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[Continued on next page]

(54) Title: AN IMPROVED PIECING MECHANISM IN AN AIR SPINNING MACHINE

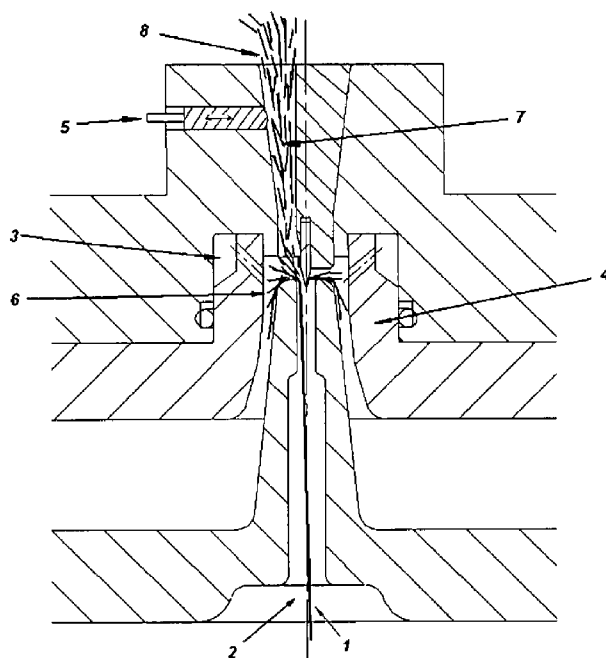


Fig. 2

(57) Abstract: A piecing mechanism in an air spinning machine is provided with a drafting device for supplying silver (7) to the spinning nozzle (4) and means for withdrawing a calculated length of wound yarn (1) from the package. The calculated length of yarn is fed into the spinning nozzle (4) wherein a plunger (5) is provided for controlling the suction of the wound yarn.



Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

AN IMPROVED PIECING MECHANISM IN AN AIR SPINNING MACHINE**FIELD OF INVENTION**

The present invention relates to an improved piecing mechanism in an air spinning machine. This invention particularly relates to the joining of the spun yarn to the
5 drafted fibre during starting and restarting the machine after yarn breakage.

BACKGROUND OF THE INVENTION

The process for preparing a piecing mechanism is very critical in the quality and productivity aspect of textile air spinning machine. For carrying out the piecing
10 mechanism, several concepts and devices have already been developed.

The air jet spinning arrangement comprises a drafting zone, involves main drafting zone of pair of apron rollers and delivery rollers and an air spinning device where such yarn is formed by twisting the fibres by utilizing whirling air flow. When the
15 spinning process is interrupted due to breakage of yarn, the piecing process is done by inserting winding side yarn (lead yarn) from spinning nozzle outlet to the spinning device and also the sliver end is guided to the spinning device and these two ends are spliced by spinning process during restarting of the machine and by such way piecing is done. In known piecing mechanism, both sliver and winding end are
20 placed in a suction tube away from the spinning device during stationary state. This increases the success rate of yarn piecing and improves the yarn pieced part without requiring adjustment of the pulling time of lead yarn and supply time of sliver to the spinning device. However, this piecing mechanism adversely affects the quality of the yarn resulting in more thick places during splicing since both yarn and sliver are
25 fed simultaneously to the spinning device. Such kind of device is disclosed in United States patent number 5813209 filed by Murata machinery Ltd.

Yet in another method of piecing mechanism, the winding end yarn is guided up to the delivery roller by lifting the top roller and a suction tube is placed to hold the

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same. Then the sliver end is prepared by stopping the delivery rollers and apron rollers one after another and the apron rollers are slightly moved backward so as to pull the sliver end into the aprons. Therefore, the negative pressure in the suction tube does not affect the sliver end. While piecing, the top rollers are closed and the
5 sliver end is allowed to be spliced along with the winding end right from the delivery roller. But this process is more complicated since lifting of the top rollers during spinning and placing a suction tube in between delivery rollers and apron rollers will impose more practical difficulties. Further, the loaded fibre in the apron moved reversely leads to the higher fibre crimpiness and shows the negative effect in the
10 spun yarn quality. This method of piecing is described in United States patent number 7464530 (United States patent application no. 2008066442) filed by Rieter AG Maschinenfabrik.

OBJECTS OF THE INVENTION

15 The object of the present invention is to eliminate the complicated process in piecing mechanism so as to provide a simple and an improved piecing method in an air spinning machine.

Another object of the present invention is to provide a spinning nozzle, which
20 controls the suction for piecing at both the sliver input end and yarn winding end quite simply in an air spinning machine.

Yet another object of the present invention is to improve the reliability of piecing and quality of the pieced part of the yarn in an air spinning machine.

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Yet another object of the present invention is to improve the success rate of piecing and to produce yarn having stable quality.

SUMMARY OF THE INVENTION

The drafted sliver end is found at the top of the spinning nozzle and wound yarn is collected from the bottom of the nozzle after the breakage of spun yarn occurred. A calculated length of winding end yarn is placed in the outlet of spinning nozzle so that it will be sucked into the whirling zone of air spinning nozzle. For controlling the suction at winding yarn input side, a plunger is provided at the sliver input side. The magnitude of suction at winding yarn side is high and suction at sliver input side is low when the plunger is closed or partially open. This plunger will divert the suction, which is required at sliver input side in the normal spinning operation, to winding yarn input side during piecing operation. Such an arrangement will eliminate the complicated components of the device such as auxiliary nozzles, suction tube etc. Further, the sliver is supplied to the nozzle through sliver input side, so that sliver is whirled together with the end part of supplied winding end yarn. Thus the yarn piecing operation is carried out by improving the reliability of piecing and quality of the pieced part of the yarn in an air spinning machine.

According to the first aspect of the present invention, there is provided an improved piecing mechanism in an air spinning machine having a drafting device for supplying sliver in a spinning nozzle for piecing with wound yarn and means for withdrawing a calculated length of wound yarn and placing the yarn in the outlet of the spinning nozzle so that the yarn is sucked into the whirling zone of the spinning nozzle wherein at least a plunger is provided in the nozzle for controlling the suction of the wound yarn.

According to another aspect of the present invention, there is provided an improved piecing mechanism in an air spinning machine having a drafting device for supplying sliver in a spinning nozzle for piecing with wound yarn and means for withdrawing a calculated length of wound yarn and placing the yarn in the outlet of the spinning nozzle so that the yarn is sucked into the whirling zone of the spinning nozzle

wherein a plunger is provided at the sliver input side of the nozzle for controlling the suction of the wound yarn.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

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Figure 1 illustrates the insertion of calculated length of wound yarn (1) into the whirling zone (6) of the spinning nozzle (4).

Figure 2 illustrates the piecing action of drafted sliver end (7) and wound yarn (1) at the whirling zone (6) of the spinning nozzle (4).

10 **Figure 3** illustrates the position of the plunger (5) and the direction of the increased sucking air (10) for the entry of winding yarn end (1) inside the spinning nozzle (4) before the piecing operation.

Figure 4 illustrates the normal spinning operation of air spinning machine.

Figure 5 illustrates the condition after breakage of spun yarn

15 **Figure 6** illustrates the condition when air supply to the nozzle is stopped

Figure 7 illustrates the condition when the plunger is closed and compressed air is supplied and suction at winding yarn end side is high and suction at sliver end is low.

20 **Figure 8** illustrates the condition when wound yarn is taken from the package and placed in front of winding yarn input side

Figure 9 illustrates the condition when wound yarn is carried along the air and placed in the spinning zone of the spinning nozzle

Figure 10 illustrates the condition when the plunger is open and suction at winding yarn end is low and suction at sliver end is high

25 **Figure 11** illustrates the condition when the drafting system is restarted and fibres are placed at sliver input side

Figure 12 illustrates the condition when the sliver is sucked into the spinning zone of the spinning nozzle

Figure 13 illustrates the condition when the winding mechanism is restarted.

DETAILED DESCRIPTION OF THE INVENTION

Figure-1 shows the calculated length of wound yarn (1) being sucked into the spinning nozzle by placing it in the winding yarn input side (2) (outlet of spinning nozzle) through compressed air (3) produced inside the air spinning nozzle (4). A plunger (5) is placed at sliver input side (8) of the nozzle (4) as shown in figure, which controls the suction at winding yarn input side (2). During piecing wound yarn is picked from yarn package and placed at the winding yarn input side (2). Due to partial or full closure of plunger (5) provision, there will be high flow of air at the winding yarn side (2), which will carry the calculated length of yarn into the whirling zone (6) of spinning nozzle (4).

The selection of the yarn length is very important, so that it should be sufficient for end part of the wound yarn (1) to be placed in the whirling zone (6) of air spinning nozzle (4). The length of the wound yarn (1) will be such that the piecing end will be in the middle of the whirling zone (6) as shown in figure-1, which will be of calculated length, for example around 22 mm. The piecing operation is feasible with the winding yarn when the inserted length is in the range of not less than 20% or not more than 50% of calculated length of yarn. Therefore, while increasing the winding yarn length to be inserted, the quality of piecing is deteriorated and by increasing beyond 50% of calculated length of yarn, the wound yarn (1) will disturb the air flow pattern and the piecing operation is not possible. Then, by decreasing the inserted length of the wound yarn below 20% of calculated length of yarn, it is not sufficient to pull the drafted fibers into the whirling zone (6) and hence the piecing operation is not possible. Thus the yarn piecing operation is done by improving the reliability of piecing and quality of the pieced part of the yarn in an air spinning machine when very specific length of wound yarn (1) is supplied to the whirling zone (6).

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During normal operation of the machine suction is low at the winding yarn input side (2) and suction is high at sliver input side (8). The plunger (5) will be open.

Figure-2 shows the sliver (7) is being supplied to the spinning nozzle (4), through the
5 sliver input side (8) towards the whirling zone (6), so that it gets whirled together with
the end part of the supplied calculated length of wound yarn (1) at the whirling zone
(6). The piecing of broken yarn according to present invention is carried out by
providing plunger (5) in the spinning nozzle (4) which controls the suction for
piecing, both at the the sliver (7) input end (8) and winding yarn input side (2),
10 quite simply in an air spinning machine.

Figure-3 shows the partially closed position of the plunger (5) and the direction of
the increased suction of air (10) for the entry of wound yarn (1) inside the spinning
nozzle (4) before the piecing operation.

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For providing the improved suction of the wound yarn (1), the suction that is used
for pulling the drafted sliver (7) in a normal spinning operation is diverted by means
of plunger (5), which is placed at the sliver input side (8). The plunger will partially or
fully close the sliver input side (8), which results in increased suction (10) at winding
20 yarn input side (2) for drawing the required length of wound yarn (1). After the wound
yarn is placed inside the whirling zone (6), the plunger (5) will be partially or fully
open to allow the drafted sliver (7) inside the nozzle (4), thereby facilitating improved
piecing process. The amount of closing distance in the sliver input side (8) by the
plunger (5) during piecing is determined by different counts & raw material used for
25 the spinning process. This mechanism eliminates other extra components such as
auxiliary nozzle, suction tube, etc. for the piecing purpose. Thus the present
invention eliminates the complicated process in the existing piecing mechanism so
as to provide a simple and an improved method of piecing in an air spinning
machine.

WORKING OF THE INVENTION:

Step 1: During normal spinning operation, suction (2) towards whirling zone (6) at the winding yarn side (2) is low. Suction at sliver input side (8) towards whirling zone
5 (6) is high. Compressed air (3) towards whirling zone (6) is ON. The plunger (5) is at open state. This arrangement is shown in figure 4

Step 2: The yarn gets cut for some reasons. No yarn is being spun in the nozzle (4). The supplied sliver (7) is eliminated as waste. The suction (2 & 8), compressed air
10 (3) and plunger position (5) remains same as in step 1. This arrangement is shown in figure 5

Step 3: The air supply (3) to the nozzle (4) is cut off and the nozzle (4) is cleaned. Now no sliver or yarn is present in the nozzle (4). Suction (2 & 8) is nil. The plunger
15 (5) is at open state. This arrangement is shown in figure 6

Step 4: The plunger (5) is closed and the compressed air (3) is ON. The magnitude of suction (2) at winding yarn side(2) is increased and the magnitude of suction at
20 sliver input side(8) is decreased when compared to that of spinning condition. No sliver or yarn is present in the nozzle (4). This arrangement is shown in figure 7

Step 5: The suction at winding yarn input side (2) is high. The suction at sliver input side(8) is low or nil depending upon whether the plunger (5) is fully closed or partially
25 closed. The air (3) is ON. The wound yarn end is picked from the package and placed in front of winding yarn input side (2). The high flow of air at this end carries the yarn end along its flowing direction. Only calculated amount of 22 mm yarn is allowed inside the nozzle (4). The arrangement is shown in figure 8

Step 6: The wound yarn end is carried to the whirling zone (6) of the nozzle (4). The

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yarn end is continuously revolved together with the air in whirling zone (6). This arrangement is shown in figure 9

5 Step 7: The plunger (5) is open. This makes the magnitude of suction at winding yarn side(2) get reduced and the magnitude of suction at sliver input side(8) get increased. The compressed air (3) is still ON. The yarn end continuously revolves in the whirling zone (6) of spinning nozzle (4). This arrangement is shown in figure 10

10 Step 8: Now the drafting system is switched ON. The supplying sliver (7) is placed at the sliver input side (8). The sliver is yet to enter the nozzle (4) and the wound yarn is still revolving in the whirling zone (6). This arrangement is shown in figure 11

15 Step 9: The sliver gets sucked into the nozzle (4) due to high suction (8) at sliver input side. The sliver is joined to the wound yarn which is already revolving in the whirling zone (6). This arrangement is shown in figure 12

20 Step 10: The winding mechanism is switched ON. This will pull the yarn from the nozzle (4) and continuous spinning process is started. The suction at winding yarn input side(2) remains low. The suction at sliver input side (8) remains high. The plunger (5) is open and the compressed air (3) remains ON. This arrangement is shown in figure 13

25 The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. Hence any modification of the disclosed embodiment incorporating the spirit and substance of the invention should be construed within the scope of the invention.

CLAIMS

- 5 1) An improved piecing mechanism in an air spinning machine having a drafting system for supplying sliver (7) in a spinning nozzle (4) for piecing with wound yarn (1) and means for withdrawing a calculated length of wound yarn (1) and placing the yarn (1) in the outlet (2) of the spinning nozzle (4) so that the yarn (1) is sucked into the whirling zone (6) of the spinning nozzle (4) wherein at least a plunger (5) is provided in the nozzle (4) for controlling the suction of
10 the wound yarn (1).
- 2) An improved piecing mechanism in an air spinning machine as claimed in claim 1, wherein a plunger (5) is provided at the sliver input side (8) of the nozzle (4) for controlling the suction of the wound yarn (1).
- 15 3) An improved piecing mechanism in an air spinning machine as claimed in claim 1, wherein a calculated length of 22 mm of wound yarn (1) is inserted into the nozzle (4) at the winding yarn input end (2).
- 20 4) An improved piecing mechanism in an air spinning machine as claimed in claim 3, wherein length of yarn in the range of not less than 20% and not more than 50% of the calculated length of yarn is supplied to the whirling zone (6) of spinning nozzle (4).
- 25 5) An improved piecing mechanism in an air spinning machine as claimed in claim 1, wherein suction at the winding yarn input side (2) is increased by partial or full closure of plunger (5).
- 30 6) An improved piecing mechanism in an air spinning machine as claimed in claim 1, wherein sliver (7) is supplied from the drafting system to the whirling

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zone (6) of spinning nozzle (4) for entangling with wound yarn (1) when plunger (5) is partially or fully open for piecing.

- 5 7) An improved piecing mechanism in an air spinning machine substantially herein described with reference to the accompanying drawings.

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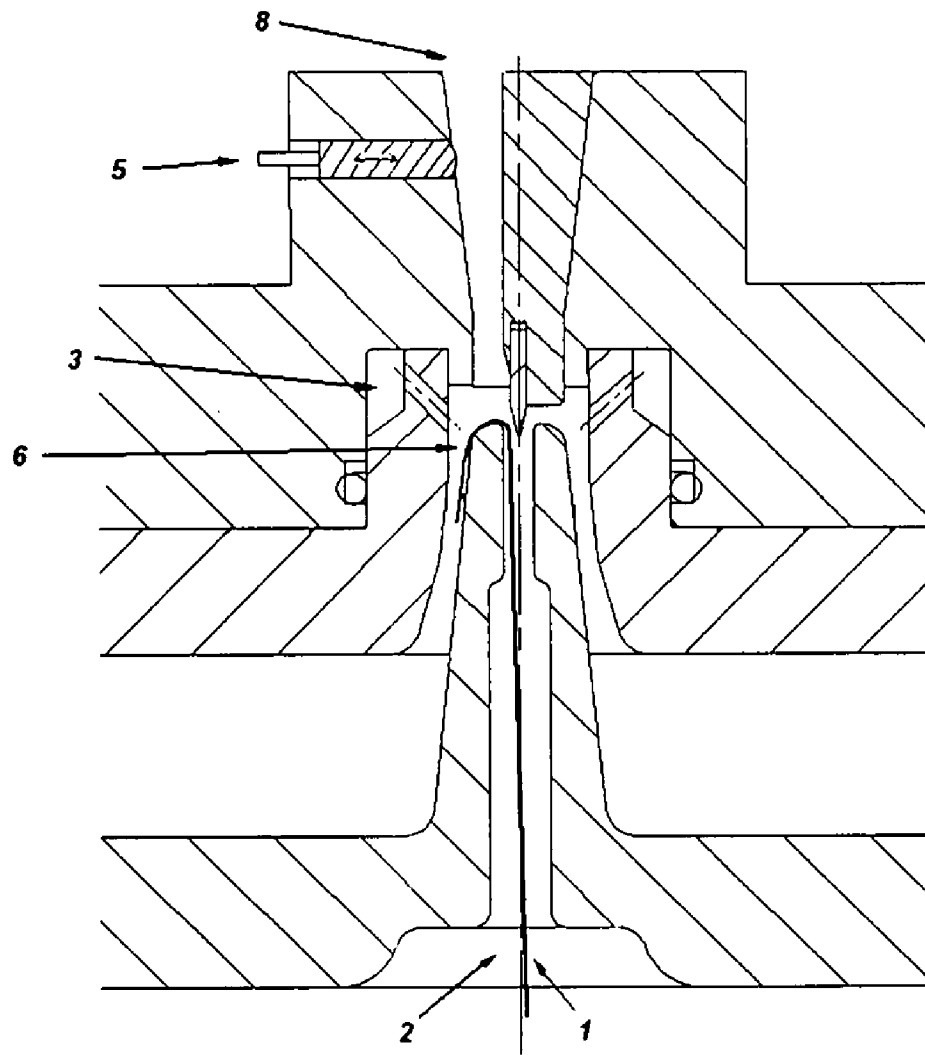


Fig. 1

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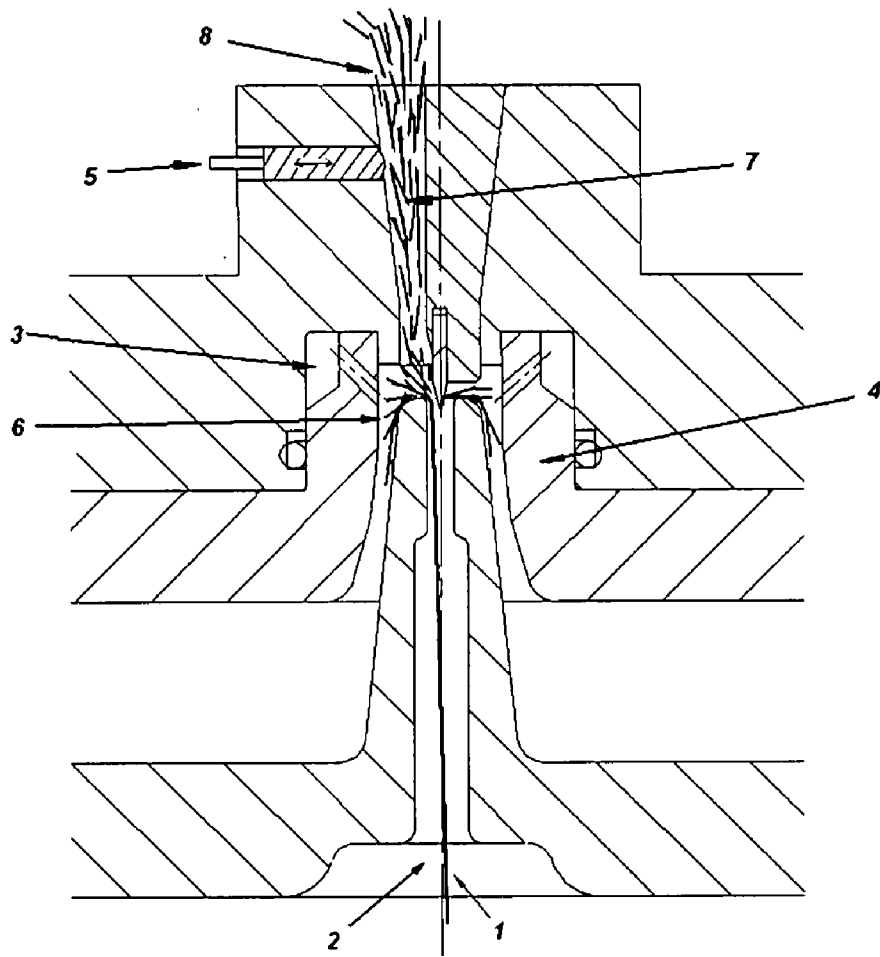


Fig. 2

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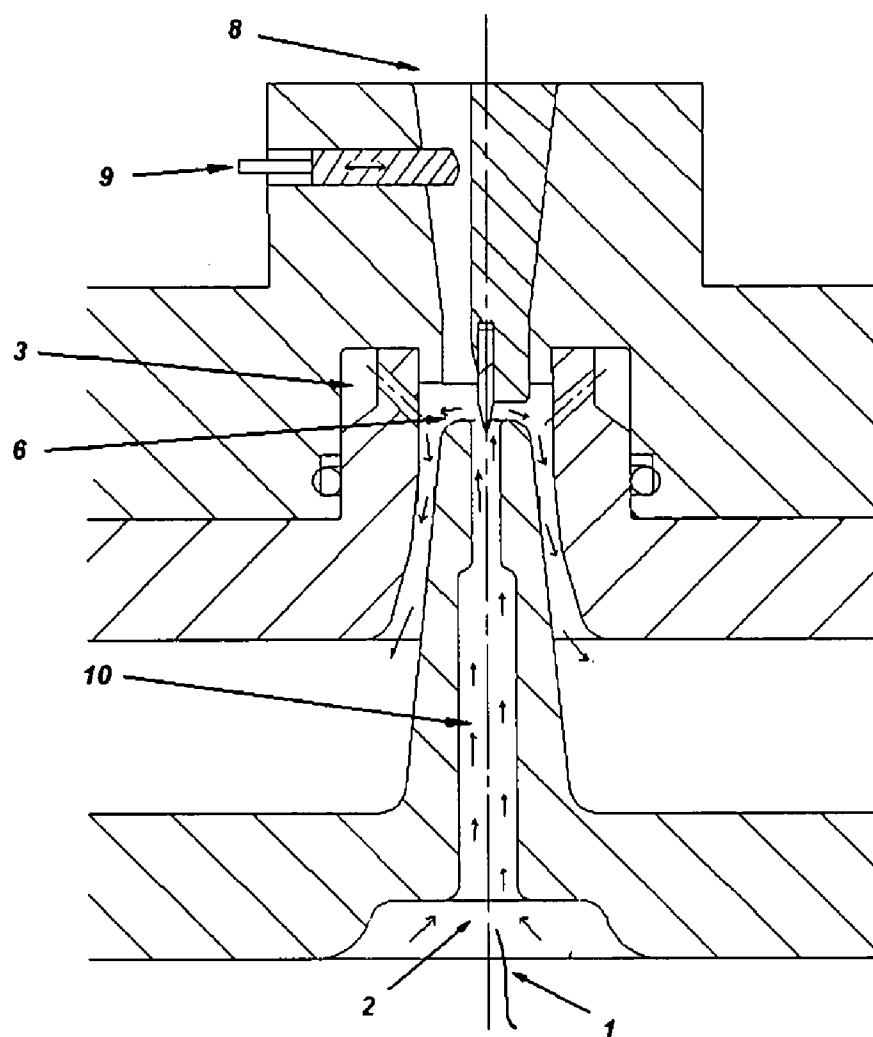


Fig. 3

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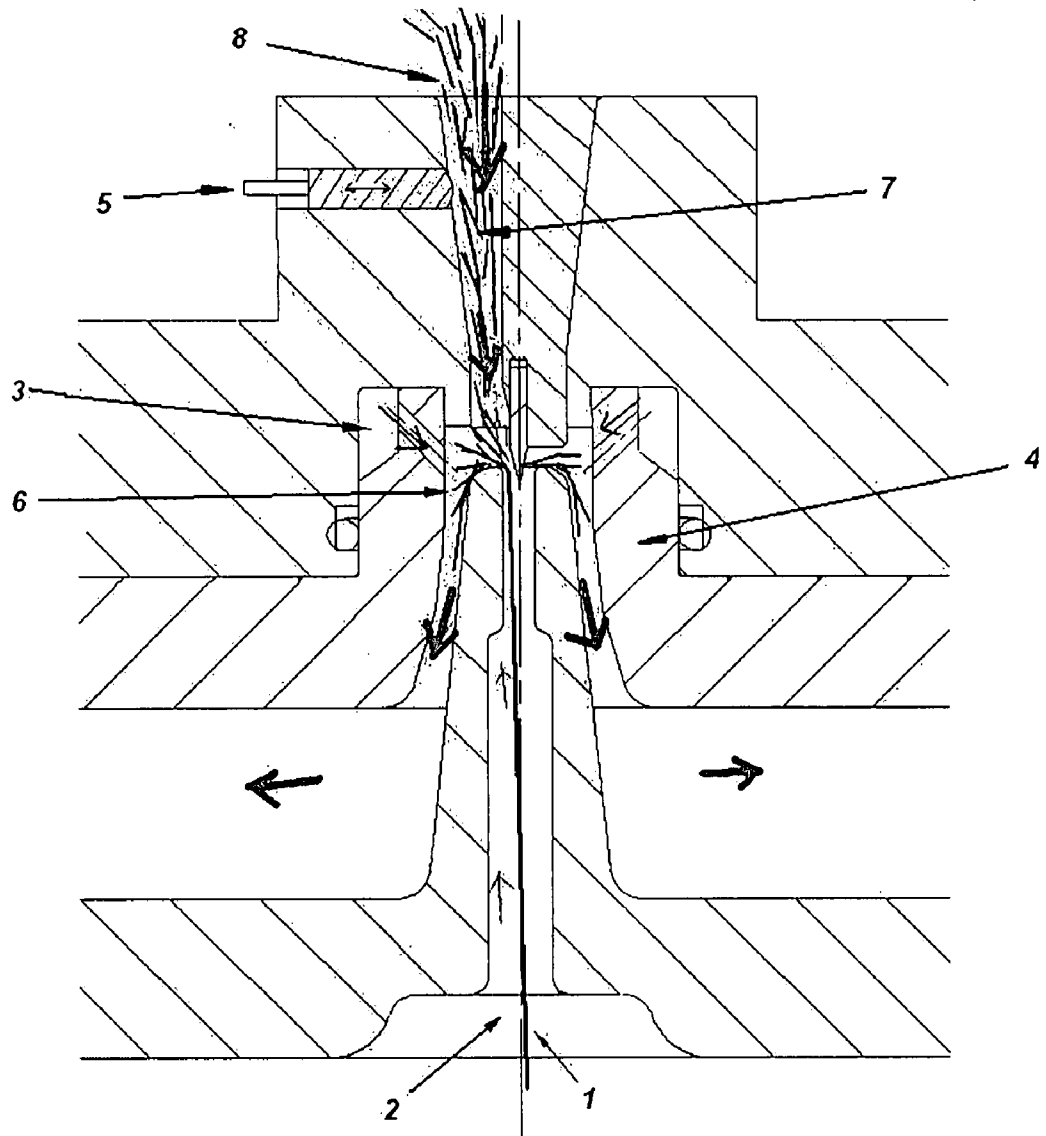


Fig. 4

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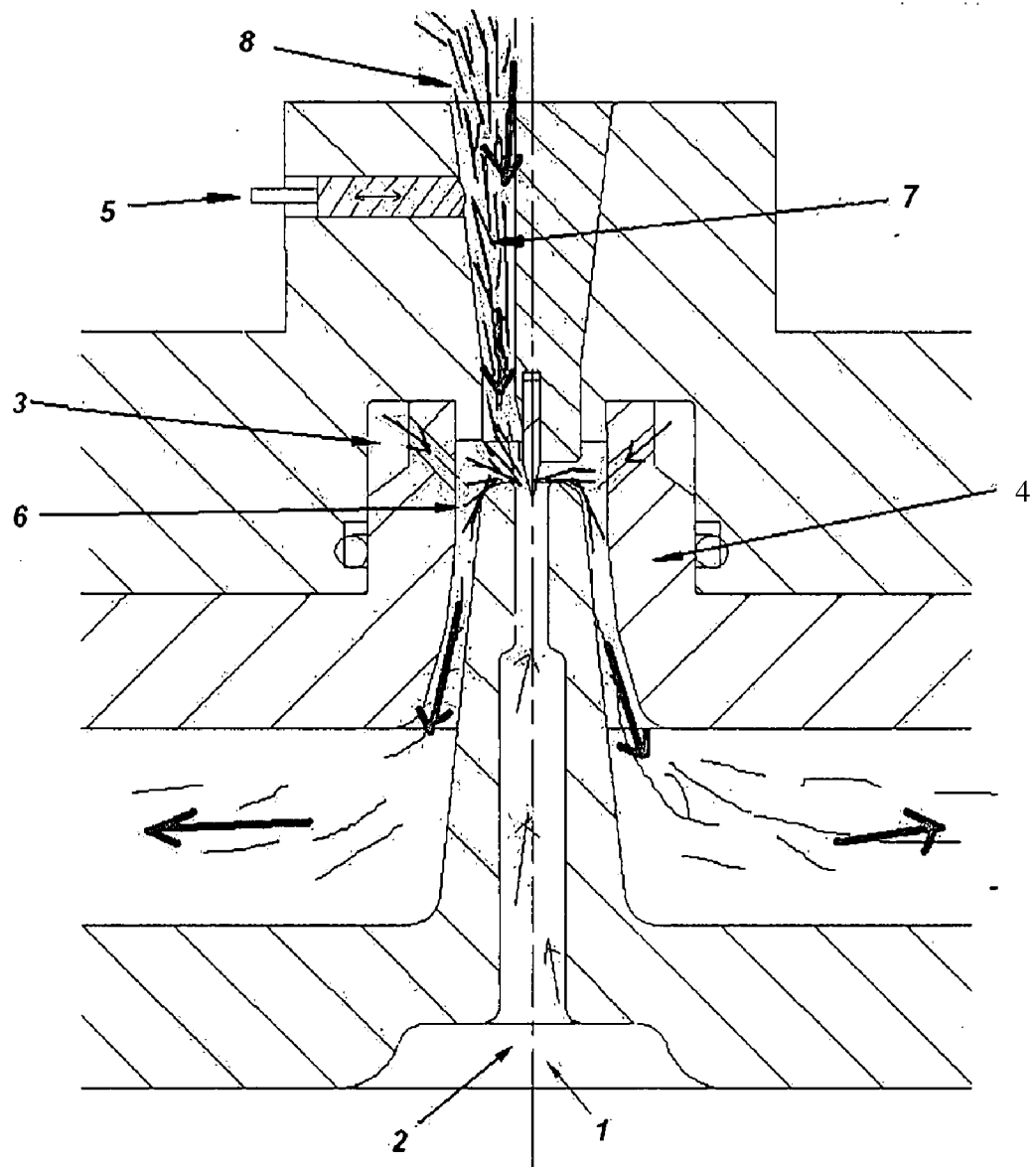


Fig. 5

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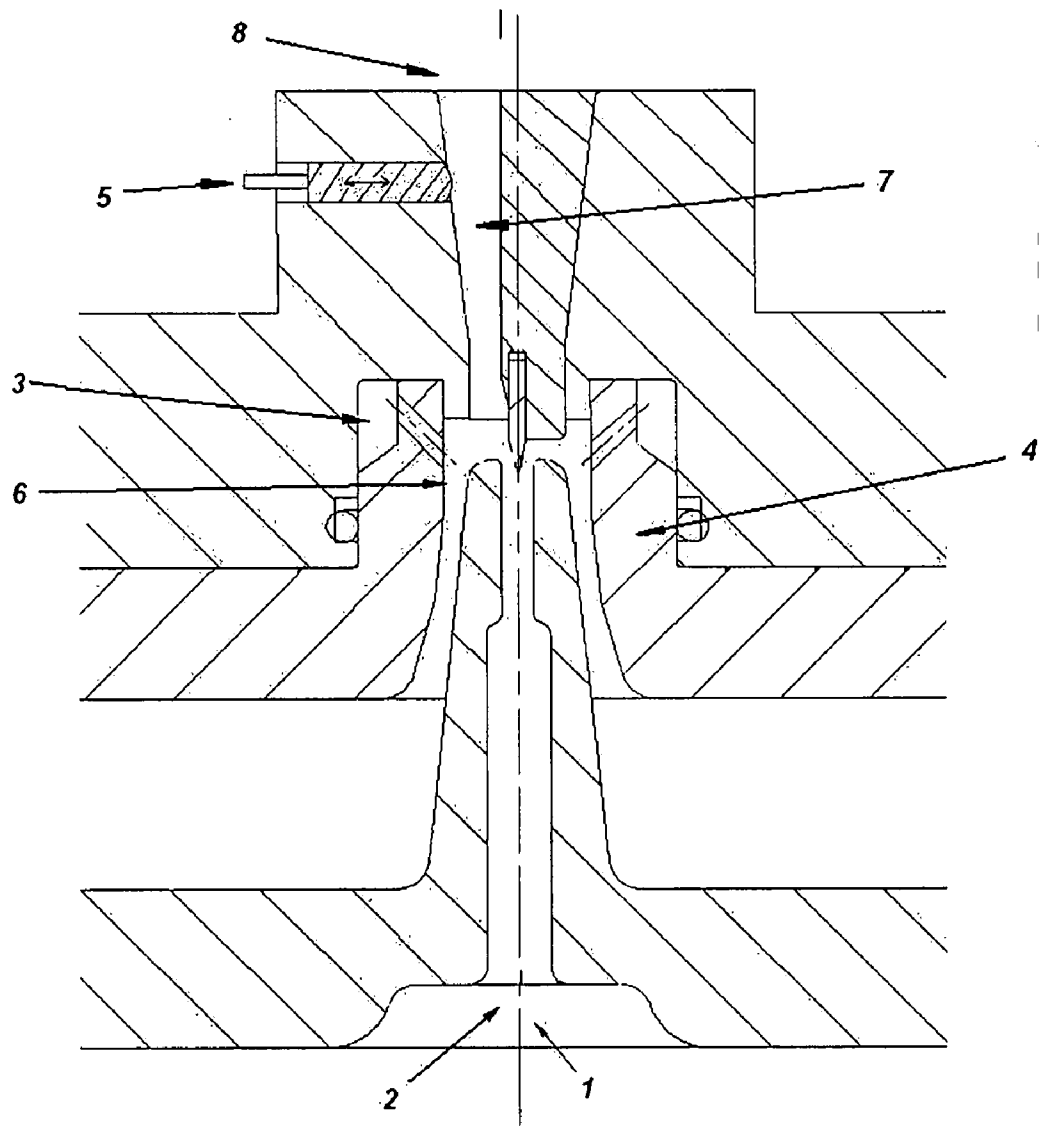


Fig. 6

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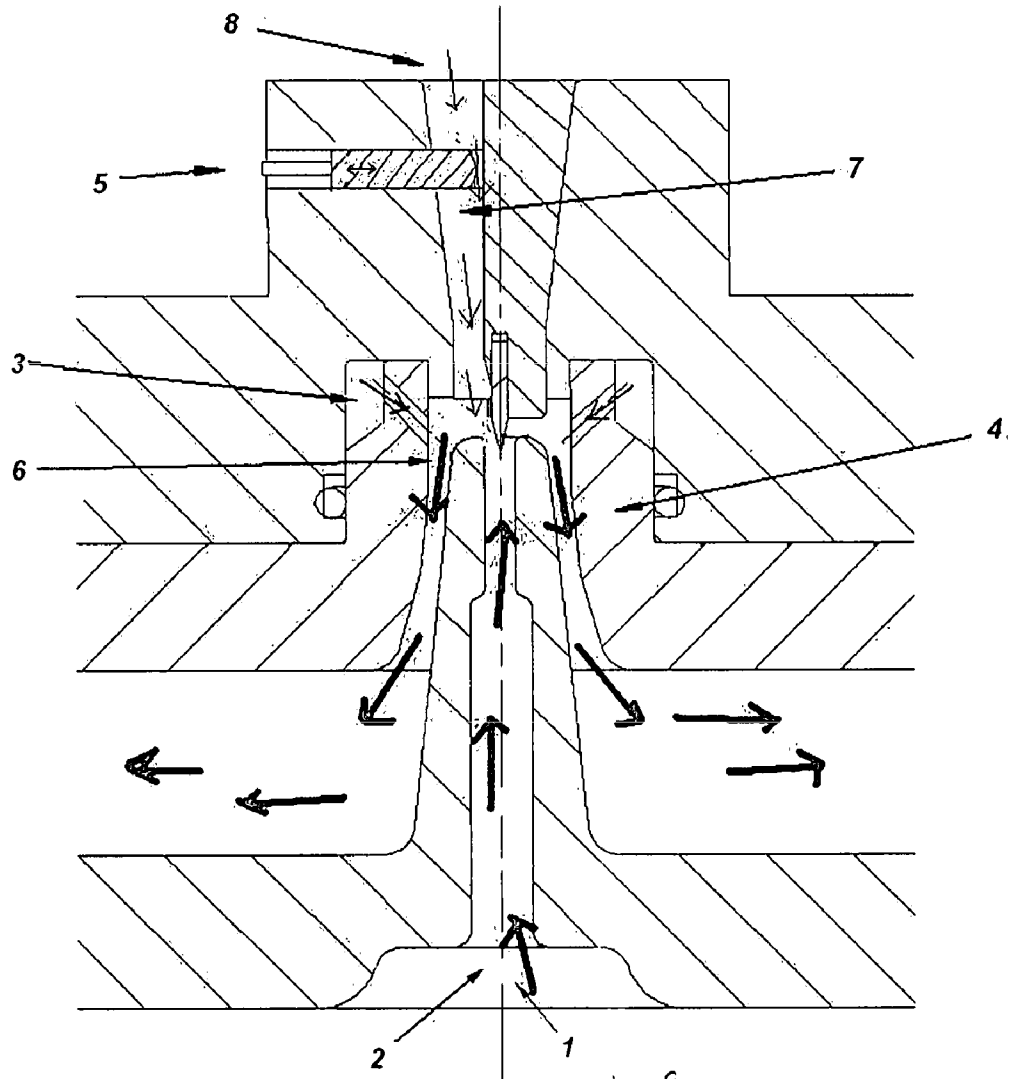


Fig. 7

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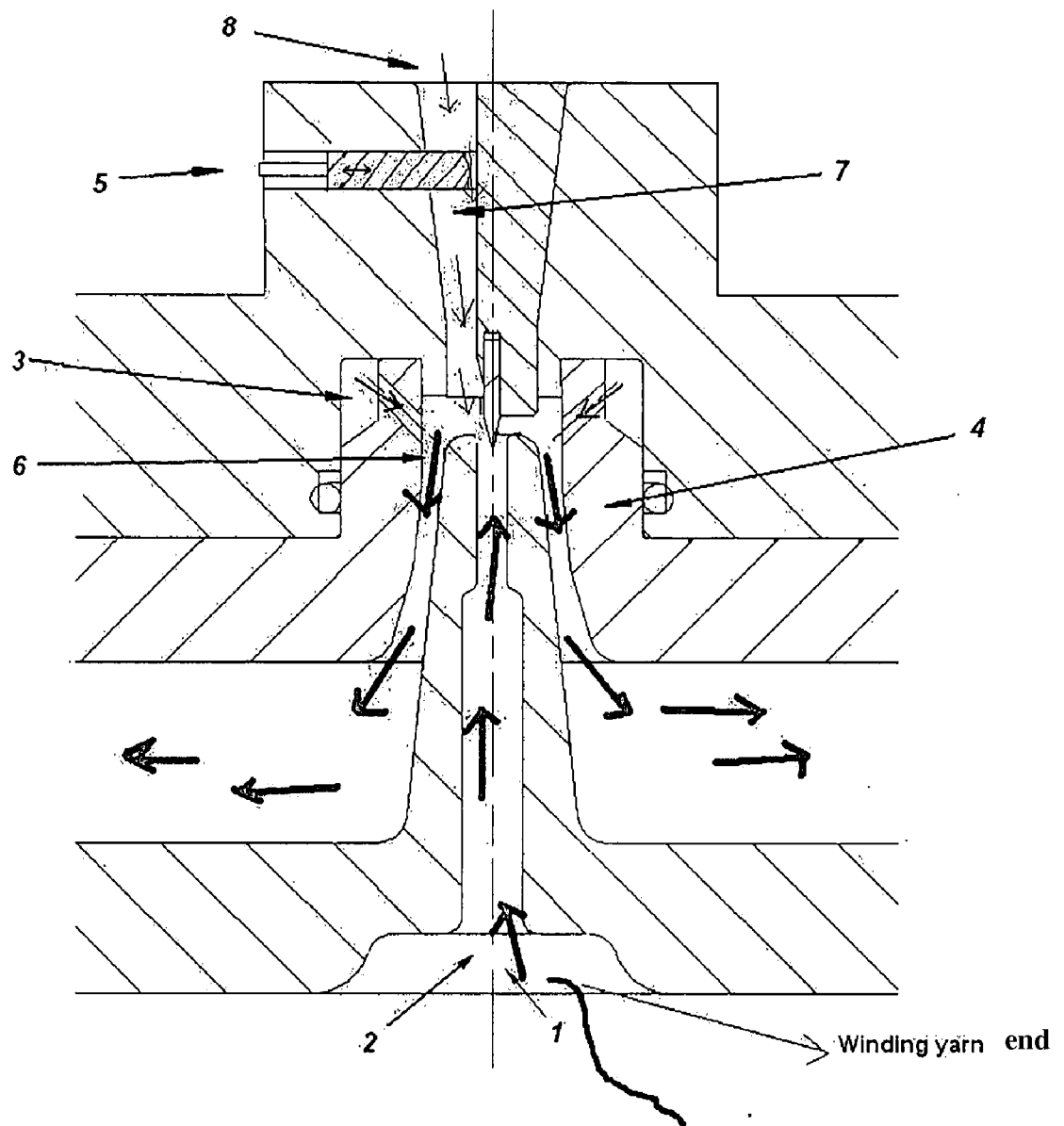


Fig. 8

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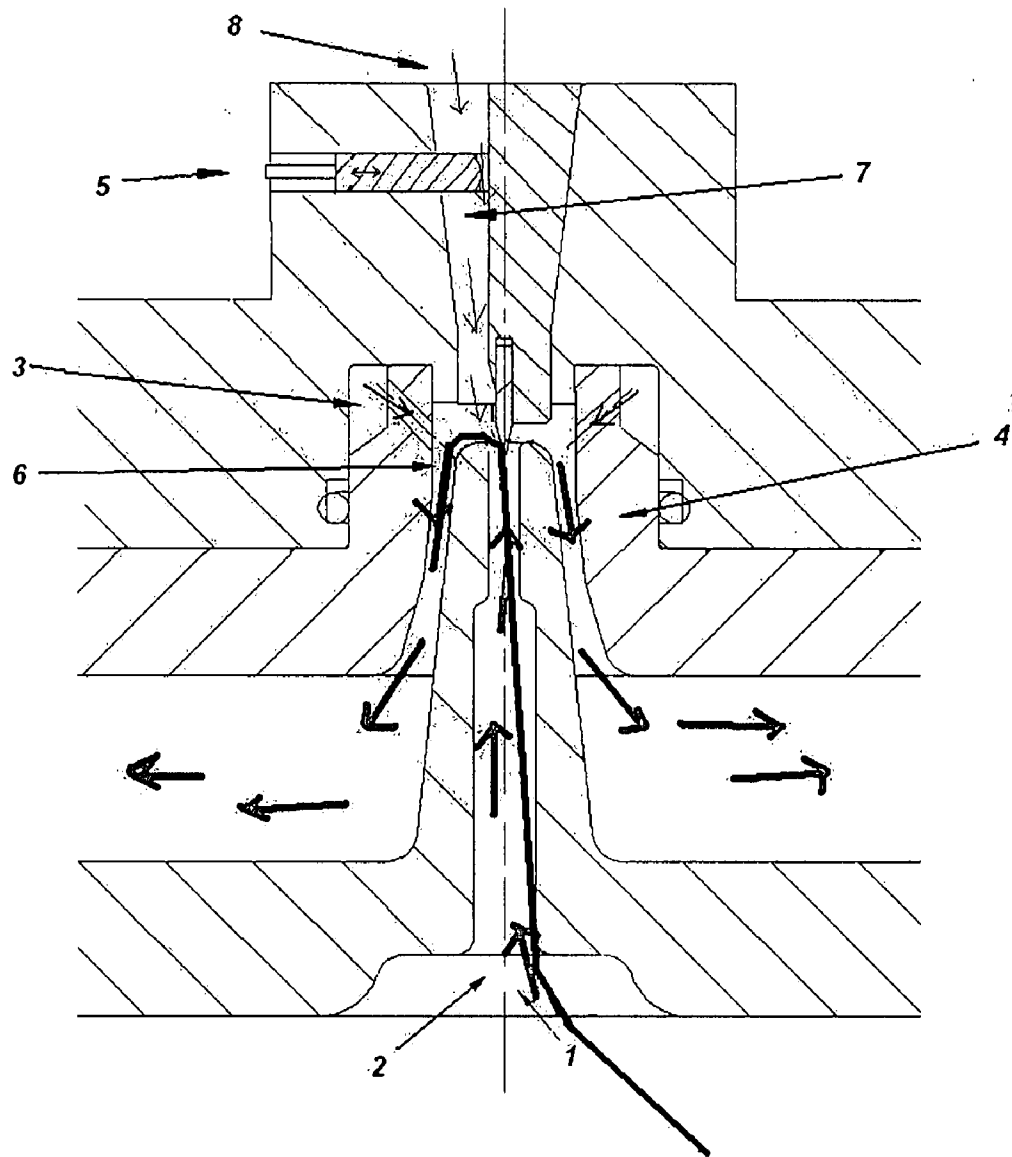


Fig. 9

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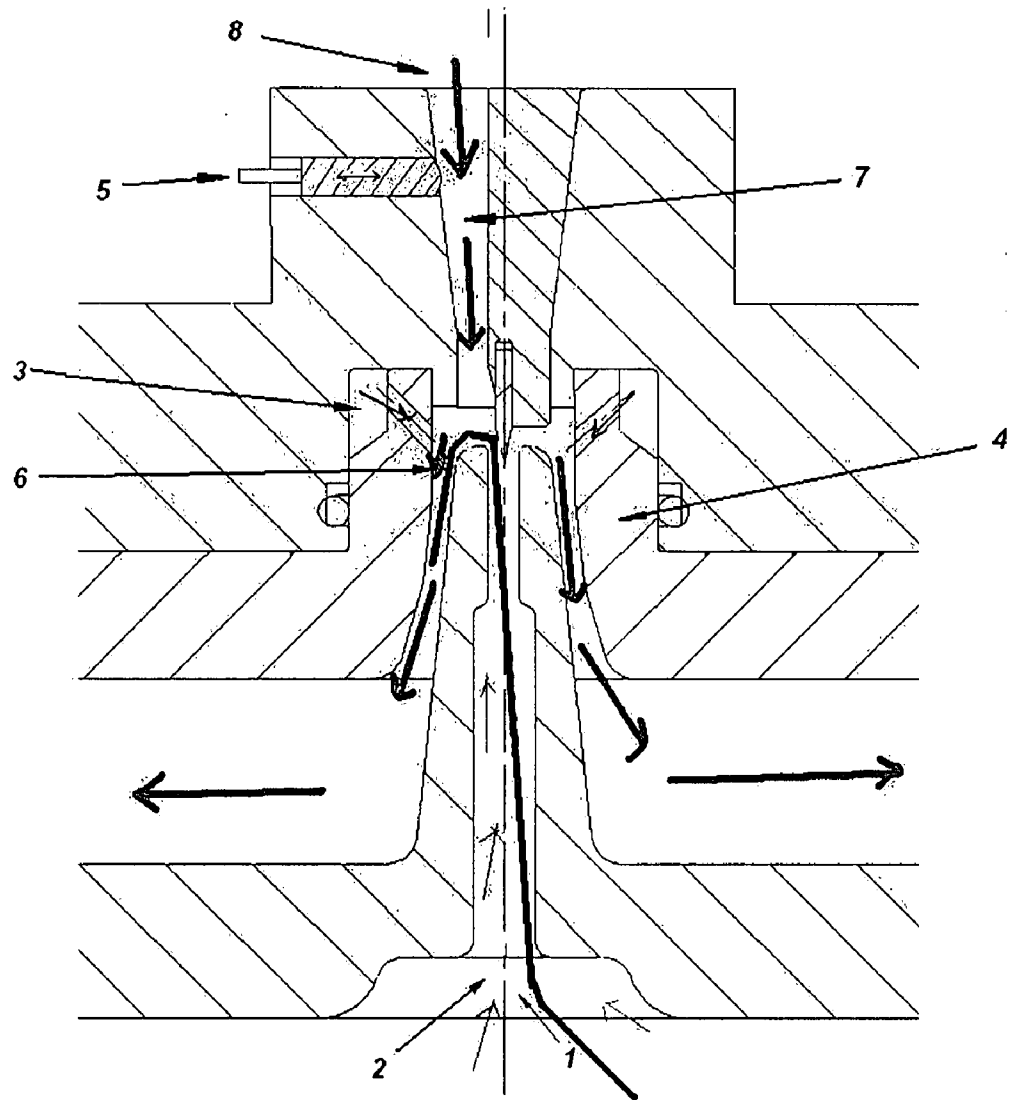


Fig. 10

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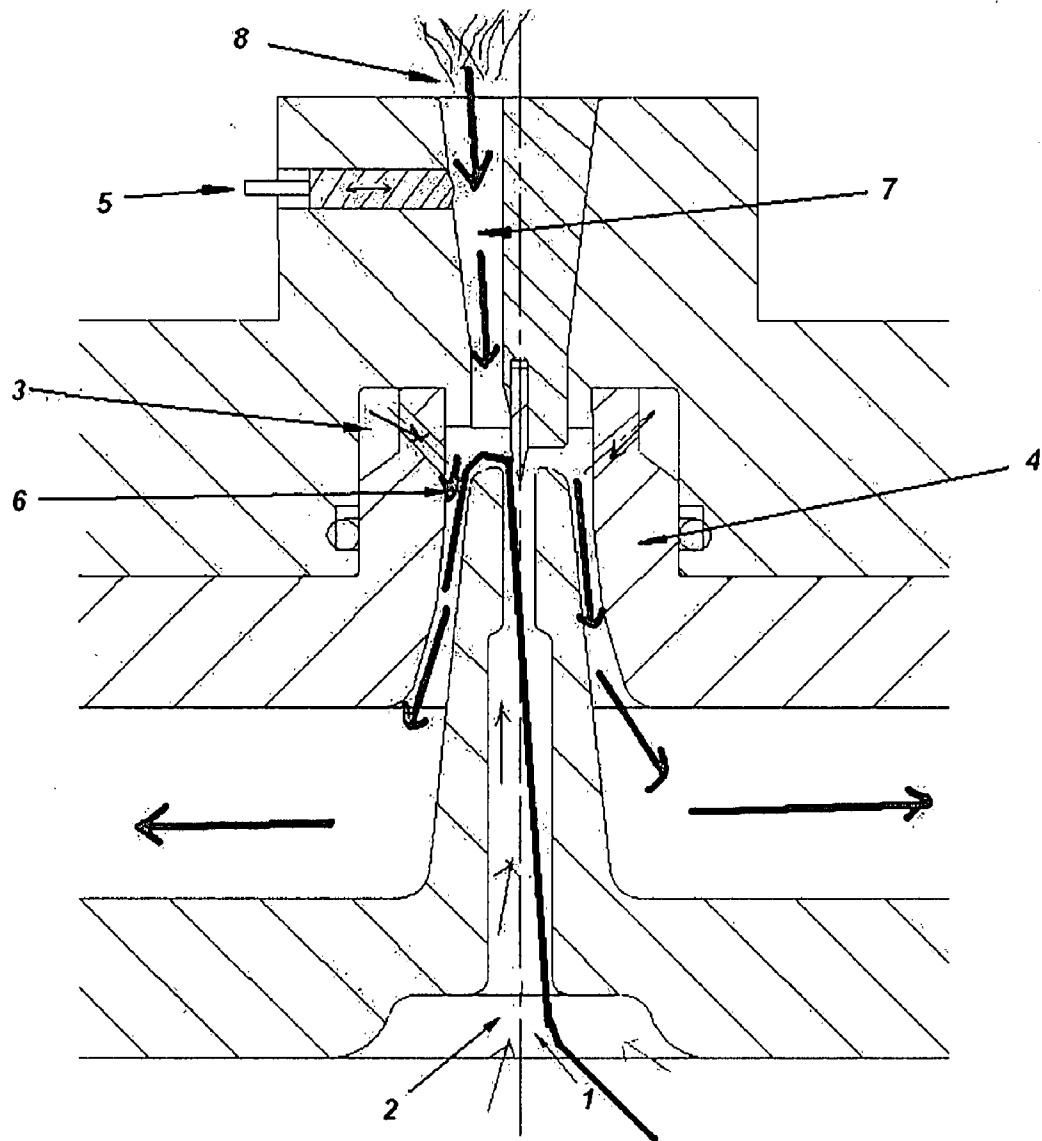


Fig. 11

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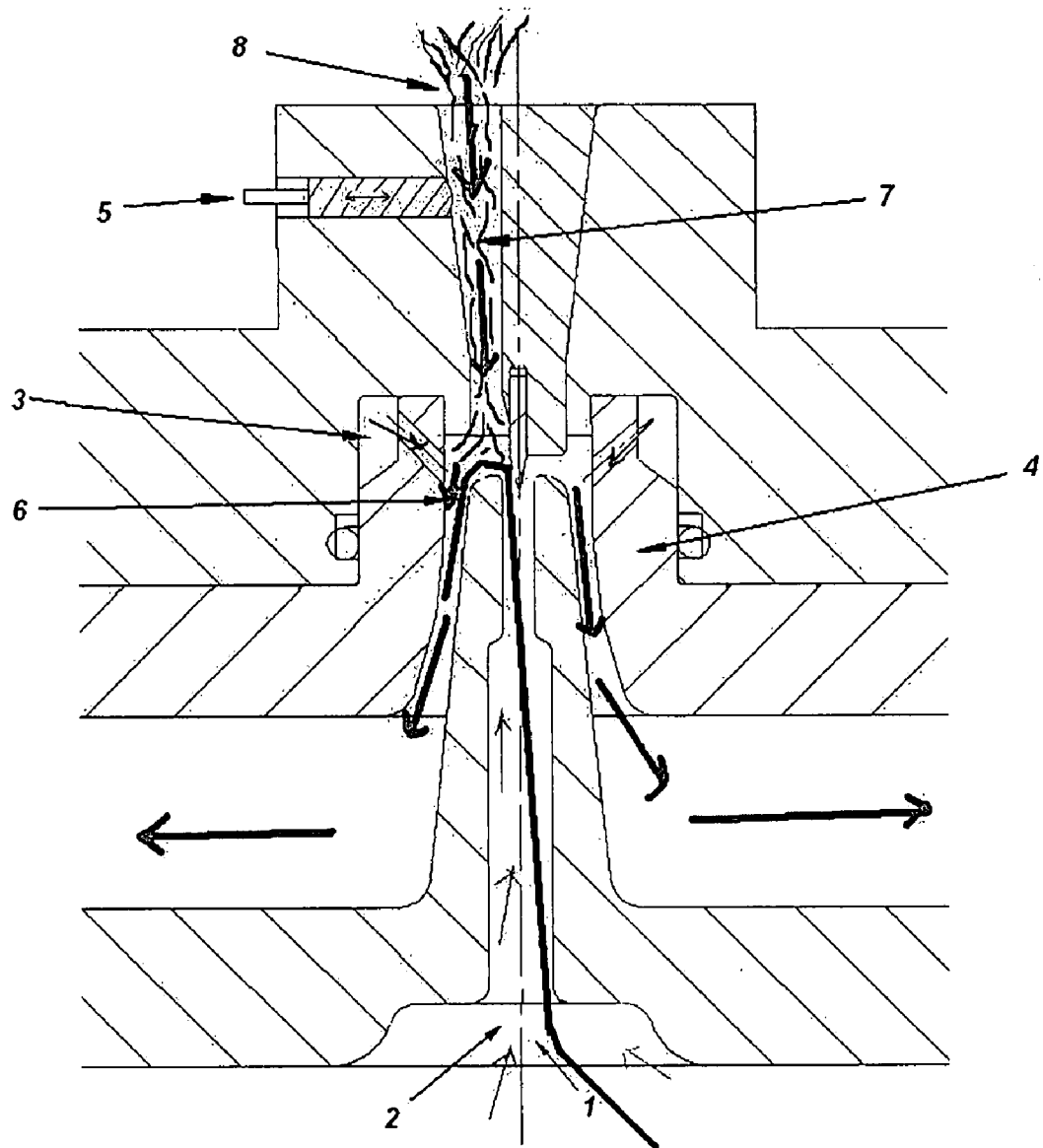


Fig. 12

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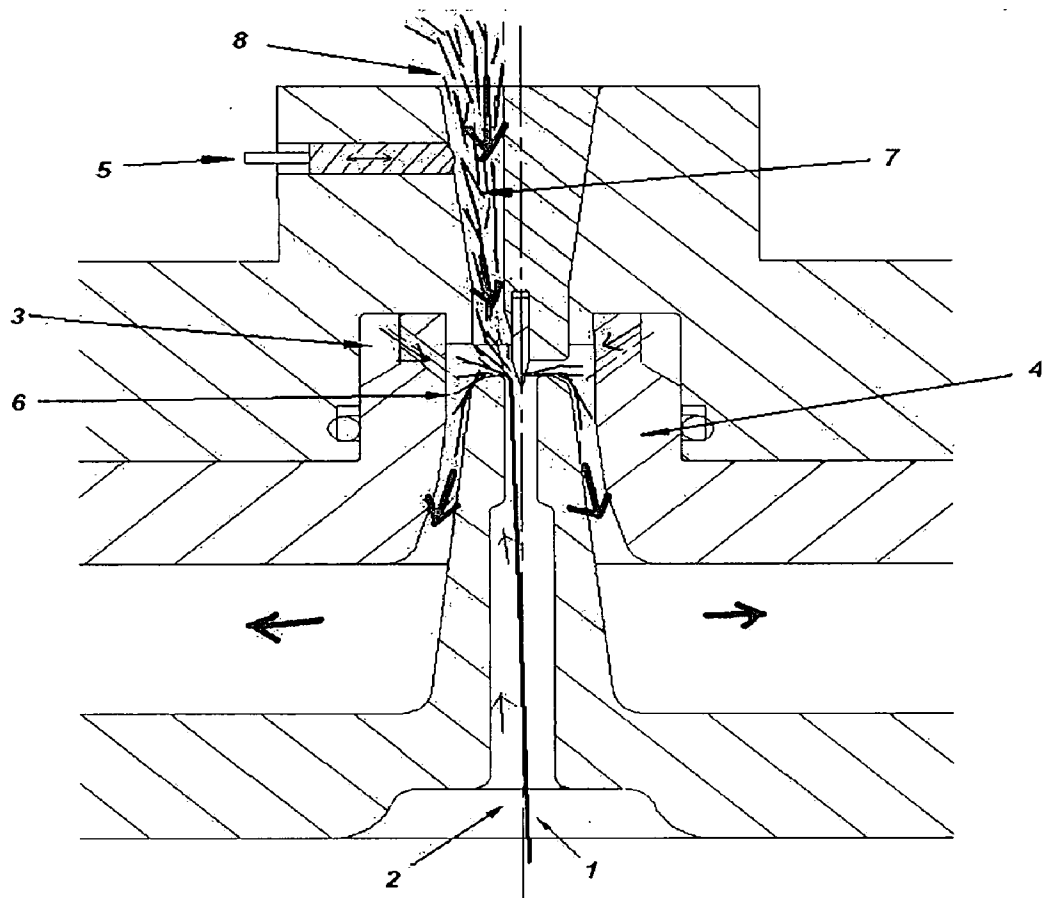


Fig. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2012/052550

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: D01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI,EPODOC,CNPAT,CNKI: plunger, insert+, channel, passage, aperture, air, air w current, gas, atmosphere, airflow, air w stream, splicer, splicing, piecing, piecer, suction

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN100537862C(RIETER AG MASCHF) 09 Sep. 2009(09.09.2009) the embodiment, figures 1-6	1-6
A	CN101040073A(RIETER AG MASCHF) 19 Sep. 2007(19.09.2007) the whole document	1-6
A	CN1093187C(MURATA MACHINERY LTD) 23 Oct. 2002(23.10.2002) the whole document	1-6
A	US4229935A(WAIN JOHN K) 28 Oct. 1980(28.10.1980) the whole document	1-6

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
19 Sep. 2012(19.09.2012)Date of mailing of the international search report
04 Oct. 2012 (04.10.2012)Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China
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Facsimile No. 86-10-62019451

Authorized officer

LI, Qing

Telephone No. (86-10)62085410

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2012/052550

A. CLASSIFICATION OF SUBJECT MATTER

D01H4/50(2006.01)i

D01H4/48(2006.01)i

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2012/052550

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 7
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
Claim 7 defines the piecing mechanism with reference to the accompanying drawings, so the solution of claim 7 can not be determined clearly and is unclear.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2012/052550

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