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Cooling device for cooling a serial printer

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FIG. 1

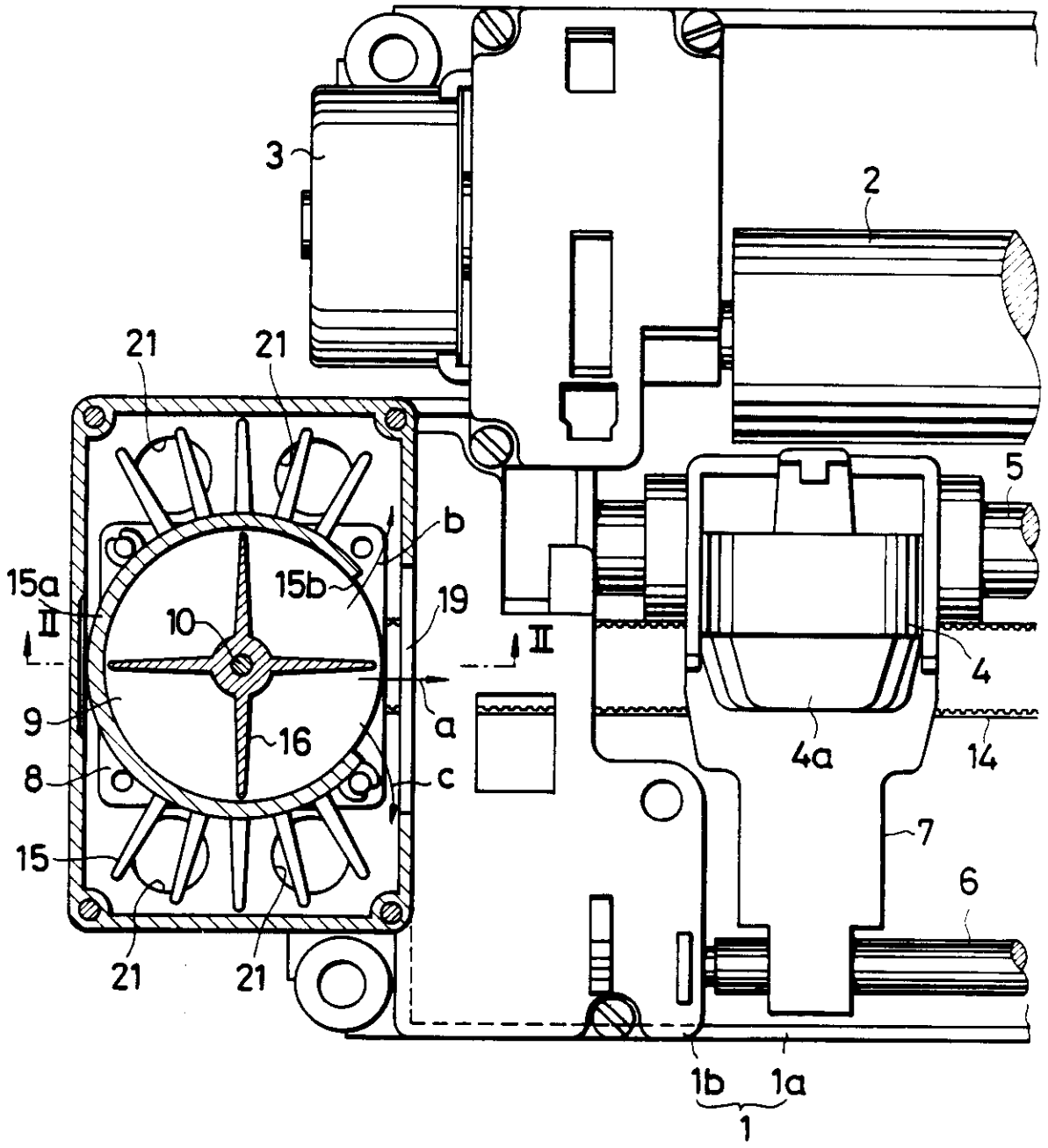


FIG. 2

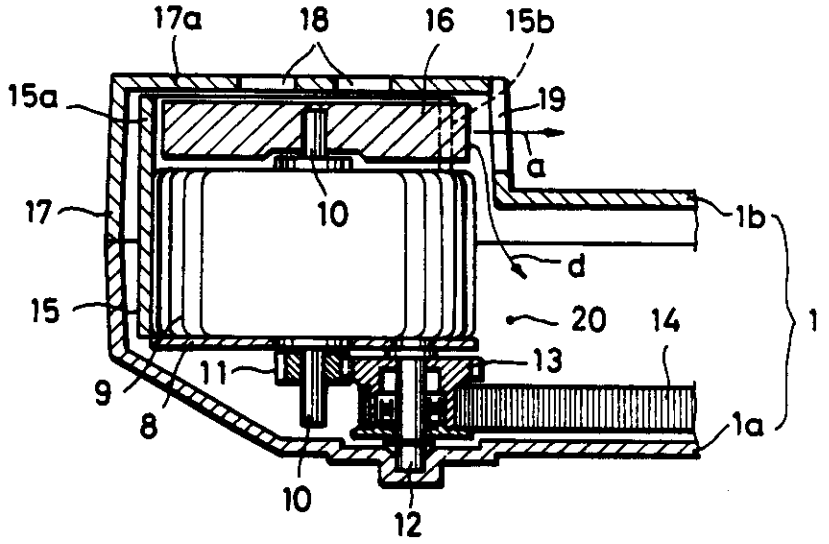

17a
18
16
15b
15a
19
a
17
10
1b
d
15
20
14
1
11
13
9
8
1a
10
12

FIG. 3

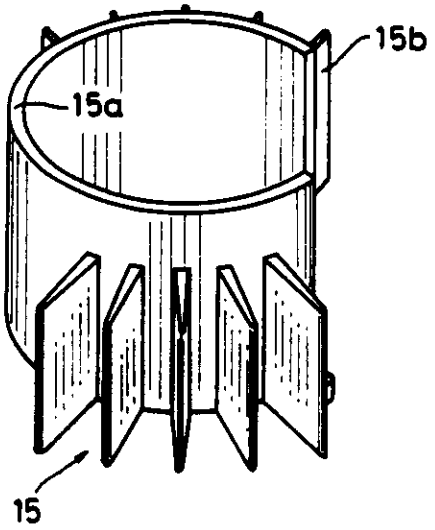

15b
15a
15

FIG. 4

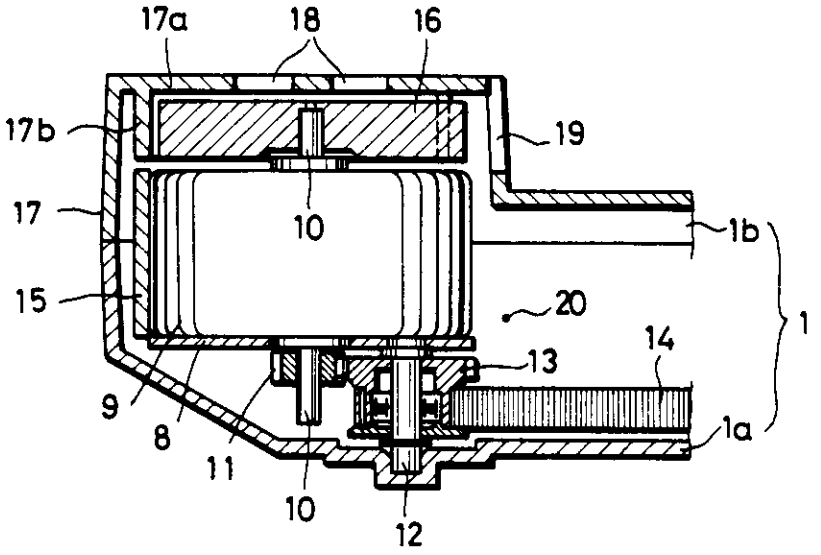
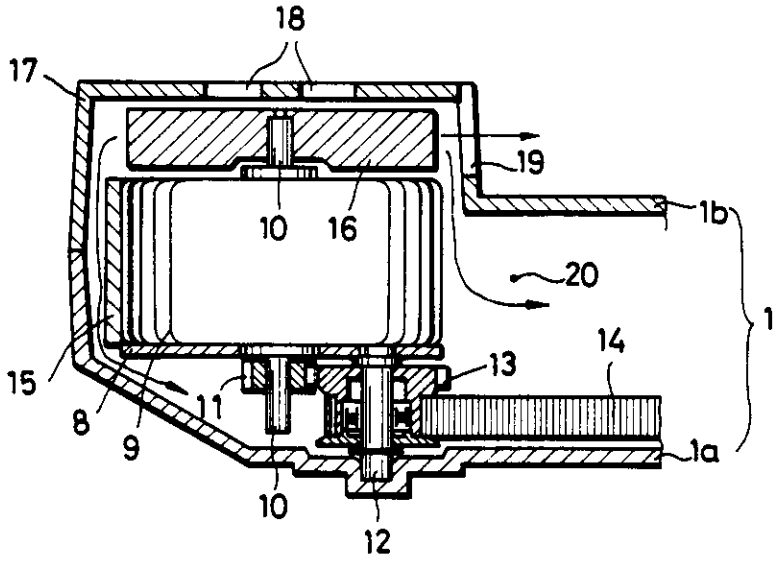

17a
18
16
17b
19
17
10
1b
15
20
14
13
1
9
8
11
1a
10
12

FIG. 5


18
17
19
1b
10
16
20
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14
15
13
11
8
9
1a
10
12

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"COOLING DEVICE FOR COOLING A SERIAL PRINTER"

The present invention relates to a cooling device for cooling a serial printer, e.g. a printer having a reciprocating print head that prints characters, numerals, symbols, etc. on a record medium such as paper.

A serial dot matrix printer having a reciprocating print head that prints characters and other symbols on paper is disclosed in U.S. Patent Specification No. 4,452,542. The actuator of the print head generates a considerable amount of heat when the head is in operation. For this reason, heat-dissipating fins are attached to the print head of this serial dot matrix printer to prevent the head from overheating.

As the head is moved, the heat-dissipating fins move through the surrounding air. Thus, the generated heat is dissipated through the fins. In general, the mechanism of the printer is housed in a casing and, therefore, the air through which the head travels is stagnant. Accordingly, the capability of the known heat-dissipating fins to dissipate heat is insufficient, notwithstanding the fact that the fins move through the air as the print head itself moves therethrough. Consequently, if the printer prints at a high speed, e.g. 400 characters per second, the head overheats. The head incorporates a temperature sensor for detecting overheating in order that the printing operation may be automatically halted when the head overheats. Consequently, when the head of a high-speed printer is operated continuously for a

considerable period, the temperature sensor operates, frequently interrupting the printing operation.

In the past, many components of a printer, including a carriage motor and a motor for shifting the carriage to the next line to be printed, were secured to a frame made of a metal plate. Therefore the heat produced by these motors could be dissipated through this metal frame. In recent years, however, as disclosed in Japanese Patent Application No. 276304/1984, the frame of a printer has tended to be made from plastics materials. As a result, the heat generated by the motor is difficult to dissipate. This problem is more conspicuous in high-speed printers, and may cause the motors to overheat and break down.

According, therefore, to the present invention, there is provided a cooling device for cooling a serial printer comprising a frame; a carriage slidably mounted on said frame or on means secured thereto; a print head carried by the carriage; a carriage motor which is arranged to reciprocate the carriage with respect to the frame and which is arranged to drive a fan; and means for directing air moved by the fan onto at least a part of the print head so as to cool the latter.

Preferably the print head is provided with heat-dissipating fins onto which at least some of the said air moved by the fan is in operation directed.

Thus the cooling device of the present invention is provided with a simple means that greatly enhances the ability

to cool the print head.

The cooling device of the present invention, moreover, is such that even if the device has a plastics frame, the heat produced by the carriage motor can be effectively dissipated, thereby preventing the printer from overheating.

As will be appreciated, when the print head is in operation, the fan which rotates with the carriage motor blows air toward the print head to ventilate the area in which the print head is located. This greatly enhances the heat-dissipating or cooling efficiency of the fins of the print head.

Preferably the means for directing air comprises a wall member surrounding the fan and provided with an air exhaust port which faces the print head.

There may be a casing formed upon the frame which houses the carriage motor and also acts as the said wall member, the casing having an air intake port or ports.

Preferably, at least part of the said wall member is integral with heat-dissipating fins which are formed on the outer periphery of the carriage motor.

Alternatively, at least part of the said wall member is integral with the casing.

The fan may be rigidly mounted on an output shaft of the carriage motor.

The said output shaft preferably extends on opposite sides of the carriage motor, the fan being mounted on the portion of the output shaft which extends on one side of the carriage motor, the portion of the output shaft on the

opposite side of the carriage motor being provided with drive means for transmitting drive to the carriage.

The frame is preferably provided with guide shafts on which the carriage is slidably mounted.

The carriage motor is preferably mounted on one side of the frame.

The heat generated by the carriage motor may be dissipated through its said heat-dissipating fins. In this case, as the carriage motor is driven, the fan blows air to ventilate the surroundings of the last-mentioned fins. Thus, the heat-dissipating or cooling efficiency of the fins on the carriage motor is greatly improved.

The invention also comprises a serial printer provided with a cooling device as set forth above.

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

Fig. 1 is a plan view in cross section of a portion of a serial printer provided with a cooling device according to the invention;

Fig. 2 is a cross-sectional view taken on line II-II of Fig. 1;

Fig. 3 is a perspective view of the heat-dissipating fins of a carriage motor shown in Figs. 1 and 2, the fins having a wall member integral with the fins;

Fig. 4 is a cross-sectional view similar to Fig. 2 but illustrating another cooling device according to the invention; and

Fig. 5 is a cross-sectional view similar to Figs. 2 and 4 but illustrating a further cooling device according to the invention.

Terms such as "left" and "right", as used in the description below, are to be understood to refer to directions as seen in the accompanying drawings.

Referring to Figs. 1 and 2, there is shown a serial printer provided with a cooling device according to the present invention. As shown therein, a printer has a frame 1 made from plastics material. The frame 1 consists of a lower frame 1a and an upper frame 1b. A platen 2 is rotatably mounted on the frame 1, and is rotated by an electric motor 3 that is arranged to move the platen periodically to the next line to be printed. A print head 4 that faces the platen 2 is carried on a carriage 7 which is mounted on guide shafts 5,6 so as to be slidable thereon, the guide shafts 5,6 being mounted on the frame 1. The print head 4 is, in operation, reciprocated parallel to the platen 2 by a carriage motor 9 which is mounted on the left hand side of the frame 1. Heat-dissipating fins 4a are mounted on the rear portion of the print head 4 and are arranged to dissipate the heat produced during printing operation.

The carriage motor 9 is mounted on a plate 8 which is fixedly mounted on the lower frame 1a. The carriage motor 9 has an output shaft 10 which extends above and below the body of the carriage motor 9 and thus to opposite sides thereof. A pinion 11 is rigidly fixed to the downwardly protruding

portion of the output shaft 10, and is in mesh with a belt-driving wheel 13 that is rotatably mounted on a shaft 12 depending from the plate 8. Thus, rotary motion of the carriage motor 9 is transmitted to the belt-driving wheel 13 via the pinion 11, so that an endless timing belt 14 is driven by the belt-driving wheel 13. The endless belt 14 reciprocates the carriage 7 along the guide shafts 5,6. The endless belt 14 is entrained around another belt-driving wheel (not shown) mounted at the right hand end of the endless belt 14.

Heat-dissipating fins 15 are mounted on the outer periphery of the body of the carriage motor 9 to dissipate the heat generated by the operation of the carriage motor 9. A fan 16 in the form of a crisscross is rigidly fixed to the end of the output shaft 10 which extends above the body of the carriage motor 9. The fins 15 are substantially equal in height to the body of the carriage motor 9. In the embodiment of Figs. 1-3, member 15a is formed integrally with the upper portions of the fins 15. This wall member 15a surrounds the lateral portion of the fan 16, and is provided with a cutout to form an air exhaust port 15b which faces the print head 4. The carriage motor 9, the fins 15, the wall member 15a integral with the fins 15, and the fan 16 are disposed within a casing 17 which is formed integrally with the frame 1. The top wall 17a of the casing 17 covers the upper surface of the fan 16 and is formed with an air intake port or ports 18 close to the centre of rotation of the fan 16. Air exhaust ports 19 and 20 are formed in the lateral portion of the casing 17. Other air exhaust ports 21 are formed in the lower portion of the casing.

The exhaust port 19 is located substantially opposite to the air exhaust port 15b.

When the carriage motor 9 is operated, the timing belt 14 is driven via the pinion 11 and the belt-driving wheel 13 so that the carriage 7 is moved along the guide shafts 5,6. At this time, the print head 4 prints desired characters on a record medium (not shown). The heat produced by the print head 4 is, in operation, dissipated through the fins 4a on the rear side of the head 4. Since the fan 16 rotates with the motor 9, air is taken from the outside of the frame 1 through the air intake ports 18 and directed as indicated by the arrows a-d. The air discharged from the exhaust port 15b is forced toward the print head 4 and fins 4a through the exhaust port 19. Therefore, the region through which the head 4 moves is always ventilated; hence the air inside the region is prevented from stagnating. This greatly enhances the heat-dissipating or cooling efficiency of the fins 4a. A portion of the air blown by the fan 16 is also forced into the space between the lower frame 1a and the upper frame 1b as indicated by the arrow d in Fig. 2. Also, some of the air is forced into the casing 17 as indicated by the arrows b and c in Fig. 1. This improves the capability of the fins to dissipate the heat produced by the carriage motor 9.

While a preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that various changes and variations may be made.

For example, as shown in Fig. 4, wall members 17a and 17b surrounding the fan 16 may be formed integrally with the casing 17, which is integral with the frame 1.

Another example is shown in Fig. 5, where the outer wall of the casing 17 constitutes the wall that surrounds the fan 16.

In this way, it is merely a matter of design with which component the wall member surrounding the fan 16 is formed integrally. It is also possible to mount the wall member independently.

Further, the fan 16 may be mounted on the portion of the output shaft 10 which carries the pinion 11.

As described in detail above, the space through which the print head 4 moves is ventilated during a printing operation. This greatly enhances the heat-dissipating or cooling efficiency of the fins 4a. Consequently, the print head 4 will not overheat even after the high-speed printer is used continuously for a long period. Hence, it is unlikely that overheating of the head will interrupt the printing operation. Additionally, the carriage motor 9 of the printer can be effectively cooled. Therefore, even if the frame 1 of the printer is made from plastics, or if the printer is a high-speed printer, the carriage motor 9 moving the print head 4 is unlikely to overheat; hence the motor does not break down. Furthermore, the structure is very simple and so the printer can be cooled or prevented from overheating at a low cost.

C L A I M S

1. A cooling device for cooling a serial printer comprising a frame; a carriage slidably mounted on said frame or on means secured thereto; a print head carried by the carriage; a carriage motor which is arranged to reciprocate the carriage with respect to the frame and which is arranged to drive a fan; and means for directing air moved by the fan onto at least a part of the print head so as to cool the latter.

2. A cooling device as claimed in claim 1, in which the print head is provided with heat-dissipating fins onto which at least some of the said air moved by the fan is in operation directed.

3. A cooling device as claimed in claim 1 or 2, in which the means for directing air comprises a wall member surrounding the fan and provided with an air exhaust port which faces the print head.

4. A cooling device as claimed in claim 3, in which there is a casing formed upon the frame which houses the carriage motor and also acts as the said wall member, the casing having an air intake port or ports.

5. A cooling device as claimed in claim 3 or 4, in which at least part of the said wall member is integral with heat-dissipating fins which are formed on the outer periphery of the carriage motor.

6. A cooling device as claimed in claim 4, in which at least part of the said wall member is integral with the casing.

7. A cooling device as claimed in any preceding claim, in which the fan is rigidly mounted on an output shaft of the carriage motor.

8. A cooling device as claimed in claim 7, in which the said output shaft extends on opposite sides of the carriage motor, the fan being mounted on the portion of the output shaft which extends on one side of the carriage motor, the portion of the output shaft on the opposite side of the carriage motor being provided with drive means for transmitting drive to the carriage.

9. A cooling device as claimed in any preceding claim, in which the frame is provided with guide shafts on which the carriage is slidably mounted.

10. A cooling device as claimed in any preceding claim, in which the carriage motor is mounted on one side of the frame.

11. A cooling device as claimed in any preceding claim, in which the frame is made of plastics material.

12. A cooling device for cooling a serial printer substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

13. A serial printer provided with a cooling device as claimed in any preceding claim.

14. A device for cooling a serial printer having a frame to which the mechanism of the printer is held, guide shafts fixedly mounted upon the frame, a carriage slidably supported upon the guide shafts, a print head carried upon the carriage

and provided with heat-dissipating fins, and a carriage motor mounted on one side of the frame for reciprocating the carriage, said device comprising:

a fan rigidly mounted upon the output shaft of the carriage motor; and

a wall member surrounding the fan and provided with an air exhaust port that faces the print head.

~~15. Any novel integer or step, or combination of integers or steps, as hereinbefore described and/or as shown in the accompanying drawings.~~

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19.09.1985 in Japan - doc: 60207105

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Patent Granted with effect from 31.08.1989 (Section 25(1)) with title COOLING DEVICE FOR COOLING A SERIAL PRINTER

**** END OF REGISTER ENTRY ****