatus constructed in accordance with the invention will now be described by way of example with reference to the accompanying drawing, the single Figure of which is a semi-schematic cross-sectional view of the apparatus seen in side elevation.

A copying cylinder 2, which rotates in a counterclockwise direction as seen in the drawing, as shown by the arrow, is mounted in an apparatus housing 1. The image of an original 8 positioned on a transparent supporting plate 7 is projected onto the surface of the cylinder 2 by means of an arrangement of mirrors 3 to 5, which are moved at different speeds in the direction of the arrows B, and a fixed imaging lens 6. During the imaging process the original 8 is illuminated by fluorescent tubes 9 which are moved with mirror 3.

Around the periphery of the copying cylinder 2 there are arranged a corona discharge device 10 for uniformly charging the surface of the cylinder before it is exposed and a developing device 11 for applying toner powder to the electrostatic charge image produced by the image-wise exposure. Beneath the developing device 11 there is a supply stack 12 for sheets of paper which are picked up individually by a friction-roller 13 and fed to a pair of transport rollers 14. The pair of transport rollers 14 conveys the individual sheets between the copying cylinder 2 and a transfer corona 15 which transfers the toner image present on the cylinder onto a sheet 31 which forms the final copy support. A removal corona 16 arranged downstream, as defined with respect to the normal direction of movement of the images, of the transfer corona 15 removes the electrostatic attractive forces that have formed between the copying cylinder 2 and the sheet 31 during the transfer process, so that the sheet may be removed from the copying cylinder and conveyed to a fixing device.

For fixing the toner image, a conventional quartz-

sheathed flash lamp 17 is provided which by means of a series of short, high-energy flashes which irradiate the surface of each sheet of paper in four overlapping portions, preferentially heats the toner image which owing to its dark colour strongly absorbs infrared radiation. The toner which consists, for example, of thermoplastic material with an admixture of carbon black is thus brought to its melting temperature and fused onto the copy support while the copy support itself, which is formed, for example, by a sheet of white, and hence relatively highly reflective, writing paper, is warmed only slightly. The low degree of warming of the actual copy support is a substantial advantage of the radiation fixing process since, apart from the reduced risk of scorching the copy support, it permits a significantly wider choice of material for the copy support. It is possible to process copy supports of differing thermal capacities, for example of different thicknesses and different moisture contents, without the flash sequence having to be altered because the temperature reached by the actual copy support in the fixing process is no longer a decisive factor in the achievement of a uniform fixing result. For the same reason the colour of the copy support no longer plays an important role provided that it absorbs the radiation from the flash lamp much less strongly than the toner does. Therefore, in addition to smooth white papers, it is also possible to process *inter alia* rough brown or grey papers, for example packing paper, or transparent sheets. Also, the low degree of heating greatly reduces the effect of the fixing process on the copy support with the result that, for example, buckling or distortion of punch cards or the like, which would hinder further processing, or softening of layers of adhesive material or self-copying layers present on the paper is largely avoided.

Beneath the flash lamp 17, which is surrounded by a reflector 27 of a type known *per se* that distributes the radiation of the flash lamp substantially evenly over the record support, there is arranged a guide 18 and 19 for the copy support 31, which guide is formed, for example, in known manner, by thin wires which do not absorb the radiation of the flash lamp. A fan 20 draws outside air through the reflector 27, which is constructed as a ventilation channel and thence blows the air through an air duct 21 to a filter 22 filled with active carbon. After passing the carbon filter 22, the air from the air duct 21 enters a mixing chamber 23 into which another air duct 24 also opens. A stream of cooling air is blown through this further air duct 24 by means of a further fan 25 from a compartment 26 that is sealed off from the rest of the apparatus and is provided with an inlet for outside air. In the compartment 26 are concentrated the control and safety electronics of the apparatus which, while likewise requiring a certain amount of cooling, only moderately warm the cooling air passed through them and above all do not charge it with harmful gases or vapours. This moderately warmed, clean cooling air may be discharged into the outside air without being filtered, as a result of which, in contrast to the cooling air that is slowed down by the carbon filter 22, it may easily be made to flow as fast as is desired, and upon discharge may be guided by deflector plates 28 in any desired direction which will be maintained for a certain time even outside the apparatus. This high volume stream of relatively cool and clean air is mixed in the mixing chamber 23 with the hot, relatively slow moving, low-volume, outgoing air stream that has passed through the filter 22, which if discharged from the apparatus unmixed would rise immediately on leaving the apparatus and enter the respiratory organs of the operator in undiluted form, in which case the operator could still be irritated by very small residual quantities of air impurities that had not been caught in the filter 22. When the two air streams are mixed as described above, however, such residual impurities are rendered harmless by extensive dilution with clean air. This is especially the case when the deflector plates 28 first direct the outgoing stream of cooling air downwardly, as shown in the drawing, so that the cooling air is further mixed with the surrounding air before it rises to face-level.

After passing through the fixing station the copy support 31 is gripped by a pair of delivery rollers 29 and fed onto a delivery pile 30.

CLAIMS

1. Electrostatic copying apparatus including an image-fixing device for fusing toner powder onto a final copy support, in which the toner powder is brought to its melting temperature by intensive irradiation over a short period with a flash lamp, that is of a type known *per se* which produces very little ozone and, is provided with a filter to reduce emission of ultraviolet radiation, arranged in a reflector housing wherein in use a stream of cooling air is passed through the interior of the reflector and then through an active carbon filter, and the stream of filtered cooling air is mixed with a further air stream having a higher rate of flow than the air stream from the toner-fixing device before it emerges into the outside air.

2. Copying apparatus as claimed in claim 1, wherein the mixed air stream is directed at least slightly downwards at its outlet from the apparatus.

3. Copying apparatus as claimed in claim 2, wherein deflector plates are provided at the outlet of the mixed air stream.

4. Copying apparatus as claimed in any one of claims 1 to 3, wherein the further air stream comprises air which has passed through an electronics compartment of the apparatus.

5. Electrostatic copying apparatus substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

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