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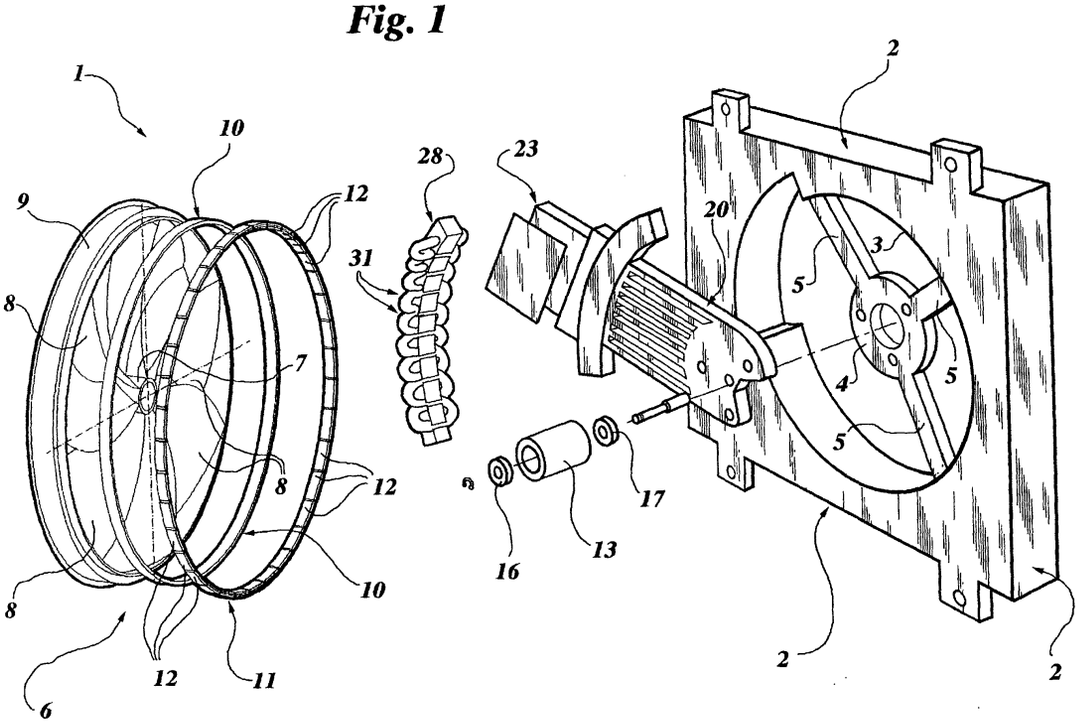
(54) An electric fan

(57) An electric fan (1) comprises a blade impeller (6, 8) and an electric motor with a rotor part (11, 12) including a plurality of permanent magnets (12) fixed to a peripheral ring (19) of the impeller (6), and a stator part (28, 31) which faces a portion of the said ring (11) of magnets (12) of the rotor and which comprises a winding (31) and a support structure (2;20) in which the impeller (6) is rotatably mounted and to which the stator part of the motor is fixed.

The support structure comprises a bracket (20) of generally elongate form having a first end (20a) provided with rotation support means (21) for the impeller (6) and a second end (20b) to which the stator part (28-31) of the electric motor is fixed.

Fig. 1



EP 1 225 341 A2

Description

[0001] The present invention relates to an electric fan usable, for example, for cooling a heat exchanger such as a radiator associated with the internal combustion engine of a motor vehicle.

[0002] More specifically, the subject of the invention is an electric fan of the type comprising a blade impeller and an associated electric motor including a rotor part comprising a ring of permanent magnets fixed to a peripheral ring of the impeller, and a stator part which faces a portion of the said ring of magnets of the impeller and which includes a winding and a support structure in which the impeller is rotatably mounted and to which the said stator part of the motor is fixed.

[0003] The object of the present invention is to provide an electric fan of the above-specified type, which has a particularly simple structure which can be assembled and installed in a simple and economic manner.

[0004] This and other objects are achieved according to the invention with an electric fan of the above-specified type, characterised in that the said support structure comprises a bracket of generally elongate form having a first end provided with means for supporting rotation of the impeller and a second end to which the said stator part of the electric motor is fixed.

[0005] In a preferred embodiment of the invention a receptacle is formed in the said second end of the bracket, which can receive control circuit means coupled to the stator part of the electric motor. Advantageously the bracket is made of a metal material such as aluminium, and is in heat exchange relation with at least some components of the said circuit means in order to encourage the dissipation of heat.

[0006] According to a further advantageous characteristic of the invention the winding of the stator part is made with stacks of laminations of electrically conductive material such as copper or its alloys, carried by a support plate which also carries connection conductors for interconnecting them.

[0007] Further characteristics and advantages of the electric fan according to the invention will become apparent from the following detailed description given purely by way of non-limitative example, with reference to the attached drawings, in which:

Figure 1 is a partly exploded perspective view of an electric fan according to the invention;

Figure 2 is an axially sectioned partial view of a peripheral portion of the impeller of the electric fan of the invention;

Figure 3 is an axially sectioned partial view of the hub of the impeller;

Figure 4 is a perspective view of a support bracket of the electric fan;

Figure 5 is a perspective view of a variant embodiment of the support bracket;

Figure 6 is a perspective view which shows the bracket of Figure 5 in association with an air conveying support structure for the electric fan;

Figures 7 and 8 are sectioned views taken on the lines VII-VII and VIII-VIII respectively of Figure 5;

Figure 9 is a partial perspective view which shows a particular way of making the stator part of an electric fan according to the invention;

Figure 10 is a perspective view, on an enlarged scale, of a detail seen from the direction of the arrow X of Figure 9; and

Figure 11 is a perspective view which shows the detail of Figure 10 seen from the direction of the arrow XI of this Figure.

[0008] With reference to Figure 1, an electric fan 1 according to the invention comprises a support casing 2 in which there is defined an essentially circular passage 3. At the exit from this passage, that is to say essentially on the rear side of the support body 2, extends a support ring 4 interconnected with the body 2 by means of a series of spokes 5.

[0009] The electric fan 1 comprises an impeller generally indicated 6, having a hub 7 from which extends a ring of arcuate blades 8. The outer ends of these blades are joined to a peripheral ring 9.

[0010] Conveniently, according to a technique already known per se, the hub 7, the blades 8 and the peripheral ring 9 of the impeller are made in one piece of moulded plastics material.

[0011] In Figures 1 and 2 the reference numeral 10 indicates a metal ring on the outer surface of which is fixed, for example by adhesive, a ring 11 of permanent magnets 12.

[0012] As seen in Figure 2, the ring 2 and the ring 11 formed by the magnets 12 are embedded in the peripheral ring 9 of the bladed impeller 6 upon moulding of this latter, in such a way that the rotor part of the motor associated with this impeller is practically integral with it.

[0013] As seen in Figure 3, a tubular metal insert 13 is conveniently embedded, upon moulding, in the hub 7 of the impeller 6, at the ends of which are defined two seats 14 and 15 of greater diameter to allow respective bearing supports 16 and 17 (Figure 1) to be fitted to them.

[0014] The electric fan 1 further includes a support bracket generally indicated 20 in Figure 1 and 4.

[0015] This support bracket 20 is conveniently made of metal such as aluminium or its alloys. It has a generally elongate form and one end 20a thereof carries a pin 21 which is inserted into the bearing support 16 and 17 of the impeller 6 to act as a fixed shaft for the rotation of this latter.

[0016] The end 20a of the bracket 20 further has three holes for the passage of screws which, being engaged in corresponding holes of the ring 4 of the support body 2, contribute to the fixing of the bracket 20 to this body.

[0017] The other end 20b of the bracket 20 forms a receptacle 23 in which is conveniently housed a circuit

board (not illustrated) carrying the control circuit components associated with the motor of the electric fan. In particular at least some of these components, in the mounted condition, are in heat exchange relationship with the bracket 20 which therefore also acts as a dissipater for heat developed in operation of these components.

[0018] The end portion 20b of the bracket 20 has a pair of through holes 24 (only one of which is visible in Figure 4) for the passage of corresponding fixing screws which allow this end of the bracket 20 also to be fixed to the support body 2. Adjacent the receptacle 23 defined in the bracket 20 there is fixed to this latter a terminal block of 25 of electrically insulating material from which extend terminals 26 which are intended to be connected to the circuits housed in the said receptacle, and a plurality of electrical terminals 27 intended for connection of the windings of the stator part of the motor of the electric fan.

[0019] The stator part comprises a stack of stator laminations 28 in the form of arcuate segments, forming a plurality of teeth 29 alternating with recesses 30. Around these teeth and in the said recesses are wound conductors which form the winding 31 (Figure 1) of the stator part.

[0020] The stack of stator laminations 28 and the terminal block 25 are conveniently fixed to the bracket 20 by means of the same pair of screws.

[0021] In the embodiment illustrated in Figures 1 and 4 the intermediate portion of the support bracket 20 has a plurality of longitudinal slots 32 intended to allow the passage of air which in operation is blown by the impeller 20 into the passage 3 of the support body 2.

[0022] A variant embodiment of the support bracket 20 will now be described with reference to Figures from 5 to 8. In these Figures the parts and elements which are the same as or essentially equivalent to parts and elements already described have been again allocated the same reference numerals.

[0023] In the variant illustrated in particular in Figure 5 the intermediate portion of the support bracket 20 forms a plurality of angularly spaced deflector elements or flow straighteners 40. A similar series of deflector elements or flow straighteners indicated 41 in Figure 6 extend from the support ring 4 to the outlet of the conveyor duct 3. The deflectors or flow straighteners 41 form an angularly complementary assembly to that formed by the deflectors or flow straighteners 40 of the support bracket 20. In other words, when the bracket 20 is mounted in position on the body 2 its deflectors or flow straighteners 40 combine with the deflectors or flow straighteners 41 to form, overall, a ring of angularly equally spaced deflectors or straighteners.

[0024] As is shown in Figures 7 and 8, each deflector or flow straightener 40 has in its radially innermost region an essentially straight cross section as shown in Figure 7, which progressively curves in the direction of its radially outer portion in correspondence with which, as seen in Figure 8, its cross section has an accentuated curvature. The same is obviously true for the flow straighteners 41 of the support body 2.

[0025] For the rest, the support bracket 20 essentially corresponds to that previously described with reference to Figures 1 and 4.

[0026] In general, in an electric fan of the type described above, the winding of the stator part of the electric motor must be made with conductors having a large cross section for the purpose of ensuring a high performance. However, the formation of windings with conductors of large cross section is a complicated operation.

[0027] The problems connected with the winding of wires of large cross section can be avoided with the arrangement which will now be described with a reference to Figures from 9 to 11.

[0028] These Figures illustrate portions of the stator part of the motor associated with the electric fan, in which the winding 31 is made with stacks 50 of laminations 51 of electrically conductive material such as copper or its alloys, carried by a support plate 52 of electrically insulating material which carries connection conductors 53 for interconnecting them (Figure 11).

[0029] Naturally, the principle of the invention remaining the same, the embodiments and details of construction can be widely varied with respect to what has been described and illustrated purely by way of non-limitative example, without by this departing from the ambit of the invention as defined in the attached claims.

Claims

1. An electric fan (1) comprising
a blade impeller (6, 8) and
an associated electric drive motor including a rotor part (11, 12) comprising a plurality of permanent magnets (12) fixed to a peripheral ring (9) of the impeller (6), and a stator part (28, 31) which faces a portion of the said ring (11) of magnets (12) of the rotor and which includes a winding (31) and
a support structure (2;20) in which the impeller (6) is rotatably mounted and to which the said stator part of the motor is fixed;
the electric fan being **characterised in that** the said support structure comprises bracket (20) of generally elongate shape having a first end (20a) provided with rotation support means (21) for the impeller (6), and a second end (20b) to which the said stator part (28-31) of the electric motor is fixed.

2. An electric fan according to Claim 1, in the which the second end (20b) of the support bracket (20) has a receptacle (23) formed therein able to receive control circuit means coupled to the stator part (28-31) of the said electric motor.

3. An electric fan according to Claim 2, in which the

support bracket (20) is of metal material, in particular aluminium, and is in heat exchange relationship with at least some components of the said circuit means to encourage dissipation of heat.

4. An electric fan according to any preceding claim, in which the ends (20a, 20b) of the said support bracket (20) are provided with means (22, 24) able to allow anchorage to a supporting structure (2) in use.

5. An electric fan according to any preceding claim, in which the impeller (6) is of moulded plastics material and the magnets (12) of the rotor part (11) are fixed, for example by adhesive, to a metal support ring (10), the said ring (10) and the magnets (12) being embedded in the plastics material of the impeller (6).

6. An electric fan according to any preceding claim, in which the said first end (20a) of the bracket (20) has a pin (21) fixed to it and operable to function as a fixed shaft, in which the impeller (6) has a hub (7) provided with rotation support means (16, 17) rotatably mounted on the said pin or fixed shaft (21).

7. An electric fan according to any preceding claim in which the intermediate portion of the support bracket (20) has a plurality of angularly spaced deflector elements or flow straightener elements (40) formed therein.

8. An electric fan according to any preceding claim, in which the winding (31) of the stator part (28-31) is formed with stacks (50) of laminations (51) of electrically conductive material such as copper or its alloys, carried by a support plate (52) which also carries connector conductors (53) for interconnecting them.

Fig. 1

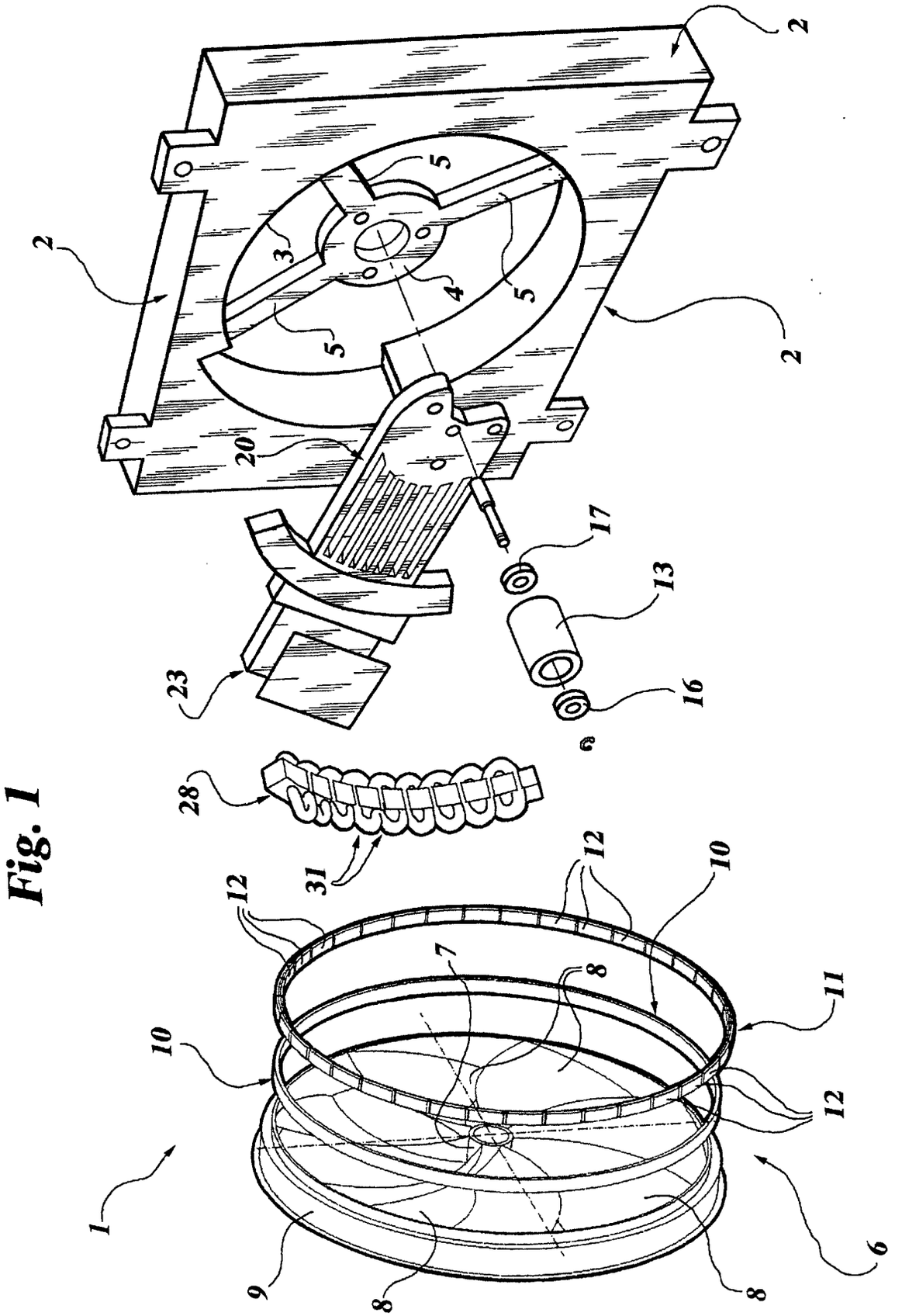


Fig. 2

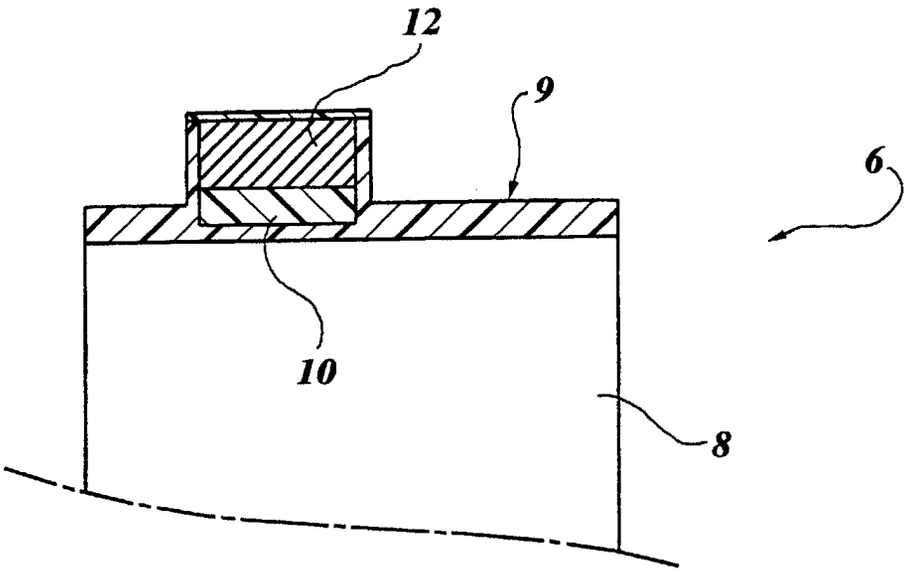


Fig. 3

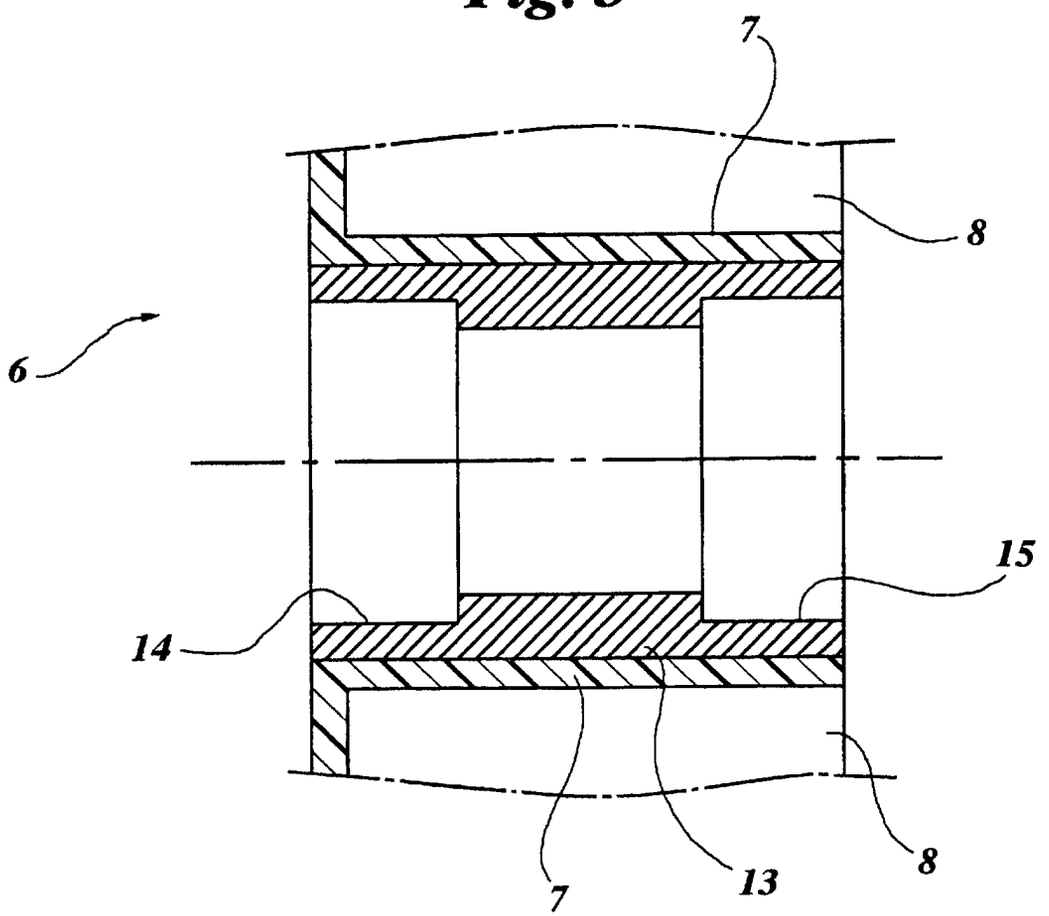


Fig. 4

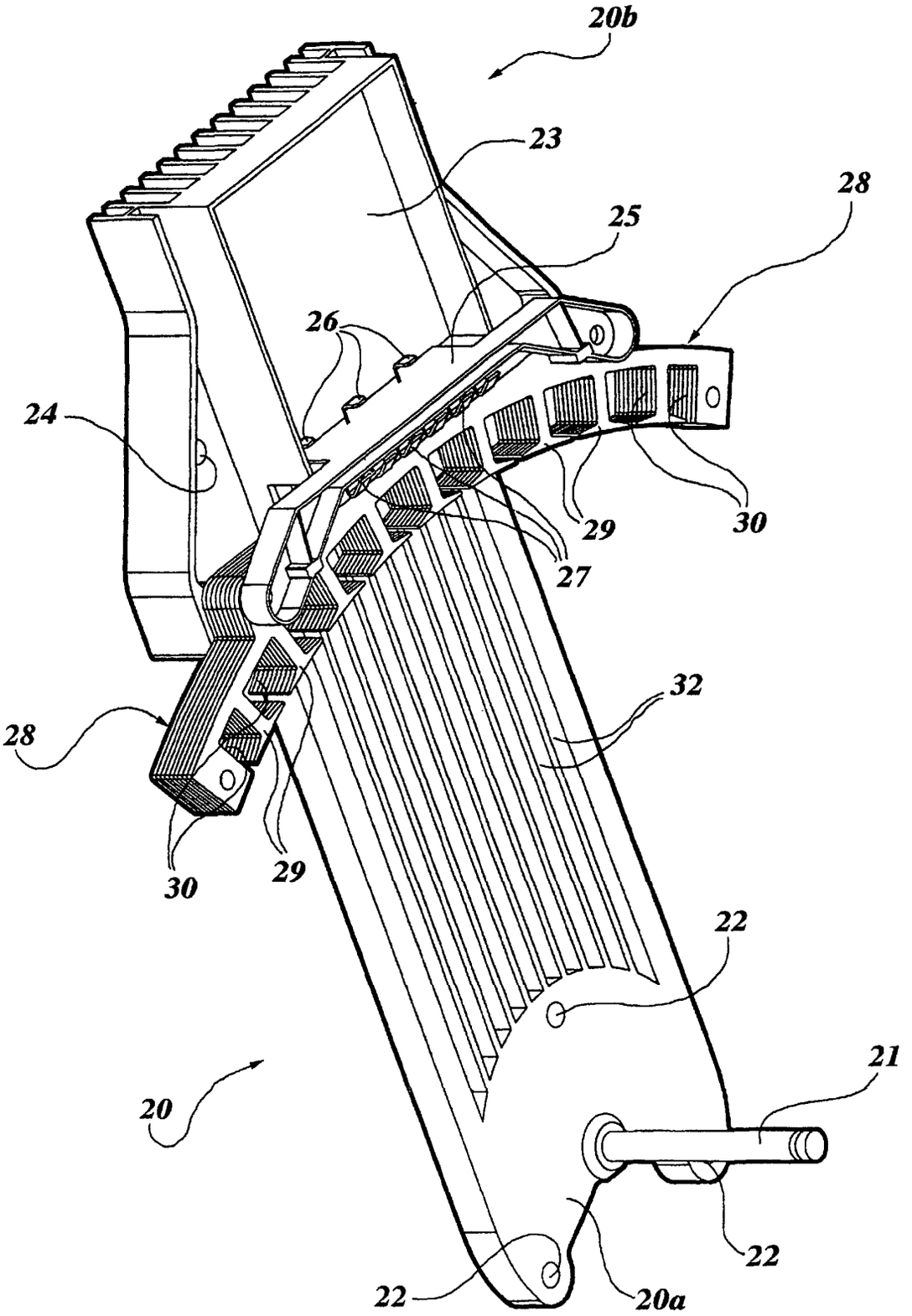


Fig. 7

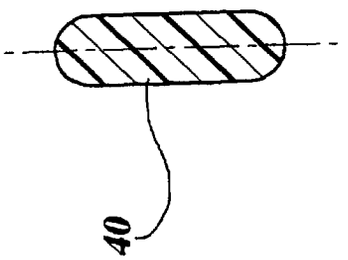


Fig. 8

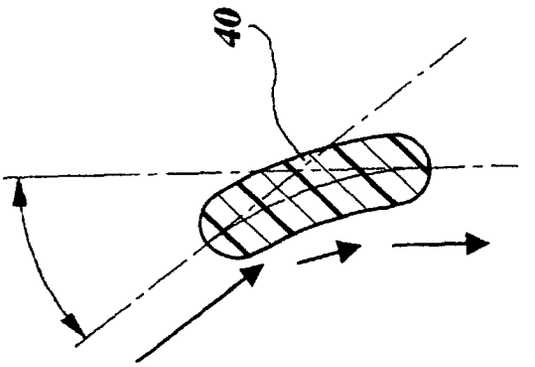
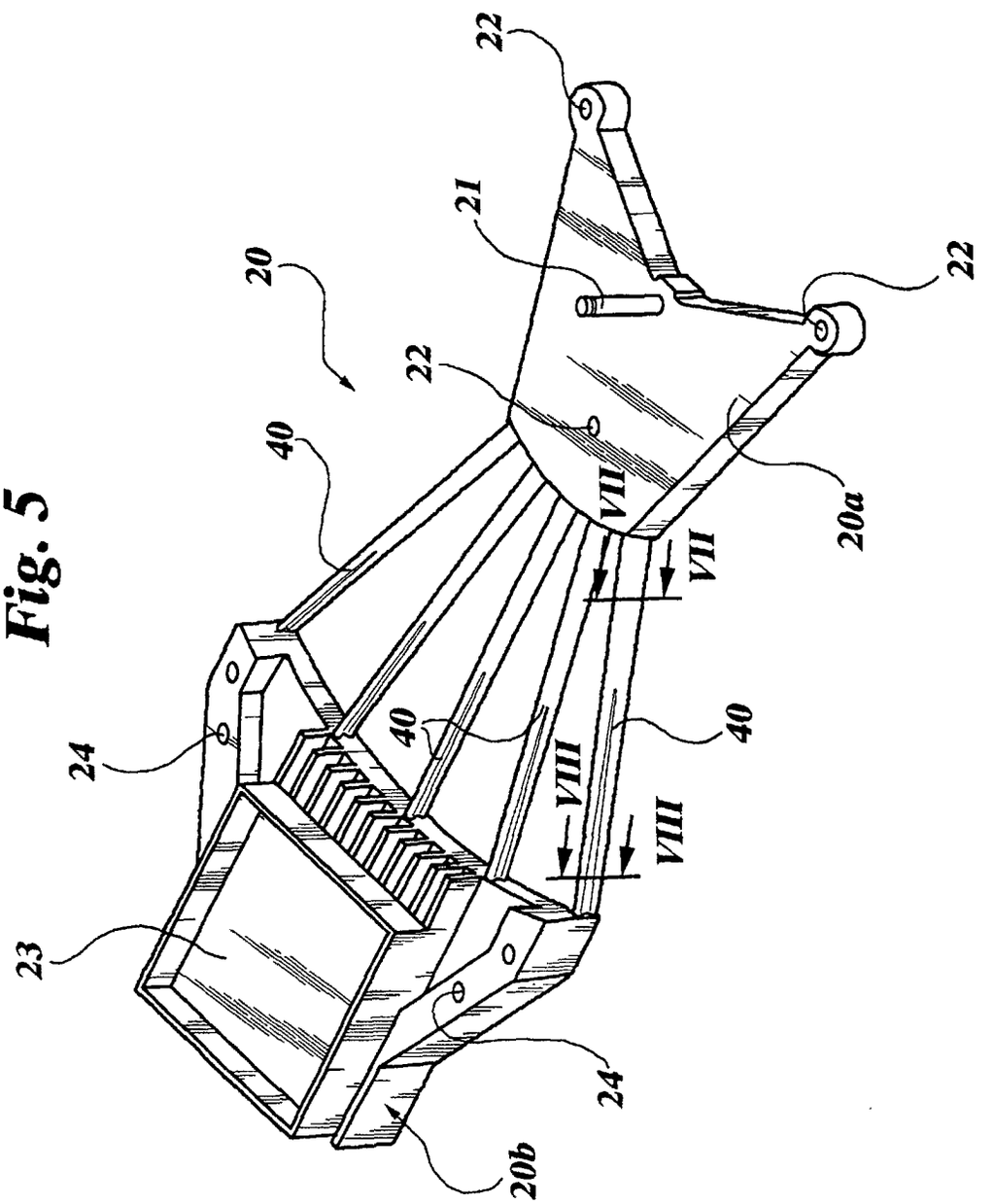


Fig. 5



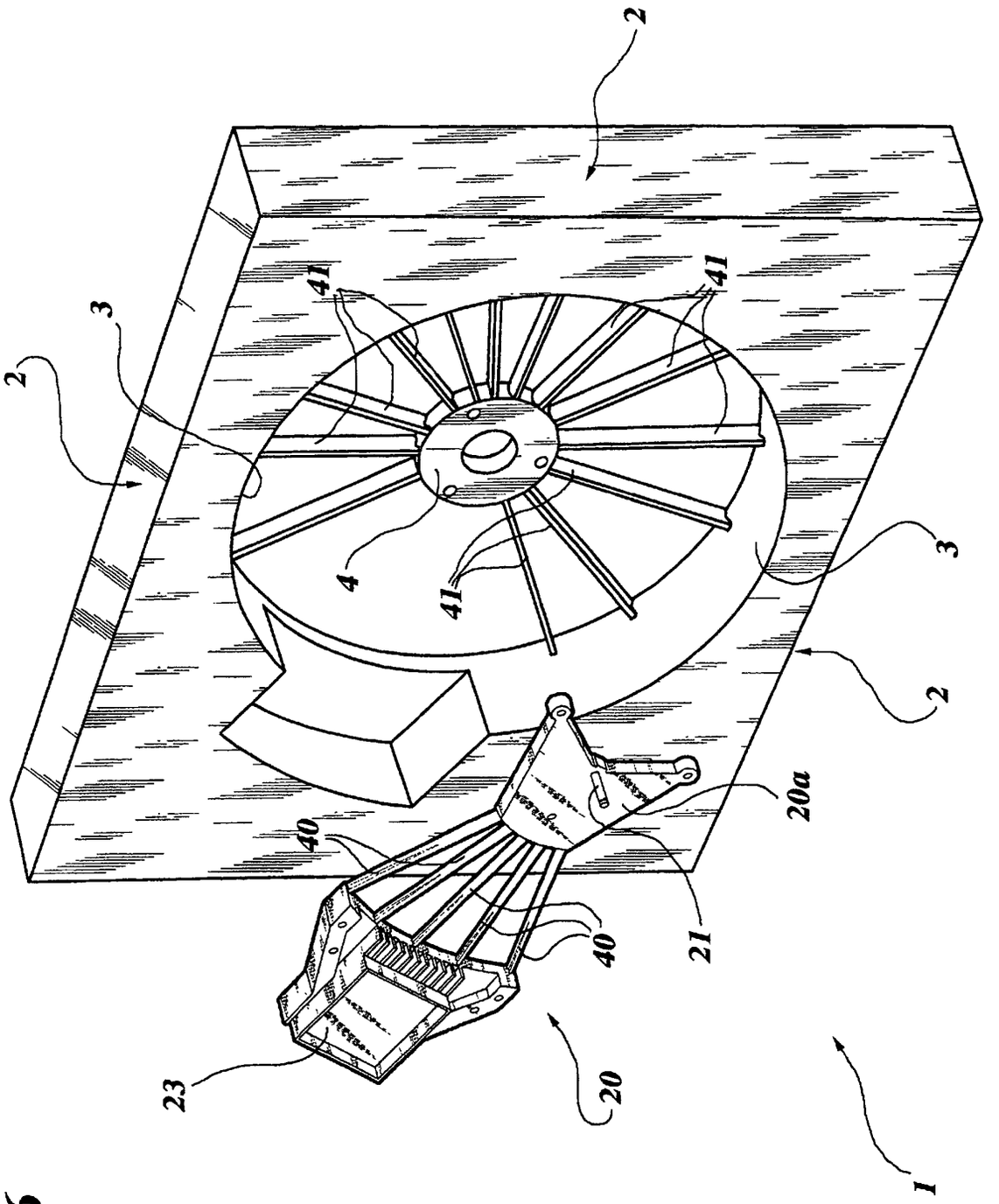


Fig. 6

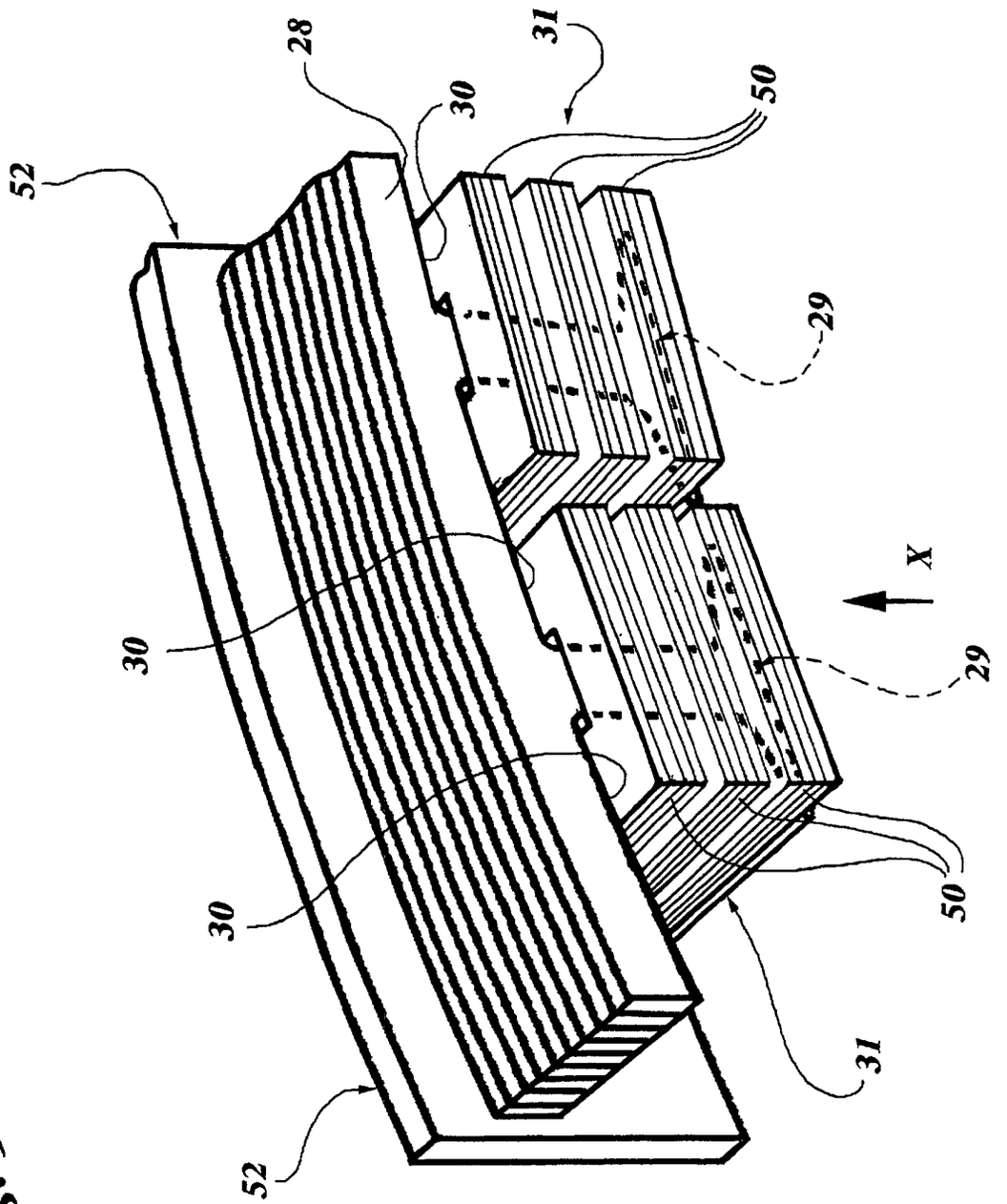
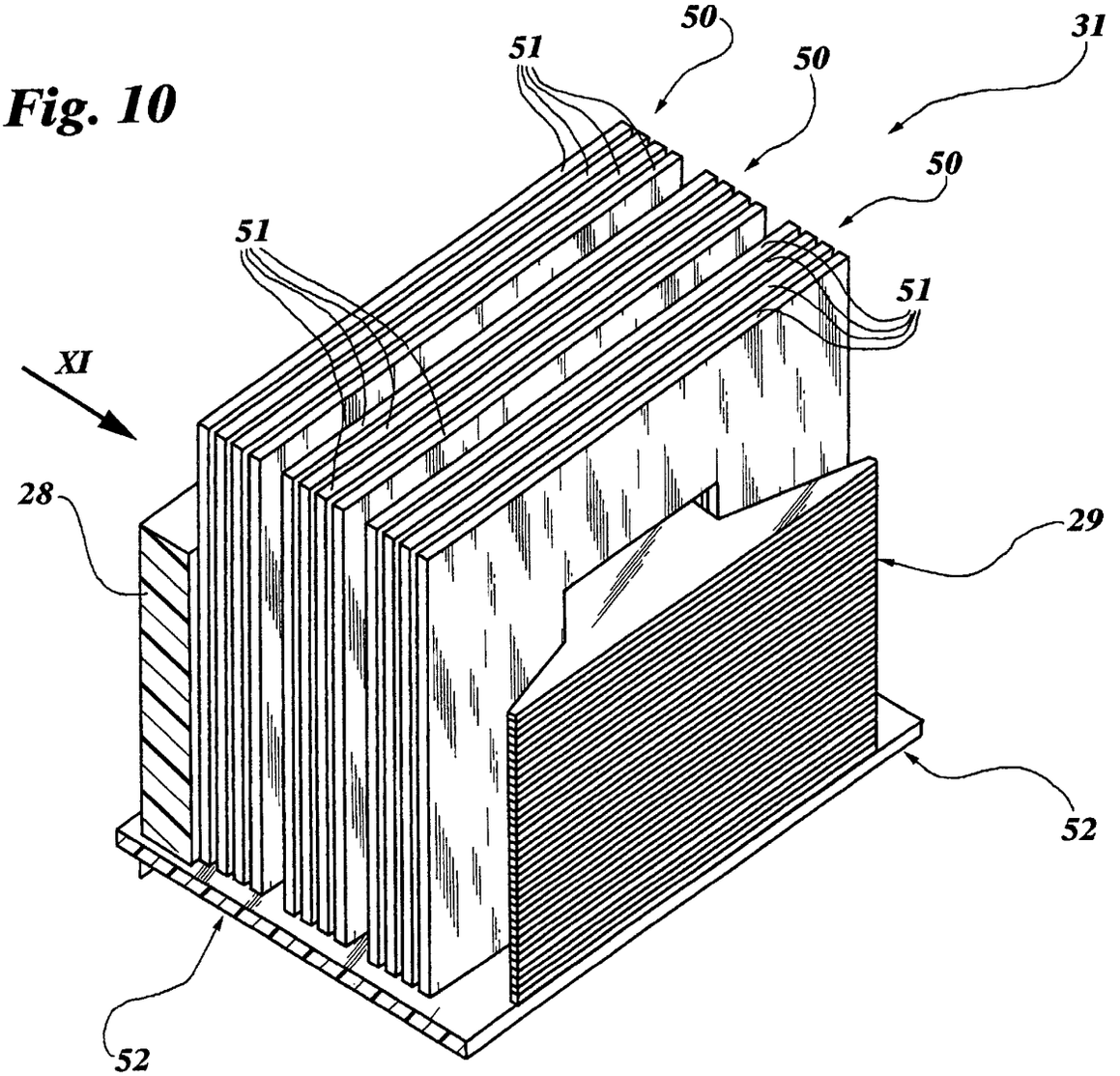


Fig. 9

Fig. 10



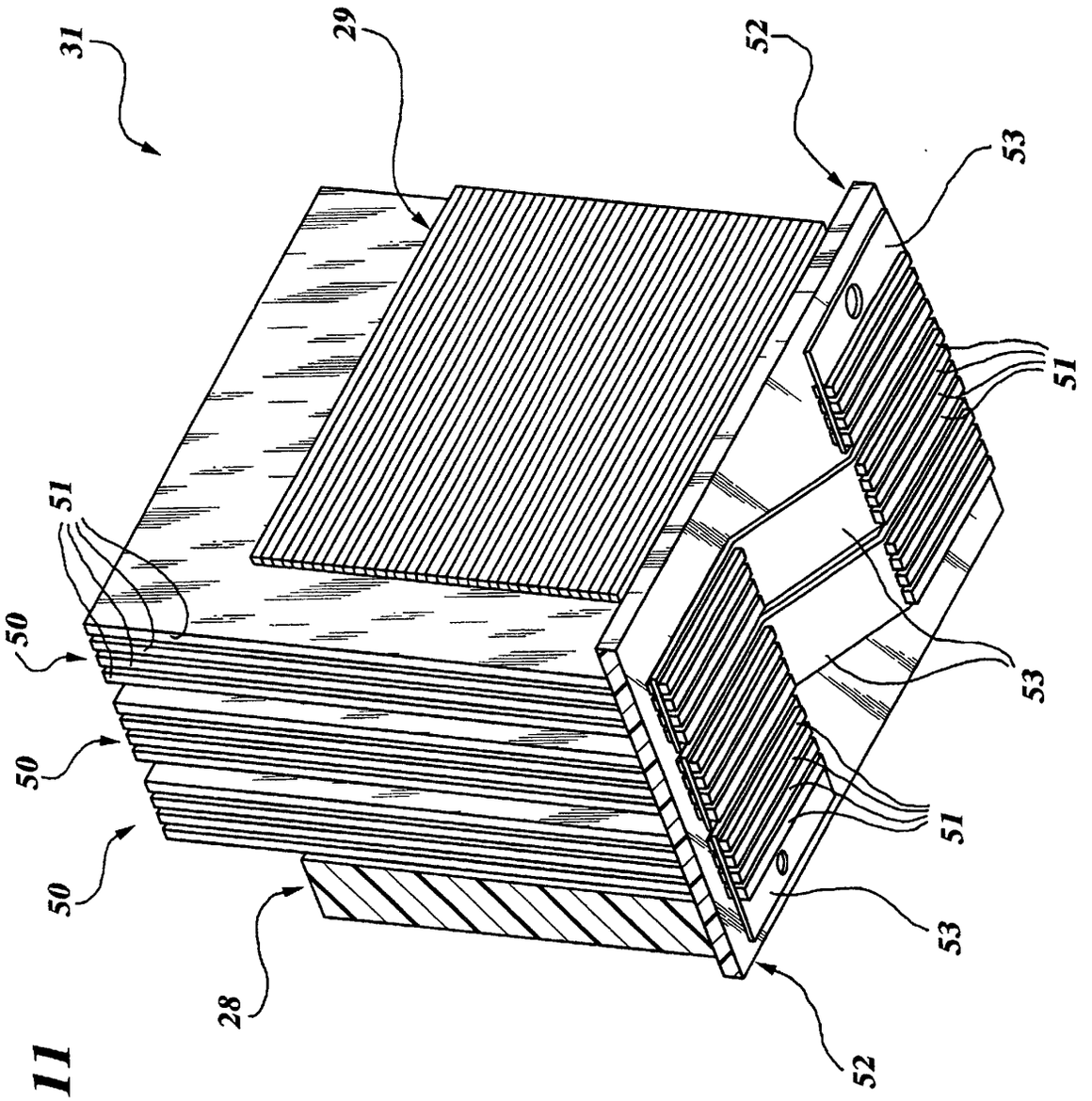


Fig. 11