

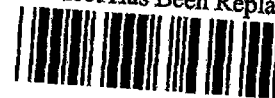
REPLACED SHEETS		SG
☒	Description : paged ...1... to paged ...13...	
☒	Claim(s) : paged ...14... to paged ...16...	
☒	Drawing(s) : paged ...17... to paged ...21...	
☒	Abstract : paged ...22... to paged ...23...	
DATE OF RECEIPT		

APPARATUS WITH SILENCING MEANS

9608850-5 IIR

ORIGINAL

This Sheet Has Been Replaced



The present invention relates to an apparatus with a noise reduction measure thereof. In particular, but not exclusively, the present invention relates to impact dot printers and a noise reduction measure thereof.

Generally, impact dot printers are designed to print by driving print wires arranged in the print head to give impact to a sheet of paper through an ink ribbon. This causes noise when the print wires collide with the platen, and such noise emanates from the printer most notably from a sheet discharge section, thereby increasing the noise level of the printer.

One known measure to reduce noise from such impact dot printers is disclosed in Japanese Utility Model Unexamined Publication No. 64-48263. The construction thereof will be described with reference to Figures 12 to 16.

In Figure 12, reference numeral 10 designates a printer case, inside which a print head (not shown), a platen (not shown), and the like are accommodated. A sheet discharge section of the case 10 is covered by a first cover 11 and a second cover 12. As shown in Figure 14, a sheet discharge path 13 for a sheet P passes underneath the first cover 11 and a second cover 12.

As shown in Figures 13, 14, inside the second cover 12 there is provided reflecting plates 12a for reflecting sound waves and a sheet guide plate 12b for guiding the printed sheet P. Each reflecting plate 12a extends in a direction orthogonal to a sheet forward direction A. The reflecting plates 12a are arranged to partially change the section of the sheet discharge path 13, so that by reflecting a sound wave propagated through the sheet discharge path 13 by the reflecting plates 12a, the noise level can be reduced.

In Figures 12 to 16, reference numeral 14 designates a sheet guide, which, to print on a continuous sheet, guides a discharged continuous sheet. The second cover 12 covers the top of the sheet guide 14. The sheet guide 14 is mounted such that it may be moved relative to the case 10. To print on a non-continuous or cut sheet (not shown),



the sheet guide 14 is turned upward as shown in Figure 15, so that the cut sheet can be supplied to the print section along the sheet guide 14. The second cover 12 is pivoted at turning support sections 15 (see Figure 12) relative to the first cover 11, so that the second cover 12 can be turned together with the sheet guide 14 when the sheet guide 14 is turned.

6 This conventional printer thus addresses the problem of noise reduction but does not achieve an adequate reduction for the following reasons.

First, the reflecting plates 12a are arranged only on the second cover 12. This means that the reflecting plates 12a are disposed at a distance from the head and the platen, which are the major sources of noise.

Second, the reflecting plates 12a and the sheet guide plate 12b have the same height as shown in Figure 14, which means in practice that the front end of a printed sheet easily jams. Such trouble is particularly noticeable with narrow sheets. One ready solution to this jamming problem, is to design the sheet discharge path 13 with more depth. However, this solution leads to an increase in noise because more noise can be heard due to the increase in the space of the sheet discharge path 13.

Third, when the sheet guide 14 is turned for printing a cut sheet, an opening S1 is created between side plates 11c of the first cover 11 and side plates 12c of the second cover 12 as shown in Figure 15. Further, as shown in Figure 16, an opening S2 is also created between the rear edge of a top plate 11d of the first cover 11 and a top plate 12d of the second cover 12. These two openings S1 and S2 naturally lead to an increase in noise.

Similar problems have also been experienced with other types of apparatus such as photocopiers and facsimile machines.

An object of the present invention is to overcome the above problems and accordingly provide an apparatus with features which reduce the noise.

An impact dot printer according to the present invention includes: a print section formed of a platen and a print head, the print head confronting the platen; and characterised by a silencing means disposed above the print section.



The silencing means is designed to have a reflecting plate for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to a sheet forward direction, and/or have a sound absorbing member for absorbing sound. The silencing means may also be designed to have a reinforcing plate serving as a sheet guide for guiding a printed sheet, the reinforcing plate being a plate-like body and intersecting the reflecting plate. By arranging a sheet discharge plate for guiding a printed sheet between the platen and the silencing means, the silencing means can be disposed closer to the platen. Further, by making the reinforcing plate deeper than the reflecting plate, the silencing means can be put closer to the print section without involving the sheet discharge plate. The distance between a plurality of reinforcing plates serving as sheet guide plates is preferably smaller than the width of a smallest sheet which it is intended to be supplied for printing to prevent jamming.

The printer includes a printer case accommodating therein at least a platen and a print head; a first cover for covering the top of the printer case, the first cover having a top plate and side plates formed integrally with the top plate; a second cover turnably mounted on the first cover, the second cover having a top plate and side plates formed integrally with the top plate; and a first overlap portion between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover. This overlap portion is formed by a fan-like overlap strip formed on the ends of the side plates of one of the covers, overlapping the side plates of the other cover. Further, a second overlap portion is disposed between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of the turning section between the first cover and the second cover when the second cover is turned relative to the first cover. This second overlap portion can be formed by overlapping an arcuate surface corresponding to a locus formed by turning a front end of one of the covers, either the first cover or the second cover, upon the other cover, the front end being on the side of the center of turning. The second cover is formed so as to be turnable above the first cover, and a cutter for cutting



a sheet may be arranged on a edge of the first cover, the edge being exposed when the second cover is turned above the first cover. The first cover and the second cover are designed so as to form an upper portion of a sheet discharge path. In this case, it is desirable to arrange a similar silencing means having a reflecting plate and a sheet guide plate also on the second cover.

Embodiments of the present invention will now be described with reference to the accompanying drawings, of which:

Figure 1 is a perspective view showing the external aspect of the preferred embodiment of the present invention;

Figure 2 is a sectional view of the preferred embodiment;

Figure 3 is an underside view of a first cover and a second cover of the preferred embodiment;

Figure 4 is a schematic sectional view with the second cover turned;

Figure 5 is a partially enlarged view of Figure 2;

Figure 6 is a sectional view taken along a line V1-V1 of Figure 5;

Figure 7 is an enlarged sectional view taken along a line VII-VII in Figure 1;

Figure 8 is a diagram showing noise spectra both in the presence and in the absence of reflecting plates on the first and second covers;

Figure 9 is a sectional view showing a first modified embodiment;

Figure 10 is an enlarged sectional view showing a second modified embodiment;

Figure 11 is a perspective view showing the external aspect of a third modified embodiment;

Figure 12 is a perspective view showing the external aspect of the conventional printer;

Figure 13 is an enlarged partial view of the conventional printer;

Figure 14 is a sectional view taken along a line X1V-X1V in Figure 13;

Figure 15 is a schematic sectional view showing a conventional printer with a second cover thereof turned; and

Figure 16 is a partially enlarged sectional view of Figure 15.



In Figures 1 and 2, reference numeral 100 designates a printer case, composed of a lower case 101 and an upper case 102.

In Figure 2, reference numeral 130 designates a tractor that forwards a continuous sheet P fed through a sheet feed path 104 from a sheet feed inlet 103 to a platen 140. The sheet P forwarded by the tractor 130 is wound onto the platen 140, and is subjected to printing at a print section 141 between a platen 140 and a print head 150.

The print head 150 is an impact dot head having a plurality of built-in wires. The head 150 is mounted on a carriage 153 that shuttles in a direction parallel to the sheet surface while guided by guide shafts 151, 152. Printing is effected by means of wires that are driven to advance towards the sheet at an arranged time to form dots on the sheet through an ink ribbon (not shown) in association with the shuttling of the carriage 153. The ink ribbon is supplied between the sheet P and the head 150 from an ink ribbon cartridge 154.

The printed sheet P receives a sheet discharge force from a sheet discharge roller 160 as the sheet P is being guided by a sheet discharge plate 161, and passes through a sheet discharge path 180 guided by a sheet guide 170, and is discharged outside the printer from a sheet discharge outlet 181.

The top of the case 100 is covered with a first cover 110 and a second cover 120. The sheet discharge path 180 is formed mainly between the second cover 120 and the sheet guide 170.

The first cover 110 is made of a thermoplastic material and has a top plate 110a and side plates 110b formed integrally with the top plate 110a. The first cover is located over the print section 141. The first cover 110 is mounted on the upper case 102 at a front end 111 thereof and can be turned with respect to the upper case 102 so that the ink ribbon cartridge 154 can be replaced easily. Inside the first cover 110 is a silencing means that is located at a position which is the closest possible to the print section 141.

The silencing means includes reflecting plates 112, reinforcing plates 113, and a sound absorbing member 114. Each reflecting plate 112 extends in a direction orthogonal to a sheet forward direction A. Each reinforcing plate 113 extends in a direction

orthogonal to the reflecting plates 112 as shown in Figure 3. Each reflecting plate 112 and each reinforcing plate 113 are formed integrally with the first cover 110. The sound absorbing member 114 is fixed on the first cover 110 by an adhesive or the like. While a large component such as the first cover 110 is often subjected to creep and causes trouble when it comes in contact with other components when the printer has been used for a long time, the first cover 110 employed in this embodiment is free from such trouble because the first cover 110 is reinforced by the reinforcing plate 113.

An inclined portion 115 of the first cover 110 is made of a transparent member, and the sound absorbing member 114 is located slightly apart from the inclined portion 115. This construction enables the user to take a look at the printed result, immediately after printing.

The second cover 120 is also made of a thermoplastic material and has a top plate 120a and side plates 120b that are formed integrally with the top plate 120a. The second cover covers the sheet guide 170. The sheet guide 170 is mounted to pivot on the case 100. To print on a cut sheet (not shown), the sheet guide 170 is turned upward as shown in Figure 4 so as to allow the cut sheet to be fed from the platen 140 along the sheet guide 170. The second cover 120 is also mounted to pivot on the first cover 110 through turning support sections 121 (see Figure 1), and is turned together with the sheet guide 170 when the sheet guide 170 is turned.

An overlap portion 190 is arranged between the side plates of the first cover 110 and those of the second cover 120 so that no opening is formed when the second cover 120 is turned relative to the first cover 110.

As shown in Figures 2, 5 and 6, the overlap portion 190 comprises a fan-like overlap strip 191 formed integrally with a front end of each side plate 120b of the second cover 120. The fan like overlap strip overlaps the corresponding side plate 110b of the first cover while interposing a small gap c (see Figure 6) therebetween. An arcuate portion 192 creates the fan effect of the overlap strip 191 and is formed into the largest possible arc of such a range so as not to interfere with the printer case 100 when the



second cover 120 is in a horizontal position (see Figure 2) or in an inclined position (see Figure 4).

In addition between the top plate 110a of the first cover 110 and the top plate 120a of the second cover 120 is an overlap portion 200. As shown in Figure 7, this overlap portion obviates any opening forming along the axial line 121a of the turning section which could form between the top plate 110a of the first cover 110 and the top plate 120a of the second cover 120 when the second cover 120 is turned relative to the first cover 110.

The overlap portion 200 is, as shown in Figures 2, 3 and 7, formed by making the rear end of the top plate 110a in a semi-cylindrical form (the semi-cylindrical portion is designated by reference numeral 210) around the turning axial line 121a of the second cover 120 at a lower portion thereof. That is, to say, the semi-cylindrical portion 210 is formed so that an arcuate surface 211 thereof has a form corresponding to a locus created by turning the front end portion 120c of the top plate 120a of the second cover 120. The rear edge portion of the first cover 110, which is exposed when the second cover 120 has turned above the first cover 110, is formed into a cutter 110c for cutting a continuous sheet as shown in Figure 7.

The second cover 120 also has a silencing means inside the above-described top plate thereof. As shown in Figures 2 and 3, the silencing means includes reflecting plates 122 for reflecting sound waves and sheet guide plates 123. Each reflecting plate 122 extends so as to be orthogonal to the sheet forward direction A and each sheet guide plate 123 intersects orthogonally to each reflecting plate 122. Each sheet guide plate 123 also serves as a reinforcing plate. The reflecting plate 122 and the sheet guide plate 123 are formed integrally with the second cover 120. Moreover, the sheet guide plates 123 are deeper than the reflecting plates 122. The distance between adjacent sheet guide plates 123 is designed to be smaller than the width of the smallest sheet intended to be supplied to this printer. In addition the distance between them at portions 2e through which the front end corners of the sheet may pass is made even smaller.





Turning now to the sheet guide 170, one or more rib-like guide plates 171 for guiding the sheet P may be formed on the upper surface thereof. In this embodiment, there is one guide plate 171 which is designed to be greater in depth as it approaches the sheet discharge outlet 181. As a result of this construction, the front end P1 of the sheet P floats up when the sheet P is being discharged from the sheet discharge outlet 181. This facilitates the sheet P to be picked up manually. The depth of each reflecting plate 122 of the second cover 120 towards the sheet discharge path 180 is designed to taper so as to correspond to the form of the ribs of the guide plate 171. Thus the reflecting plates 120 nearer the sheet discharge outlet 181 have the smallest depth. As a result of this construction, the distance between the guide surface 172 and the lower end 122a of each reflecting plate 122 is substantially equal, thereby preventing the front end P1 of the sheet P from being jammed by the reflecting plates 122. On the back of the sheet guide 170 are a plurality of reflecting plates 173 for reflecting sound waves, each reflecting plate extending in the direction orthogonal to the sheet forward direction A.

The aforementioned impact dot printer is intended to be used with the sheet guide 170 horizontally (see Figure 2) when printing on a continuous sheet and with the sheet guide 170 turned upward (see Figure 4) when printing on a cut sheet. This impact dot printer thus has the following advantages.

Noise associated with printers of this type is mainly produced when the print wires arranged in the print head 150 collide with the platen 140 through the ink ribbon and the sheet P as well as when a member for driving the print wires inside the print head 150 collides within the print head 150. That is, the major part of such noise is produced where the print head 150 and the platen 140 are located (i.e., around the print section 141). Therefore, to reduce noise, one concentrates on positions close to the print head 150 and the platen 140, and attenuate the sound wave discharged from the opening of the printer.

According to the preferred embodiment, part of the noise energy produced at the print head 150 and the platen 140 will be absorbed by the sound absorbing member 114 arranged below the first cover 110. A major part of the rest of the noise energy will be



silenced in the course of being radiated from the sheet discharge outlet 181 through the sheet discharge path 180 being formed between the sheet P and the first and second covers 110, 120. In particular, the plurality of reflecting plates 112 which are arranged above the print head 150 and the platen 140 are as close as possible thereto and contribute to an effective elimination of sound.

Sound waves, are attenuated further if there is an increase in the cross-section of the propagation path. Thus the sound waves are further attenuated due to the change of the section. The reflecting plates 112 of the first cover 110 are arranged to jut out toward the sheet discharge path 180 further than the reflecting plates 122 of the second cover 120. Thus the sound eliminating effect of the first cover will be larger. Further, with the sound wave repetitively reflected by the reflecting plates 112, 122 arranged on the first cover 110 and the second cover 120, the energy of the sound wave will become attenuated. The energy of the sound wave radiated from the sheet discharge outlet 181 will thus be reduced. As a result, the noise from the printer will be reduced.

Since the sound wave is also reflected by the reflecting plates 173 arranged below the sheet guide 170, the noise radiated from the sheet feed inlet 103 through the sheet feed path 104 formed between the sheet guide 170 and the upper case 102 can also be reduced.

Figure 8 shows the sound spectra in the presence and absence of the reflecting plates 112 and 122 arranged on the first cover 110 and the second cover 120. The frequency of noise produced at the print head 150 and the platen 140 is mainly 1 kHz or more. Thus sound waves whose frequencies are 1 kHz or more can be effectively attenuated. Noise that is offensive to the ear is typically in a frequency range above 1 kHz. The noise reduction obtained by the preferred embodiment is thus larger in aural terms than the actual noise attenuation.

When printing on a cut sheet, the sheet guide 170 is turned upward as shown in Figure 4, which causes the second cover 120 to turn therewith. The overlap portion 190 is arranged between the side plates 110b of the first cover 110 and the side plates 120b of the second cover 120 and so no opening (S1 in Figure 15) which would have formed in a

conventional printer is created. Therefore, noise from the printer can be further prevented, thereby contributing to the noise reduction.

The overlap portion 200 is provided between the top plate 110a of the first cover 110 and the top plate 120a of the second cover 120. Accordingly, no such opening (see S2 in Figure 16) extending along the axial line of the turning section which would have formed in the conventional printer is created. Therefore, noise from the printer can be even further prevented, thereby contributing to the noise reduction.

In addition, the sheet guide plates 123 are designed to be higher than the reflecting plates 122. The distance between the sheet guide plates 123 is designed to be narrower than the width of the smallest sheet size used in this printer. These designs achieve the smooth transport of the sheet without causing the front end of the sheet being jammed by the reflecting plates 122. Particularly, the distance between the sheet guide plates 123 is narrower at portions 2e (see Figure 3) at which the front end corners of the sheet are most likely to be caught as they pass therethrough. The designs thereby ensure that the sheet will be discharged without trouble. Therefore, the distance between the bottom ends 122a of the reflecting plates 120 and the sheet guide 170 can be made small, thereby contributing to effective noise reduction or silencing. In other words, the reflecting plates can be made deeper since there is no likelihood that the sheet will be jammed. Thus, the silencing effects can be improved by increasing the change in the section of the sheet discharge path 180, which is a sound transmitting path.

In addition, the cutter 110c is provided at the rear edge of the first cover 110 as shown in Figure 7 for cutting the continuous sheet. The cutter 110c contacts the continuous sheet when the second cover 120 is turned above the first cover 110 after having printed on the continuous sheet and by picking up the front end P1 of the sheet (see Figure 2). The front end P1 of the sheet floats up by the action of the guide plate 171 of the sheet guide 170, thereby facilitating the sheet to be picked up. The second cover 120 is turned until the top plate 120a thereof abuts against the top plate 110a of the first cover 110.

This Sheet Has Been Replaced



The foregoing description of the preferred embodiment of the present invention has been described above but it should be understood that the present invention is not limited thereto but that various modifications may be made yet fall within the scope of the present invention. For example, the following modifications may be made.

First modified embodiment.

As shown in Figure 9, a sheet discharge roller 162 is made smaller in diameter than the sheet discharge roller 160 in the above-described embodiment. A sheet discharge plate 163 is made thinner than the sheet discharge plate 161 in the above-described embodiment. As a result, the silencing means provided on the first cover 110, i.e. the reflecting plates 112 and the sound absorbing member 114, can be located closer to the print section 141.

While the head 150, the carriage 153, and the ink ribbon cartridge 154 are inclined in the above-described embodiment, these components are mounted horizontally as shown in Figure 9 to make the silencing means even closer to the print section 141.

As a result of this modification, the silencing means can be arranged closer to the print section 141, thereby improving the silencing effects.

As shown in Figure 9, it is not essential that the reinforcing plates 113 or the sheet guide plates 123 be made deeper than the reflecting plates 112 or 122. If the sheet discharge plate 161 or 163 are suitably arranged, the reinforcing plates 113 do not have to have the sheet guiding function unlike the second modified embodiment which will be described later. This enables the silencing means to be put even closer to the print section 141.

Reference numeral 155 in Figure 9 designates an ink ribbon supplied from the ink ribbon cartridge 154 to the gap between the head 150 and the sheet P.

Second modified embodiment.

The second modified embodiment is characterized by removing the sheet discharge plate 163 from the above-described embodiment as shown in Figure 10. As a result of this modification, the silencing means can be put even closer to the platen and the head, thereby contributing to more effective silencing.



The reinforcing plates 113 are made deeper than the reflecting plates 112 to enable the reinforcing plates 113 to act as sheet guide plates.

This modification cannot be implemented on the conventional printer as shown in Figure 14. This is because the reflecting plates 12a are as deep as the sheet guide plates 12b. Thus the front end of the sheet after having been printed gets caught by the reflecting plates 12a. Therefore, the conventional silencing means cannot be located close to the platen and the head in the conventional printer, and so does not allow effective silencing to be achieved.

In the second modified embodiment, the angle θ at which the sheet P sent out from the platen 140 comes into contact with the sheet guide surface 113a of the reinforcing plate 113 is set to the smallest possible value. When the sheet P comes in contact with the sheet guide surface 113a of the reinforcing plate 113, the sheet P receives a reaction force f in the direction at right angle to the sheet guide surface 113a. As a result, the force, which is equal to $f_a = f \times \sin \theta$ acts on the sheet P and so pushes the sheet P back. Since the angle of contact θ between the sheet P and the sheet guide surface 113a is set to a small value, the force f_a for pushing the sheet back becomes small. Therefore, the sheet P is guided by the sheet guide surface 113a smoothly. Since the distance between the platen 140 and the sheet guide surface 113a is small, the sheet P is unlikely to be deformed, thereby allowing even fragile sheets to be discharged with stability. Since the reinforcing plate 113 projects deeper than the reflecting plate 112, the front end of the sheet does not get jammed with the reflecting plate 112 even if the front end is deformed by contact with the sheet guide surface 113a, thus enabling the sheets to be discharged surely.

In this second modified embodiment, the distance between the reinforcing plates 113 is designed to be smaller than the width of the minimum size of sheet which is intended to be fed for printing with this printer. Thus the portion through which the front end corner of the sheet will pass is made even narrower (see Figure 3).

Third modified embodiment



03 171

As shown in Figure 11, the overlap portion 190 is arranged between the side plate 110b of the first cover 110 and the side plate 120b of the second cover 120. The overlap portion maybe formed by a fan-like overlap strip 195 formed integrally with the outer side of the front end of the side plate 120b of the second cover 120 to overlap the outer side of the rear end of the side plate 110b of the first cover 110.

In Figure 11, reference numeral 105 designates a turning support section so that the first cover 110 can turnably be supported by the case 100.

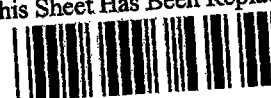
In addition, embodiments of the present invention may be applied to other types of sheet feeding apparatus such as photocopiers and facsimile machines.



CLAIMS

1. An impact dot printer comprising:
a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by
a silencing means (112, 113, 114) disposed above the print section.
2. An impact dot printer according to claim 1, in which the silencing means includes a sound absorbing member (114) for absorbing sound.
3. An impact dot printer according to claim 1 or 2, in which the silencing means includes at least one reflecting plate (112) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to a sheet forward direction (A).
4. An impact dot printer according to any one of claims 1 to 3, in which a sheet discharge plate (161) for guiding a printed sheet (P) is disposed between the platen and the silencing means.
5. An impact dot printer according to claim 3, in which the silencing means includes at least one reinforcing plate (113) serving as a sheet guide for guiding a printed sheet, the reinforcing plate being a plate like body intersecting the reflecting plate.
6. An impact dot printer according to claim 5, in which the reinforcing plate is deeper than the reflecting plate.
7. An impact dot printer according to claim 5 or 6, in which there are two or more reinforcing plates and a distance between adjacent reinforcing plates is smaller than a width of a smallest sheet to be supplied for printing.

This Sheet Has Been Replaced





8. An impact dot printer according to any one of the preceding claims, further comprising:

a printer case (100) accommodating therein at least the platen and the print head;
a first cover (110) for covering a top of the printer case, the first cover having a top plate (110a) and side plates (110b) formed integrally with the top plate; and
a second cover (120) turnably mounted on the first cover, the second cover having a top plate (120a) and side plates (120b) formed integrally with the top plate.

9. An impact dot printer as claimed in claim 8, further comprising:

a first overlap portion (190) between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover.

10. An impact dot printer according to claim 9, in which the first overlap portion is formed from a fan like overlap strip (191) formed on the ends of the side plates of one of the covers, and overlapping the side plates of the other cover.

11. An impact dot printer as claimed in any one of claims 8 to 10, further comprising:

a second overlap portion (200) between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of a turning section (121a) between the first cover and the second cover when the second cover is turned relative to the first cover.

12. An impact dot printer according to claim 11, in which the second overlap portion is formed by overlapping an arcuate surface (211) corresponding to a locus formed by turning a front end (120c) of one of the covers, either first cover or the second cover, upon the other cover, the front end being on the side of the centre of turning.





13. An impact dot printer according to claim 11 or 12, in which the second cover is formed so as to be turnable relative to the first cover, and a cutter (110c) for cutting a sheet is arranged on an edge of the first cover, the edge being exposed when the second cover is turned above the first cover.

14. An impact dot printer according to any one of the preceding claims, in which the second cover has a reflecting plate (122) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to the sheet forward direction (A);

at least one sheet guide plate (123) for guiding the printed sheet (P), the sheet guide plate being a plate-like body intersecting the reflecting plate; and in which the sheet guide plate is deeper than the reflecting plate.

15. An impact dot printer according to claim 14, in which there is a plurality of sheet guide plates and the distance between adjacent sheet guide plates is smaller than a width of a smallest sheet to be supplied for printing.

16. An impact dot printer according to any one of the preceding claims except when dependent on claim 4, in which both the first cover and the second cover form an upper portion of a sheet discharge path (180).

17. An apparatus comprising:

a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by

a silencing means (112, 113, 114) disposed above the print section.



ABSTRACTAPPARATUS WITH SILENCING MEANS

An impact dot printer is disclosed which is designed to reduce noise and comprises a first cover (110), a second cover (120), and an overlap portion (190, 200). The first cover is located above a print section (141), and includes sound wave reflecting plates (112), sheet guide plates (113), and a sound absorbing member (114). Each reflecting plate, each sheet guide plate, and the sound absorbing member being arranged close to the print section. The second cover is disposed so as to be turnable relative to the first cover and form a sheet discharge path (180) together with the first cover. The second cover also has sound wave reflecting plates (122) and sheet guide plates (123). Each sheet guide plate is designed to be deeper than each reflecting plate and the lateral distance between the sheet guide plates is made smaller than the width of the smallest sheet which is intended to be fed into the printer. The overlap portion is arranged so that no opening is provided between the first cover and second cover.

Figure 2.

This Sheet Has Been Replaced



Fig. 1

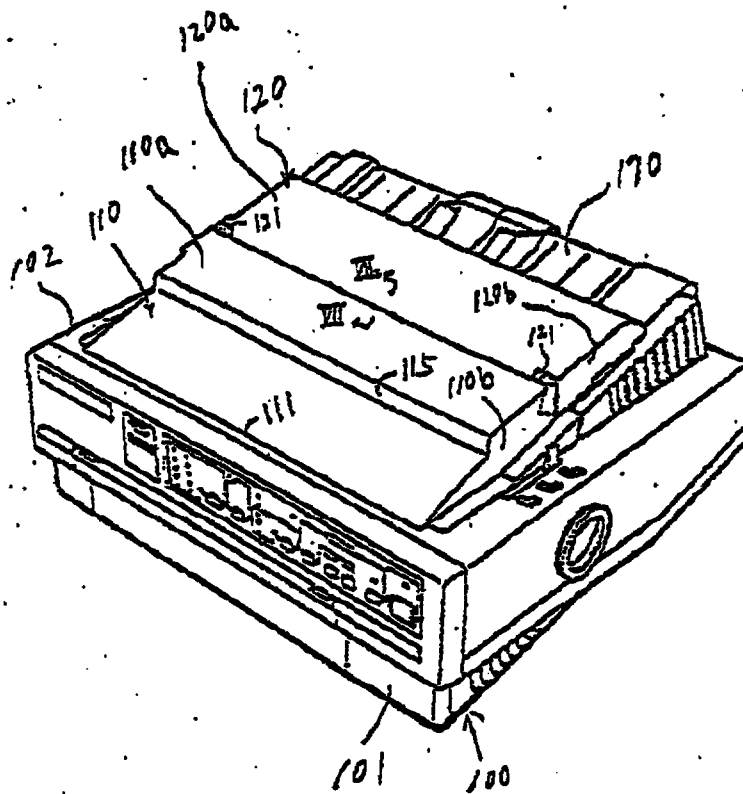


Fig. 2



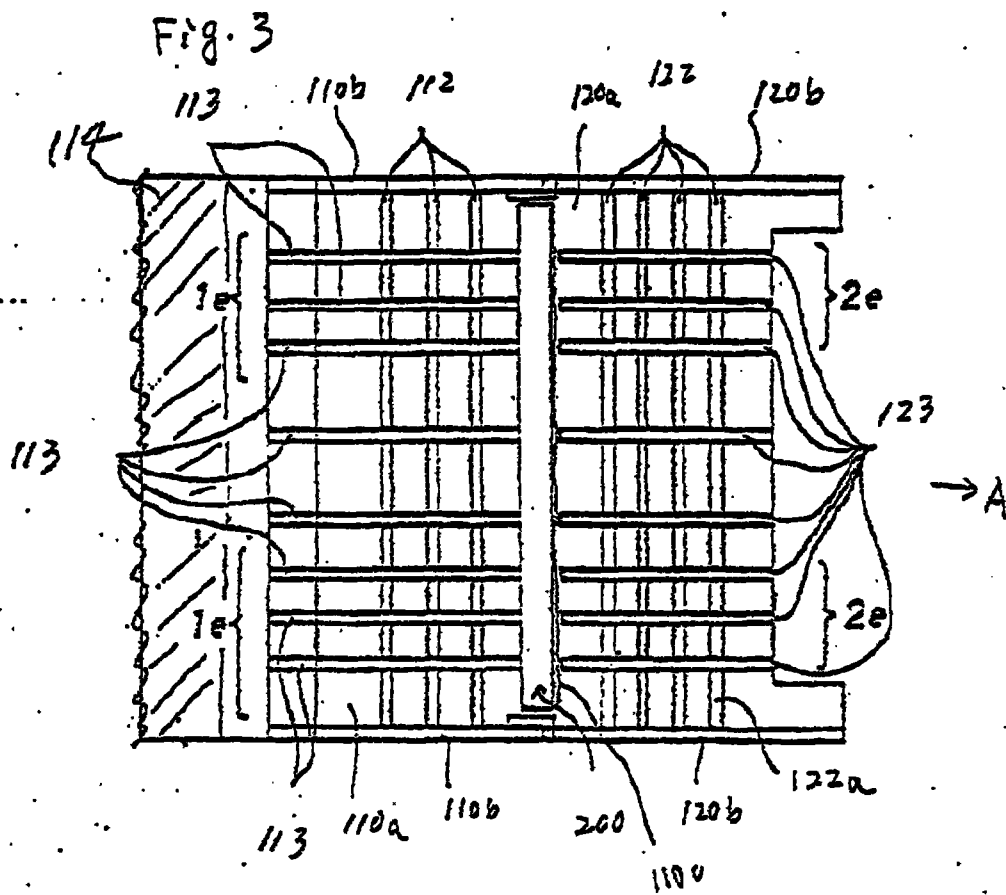


Fig. 4

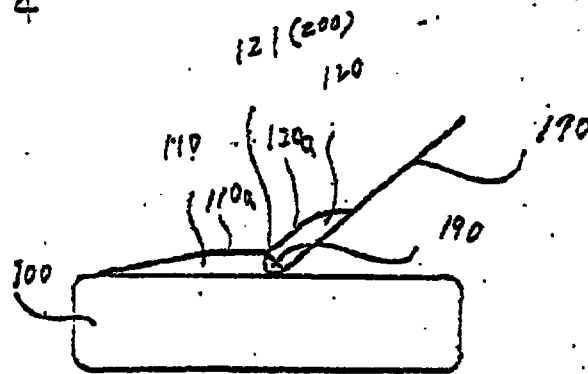


Fig. 5

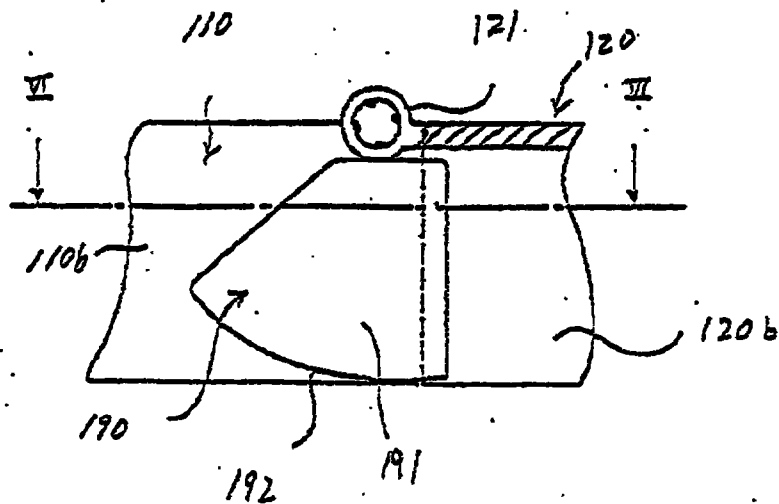


Fig. 6

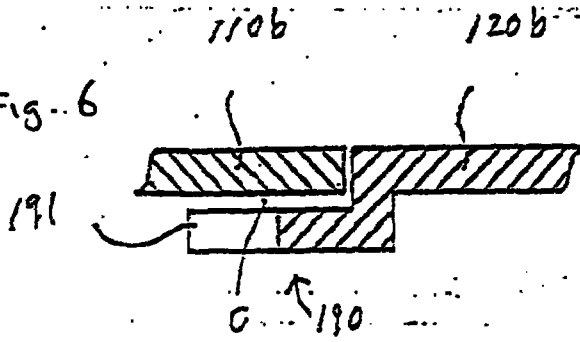


Fig. 7

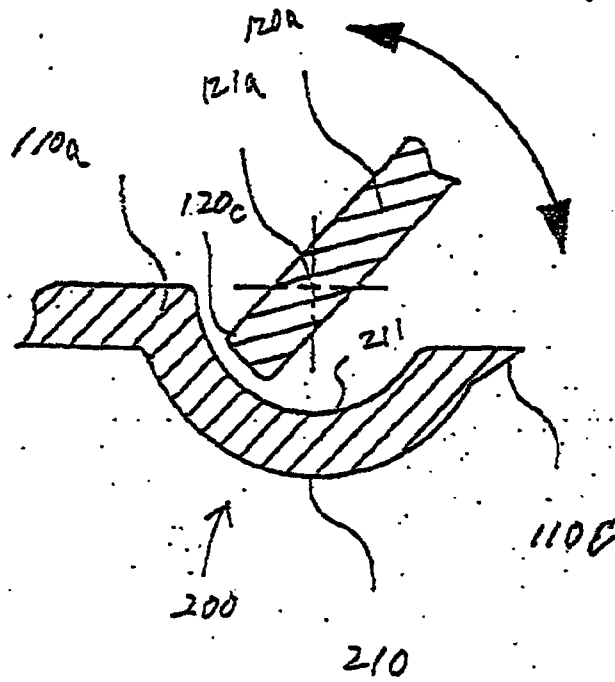


Fig. 8

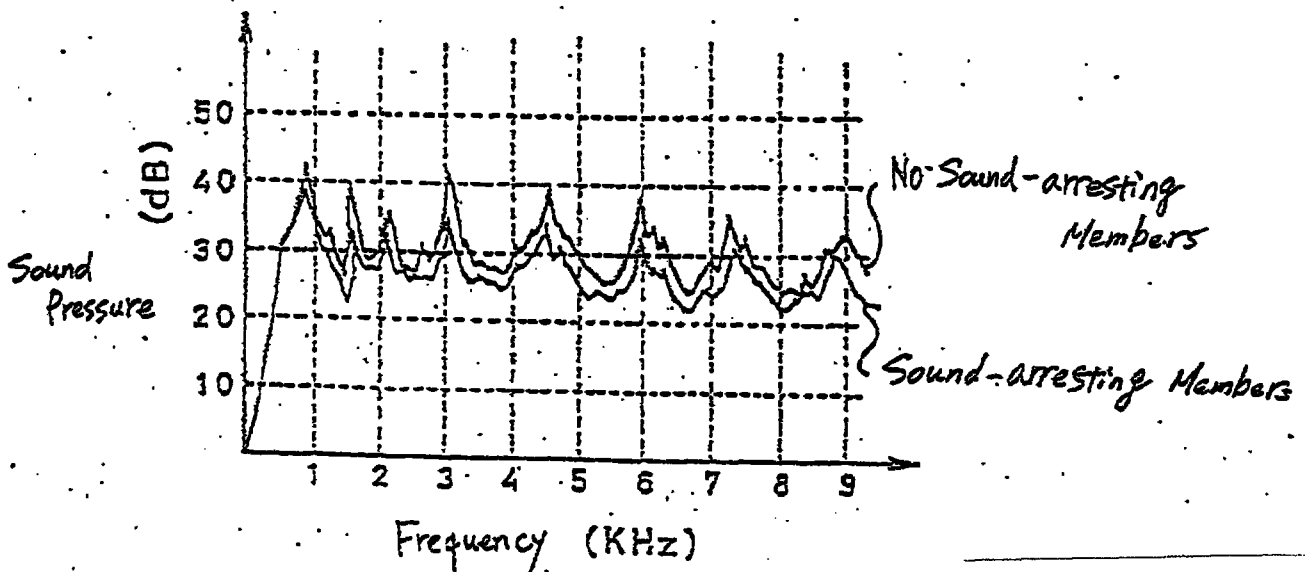


Fig. 9

~~106 107 108 109~~
~~110 111 112 113~~

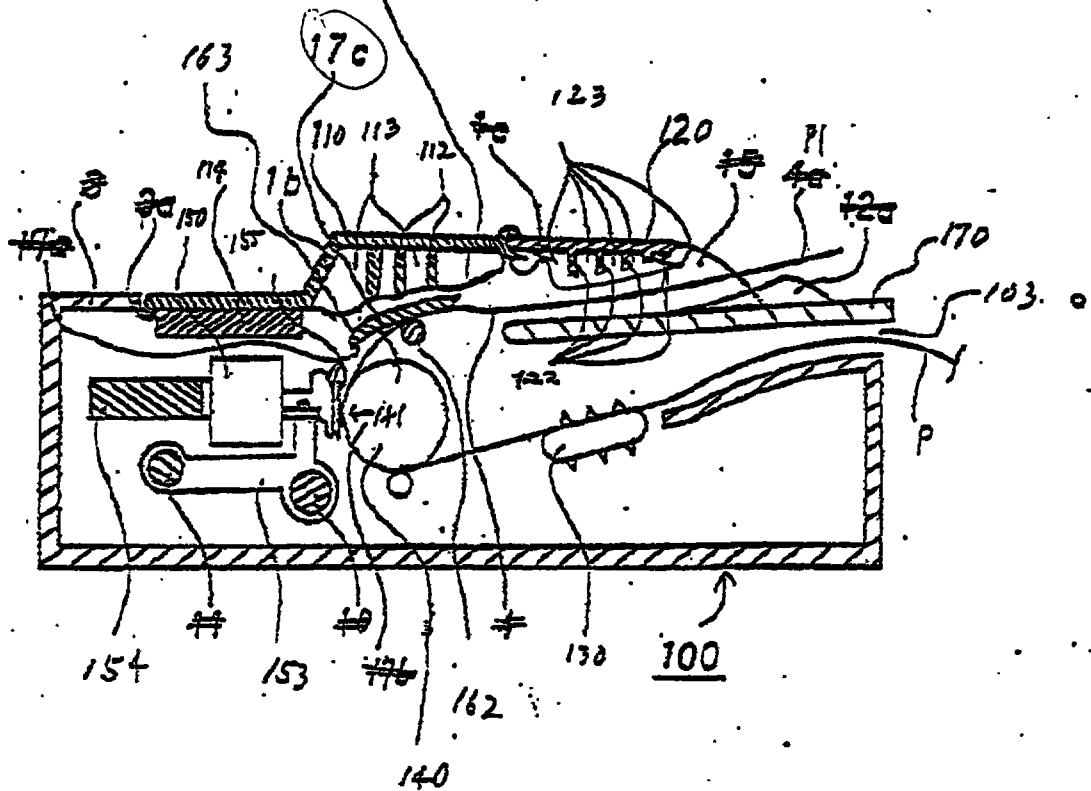
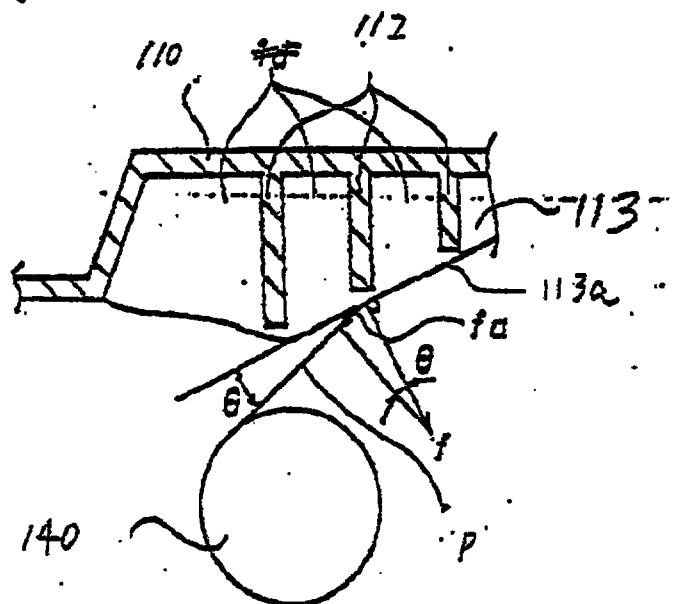


Fig. 10



[B4]

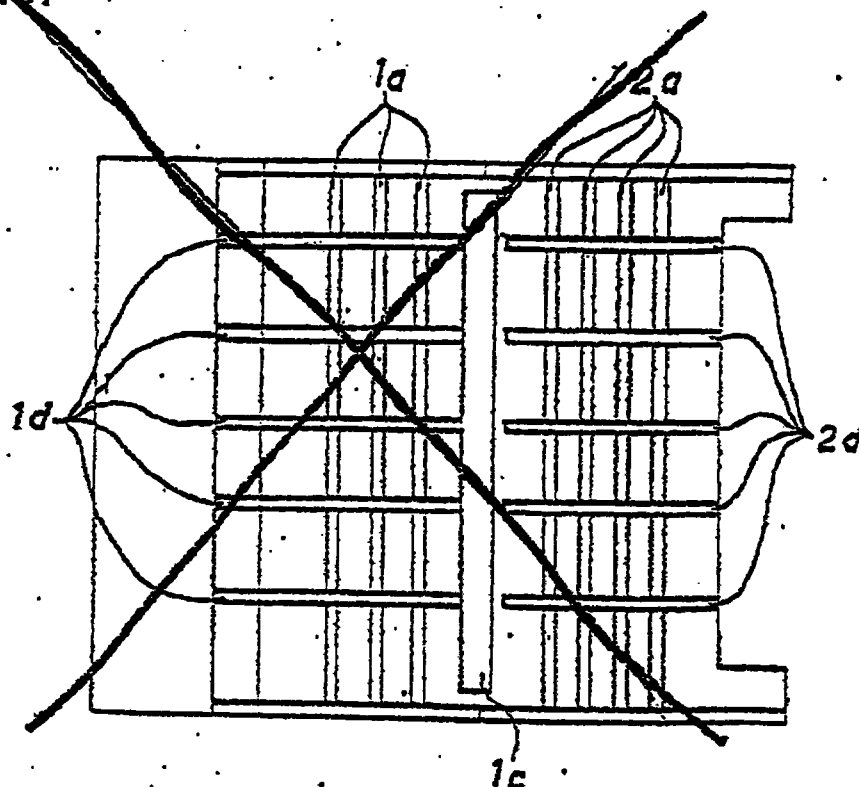


Fig. 11

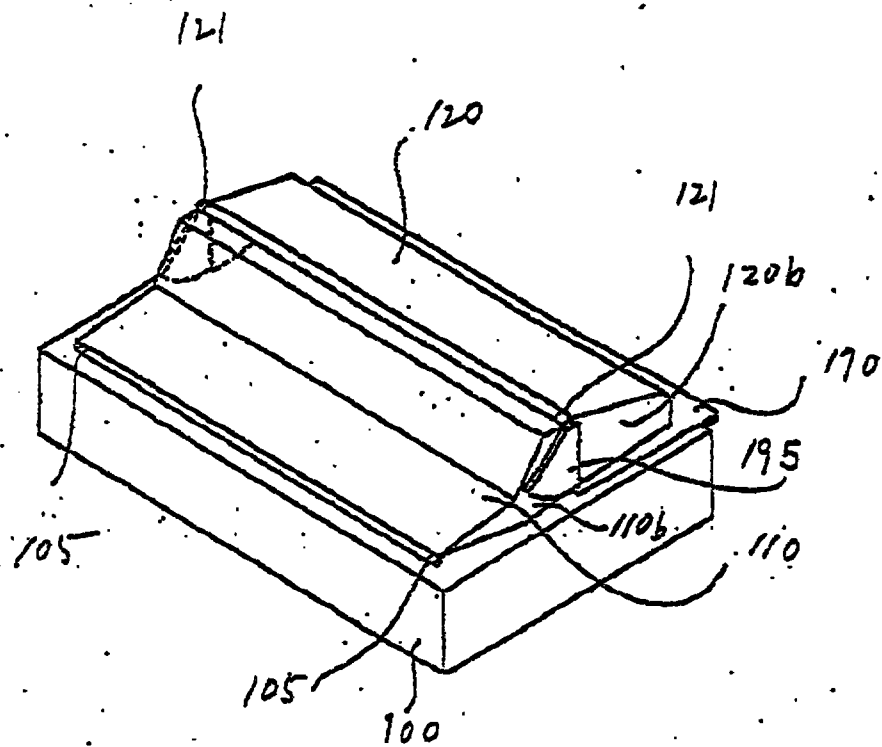


Fig. 13

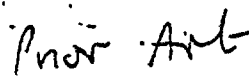


Fig. 14

Andere Art

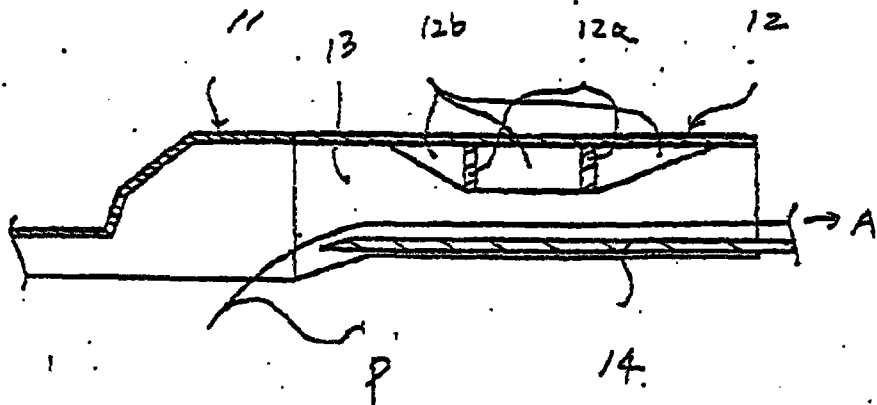
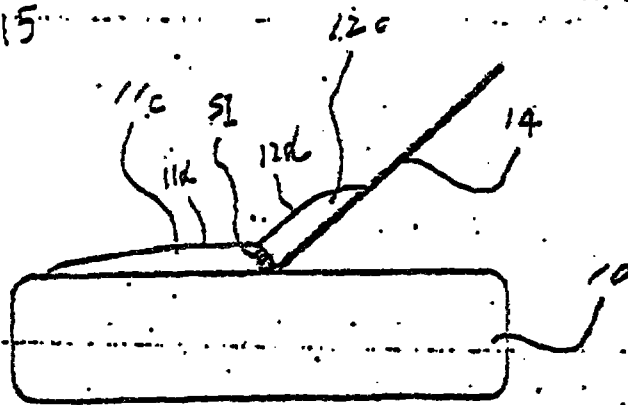


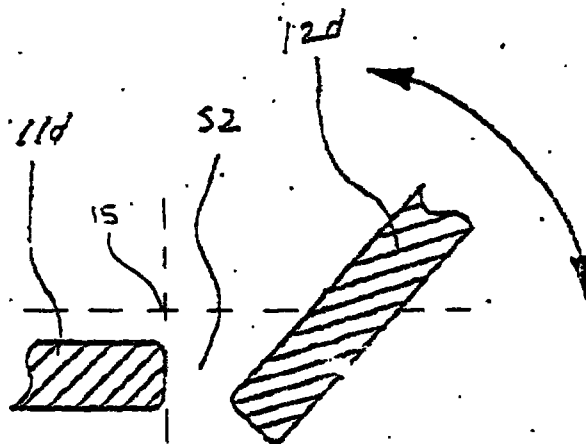
Fig. 15



Prior Art

Fig. 16

Prior Art



9608850-5 202

REPLACED SHEETS		SG
☒	Description : paged 1 to paged 9	
☒	Claim(s) : paged 1 to paged 14	
☐	Drawing(s) : paged 1 to paged 1	
☒	Abstract : paged 1 to paged 1	
DATE OF RECEIPT		

1

REPLACEMENT SHEETS		SG
☒	Description : paged 1 to paged 13	
☒	Claim(s) : paged 1 to paged 16	
☒	Drawing(s) : paged 1 to paged 16	
☒	Abstract : paged 1 to paged 1	
DATE OF RECEIPT		17/1/97

APPARATUS WITH SILENCING MEANS

The present invention relates to an apparatus with a noise reduction measure thereof. In particular, but not exclusively, the present invention relates to impact dot printers and a noise reduction measure thereof.

Generally, impact dot printers are designed to print by driving print wires arranged in the print head to give impact to a sheet of paper through an ink ribbon. This causes noise when the print wires collide with the platen, and such noise emanates from the printer most notably from a sheet discharge section, thereby increasing the noise level of the printer.

One known measure to reduce noise from such impact dot printers is disclosed in Japanese Utility Model Unexamined Publication No. 64-48263. The construction thereof will be described with reference to Figures 12 to 16.

In Figure 12, reference numeral 10 designates a printer case, inside which a print head (not shown), a platen (not shown), and the like are accommodated. A sheet discharge section of the case 10 is covered by a first cover 11 and a second cover 12. As shown in Figure 14, a sheet discharge path 13 for a sheet P passes underneath the first cover 11 and a second cover 12.

As shown in Figures 13, 14, inside the second cover 12 there is provided reflecting plates 12a for reflecting sound waves and a sheet guide plate 12b for guiding the printed sheet P. Each reflecting plate 12a extends in a direction orthogonal to a sheet forward direction A. The reflecting plates 12a are arranged to partially change the section of the sheet discharge path 13, so that by reflecting a sound wave propagated through the sheet discharge path 13 by the reflecting plates 12a, the noise level can be reduced.

In Figures 12 to 16, reference numeral 14 designates a sheet guide, which, to print on a continuous sheet, guides a discharged continuous sheet. The second cover 12 covers the top of the sheet guide 14. The sheet guide 14 is mounted such that it may be moved relative to the case 10. To print on a non-continuous or cut sheet (not shown),

This is the replacement sheet

Date: 17 JAN 1997



the sheet guide 14 is turned upward as shown in Figure 15, so that the cut sheet can be supplied to the print section along the sheet guide 14. The second cover 12 is pivoted at turning support sections 15 (see Figure 12) relative to the first cover 11, so that the second cover 12 can be turned together with the sheet guide 14 when the sheet guide 14 is turned.

This conventional printer thus addresses the problem of noise reduction but does not achieve an adequate reduction for the following reasons.

First, the reflecting plates 12a are arranged only on the second cover 12. This means that the reflecting plates 12a are disposed at a distance from the head and the platen, which are the major sources of noise.

Second, the reflecting plates 12a and the sheet guide plate 12b have the same height as shown in Figure 14, which means in practice that the front end of a printed sheet easily jams. Such trouble is particularly noticeable with narrow sheets. One ready solution to this jamming problem, is to design the sheet discharge path 13 with more depth. However, this solution leads to an increase in noise because more noise can be heard due to the increase in the space of the sheet discharge path 13.

Third, when the sheet guide 14 is turned for printing a cut sheet, an opening S1 is created between side plates 11c of the first cover 11 and side plates 12c of the second cover 12 as shown in Figure 15. Further, as shown in Figure 16, an opening S2 is also created between the rear edge of a top plate 11d of the first cover 11 and a top plate 12d of the second cover 12. These two openings S1 and S2 naturally lead to an increase in noise.

Similar problems have also been experienced with other types of apparatus such as photocopiers and facsimile machines.

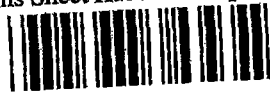
An object of the present invention is to overcome the above problems and accordingly provide an apparatus with features which reduce the noise.

An impact dot printer according to the present invention includes: a print section formed of a platen and a print head, the print head confronting the platen; and characterised by a silencing means disposed above the print section.

This is the replacement sheet

17 JAN 1987

Date:



The silencing means is designed to have a reflecting plate for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to a sheet forward direction, and/or have a sound absorbing member for absorbing sound. The silencing means may also be designed to have a reinforcing plate serving as a sheet guide for guiding a printed sheet, the reinforcing plate being a plate-like body and intersecting the reflecting plate. By arranging a sheet discharge plate for guiding a printed sheet between the platen and the silencing means, the silencing means can be disposed closer to the platen. Further, by making the reinforcing plate deeper than the reflecting plate, the silencing means can be put closer to the print section without involving the sheet discharge plate. The distance between a plurality of reinforcing plates serving as sheet guide plates is preferably smaller than the width of a smallest sheet which it is intended to be supplied for printing to prevent jamming.

The printer includes a printer case accommodating therein at least a platen and a print head; a first cover for covering the top of the printer case, the first cover having a top plate and side plates formed integrally with the top plate; a second cover turnably mounted on the first cover, the second cover having a top plate and side plates formed integrally with the top plate; and a first overlap portion between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover. This overlap portion is formed by a fan-like overlap strip formed on the ends of the side plates of one of the covers, overlapping the side plates of the other cover. Further, a second overlap portion is disposed between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of the turning section between the first cover and the second cover when the second cover is turned relative to the first cover. This second overlap portion can be formed by overlapping an arcuate surface corresponding to a locus formed by turning a front end of one of the covers, either the first cover or the second cover, upon the other cover, the front end being on the side of the center of turning. The second cover is formed so as to be turnable above the first cover, and a cutter for cutting

This is the replacement sheet

17 JAN 1997

Date:



a sheet may be arranged on a edge of the first cover, the edge being exposed when the second cover is turned above the first cover. The first cover and the second cover are designed so as to form an upper portion of a sheet discharge path. In this case, it is desirable to arrange a similar silencing means having a reflecting plate and a sheet guide plate also on the second cover.

Embodiments of the present invention will now be described with reference to the accompanying drawings, of which:

Figure 1 is a perspective view showing the external aspect of the preferred embodiment of the present invention;

Figure 2 is a sectional view of the preferred embodiment;

Figure 3 is an underside view of a first cover and a second cover of the preferred embodiment;

Figure 4 is a schematic sectional view with the second cover turned;

Figure 5 is a partially enlarged view of Figure 2;

Figure 6 is a sectional view taken along a line V1-V1 of Figure 5;

Figure 7 is an enlarged sectional view taken along a line VII-VII in Figure 1;

Figure 8 is a diagram showing noise spectra both in the presence and in the absence of reflecting plates on the first and second covers;

Figure 9 is a sectional view showing a first modified embodiment;

Figure 10 is an enlarged sectional view showing a second modified embodiment;

Figure 11 is a perspective view showing the external aspect of a third modified embodiment;

Figure 12 is a perspective view showing the external aspect of the conventional printer;

Figure 13 is an enlarged partial view of the conventional printer;

Figure 14 is a sectional view taken along a line X1V-X1V in Figure 13;

Figure 15 is a schematic sectional view showing a conventional printer with a second cover thereof turned; and

Figure 16 is a partially enlarged sectional view of Figure 15.

This is the replacement sheet

Date: 17 JAN 1997

In Figures 1 and 2, reference numeral 100 designates a printer case, composed of a lower case 101 and an upper case 102.

In Figure 2, reference numeral 130 designates a tractor that forwards a continuous sheet P fed through a sheet feed path 104 from a sheet feed inlet 103 to a platen 140. The sheet P forwarded by the tractor 130 is wound onto the platen 140, and is subjected to printing at a print section 141 between a platen 140 and a print head 150.

The print head 150 is an impact dot head having a plurality of built-in wires. The head 150 is mounted on a carriage 153 that shuttles in a direction parallel to the sheet surface while guided by guide shafts 151, 152. Printing is effected by means of wires that are driven to advance towards the sheet at an arranged time to form dots on the sheet through an ink ribbon (not shown) in association with the shuttling of the carriage 153. The ink ribbon is supplied between the sheet P and the head 150 from an ink ribbon cartridge 154.

The printed sheet P receives a sheet discharge force from a sheet discharge roller 160 as the sheet P is being guided by a sheet discharge plate 161, and passes through a sheet discharge path 180 guided by a sheet guide 170, and is discharged outside the printer from a sheet discharge outlet 181.

The top of the case 100 is covered with a first cover 110 and a second cover 120. The sheet discharge path 180 is formed mainly between the second cover 120 and the sheet guide 170.

The first cover 110 is made of a thermoplastic material and has a top plate 110a and side plates 110b formed integrally with the top plate 110a. The first cover is located over the print section 141. The first cover 110 is mounted on the upper case 102 at a front end 111 thereof and can be turned with respect to the upper case 102 so that the ink ribbon cartridge 154 can be replaced easily. Inside the first cover 110 is a silencing means that is located at a position which is the closest possible to the print section 141.

The silencing means includes reflecting plates 112, reinforcing plates 113, and a sound absorbing member 114. Each reflecting plate 112 extends in a direction orthogonal to a sheet forward direction A. Each reinforcing plate 113 extends in a direction

This is the replacement sheet

Date: 17 JAN 1997

orthogonal to the reflecting plates 112 as shown in Figure 3. Each reflecting plate 112 and each reinforcing plate 113 are formed integrally with the first cover 110. The sound absorbing member 114 is fixed on the first cover 110 by an adhesive or the like. While a large component such as the first cover 110 is often subjected to creep and causes trouble when it comes in contact with other components when the printer has been used for a long time, the first cover 110 employed in this embodiment is free from such trouble because the first cover 110 is reinforced by the reinforcing plate 113.

An inclined portion 115 of the first cover 110 is made of a transparent member, and the sound absorbing member 114 is located slightly apart from the inclined portion 115. This construction enables the user to take a look at the printed result, immediately after printing.

The second cover 120 is also made of a thermoplastic material and has a top plate 120a and side plates 120b that are formed integrally with the top plate 120a. The second cover covers the sheet guide 170. The sheet guide 170 is mounted to pivot on the case 100. To print on a cut sheet (not shown), the sheet guide 170 is turned upward as shown in Figure 4 so as to allow the cut sheet to be fed from the platen 140 along the sheet guide 170. The second cover 120 is also mounted to pivot on the first cover 110 through turning support sections 121 (see Figure 1), and is turned together with the sheet guide 170 when the sheet guide 170 is turned.

An overlap portion 190 is arranged between the side plates of the first cover 110 and those of the second cover 120 so that no opening is formed when the second cover 120 is turned relative to the first cover 110.

As shown in Figures 2, 5 and 6, the overlap portion 190 comprises a fan-like overlap strip 191 formed integrally with a front end of each side plate 120b of the second cover 120. The fan like overlap strip overlaps the corresponding side plate 110b of the first cover while interposing a small gap c (see Figure 6) therebetween. An arcuate portion 192 creates the fan effect of the overlap strip 191 and is formed into the largest possible arc of such a range so as not to interfere with the printer case 100 when the

This is the replacement sheet

Date: 17 JAN 1997

second cover 120 is in a horizontal position (see Figure 2) or in an inclined position (see Figure 4).

In addition between the top plate 110a of the first cover 110 and the top plate 120a of the second cover 120 is an overlap portion 200. As shown in Figure 7, this overlap portion obviates any opening forming along the axial line 121a of the turning section which could form between the top plate 110a of the first cover 110 and the top plate 120a of the second cover 120 when the second cover 120 is turned relative to the first cover 110.

The overlap portion 200 is, as shown in Figures 2, 3 and 7, formed by making the rear end of the top plate 110a in a semi-cylindrical form (the semi-cylindrical portion is designated by reference numeral 210) around the turning axial line 121a of the second cover 120 at a lower portion thereof. That is, to say, the semi-cylindrical portion 210 is formed so that an arcuate surface 211 thereof has a form corresponding to a locus created by turning the front end portion 120c of the top plate 120a of the second cover 120. The rear edge portion of the first cover 110, which is exposed when the second cover 120 has turned above the first cover 110, is formed into a cutter 110c for cutting a continuous sheet as shown in Figure 7.

The second cover 120 also has a silencing means inside the above-described top plate thereof. As shown in Figures 2 and 3, the silencing means includes reflecting plates 122 for reflecting sound waves and sheet guide plates 123. Each reflecting plate 122 extends so as to be orthogonal to the sheet forward direction A and each sheet guide plate 123 intersects orthogonally to each reflecting plate 122. Each sheet guide plate 123 also serves as a reinforcing plate. The reflecting plate 122 and the sheet guide plate 123 are formed integrally with the second cover 120. Moreover, the sheet guide plates 123 are deeper than the reflecting plates 122. The distance between adjacent sheet guide plates 123 is designed to be smaller than the width of the smallest sheet intended to be supplied to this printer. In addition the distance between them at portions 2e through which the front end corners of the sheet may pass is made even smaller.

This is the replacement sheet

Date: 17 JAN 1997

Turning now to the sheet guide 170, one or more rib-like guide plates 171 for guiding the sheet P may be formed on the upper surface thereof. In this embodiment, there is one guide plate 171 which is designed to be greater in depth as it approaches the sheet discharge outlet 181. As a result of this construction, the front end P1 of the sheet P floats up when the sheet P is being discharged from the sheet discharge outlet 181. This facilitates the sheet P to be picked up manually. The depth of each reflecting plate 122 of the second cover 120 towards the sheet discharge path 180 is designed to taper so as to correspond to the form of the ribs of the guide plate 171. Thus the reflecting plates 120 nearer the sheet discharge outlet 181 have the smallest depth. As a result of this construction, the distance between the guide surface 172 and the lower end 122a of each reflecting plate 122 is substantially equal, thereby preventing the front end P1 of the sheet P from being jammed by the reflecting plates 122. On the back of the sheet guide 170 are a plurality of reflecting plates 173 for reflecting sound waves, each reflecting plate extending in the direction orthogonal to the sheet forward direction A.

The aforementioned impact dot printer is intended to be used with the sheet guide 170 horizontally (see Figure 2) when printing on a continuous sheet and with the sheet guide 170 turned upward (see Figure 4) when printing on a cut sheet. This impact dot printer thus has the following advantages.

Noise associated with printers of this type is mainly produced when the print wires arranged in the print head 150 collide with the platen 140 through the ink ribbon and the sheet P as well as when a member for driving the print wires inside the print head 150 collides within the print head 150. That is, the major part of such noise is produced where the print head 150 and the platen 140 are located (i.e., around the print section 141). Therefore, to reduce noise, one concentrates on positions close to the print head 150 and the platen 140, and attenuate the sound wave discharged from the opening of the printer.

According to the preferred embodiment, part of the noise energy produced at the print head 150 and the platen 140 will be absorbed by the sound absorbing member 114 arranged below the first cover 110. A major part of the rest of the noise energy will be

This is the replacement sheet

Date: 17 JAN 1997

silenced in the course of being radiated from the sheet discharge outlet 181 through the sheet discharge path 180 being formed between the sheet P and the first and second covers 110, 120. In particular, the plurality of reflecting plates 112 which are arranged above the print head 150 and the platen 140 are as close as possible thereto and contribute to an effective elimination of sound.

Sound waves, are attenuated further if there is an increase in the cross-section of the propagation path. Thus the sound waves are further attenuated due to the change of the section. The reflecting plates 112 of the first cover 110 are arranged to jut out toward the sheet discharge path 180 further than the reflecting plates 122 of the second cover 120. Thus the sound eliminating effect of the first cover will be larger. Further, with the sound wave repetitively reflected by the reflecting plates 112, 122 arranged on the first cover 110 and the second cover 120, the energy of the sound wave will become attenuated. The energy of the sound wave radiated from the sheet discharge outlet 181 will thus be reduced. As a result, the noise from the printer will be reduced.

Since the sound wave is also reflected by the reflecting plates 173 arranged below the sheet guide 170, the noise radiated from the sheet feed inlet 103 through the sheet feed path 104 formed between the sheet guide 170 and the upper case 102 can also be reduced.

Figure 8 shows the sound spectra in the presence and absence of the reflecting plates 112 and 122 arranged on the first cover 110 and the second cover 120. The frequency of noise produced at the print head 150 and the platen 140 is mainly 1 kHz or more. Thus sound waves whose frequencies are 1 kHz or more can be effectively attenuated. Noise that is offensive to the ear is typically in a frequency range above 1 kHz. The noise reduction obtained by the preferred embodiment is thus larger in aural terms than the actual noise attenuation.

When printing on a cut sheet, the sheet guide 170 is turned upward as shown in Figure 4, which causes the second cover 120 to turn therewith. The overlap portion 190 is arranged between the side plates 110b of the first cover 110 and the side plates 120b of the second cover 120 and so no opening (S1 in Figure 15) which would have formed in a

conventional printer is created. Therefore, noise from the printer can be further prevented, thereby contributing to the noise reduction.

The overlap portion 200 is provided between the top plate 110a of the first cover 110 and the top plate 120a of the second cover 120. Accordingly, no such opening (see S2 in Figure 16) extending along the axial line of the turning section which would have formed in the conventional printer is created. Therefore, noise from the printer can be even further prevented, thereby contributing to the noise reduction.

In addition, the sheet guide plates 123 are designed to be higher than the reflecting plates 122. The distance between the sheet guide plates 123 is designed to be narrower than the width of the smallest sheet size used in this printer. These designs achieve the smooth transport of the sheet without causing the front end of the sheet being jammed by the reflecting plates 122. Particularly, the distance between the sheet guide plates 123 is narrower at portions 2e (see Figure 3) at which the front end corners of the sheet are most likely to be caught as they pass therethrough. The designs thereby ensure that the sheet will be discharged without trouble. Therefore, the distance between the bottom ends 122a of the reflecting plates 120 and the sheet guide 170 can be made small, thereby contributing to effective noise reduction or silencing. In other words, the reflecting plates can be made deeper since there is no likelihood that the sheet will be jammed. Thus, the silencing effects can be improved by increasing the change in the section of the sheet discharge path 180, which is a sound transmitting path.

In addition, the cutter 110c is provided at the rear edge of the first cover 110 as shown in Figure 7 for cutting the continuous sheet. The cutter 110c contacts the continuous sheet when the second cover 120 is turned above the first cover 110 after having printed on the continuous sheet and by picking up the front end P1 of the sheet (see Figure 2). The front end P1 of the sheet floats up by the action of the guide plate 171 of the sheet guide 170, thereby facilitating the sheet to be picked up. The second cover 120 is turned until the top plate 120a thereof abuts against the top plate 110a of the first cover 110.

This is the replacement sheet

Date: 17 JAN 1997

The foregoing description of the preferred embodiment of the present invention has been described above but it should be understood that the present invention is not limited thereto but that various modifications may be made yet fall within the scope of the present invention. For example, the following modifications may be made.

First modified embodiment.

As shown in Figure 9, a sheet discharge roller 162 is made smaller in diameter than the sheet discharge roller 160 in the above-described embodiment. A sheet discharge plate 163 is made thinner than the sheet discharge plate 161 in the above-described embodiment. As a result, the silencing means provided on the first cover 110, i.e. the reflecting plates 112 and the sound absorbing member 114, can be located closer to the print section 141.

While the head 150, the carriage 153, and the ink ribbon cartridge 154 are inclined in the above-described embodiment, these components are mounted horizontally as shown in Figure 9 to make the silencing means even closer to the print section 141.

As a result of this modification, the silencing means can be arranged closer to the print section 141, thereby improving the silencing effects.

As shown in Figure 9, it is not essential that the reinforcing plates 113 or the sheet guide plates 123 be made deeper than the reflecting plates 112 or 122. If the sheet discharge plate 161 or 163 are suitably arranged, the reinforcing plates 113 do not have to have the sheet guiding function unlike the second modified embodiment which will be described later. This enables the silencing means to be put even closer to the print section 141.

Reference numeral 155 in Figure 9 designates an ink ribbon supplied from the ink ribbon cartridge 154 to the gap between the head 150 and the sheet P.

Second modified embodiment.

The second modified embodiment is characterized by removing the sheet discharge plate 163 from the above-described embodiment as shown in Figure 10. As a result of this modification, the silencing means can be put even closer to the platen and the head, thereby contributing to more effective silencing.

This is the replacement sheet

Date: 17 JAN 1997

The reinforcing plates 113 are made deeper than the reflecting plates 112 to enable the reinforcing plates 113 to act as sheet guide plates.

This modification cannot be implemented on the conventional printer as shown in Figure 14. This is because the reflecting plates 12a are as deep as the sheet guide plates 12b. Thus the front end of the sheet after having been printed gets caught by the reflecting plates 12a. Therefore, the conventional silencing means cannot be located close to the platen and the head in the conventional printer, and so does not allow effective silencing to be achieved.

In the second modified embodiment, the angle θ at which the sheet P sent out from the platen 140 comes into contact with the sheet guide surface 113a of the reinforcing plate 113 is set to the smallest possible value. When the sheet P comes in contact with the sheet guide surface 113a of the reinforcing plate 113, the sheet P receives a reaction force f in the direction at right angle to the sheet guide surface 113a. As a result, the force, which is equal to $f_a = f \times \sin \theta$ acts on the sheet P and so pushes the sheet P back. Since the angle of contact θ between the sheet P and the sheet guide surface 113a is set to a small value, the force f_a for pushing the sheet back becomes small. Therefore, the sheet P is guided by the sheet guide surface 113a smoothly. Since the distance between the platen 140 and the sheet guide surface 113a is small, the sheet P is unlikely to be deformed, thereby allowing even fragile sheets to be discharged with stability. Since the reinforcing plate 113 projects deeper than the reflecting plate 112, the front end of the sheet does not get jammed with the reflecting plate 112 even if the front end is deformed by contact with the sheet guide surface 113a, thus enabling the sheets to be discharged surely.

In this second modified embodiment, the distance between the reinforcing plates 113 is designed to be smaller than the width of the minimum size of sheet which is intended to be fed for printing with this printer. Thus the portion $1e$ through which the front end corner of the sheet will pass is made even narrower (see Figure 3).

Third modified embodiment

This is the replacement sheet

Date: 17 JAN 1997

As shown in Figure 11, the overlap portion 190 is arranged between the side plate 110b of the first cover 110 and the side plate 120b of the second cover 120. The overlap portion maybe formed by a fan-like overlap strip 195 formed integrally with the outer side of the front end of the side plate 120b of the second cover 120 to overlap the outer side of the rear end of the side plate 110b of the first cover 110.

In Figure 11, reference numeral 105 designates a turning support section so that the first cover 110 can turnably be supported by the case 100.

In addition, embodiments of the present invention may be applied to other types of sheet feeding apparatus such as photocopiers and facsimile machines.

This is the replacement sheet

Date: 17 JAN 1997

CLAIMS

1. An impact dot printer comprising:
a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by
a silencing means (112, 113, 114) disposed above the print section.
2. An impact dot printer according to claim 1, in which the silencing means includes a sound absorbing member (114) for absorbing sound.
3. An impact dot printer according to claim 1 or 2, in which the silencing means includes at least one reflecting plate (112) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to a sheet forward direction (A).
4. An impact dot printer according to any one of claims 1 to 3, in which a sheet discharge plate (161) for guiding a printed sheet (P) is disposed between the platen and the silencing means.
5. An impact dot printer according to claim 3, in which the silencing means includes at least one reinforcing plate (113) serving as a sheet guide for guiding a printed sheet, the reinforcing plate being a plate like body intersecting the reflecting plate.
6. An impact dot printer according to claim 5, in which the reinforcing plate is deeper than the reflecting plate.
7. An impact dot printer according to claim 5 or 6, in which there are two or more reinforcing plates and a distance between adjacent reinforcing plates is smaller than a width of a smallest sheet to be supplied for printing.



This is the replacement sheet

17 JAN 1997

Date:



8. An impact dot printer according to any one of the preceding claims, further comprising:

a printer case (100) accommodating therein at least the platen and the print head;
a first cover (110) for covering a top of the printer case, the first cover having a top plate (110a) and side plates (110b) formed integrally with the top plate; and
a second cover (120) turnably mounted on the first cover, the second cover having a top plate (120a) and side plates (120b) formed integrally with the top plate.

9. An impact dot printer as claimed in claim 8, further comprising:

a first overlap portion (190) between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover.

10. An impact dot printer according to claim 9, in which the first overlap portion is formed from a fan like overlap strip (191) formed on the ends of the side plates of one of the covers, and overlapping the side plates of the other cover.

11. An impact dot printer as claimed in any one of claims 8 to 10, further comprising:

a second overlap portion (200) between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of a turning section (121a) between the first cover and the second cover when the second cover is turned relative to the first cover.

12. An impact dot printer according to claim 11, in which the second overlap portion is formed by overlapping an arcuate surface (211) corresponding to a locus formed by turning a front end (120c) of one of the covers, either first cover or the second cover, upon the other cover, the front end being on the side of the centre of turning.





13. An impact dot printer according to claim 11 or 12, in which the second cover is formed so as to be turnable relative to the first cover, and a cutter (110c) for cutting a sheet is arranged on an edge of the first cover, the edge being exposed when the second cover is turned above the first cover.

14. An impact dot printer according to any one of the preceding claims, in which the second cover has a reflecting plate (122) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to the sheet forward direction (A);

at least one sheet guide plate (123) for guiding the printed sheet (P), the sheet guide plate being a plate-like body intersecting the reflecting plate; and in which the sheet guide plate is deeper than the reflecting plate.

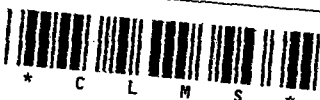
15. An impact dot printer according to claim 14, in which there is a plurality of sheet guide plates and the distance between adjacent sheet guide plates is smaller than a width of a smallest sheet to be supplied for printing.

16. An impact dot printer according to any one of the preceding claims except when dependent on claim 4, in which both the first cover and the second cover form an upper portion of a sheet discharge path (180).

17. An apparatus comprising:

a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by

a silencing means (112, 113, 114) disposed above the print section.



This is the replacement sheet

Date:

17 JAN 1997

ABSTRACT

APPARATUS WITH SILENCING MEANS

An impact dot printer is disclosed which is designed to reduce noise and comprises a first cover (110), a second cover (120), and an overlap portion (190, 200). The first cover is located above a print section (141), and includes sound wave reflecting plates (112), sheet guide plates (113), and a sound absorbing member (114). Each reflecting plate, each sheet guide plate, and the sound absorbing member being arranged close to the print section. The second cover is disposed so as to be turnable relative to the first cover and form a sheet discharge path (180) together with the first cover. The second cover also has sound wave reflecting plates (122) and sheet guide plates (123). Each sheet guide plate is designed to be deeper than each reflecting plate and the lateral distance between the sheet guide plates is made smaller than the width of the smallest sheet which is intended to be fed into the printer. The overlap portion is arranged so that no opening is provided between the first cover and second cover.

Figure 2.

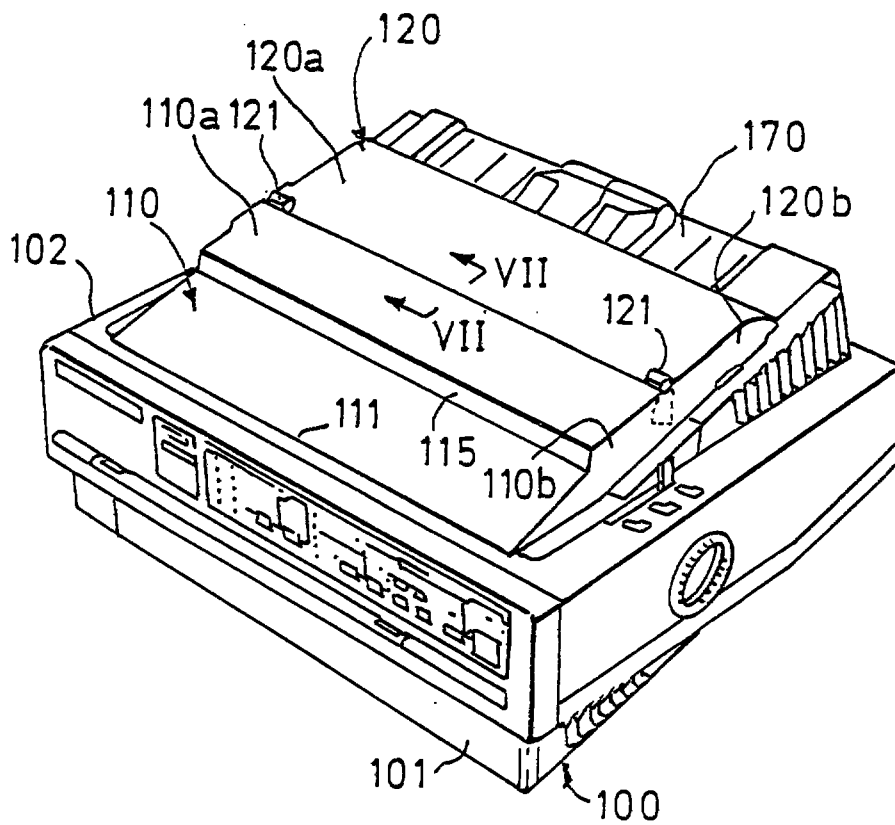


FIG.1.

This is the replacement sheet

Date: 17 JAN 1997

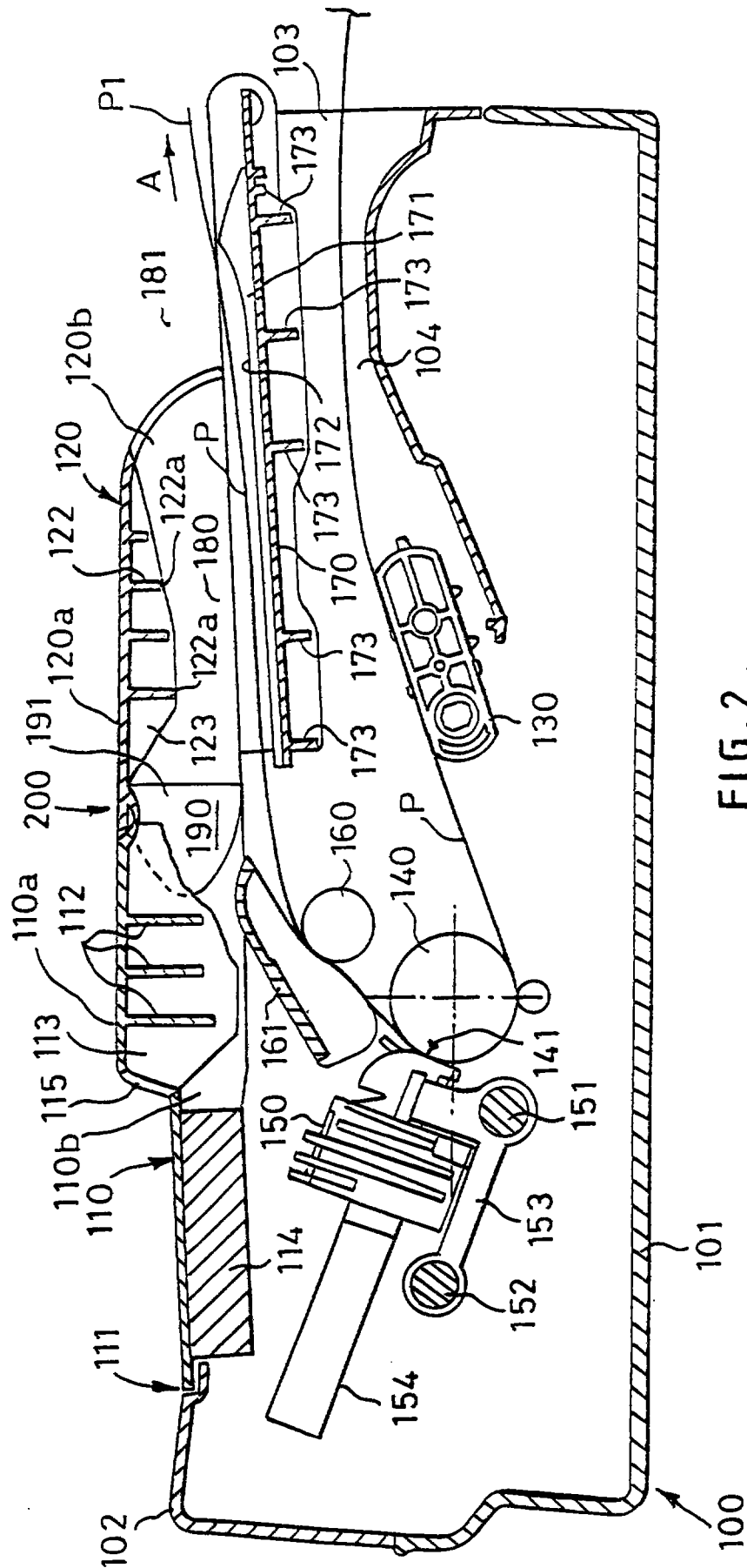
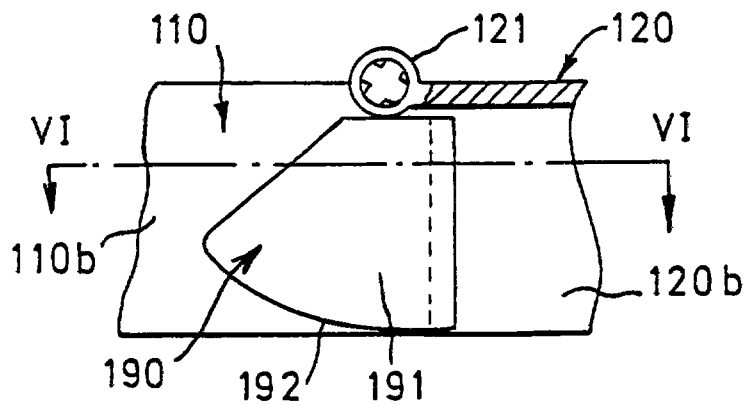
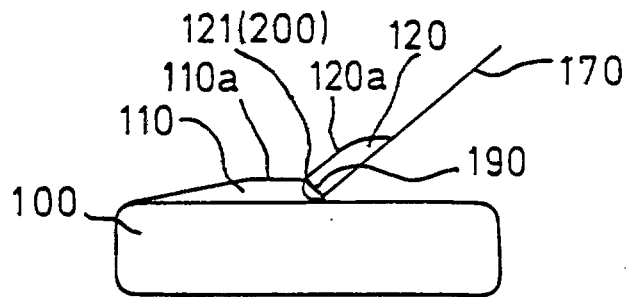
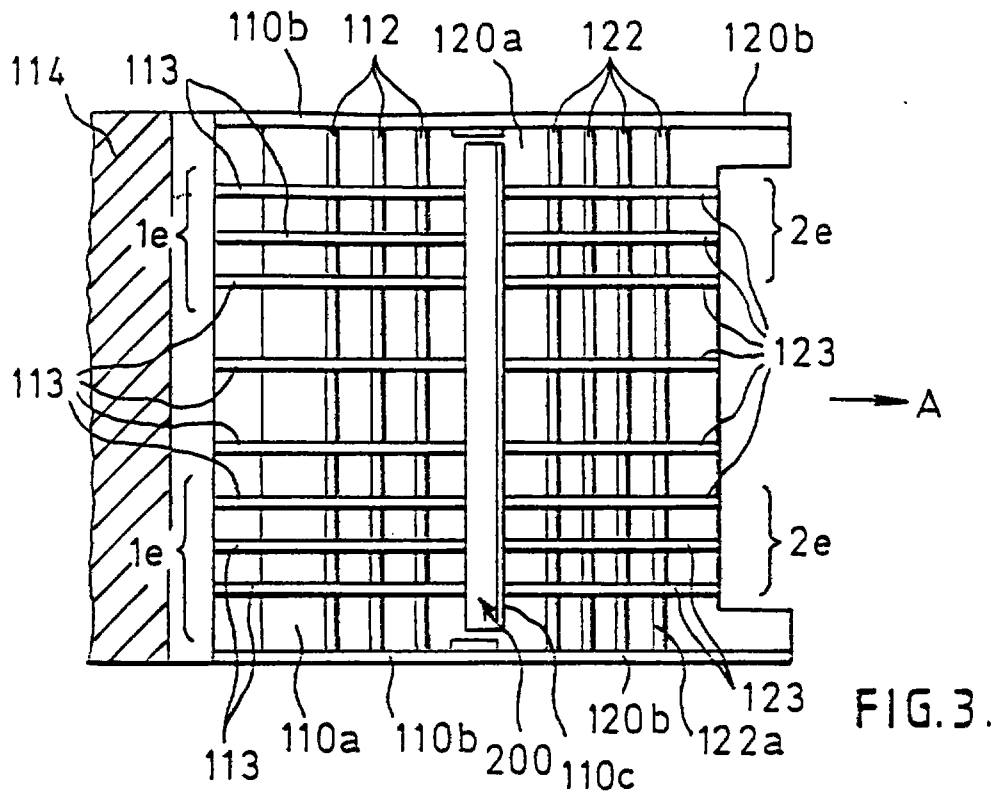


FIG. 2.

This is the replacement sheet

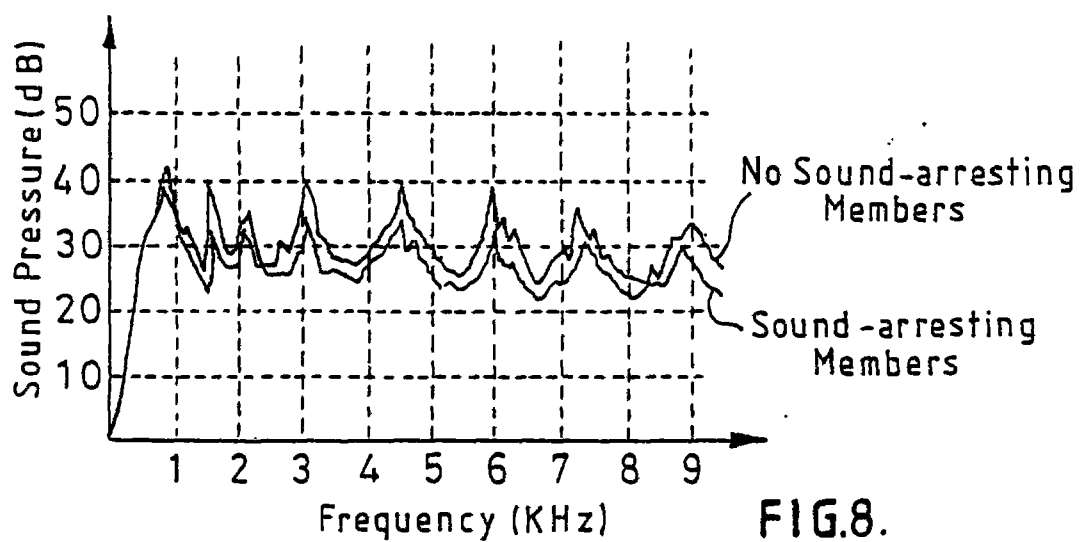
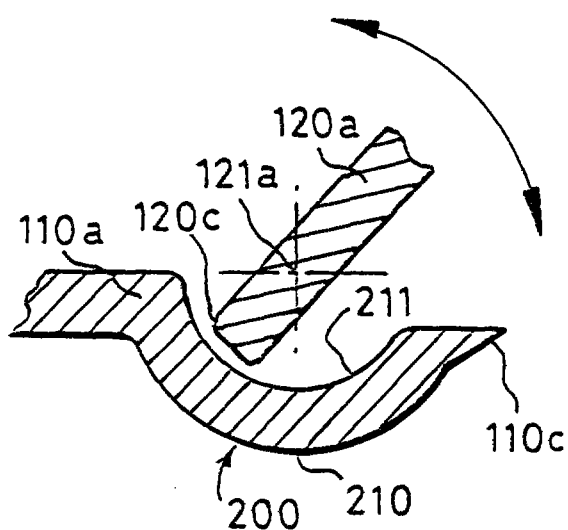
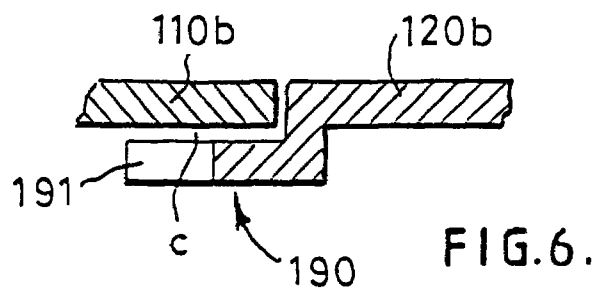
Date: 17 JAN 1997



This is the replacement sheet

17 JAN 1997

Date:



This is the replacement sheet

Date: 17 JAN 1997

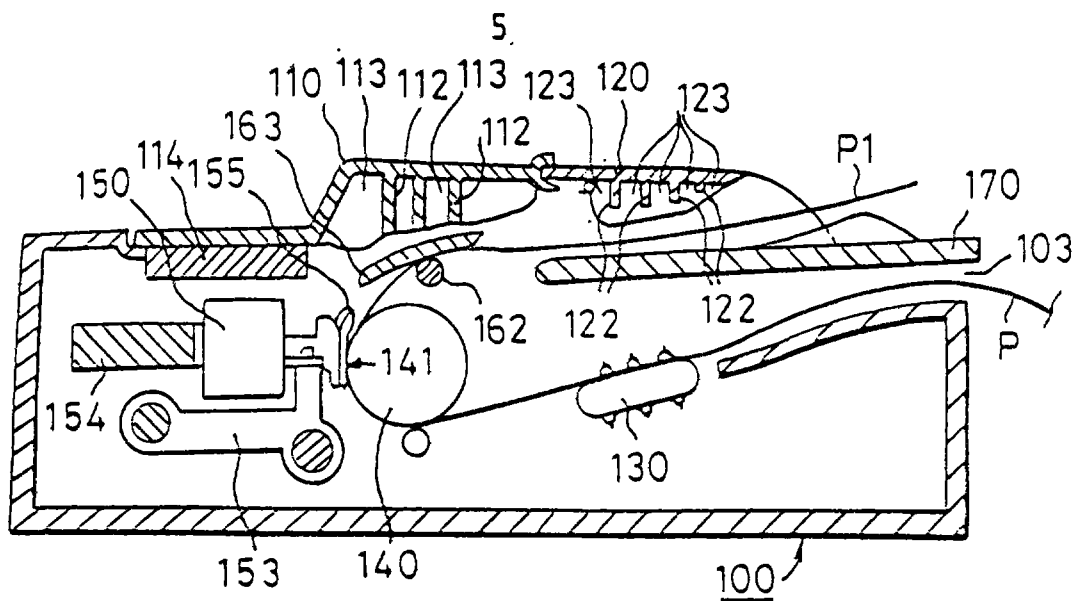


FIG. 9.

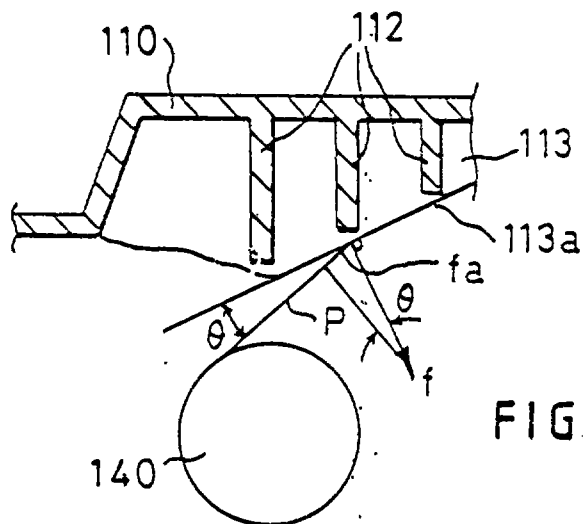


FIG. 10.

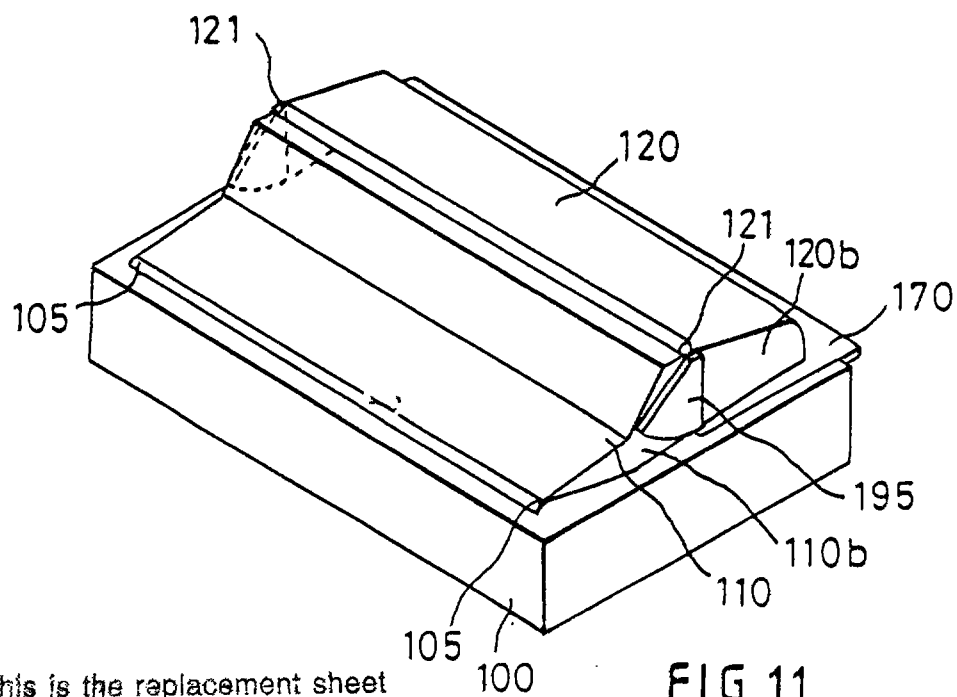
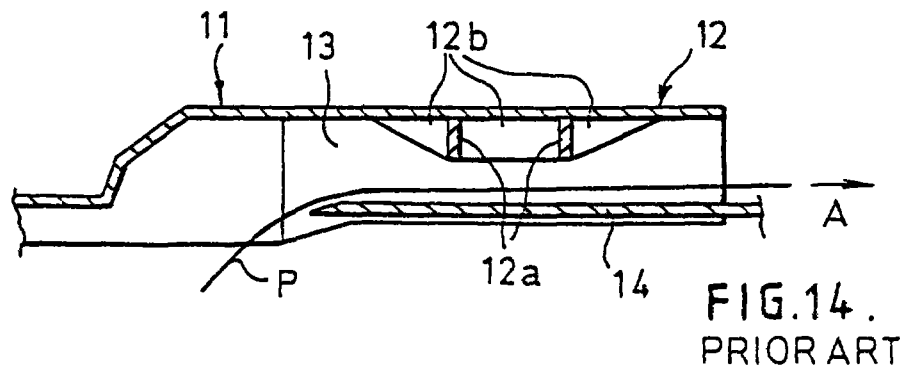
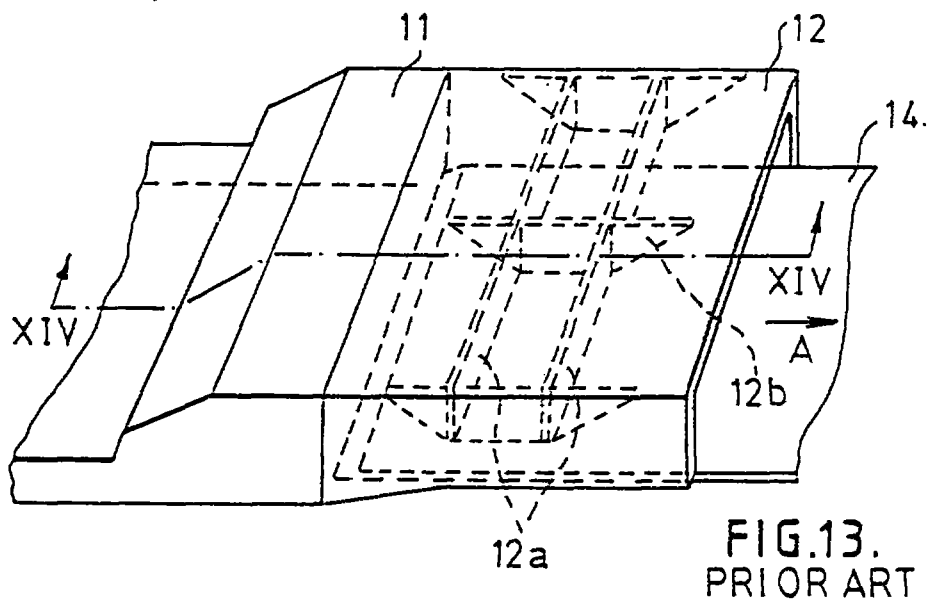
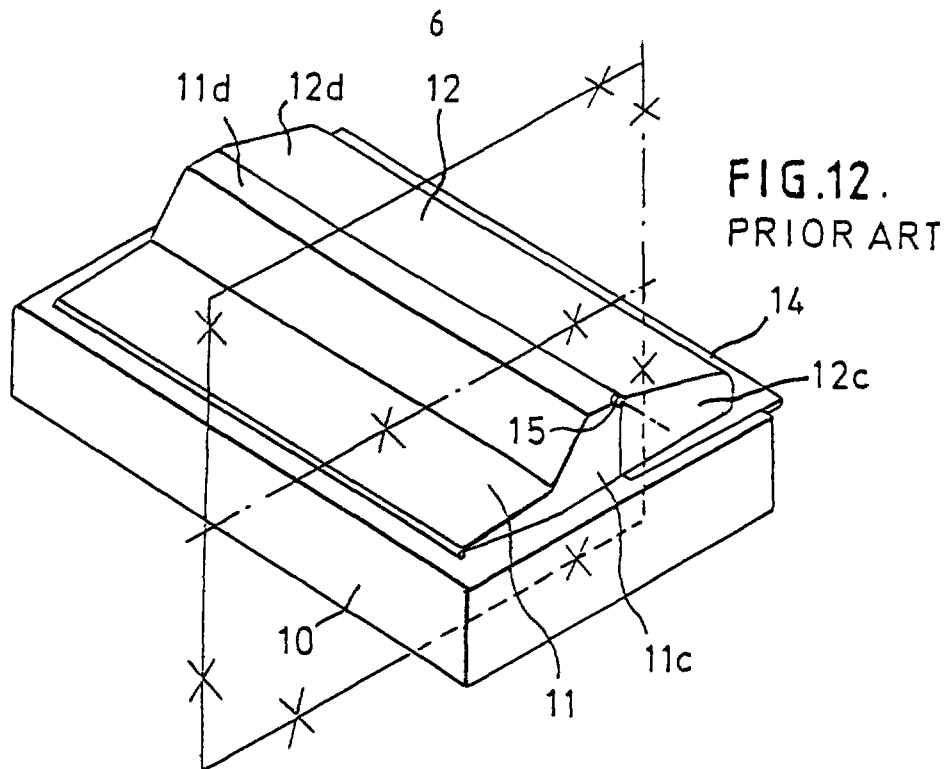


FIG. 11.

This is the replacement sheet

Date: 17 JAN 1997



This is the replacement sheet

Date: 17 JAN 1997

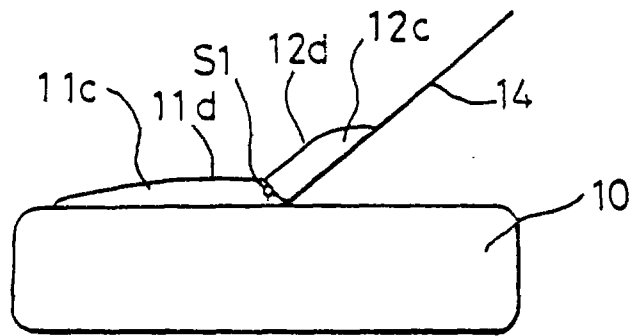


FIG. 15.
PRIOR ART

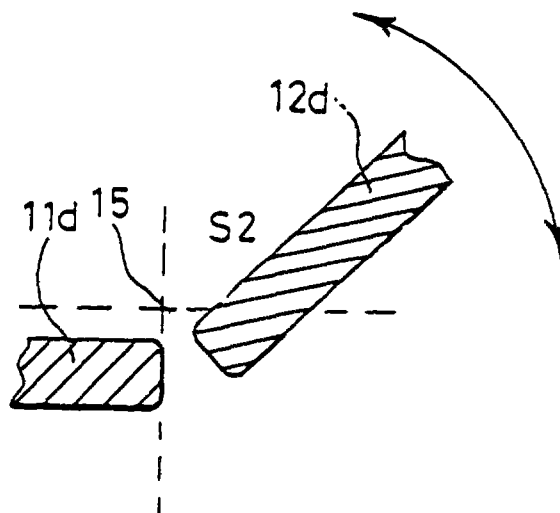


FIG. 16.
PRIOR ART

the sheet guide 14 is turned upward as shown in Figure 15, so that the cut sheet can be supplied to the print section along the sheet guide 14. The second cover 12 is pivoted at turning support sections 15 (see Figure 12) relative to the first cover 11, so that the second cover 12 can be turned together with the sheet guide 14 when the sheet guide 14 is turned.

This conventional printer thus addresses the problem of noise reduction but does not achieve an adequate reduction for the following reasons.

First, the reflecting plates 12a are arranged only on the second cover 12. This means that the reflecting plates 12a are disposed at a distance from the head and the platen, which are the major sources of noise.

Second, the reflecting plates 12a and the sheet guide plate 12b have the same height as shown in Figure 14, which means in practice that the front end of a printed sheet easily jams. Such trouble is particularly noticeable with narrow sheets. One ready solution to this jamming problem, is to design the sheet discharge path 13 with more depth. However, this solution leads to an increase in noise because more noise can be heard due to the increase in the space of the sheet discharge path 13.

Third, when the sheet guide 14 is turned for printing a cut sheet, an opening S1 is created between side plates 11c of the first cover 11 and side plates 12c of the second cover 12 as shown in Figure 15. Further, as shown in Figure 16, an opening S2 is also created between the rear edge of a top plate 11d of the first cover 11 and a top plate 12d of the second cover 12. These two openings S1 and S2 naturally lead to an increase in noise.

Similar problems have also been experienced with other types of apparatus such as photocopiers and facsimile machines.

This is the replacement sheet

23 SEP 1998

REPLACEMENT SHEETS		SG
☒	Description : paged .2. to paged .4.	
☒	Claim(s) : paged .14. to paged .17.	
☒	Drawing(s) : paged to paged	
☒	Abstract : paged .15. to paged	
DATE OF RECEIPT		23/9/98

An object of the present invention is to overcome the above problems and accordingly provide an apparatus with features which reduce the noise.

An impact dot printer according to the present invention comprises a print section formed of a platen and a print head, the print head confronting the platen; and is characterised by

a silencing means disposed above the print section, including at least one reflecting plate for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to a sheet forward direction;

a printer case accommodating therein at least the platen and the print head;

a first cover for covering a top of the printer case, the first cover having a top plate and side plates formed integrally with the top plate;

a second cover turnably mounted on the first cover, the second cover having a top plate and side plates formed integrally with the top plate;

a first overlap portion between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover; and

a second overlap portion between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of a turning section between the first cover and the second cover when the second cover is turned relative to the first cover.

Embodiments of the present invention will now be described with reference to the accompanying drawings, of which:

Figure 1 is a perspective view showing the external aspect of the preferred embodiment of the present invention;

Figure 2 is a sectional view of the preferred embodiment;

Figure 3 is an underside view of a first cover and a second cover of the preferred embodiment;

Figure 4 is a schematic sectional view with the second cover turned;

Figure 5 is a partially enlarged view of Figure 2;

Figure 6 is a sectional view taken along a line V1-V1 of Figure 5;

Figure 7 is an enlarged sectional view taken along a line VII-VII in Figure 1;

Figure 8 is a diagram showing noise spectra both in the presence and in the absence of reflecting plates on the first and second covers;

Figure 9 is a sectional view showing a first modified embodiment;

Figure 10 is an enlarged sectional view showing a second modified embodiment;

Figure 11 is a perspective view showing the external aspect of a third modified embodiment;

Figure 12 is a perspective view showing the external aspect of the conventional printer;

Figure 13 is an enlarged partial view of the conventional printer;

Figure 14 is a sectional view taken along a line XIV-XIV in Figure 13;

Figure 15 is a schematic sectional view showing a conventional printer with a second cover thereof turned; and

Figure 16 is a partially enlarged sectional view of Figure 15.

**CLAIMS****1. An impact dot printer comprising:**

a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by

a silencing means (112, 113, 114) disposed above the print section, including at least one reflecting plate (112) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to a sheet forward direction (A);

a printer case (100) accommodating therein at least the platen and the print head;

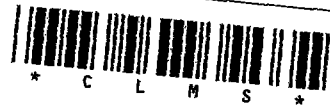
a first cover (110) for covering a top of the printer case, the first cover having a top plate (110a) and side plates (110b) formed integrally with the top plate;

a second cover (120) turnably mounted on the first cover, the second cover having a top plate (120a) and side plates (120b) formed integrally with the top plate;

a first overlap portion (190) between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover; and

a second overlap portion (200) between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of a turning section (121a) between the first cover and the second cover when the second cover is turned relative to the first cover.

2. An impact dot printer according to claim 1, in which the first overlap portion is formed from a fan like overlap strip (191) formed on the ends of the side plates of one of the covers, and overlapping the side plates of the other cover.



3. An impact dot printer according to claim 1 or claim 2, in which the second overlap portion is formed by overlapping an arcuate surface (211) corresponding to a locus formed by turning a front end (120c) of one of the covers, either first cover or the second cover, upon the other cover, the front end being on the side of the centre of turning.

4. An impact dot printer according to any one of the preceding claims in which the second cover is formed so as to be turnable relative to the first cover, and a cutter (110c) for cutting a sheet is arranged on an edge of the first over, the edge being exposed when the second cover is turned above the first cover.

5. An impact dot printer according to any one of the preceding claims, in which the second cover has a reflecting plate (122) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to the sheet forward direction (A);

at least one sheet guide plate (123) for guiding the printed sheet (P), the sheet guide plate being a plate-like body intersecting the reflecting plate; and in which the sheet guide plate is deeper than the reflecting plate.

6. An impact dot printer according to claim 5, in which there is a plurality of sheet guide plates and the distance between adjacent sheet guide plates is smaller than a width of a smallest sheet to be supplied for printing.

7. An impact dot printer according to any one of the preceding claims, in which both the first cover and the second cover form an upper portion of a sheet discharge path (180).

This is the replacement sheet

Date: 23 SEP 1999



8. An impact dot printer according to any one of the preceding claims, further comprising:

a printer case (100) accommodating therein at least the platen and the print head;
a first cover (110) for covering a top of the printer case, the first cover having a top plate (110a) and side plates (110b) formed integrally with the top plate; and
a second cover (120) turnably mounted on the first cover, the second cover having a top plate (120a) and side plates (120b) formed integrally with the top plate.

9. An impact dot printer as claimed in claim 8, further comprising:

a first overlap portion (190) between the side plates of the first cover and the side plates of the second cover so that no opening is formed between the side plates of the first cover and the side plates of the second cover when the second cover is turned relative to the first cover.

10. An impact dot printer according to claim 9, in which the first overlap portion is formed from a fan like overlap strip (191) formed on the ends of the side plates of one of the covers, and overlapping the side plates of the other cover.

11. An impact dot printer as claimed in any one of claims 8 to 10, further comprising:

a second overlap portion (200) between the top plates of the first cover and the top plates of the second cover so that no opening is formed along the axial line of a turning section (121a) between the first cover and the second cover when the second cover is turned relative to the first cover.

12. An impact dot printer according to claim 11, in which the second overlap portion is formed by overlapping an arcuate surface (211) corresponding to a locus formed by turning a front end (120c) of one of the covers, either first cover or the second cover, upon the other cover, the front end being on the side of the centre of turning.

This is the replacement sheet

Date: 23 SEP 1998



This Sheet Has Been Replaced



17



13. An impact dot printer according to claim 11 or 12, in which the second cover is formed so as to be turnable relative to the first cover, and a cutter (110c) for cutting a sheet is arranged on an edge of the first cover, the edge being exposed when the second cover is turned above the first cover.
14. An impact dot printer according to any one of the preceding claims, in which the second cover has a reflecting plate (122) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to the sheet forward direction (A);
at least one sheet guide plate (123) for guiding the printed sheet (P), the sheet guide plate being a plate-like body intersecting the reflecting plate; and in which
the sheet guide plate is deeper than the reflecting plate.
15. An impact dot printer according to claim 14, in which there is a plurality of sheet guide plates and the distance between adjacent sheet guide plates is smaller than a width of a smallest sheet to be supplied for printing.
16. An impact dot printer according to any one of the preceding claims except when dependent on claim 4, in which both the first cover and the second cover form an upper portion of a sheet discharge path (180).
17. An apparatus comprising:
a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by
a silencing means (112, 113, 114) disposed above the print section.

This is the replacement sheet

23 SEP 1998

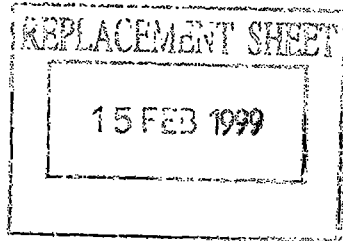
ABSTRACT
APPARATUS WITH SILENCING MEANS

An impact dot printer is disclosed which is designed to reduce noise and comprises a first cover (110), a second cover (120), and an overlap portion (190, 200). The first cover is located above a print section (141), and includes sound wave reflecting plates (112), sheet guide plates (113), and a sound absorbing member (114). Each reflecting plate, each sheet guide plate, and the sound absorbing member being arranged close to the print section. The second cover is disposed so as to be turnable relative to the first cover and form a sheet discharge path (180) together with the first cover. The second cover also has sound wave reflecting plates (122) and sheet guide plates (123). Each sheet guide plate is designed to be deeper than each reflecting plate and the lateral distance between the sheet guide plates is made smaller than the width of the smallest sheet which is intended to be fed into the printer. The overlap portion is arranged so that no opening is provided between the first cover and second cover.

Figure 2.

This is the replacement sheet

Date: 23 SEP 1998



REPLACEMENT SHEET

17

13. An impact dot printer according to claim 11 or 12, in which the second cover is formed so as to be turnable relative to the first cover, and a cutter (110c) for cutting a sheet is arranged on an edge of the first cover, the edge being exposed when the second cover is turned above the first cover.

14. An impact dot printer according to any one of the preceding claims, in which the second cover has a reflecting plate (122) for reflecting a sound wave, the reflecting plate extending in a direction orthogonal to the sheet forward direction (A);

at least one sheet guide plate (123) for guiding the printed sheet (P), the sheet guide plate being a plate-like body intersecting the reflecting plate; and in which the sheet guide plate is deeper than the reflecting plate.

15. An impact dot printer according to claim 14, in which there is a plurality of sheet guide plates and the distance between adjacent sheet guide plates is smaller than a width of a smallest sheet to be supplied for printing.

16. An impact dot printer according to any one of the preceding claims except when dependent on claim 4, in which both the first cover and the second cover form an upper portion of a sheet discharge path (180).

~~17. An apparatus comprising:~~

~~a print section (141) formed of a platen (140) and a print head (150), the print head confronting the platen; and characterised by~~

~~a silencing means (112, 113, 114) disposed above the print section.~~