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AUSTRALIA
Patents Act 1990

PATENT REQUEST: STANDARD PATENT AND NOTICE OF ENTITLEMENT

I/We, being the person(s) identified below as the Applicant,
request the grant of a patent to the person(s) identified below
as the Nominated Person, for an invention described in the
accompanying standard complete specification.

Full application details follow.

Applicant and Nominated Person:

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Invention Title:

AIR GUN FOR PRODUCING NONWOVEN FABRICS.

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BASIC CONVENTION APPLICATION(S) DETAILS

Application Number	Country	Country Code	Date of Application
2-224753	JP		27th August 1990

Drawing number recommended to accompany the abstract: 1

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being the applicant in respect of this Application state the following:-

The person(s) nominated for the grant of the patent:

The nominated person is the assignee of the inventors.

The person(s) nominated for the grant of the patent:

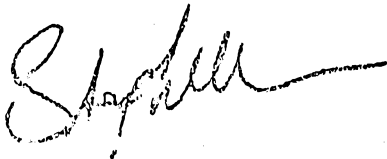
The applicant and nominated person is the basic applicant.

The basic application(s) listed above is/are the first application(s) made in a Convention country in respect of the invention.

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21st August 1991

GRIFFITH HACK & CO



Patent Attorneys for and
on behalf of the applicant.



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AU 612767 28441/89 D04H 01/56
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(57) Claim

1. An air gun for producing nonwoven fabrics comprising:

a) an air nozzle being provided with an inlet for receiving a filament delivered from a spinning nozzle, an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed air out of the compressed air blow port into a carrier path for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of delivering the filament from the filament outlet while drawing the same;

b) a connection pipe connected on the side of the filament outlet of said air nozzle;

c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove a part of air flowing into the carrier path, wherein said exhaust path is capable of being opened when the filaments are introduced and closed during normal operation; and

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d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament; whereby said carrier path is formed passing through the filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle so that at the start of operation passage of the filament into the air gun can be assisted.

8. A control method for an air gun for producing nonwoven fabrics, said air gun comprising

a) an air nozzle being provided with an inlet for receiving a filament delivered from a spinning nozzle, an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed air out of the compressed air blow port into a carrier path for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of delivering the filament from the filament outlet while drawing the same;

b) a connection pipe connected on the side of the filament outlet of said air nozzle;

c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove a part of air flowing into the carrier path, said exhaust path being capable of opening and closing; and

d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament; whereby said carrier path is formed passing through the filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle;

which method comprises the steps of:

opening the exhaust pipe of the air gun when introducing the filament from the spinning nozzle into the filament inlet of the air nozzle, and thereafter closing the exhaust path under normal operation the arrangement being such that at the start of operation passage of the filament into the air gun can be assisted.

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ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

Invention Title:

AIR GUN FOR PRODUCING NONWOVEN FABRICS.

The following statement is a full description of this invention, including the best method of performing it known to me:-

AIR GUN FOR PRODUCING NONWOVEN FABRICS

BACKGROUND OF THE INVENTION

The present invention relates to an air gun for producing nonwoven fabrics, and particularly to an air gun for producing nonwoven fabrics in which at the start ^{passage of} of operation, ^{into the air gun can be assisted.} a filament ~~can be easily introduced.~~

As an air gun producing nonwoven fabrics, particularly, an air gun for drawing and receiving filaments spun from spinning nozzles at high speed and putting them on an air flow and delivering them onto a screen belt to form a web which is intermediate of nonwoven fabric, there has been heretofore proposed a configuration which includes an inlet for receiving filaments spun from spinning nozzles, a carrier path for putting said filaments introduced through said inlet to deliver them, and a compressed air blow port which is opened in the midst of said carrier path to jet air from a compressed air source into the carrier path.

In such an air gun as described, more specifically, an accelerating pipe constituting a part of the carrier path is connected on the side of downstream.

When compressed air is blown out of the compressed air blow port, a negative pressure is generated in the filament inlet to suck filaments from the spinning nozzle (hereinafter referred to as an ejector performance). In addition, when compressed air is blown out of the compressed



air blow port, a traction is applied to the filament downstream from that portion to draw and deliver the filament (hereinafter referred to as a receiving performance).

5 In such an air gun as described, it is desirable for economical operation and prevention of noises caused by air to maintain the receiving performance and reduce an amount of drive air.

10 As the method for maintaining the receiving performance and reducing the amount of drive air, a method for reducing an inside diameter of an accelerating pipe to increase flow velocity within the pipe is employed.

15 However, if the inside diameter of the accelerating pipe is reduced, pressure loss increases, and pressure of filament inlet increases by that portion to deteriorate the ejector performance and make it difficult to introduce filaments at the start of operation.

SUMMARY OF THE INVENTION

20 It is an object of the present invention to provide an air gun for producing nonwoven fabrics, which is designed so that at the start of operation, filaments spun from a spinning nozzle can be assisted into the air gun.

25 Therefore in accordance with a first broad aspect of the invention there is provided an air gun for producing nonwoven fabrics comprising:

30 a) an air nozzle being provided with an inlet for receiving a filament delivered from a spinning nozzle, an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed air out of the compressed air blow port into a carrier path for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of
35 delivering the filament from the filament outlet while drawing the same;

 b) a connection pipe connected on the side of



the filament outlet of said air nozzle;

c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove
5 a part of air flowing into the carrier path, wherein said exhaust path is capable of being opened when the filaments are introduced and closed during normal operation; and

d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament;

10 whereby said carrier path is formed passing through the filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle so that at the start of operation passage of the filament into the air gun can be assisted.

15 In accordance with a second broad aspect of the invention there is provided a control method for an air gun for producing nonwoven fabrics, said air gun comprising

a) an air nozzle being provided with an inlet for receiving a filament delivered from a spinning nozzle,
20 an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed air out of the compressed air blow port into a carrier path
25 for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of delivering the filament from the filament outlet while drawing the same;

b) a connection pipe connected on the side of
30 the filament outlet of said air nozzle;

c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove
a part of air flowing into the carrier path, said exhaust
35 path being capable of opening and closing; and

d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament;



whereby said carrier path is formed passing through the filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle;

which method comprises the steps of:

- 5 opening the exhaust pipe of the air gun when introducing the filament from the spinning nozzle into the filament inlet of the air nozzle, and thereafter closing the exhaust path under normal operation the arrangement being such that at the start of operation passage of the
10 filament into the air gun can be assisted.

- Synthetic resins to be spun by use of an air gun for producing nonwoven fabrics according to the present invention include, for example, polyolefine such as polyethylene, polypropylene, etc.; or ethylene vinyl
15 compound copolymers such as an ethylene vinyl chloride copolymer; _____



styrene resins; vinyl chloride resins such as polyvinyl chloride, polyvinylidene chloride, etc; polyacrylic ester; polyamide; polyester such as polyethylene terephthalate, and other synthetic resins that may be spun. These may be used in the form of a single or in the form of a mixture. A suitable amount of inorganic pigments or organic pigments may be blended into the synthetic resins.

A bundle of spun filaments is introduced into the air gun of the present invention, drawn by an air flow and blown against a collecting surface to form a web.

Usually, a plurality of air guns are arranged since nonwoven fabrics having a practicable width are formed.

When filaments are introduced into an inlet of the air gun, the exhaust path remains opened. In this state, a negative pressure at the filament inlet increases, and the filaments are sucked into the inlet merely by moving the filaments close to the inlet of the air gun.

Thereafter, the exhaust path is closed, and the filaments are drawn and delivered under constant traction.

According to the present invention, when the filaments are introduced into the inlet of the air gun, the exhaust path is opened whereby the negative pressure of the filament inlet can be increased to facilitate the introduction of the filaments. Thereafter, the exhaust path is closed under normal operation, and the filaments can be drawn and delivered with sufficient traction.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 to 3 show embodiments of the present invention.

Fig. 1 is a half sectional view of the entire air gun;

Fig. 2 is a sectional view partly enlarged; and

Fig. 3 is a schematic view the entire apparatus for producing nonwoven fabrics provided with an air gun.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

An embodiment of the present invention will be described with reference to Figs. 1 to 3.

An air gun 30 for producing nonwoven fabrics in this embodiment has a construction as shown in Fig. 1. The air gun 30 comprises an air nozzle 3. The air nozzle 3 is provided with an inlet 9a for receiving a filament 2 delivered from a spinning nozzle 1 shown in Fig. 3, an outlet 9e for delivering the filament 2 introduced from the inlet 9a, a compressed air inlet 11 and a compressed air blow port 10b, said compressed air blow port 10b being positioned in the periphery of the filament outlet 9e to blow out compressed air from the compressed air blow port 10b into a carrier path 20 for carrying the filament introduced from the filament inlet 9a along with the air. The air nozzle 3 is used for delivering the filament from the filament outlet 9e while drawing it. The air gun 30 further comprises a connection pipe 12 connected on the side of the outlet 9e of the air nozzle 3 and an accelerating pipe 4 connected to the connection pipe 12 to guide and deliver the filament 2.

The carrier path 20 for carrying the filament 2 is formed passing through the outlet 9e, the connection pipe 12 and the accelerating pipe 4 from the inlet 9a of the



air nozzle 3. An exhaust path 13 is formed in ^{the wall of} the connection pipe 12.

This embodiment will be described hereinafter in more detail.

There are provided an air nozzle 3 for receiving a filament 2 spun from a spinneret 1 which is a collective body of spinning nozzles, an accelerating pipe 4 connected to the air nozzle 3 through a connection pipe 12, and a guide tube 5 connected to an extreme end of the accelerating pipe 4.

Connected to the extreme end of the guide tube 5 is a separator nozzle (not shown) for scattering the filament 2 delivered together with compressed air toward a screen belt 6. The filament 2 scattered by the separator nozzle is accumulated on the screen belt 6 to form a web.

The spinneret 1 as the collective body of spinning nozzles comprises nine sets each consisting of 108 small holes each having a diameter of 0.85 mm per section, and spinning is accomplished with molten resin extruded out of an extruder 1a.

As shown in Fig. 1, the air nozzle 3 is composed of a first nozzle 9, and second nozzle 10 connected to the first nozzle 9.

The first nozzle 9 has a filament inlet 9a for receiving the filament 2 delivered from the spinneret 1, and the interior continuous to the filament inlet 9a includes

a tapered pipeline 9b reduced in diameter to a middle portion toward the extreme end and a straight pipeline 9c having the same diameter from the extreme end of the tapered pipeline 9b to a filament outlet 9e. This straight pipeline 9c is formed from a nozzle pipe 9d which is projected.

The second nozzle 10 is connected to the first nozzle 9 so as to encircle the periphery of the extreme end of the nozzle pipe 9d. The second nozzle 10 has a blow nozzle 10a which encircles the extreme end of the nozzle pipe 9d. A slight clearance is formed between the inner surface of the blow nozzle 10a and the outer surface of the nozzle pipe 9d to form a compressed air blow port 10b around the filament outlet 9e at the extreme end of the nozzle pipe 9d. The inner surface of the blow nozzle 10a is gradually reduced in diameter from the air inlet 10c, is gradually increased in diameter behind the maximum constriction 10d in the midst, and thereafter assumes a straight pipeline having the same diameter from a portion corresponding to the filament outlet 9e.

On the other hand, a compressed air inlet 11 is provided on the side of the second nozzle 10, said compressed air inlet 11 being communicated with the air inlet 10c of the blow nozzle 10a. Air introduced from the compressed air inlet 11 into the blow nozzle 10a increases its flow velocity the the maximum at a point passing through the

maximum constriction 10d of the minimum inside diameter, whereby air is jetted strongly in a direction as indicated by arrow F from the compressed air blow port 10b to strongly draw the filament 2 passing near the center of the nozzle pipe 9d.

A connection pipe 12 is connected to the second nozzle 10 in a direction of delivering the filament 2, an accelerating pipe 4 for guiding the filament 2 is connected to the connection pipe 12, and a guide tube 5 is connected to the extreme end of the accelerating pipe 4.

The connection pipe 12 is formed with an exhaust path 13, said exhaust path 13 extending to be inverted at an angle 30 degrees (θ) with respect to the axial direction of the connection pipe 12 from an exhaust port 13a opened to the inner surface of the connection pipe 12 to the upstream side of air (upstream side the carrier path) and continuous to an air reservoir 13b. A closing valve 14 is provided in the midst of the exhaust path 13 continuous to the air reservoir 13b to open and close the exhaust path 13. In Fig. 2, ^athe second connection pipe 12b is connected to ^athe first connection pipe 12a, the connection pipe 12a being formed with the exhaust path 13, and the accelerating pipe 4 is connected at the second connection pipe 12b.

The angle θ extended from the exhaust port 13a so that the exhaust path 13 is inverted toward the upstream



with respect to the carrier path 20 is preferably 15 to 75 degrees. While the clearance of the exhaust port 13a used is 1mm, it is to be noted that a clearance in the range from 0.5 mm to 2.0 mm is preferred. In this way, the amount of drive air can be reduced and the receiving performance can be maintained without the filament being caught in the exhaust port 13a. The accelerating pipe 4 used has 6mm ϕ of inside diameter and 540 mm of length.

The guide tube 5 is provided to guide the filament 2 to the separator nozzle not shown, and the separator nozzle is connected to the extreme end of the guide tube 5.

The separator nozzle is provided to scatter the filament 2 delivered together with the compressed air from the accelerating pipe 4 toward the screen belt 6.

The air gun for producing nonwoven fabrics 30 constructed as described above was used and the exhaust path 13 was opened and closed to measure the amount of drive air, a degree of vacuum at the filament inlet 9a, the suction amount of air at the filament inlet 9a and the readiness of introduction of the filament 2 into the filament inlet 9a. A nylon monofilament having 520 μ m of diameter was inserted by 700 mm into the air gun from the filament inlet 9a and tension applied thereto was measured. The results are shown in Table 1.

Table 1

Embodiment	1		2		3	
	Open	Closed	Open	Closed	Open	Closed
Amount of air escape	7.8	0	7.9	0	7.8	0
Amount of drive air	33	33	27	27	23	23
Tension (g)	20	32	16	26	15	22
Degree of vacuum at inlet	620	180	620	200	640	230
Suction amount at inlet	4.6	0.8	5.1	1.4	4.6	1.8
Readiness of introduction	○	×	○	×	○	×

In Table 1 above, units of the amount of air escape, amount of drive air, and suction amount of inlet are Nm^3/hr respectively, and that of degree of vacuum is mmHg. Symbol "○" indicate 'better', and "×" indicate 'difficult'.

As will be apparent from Table 1, when the exhaust path 13 is opened, the traction (tension) with respect to the filament decreases but the degree of vacuum at the filament inlet 9a of the air gun and the suction amount of air increase, and the introduction of filament to the inlet 9a becomes easy.

On the other hand, when the exhaust path 13 is closed, the degree of vacuum at the filament inlet 9a of the air gun 30 and the suction amount of air decrease and the introduction of filament to the inlet 9a is difficult but since all air flows into the accelerating pipe 4, the traction (tension) with respect to the filament increases.

Accordingly, at the start of operation, when the filament is introduced into the air gun 30, the exhaust path 13 is opened to make the introduction of filament easy. When the filament is drawn after once being introduced, the exhaust path 13 is closed to provide a state in which tension is large.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An air gun for producing nonwoven fabrics comprising:

5 a) an air nozzle being provided with an inlet for receiving a filament delivered from a spinning nozzle, an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed
10 air out of the compressed air blow port into a carrier path for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of delivering the filament from the filament outlet while drawing the same;

15 b) a connection pipe connected on the side of the filament outlet of said air nozzle;

c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove
20 a part of air flowing into the carrier path, wherein said exhaust path is capable of being opened when the filaments are introduced and closed during normal operation; and

d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament;

25 whereby said carrier path is formed passing through the filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle so that at the start of operation passage of the filament into the air gun can be assisted.

30 2. An air gun for producing nonwoven fabrics according to claim 1, wherein said air nozzle comprises a first nozzle and a second nozzle connected to said first nozzle;

35 said first nozzle has the filament inlet and the interior of the filament inlet includes a tapered pipeline reduced in diameter to a middle portion toward the extreme end thereof and a straight pipeline having the same



diameter from the extreme end of the tapered pipeline to the filament outlet, said straight pipeline being formed from a nozzle pipe which is projected;

5 said second nozzle is connected to the first
nozzle so as to encircle the periphery of the extreme end
of the nozzle pipe, said second nozzle having a blow nozzle
encircling the extreme end of the nozzle pipe, and a slight
clearance is formed between the inner surface of said blow
10 nozzle and the outer surface of said nozzle pipe, said
clearance forming the compressed air blow port in the
periphery of the filament outlet at the extreme end of the
nozzle tube; and

15 the inner surface of the blow nozzle is gradually
reduced in diameter from an air inlet side thereof, is then
gradually increased in diameter behind the maximum
constriction portion in the midst thereof and assumes a
straight pipeline having the same diameter from a portion
corresponding to the filament outlet;

20 while the compressed air inlet is provided on the
side of the second nozzle, said compressed air inlet being
communicated with the air inlet of the blow nozzle, and air
introduced into the blow nozzle from the compressed air
inlet increases its flow velocity to the maximum at a time
25 passing through the maximum constriction portion of the
minimum inside diameter whereby air is jetted strongly from
the compressed air blow port so as to strongly draw the
filament passing near the center of the nozzle pipe; and

30 said connection pipe is connected to the second
nozzle in a direction of delivering the filament.

3. An air gun for producing nonwoven fabrics
according to claim 1 or claim 2, wherein a guide tube is
connected to said accelerating pipe.

4. An air gun for producing nonwoven fabrics
according to claim 1, wherein said exhaust path crosses at
35 an angle of 15 to 75 degrees with respect to the carrier
path and extends from an exhaust port provided in the
exhaust path toward upstream of the carrier path.



5. An air gun for producing nonwoven fabrics according to claim 4, wherein a clearance of said exhaust port opened to the carrier path is in the range of 0.5 mm to 2.0 mm.
- 5 6. An air gun for producing nonwoven fabrics according to claim 1, wherein a closing valve is connected to said exhaust path so as to open and close the same.
7. An air gun for producing nonwoven fabrics according to any of claims 1 to 6, wherein an air reservoir
10 is connected to said exhaust path so that air from the exhaust path is discharged through the air receiver.
8. A control method for an air gun for producing nonwoven fabrics, said air gun comprising
- a) an air nozzle being provided with an inlet
15 for receiving a filament delivered from a spinning nozzle, an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed
20 air out of the compressed air blow port into a carrier path for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of delivering the filament from the filament outlet while drawing the same;
- 25 b) a connection pipe connected on the side of the filament outlet of said air nozzle;
- c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove
30 a part of air flowing into the carrier path, said exhaust path being capable of opening and closing; and
- d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament; whereby said carrier path is formed passing through the
35 filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle;
- which method comprises the steps of:



opening the exhaust pipe of the air gun when introducing the filament from the spinning nozzle into the filament inlet of the air nozzle, and thereafter closing the exhaust path under normal operation the arrangement
5 being such that at the start of operation passage of the filament into the air gun can be assisted.

9. A control method for an air gun for producing nonwoven fabrics according to claim 8, wherein air is discharged toward the upstream side of the carrier path
10 with an exhaust direction of from said exhaust path set to an angle of 15 to 75 degrees with respect to said carrier path.

10. An air gun or a control method for an air gun substantially as herein described with reference to the
15 accompanying drawings.

DATED THIS 27TH DAY OF JANUARY 1994

MITSUI PETROCHEMICAL INDUSTRIES LTD.

By Its Patent Attorneys

GRIFFITH HACK & CO

20 Fellows Institute of Patent Attorneys of Australia



ABSTRACT

An air gun for producing nonwoven fabrics comprising:

- 5 a) an air nozzle being provided with an inlet for receiving a filament delivered from a spinning nozzle, an outlet for delivering the filament introduced from the filament inlet, a compressed air inlet and a compressed air blow port, said compressed air blow port being positioned in the periphery of the filament outlet to blow compressed air out of the compressed air blow port into a carrier path for carrying the filament introduced from the filament inlet on an air flow, said air nozzle being capable of delivering the filament from the filament outlet while drawing the same;
- 10 b) a connection pipe connected on the side of the filament outlet of said air nozzle;
- 15 c) an exhaust path formed in the wall of said connection pipe and branched from said carrier path on the downstream side from the compressed air blow port to remove a part of air flowing into the carrier path, wherein said exhaust path is capable of being opened when the filaments are introduced and closed during normal operation; and
- 20 d) an accelerating pipe connected to said connection pipe for guiding and delivering the filament;
- 25 whereby said carrier path is formed passing through the filament outlet of the air nozzle, the connection pipe and the accelerating pipe from the inlet of the air nozzle so that at the start of operation passage of the filament into the air gun can be assisted.



FIG.2

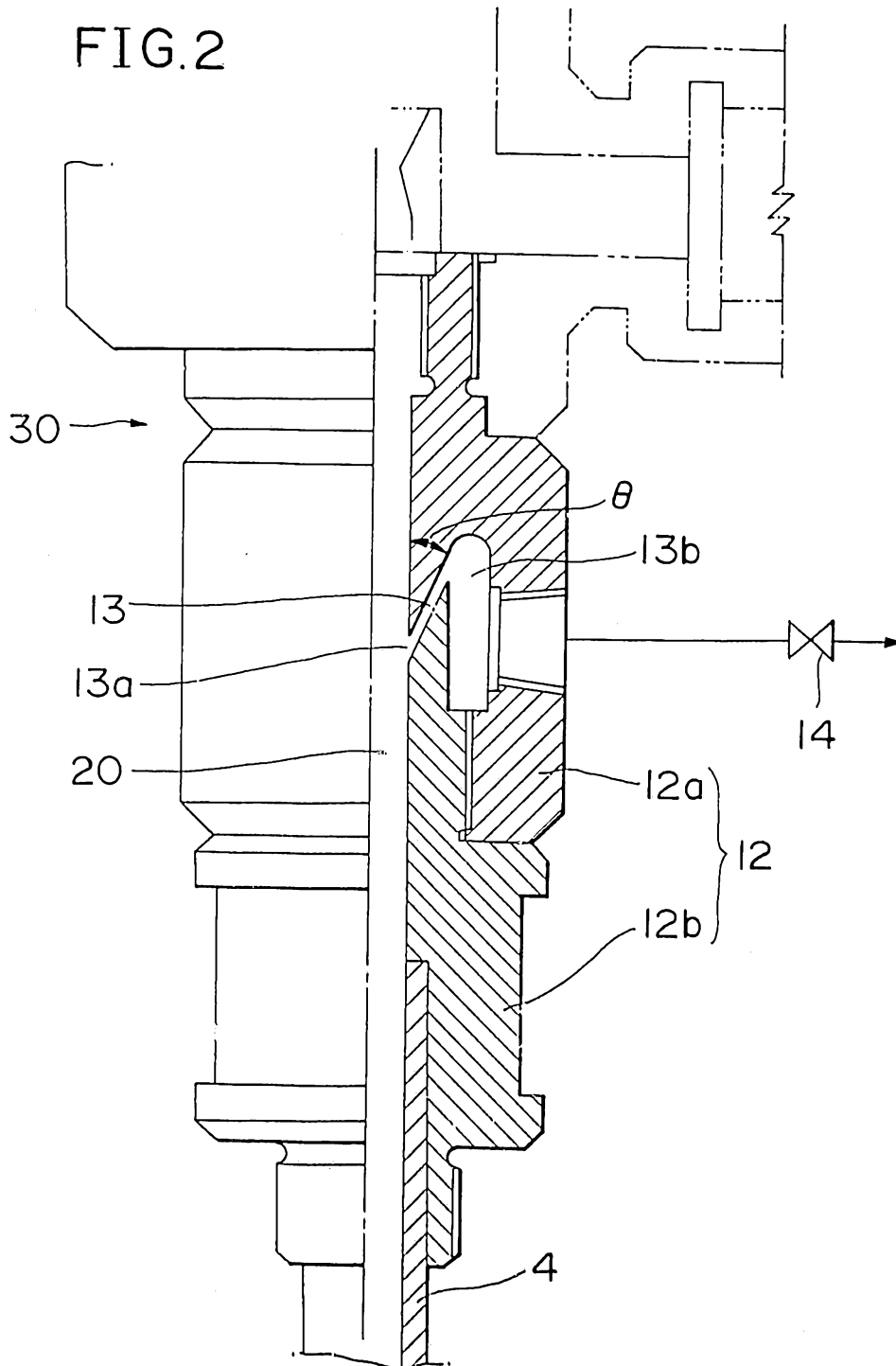


FIG. 3

