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(54) HAND CARRY-TYPE DEBURRING MACHINE

(57) [Technical Problem] Provided is a hand-held deburring machine allowing a worker to perform a deburring operation easily by holding the machine in his or her hand.

[Solution to Problem] The hand-held deburring machine (10) has a body (18) including a motor (14) connected to a polishing brush (12) having a plurality of polishing wires (12a) extending rearward from a forward end to drive the polishing brush (12) to rotate about an axis (X) extending in a longitudinal direction, the body (18) being hand-holdable by a worker, a cylindrical forward end member (20) mounted to surround the periphery of a forward end portion of the polishing wires (12a), and a guide member (22) secured to the cylindrical forward end member (20) to extend rearward and supported by the body (18) so as to be displaceable in the longitudinal direction, thereby allowing the cylindrical forward end member (20) to be displaceable rearward along the polishing brush (12). The polishing brush (12) is pushed out forward from the cylindrical forward end member (20) and rotated to perform a deburring operation by the polishing brush (12).

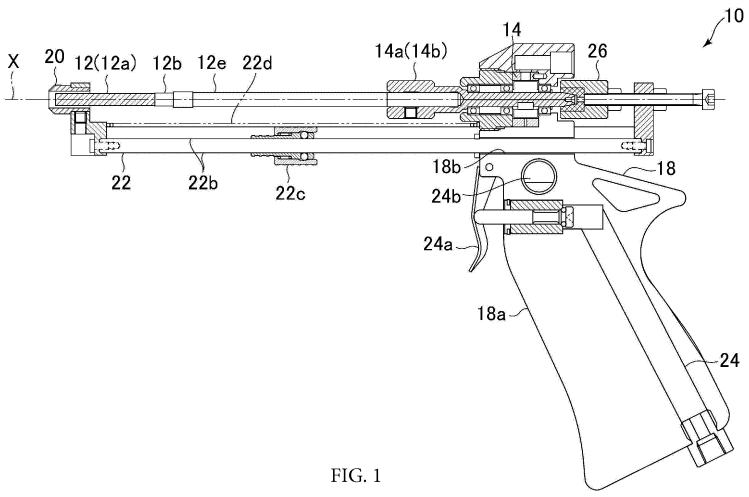

FIG. 1

EP 3 603 884 A1

Description

Technical Field:

[0001] The present invention relates to a hand-held deburring machine suitable for polishing the surface of a workpiece, particularly for removing burrs from the surface of a drilled hole provided in a workpiece.

Background Art:

[0002] For example, when a workpiece is provided with intersecting drilled holes, burrs are likely to occur at the edge of an opening where a drilled hole formed subsequently intersects a drilled hole formed previously. As a device for removing such burrs, there is known a device having a polishing brush formed by bundling a multiplicity of polishing wires. The polishing brush is inserted into the relevant drilled hole while being driven to rotate about the longitudinal axis of the polishing brush, thereby removing the burrs (Patent Literatures 1 and 2).

Citation List:

Patent Literatures:

[0003]

Patent Literature 1: Japanese Utility Model Registration Application Publication No. Hei 5-86455
Patent Literature 2: Japanese Patent Application Publication No. 2003-236738

Summary of Invention:

Technical Problem:

[0004] An object of the present invention is to provide a deburring machine using a polishing brush formed by bundling a multiplicity of polishing wires as stated above, the deburring machine being a hand-held deburring machine allowing a worker to perform a deburring operation easily by holding the machine in his or her hand.

Solution to Problem:

[0005] The present invention provides a hand-held deburring machine having the following: a body including a motor connected to a polishing brush having a plurality of polishing wires extending rearward from a forward end to drive the polishing brush to rotate about an axis extending in a longitudinal direction, the body being hand-holdable by a worker; a cylindrical forward end member mounted to surround the periphery of a forward end portion of the polishing wires; and a guide member secured to the cylindrical forward end member to extend rearward and supported by the body so as to be displaceable in the longitudinal direction, thereby allowing the cylindrical forward end member to be displaceable rearward along the polishing brush. The polishing brush is pushed out forward from the cylindrical forward end member and rotated to perform a deburring operation by the polishing brush.

[0006] With this hand-held deburring machine, a worker holds the body in his or her hand and brings the cylindrical forward end member into aligned contact with the opening of a drilled hole provided in a workpiece, and then pushes the body toward the drilled hole, thereby allowing the polishing brush to advance from the cylindrical forward end member into the drilled hole. Accordingly, the polishing wires of the polishing brush advanced into the drilled hole are opened radially outward by centrifugal force by being driven to rotate by the motor, thereby polishing the inner surface of the drilled hole and removing burrs from inside the drilled hole. Thus, the hand-held deburring machine allows a worker to remove burrs from inside a drilled hole in a workpiece easily by holding the machine in his or her hand. Further, because the periphery of the forward end portion of the polishing wires is surrounded by the cylindrical forward end member, there is no possibility of the polishing wires being undesirably opened even if the polishing brush is driven to rotate in a state where the polishing brush cannot be advanced forward from the cylindrical forward end member. Thus, safety can be maintained.

[0007] Specifically, the arrangement may be as follows. The cylindrical forward end member is engageable with the edge of the opening of a drilled hole provided in a workpiece by being partially inserted into the opening of the drilled hole, thereby facilitating alignment between the cylindrical forward end member and the drilled hole.

[0008] Further, the cylindrical forward end member may have an engaging portion engageable with a surface of a workpiece that surrounds a drilled hole provided in the workpiece when performing polishing of the inside of the drilled hole. With this arrangement, the hand-held deburring machine can be supported even more stably during a polishing operation.

[0009] Further, the body may have a pistol grip type grip portion that allows the body to be gripped, with the polishing brush pointed forward. Thus, a worker can perform an operation by gripping the pistol grip type grip portion; therefore, the worker can work while looking at the drilled hole as a work target, and it is easy to move the body forward and backward.

[0010] Further, the guide member may have a retraction stopper configured such that when the guide member retracts by a predetermined distance, the retraction stopper engages the body to stop retraction of the guide member. With this arrangement, the distance by which the polishing brush is advanced can be limited according to the deburring position in the drilled hole.

[0011] The hand-held deburring machine may further have an urging member urging the guide member forward relative to the body so that the cylindrical forward end member is positioned to surround the periphery of

the forward end portion of the polishing wires. This arrangement enables the hand-held deburring machine to return to the initial state at all times when the polishing brush is pulled out from the drilled hole.

[0012] The hand-held deburring machine may further have a rotation stopper configured to prevent rotation of the motor when the cylindrical forward end member is positioned to surround the periphery of the forward end portion of the polishing wires. With this arrangement, the motor is prevented from rotating when the polishing brush is not advanced from the cylindrical forward end member into the drilled hole, and thus safety can be improved.

[0013] The arrangement may be as follows. The motor is a pneumatic motor and has a rotating shaft connected to the polishing brush in axial alignment therewith, and the rotation stopper is configured to prevent rotation of the rotating shaft by engaging a rearward portion of the rotating shaft extending rearward from the motor.

[0014] Specifically, the arrangement may be as follows. The rotation stopper is secured to the guide member and configured to disengage from the rearward portion of the rotating shaft when the guide member is moved rearward relative to the body. This arrangement enables the polishing brush to be driven to rotate when the polishing brush is moved forward from the cylindrical forward end member supported by the guide member.

[0015] The guide member may have a forward end support member supporting the cylindrical forward end member, and at least two mutually spaced guide rods extending rearward from the forward end support member in parallel to the plurality of polishing wires and longitudinally slidably supported by the body.

[0016] With the above-described arrangement, the cylindrical forward end member can be supported relative to the body in a three-point supporting manner. Thus, the cylindrical forward end member can be stably moved in the longitudinal direction.

[0017] The arrangement may be as follows. The forward end support member is substantially in the shape of a triangle having an apex defined by a portion of the forward end support member that supports the cylindrical forward end member, and the guide rods extend rearward from respective portions of the forward end support member that are adjacent to the other apexes.

[0018] With the above-described arrangement in which the forward end support member has a substantially triangular shape, when a drilled hole needing deburring is located in a corner portion limited by the corner walls of a workpiece, the forward end support member can be easily advanced into the corner portion.

[0019] Embodiments of a hand-held deburring machine according to the present invention will be explained below on the basis of the accompanying drawings.

Brief Description of Drawings:

[0020]

Fig. 1 is a longitudinal vertical sectional view of a hand-held deburring machine according to the present invention, in which a grip portion is illustrated in a schematic view showing a basic structure thereof.

Fig. 2 is a vertical sectional view showing important parts of the hand-held deburring machine in Fig. 1, showing the hand-held deburring machine when a polishing brush is projected forward.

Fig. 3 is a drawing showing a cylindrical forward end member surrounding the periphery of a forward end portion of the polishing brush of the hand-held deburring machine in Fig. 1 and a forward end support member supporting the cylindrical forward end member as seen from the front side.

Fig. 4 is a sectional view showing the cylindrical forward end member engaged in alignment with a drilled hole provided in a workpiece when performing deburring of the inside of the drilled hole by using the hand-held deburring machine shown in Fig. 1.

Fig. 5 is a sectional view showing a cylindrical forward end member suitable for performing deburring when the junction of intersecting drilled holes is close to the surface of a workpiece.

Fig. 6 is a sectional view showing a cylindrical forward end member suitable for use when the distance from the surface of a workpiece to a drilled hole to be deburred is long.

Fig. 7 is a sectional view of a cylindrical forward end member suitable for achieving stable engagement with a workpiece.

Fig. 8 is a sectional view of a cylindrical forward end member suitable for removing burrs from inside a drilled hole provided in a circular columnar workpiece.

Fig. 9 is a sectional view of a cylindrical forward end member suitable for achieving stable engagement with a flat surface of a workpiece.

Fig. 10 is a sectional view of a cylindrical forward end member similar to Fig. 9, the cylindrical forward end member having a short cylindrical portion to be inserted into a drilled hole.

Description of Embodiments:

[0021] As shown in Fig. 1, a hand-held deburring machine 10 according to the present invention has a polishing brush 12, a body 18 having a pistol grip type grip portion 18a hand-holdable by a worker, a cylindrical forward end member 20 mounted to surround a forward end portion of the polishing brush 12, and a guide member 22 secured to the cylindrical forward end member 20 to extend rearward and supported by the body 18. The polishing brush 12 is formed in an elongated circular columnar shape by bundling a multiplicity of polishing wires 12a extending rearward from the forward end. The body 18 includes a motor 14. The motor 14 is connected to the rear end of the polishing brush 12 to drive the polish-

ing brush 12 to rotate about an axis X extending in a longitudinal direction. The guide member 22 is supported by the body 18 so as to be displaceable in the longitudinal direction, and thus the cylindrical forward end member 20 secured to the guide member 22 is displaceable rearward along the polishing brush 12, as shown in Fig. 2,

[0022] In the illustrated example, the polishing brush 12 has a cylindrical bundling member 12b bundling the rear ends of a multiplicity of polishing wires 12a to form the polishing wires 12a into a circular columnar shape as a whole, and a connecting rod 12c extending rearward from the bundling member 12b. The rear end of the connecting rod 12c is inserted into a cylindrical forward extending portion 14b of a rotating shaft 14a of the motor 14, thereby securing the polishing blush 12. As the polishing brush 12, it is possible to use a ceramic fiber deburring brush available from XEBEC Technology Co., LTD., for example. The motor 14 is a turbine motor driven by compressed air introduced through a compressed air inlet pipe 24 when the user gripping the grip portion 18a with one hand squeezes a trigger 24a. The direction of compressed air to be supplied to the motor 14 can be changed by switching flow paths in a valve member 24b by a knob (not shown), thereby allowing switching between forward rotation and reverse rotation of the motor 14. With this arrangement, burrs collapsed by rotation in one direction can be easily removed by rotation in the opposite direction. The valve member 24b functions also as a flow control valve for controlling the flow rate of compressed air. By controlling the flow rate, it is possible to control the rotational speed of the motor 14 and hence possible to control the polishing force applied by the polishing brush 12.

[0023] The guide member 22 has a forward end support member 22a fixedly supporting the cylindrical forward end member 20, and three mutually spaced guide rods 22b secured to the forward end support member 22a to extend rearward and longitudinally slidably inserted through respective support holes 18b in the body 18 (as will be stated below). As shown in Fig. 3, the forward end support member 22a is substantially in the shape of a triangle having an apex defined by a portion of the forward end support member 22a that supports the cylindrical forward end member 20. Two guide rods 22b extend rearward from respective portions of the forward end support member 22a that are adjacent to the other apexes, and the other one of the guide rods 22b extends rearward from an intermediate position between the two guide rods 22b. The guide rod 22b in the intermediate position has a stopper 22c secured thereto in a position-adjustable manner. When the guide rod 22b is displaced rearward relative to the body 18 by a predetermined distance as shown in Fig. 2, the stopper 22c engages the body 18 to stop the displacement (retraction) of the guide rod 22b (and hence the cylindrical forward end member 20).

[0024] The three guide rods 22b extend further rearward beyond the body 18, and a motor stopper 26 is secured to the rear ends of the guide rods 22b, the motor stopper 26 being axially aligned with the rotating shaft 14a of the motor 14. The motor stopper 26 has, as shown clearly in Fig. 2, a stopper support member 26a secured to the rear ends of the guide rods 22b, a position adjusting screw 26b threadedly engaged with the stopper support member 26a, and a stopper body 26d secured to the distal end of the position adjusting screw 26b. The stopper body 26d is provided with a stopper part 26c made of polyurethane or the like to receive the rear end of the rotating shaft 14a of the motor 14 so as to prevent rotation of the rotating shaft 14a. When the cylindrical forward end member 20 is positioned around the forward end of the polishing brush 12 as shown in Fig. 1, the stopper part 26c receives the rear end of the rotating shaft 14a to prevent rotation of the rotating shaft 14a. When the guide member 22 moves rearward relative to the body 18 so that the cylindrical forward end member 20 moves rearward relative to the forward end portion of the polishing brush 12 to perform a deburring operation, the stopper part 26c separates from the rear end of the rotating shaft 14a to allow rotation of the rotating shaft 14a. The position adjusting screw 26b is configured to allow adjustment of the axial position of the stopper body 26d by threadedly rotating the position adjusting screw 26b. Compression coil springs 22d are provided around the two guide rods 22b located at the opposite sides, respectively, of the guide rod 22b having the stopper 22c secured thereto so that the compression coil springs 22d extend between the body 18 and the forward end support member 22a. The compression coil springs 22d urge the forward end support member 22a so that the cylindrical forward end member 20 is positioned around the forward end of the polishing brush 12. It is preferable to mark a scale on the guide rods 22b along the longitudinal direction thereof so as to enable the user to know the amount of retraction of the guide member 22 relative to the polishing brush 12 (i.e. the distance by which the polishing brush 12 has advanced into the drilled hole), although this is not illustrated in the figures.

[0025] When using the hand-held deburring machine 10, as shown in Fig. 4, a tapered surface 20a of the cylindrical forward end member 20 positioned at the forward end of the polishing brush 12 is engaged with the opening edge of a drilled hole h in a workpiece W to be deburred, thereby aligning the cylindrical forward end member 20 with the drilled hole h. In this state, the polishing brush 12 is driven to rotate, and while doing so, the body 18 is advanced toward the workpiece W. Consequently, the polishing brush 12 advances into the drilled hole h, and the polishing wires 12a are opened radially outward by centrifugal force, thereby polishing the inner peripheral surface of the drilled hole h, and thus removing burrs from the inner peripheral surface of the drilled hole h. As shown in the figure, if a drilled hole h1 is subsequently formed so as to intersect the drilled hole h, burrs may be formed to extend into the drilled hole h along the intersecting edges of these holes. Such burrs can be removed

by polishing the inner peripheral surface of the drilled hole h as stated above. When the polishing wires 12a have shortened as a result of use, the cylindrical forward end member 20 is positioned forward of the forward end of the polishing wires 12a. In such a case, the position adjusting screw 26b is rotated to adjust the position thereof rearward relative to the guide rods 22b so that the cylindrical forward end member 20 is positioned around the forward end of the polishing wires 12a when the stopper part 26c of the motor stopper 26 reaches a position to receive the rear end of the rotating shaft 14a so as to prevent rotation of the rotating shaft 14a. The cylindrical forward end member 20 is replaceable relative to the forward end support member 22a according to the bore diameter of the drilled hole h. Similarly, the polishing brush 12 is replaceable relative to the cylindrical forward extending portion 14b.

[0026] Fig. 5 shows a modification of the cylindrical forward end member 20 which is suitable for removing burrs from the junction of intersecting drilled holes h and h1 when the drilled hole h1 is near the surface of the workpiece. That is, the cylindrical forward end member 20 of the modification is configured such that the forward portion of a bore 20b receiving the polishing brush 12 gradually increases in radius toward the front side, thereby making it easy for the polishing wires 12a to open radially immediately after entering the drilled hole h. The cylindrical forward end member 20 is not provided with a tapered surface 20a such as that of the cylindrical forward end member 20 shown in Fig. 4.

[0027] Fig. 6 shows an example of the cylindrical forward end member 20 suitable for use when a hole h2 having a large diameter is provided at a side of a drilled hole h to be deburred that is closer to the surface of the workpiece W. The cylindrical forward end member 20 is elongated in order to allow the tapered surface 20a of the cylindrical forward end member 20 to engage the opening edge of the drilled hole h located at an inner position.

[0028] Fig. 7 shows an example in which the cylindrical forward end member 20 is provided with a cylindrical portion 20c extending forward from the tapered surface 20a so as to allow the cylindrical forward end member 20 to be engaged with the drilled hole h even more stably.

[0029] Fig. 8 shows a modification of the cylindrical forward end member 20 suitable for use when the workpiece W has a circular columnar shape and a hole h3 longitudinally extending through the center of the workpiece W is formed so as to intersect a drilled hole h extending diametrically of the workpiece W. The cylindrical forward end member 20 has a forward end surface 20d which is an inwardly curved surface having a curvature corresponding to that of the outer surface of the circular columnar workpiece W.

[0030] Fig. 9 shows an example in which an annular flange 20e is provided in place of the tapered surface 20a so as to allow the cylindrical forward end member 20 to be stably engaged with the workpiece W. Fig. 10 shows a cylindrical forward end member 20 provided with a short cylindrical portion 20f configured to enter the drilled hole h, in addition to a flange 20e similar to the above. The cylindrical portion 20f makes it easy for the cylindrical forward end member 20 to align with the drilled hole h, and the flange 20e allows the cylindrical forward end member 20 to be stabilized even more during an operation.

[0031] Although some embodiments of the hand-held deburring machine according to the present invention have been described above, the present invention is not limited to the described embodiments. For example, the forward end support member 22a shown in Fig. 3 has a substantially triangular shape. The reason for this is that when a drilled hole h needing deburring is located in a corner portion limited by the corner walls of a workpiece W, the substantially triangular shape enables the forward end support member 22a to be easily advanced into the corner portion. Therefore, the forward end support member 22a may have a desired shape other than triangular shape. The motor is not limited to the pneumatic motor but may be an electric motor. Further, the hand-held deburring machine according to the present invention is suitable for removing burrs from inside a drilled hole but also usable to polish the surface of a drilled hole.

Reference Signs List:

[0032]

Drilled hole h;
workpiece W;
axis X;
hand-held deburring machine 10;
polishing brush 12;
polishing wires 12a;
cylindrical bundling member 12b;
connecting rod 12c;
motor 14;
rotating shaft 14a;
cylindrical forward extending portion 14b;
body 18;
grip portion 18a;
support holes 18b;
cylindrical forward end member 20;
tapered surface 20a;
bore 20b;
cylindrical portion 20c;
forward end surface 20d;
flange 20e;
cylindrical portion 20f;
guide member 22;
forward end support member 22a;
guide rods 22b;
stopper 22c (retraction stopper);
compression coil springs 22d (urging member);
compressed air inlet pipe 24;
trigger 24a;

valve member 24b;
motor stopper 26 (rotation stopper);
stopper support member 26a;
position adjusting screw 26b;
stopper part 26c;
stopper body 26d.

Claims

1. A hand-held deburring machine comprising:

   a body including a motor connected to a polishing brush having a plurality of polishing wires extending rearward from a forward end to drive the polishing brush to rotate about an axis extending in a longitudinal direction, the body being hand-holdable by a worker;
   a cylindrical forward end member mounted to surround a periphery of a forward end portion of the polishing wires; and
   a guide member secured to the cylindrical forward end member to extend rearward and supported by the body so as to be displaceable in the longitudinal direction, thereby allowing the cylindrical forward end member to be displaceable rearward along the polishing brush;
   wherein the polishing brush is pushed out forward from the cylindrical forward end member and rotated to perform a deburring operation by the polishing brush.

2. The hand-held deburring machine of claim 1, wherein the cylindrical forward end member is engageable with an edge of an opening of a drilled hole provided in a workpiece by being partially inserted into the opening of the drilled hole.

3. The hand-held deburring machine of claim 1 or 2, wherein the cylindrical forward end member has an engaging portion engageable with a surface of a workpiece that surrounds a drilled hole provided in the workpiece when performing polishing of inside of the drilled hole.

4. The hand-held deburring machine of any one of claims 1 to 3, wherein the body has a pistol grip type grip portion that allows the body to be gripped, with the polishing brush pointed forward.

5. The hand-held deburring machine of any one of claims 1 to 4, wherein the guide member has a retraction stopper configured such that when the guide member retracts, the retraction stopper engages the body to stop retraction of the guide member.

6. The hand-held deburring machine of any one of claims 1 to 5, further comprising: an urging member urging the guide member forward relative to the body so that the cylindrical forward end member is positioned to surround the periphery of the forward end portion of the polishing wires.

7. The hand-held deburring machine of any one of claims 1 to 6, further comprising: a rotation stopper configured to prevent rotation of the motor when the cylindrical forward end member is positioned to surround the periphery of the forward end portion of the polishing wires.

8. The hand-held deburring machine of claim 7, wherein the motor is a pneumatic motor and has a rotating shaft connected to the polishing brush in axial alignment therewith, the rotation stopper being configured to prevent rotation of the rotating shaft by engaging a rearward portion of the rotating shaft extending rearward from the motor.

9. The hand-held deburring machine of claim 8, wherein the rotation stopper is secured to the guide member, the rotation stopper being configured to disengage from the rearward portion of the rotating shaft when the guide member is moved rearward relative to the body.

10. The hand-held deburring machine of any one of claims 1 to 9, wherein the guide member has a forward end support member supporting the cylindrical forward end member, and at least two mutually spaced guide rods extending rearward from the forward end support member in parallel to the plurality of polishing wires and longitudinally slidably supported by the body.

11. The hand-held deburring machine of claim 10, wherein the forward end support member is substantially in a shape of a triangle having an apex defined by a portion of the forward end support member that supports the cylindrical forward end member, the guide rods extending rearward from respective portions of the forward end support member that are adjacent to the other apexes.

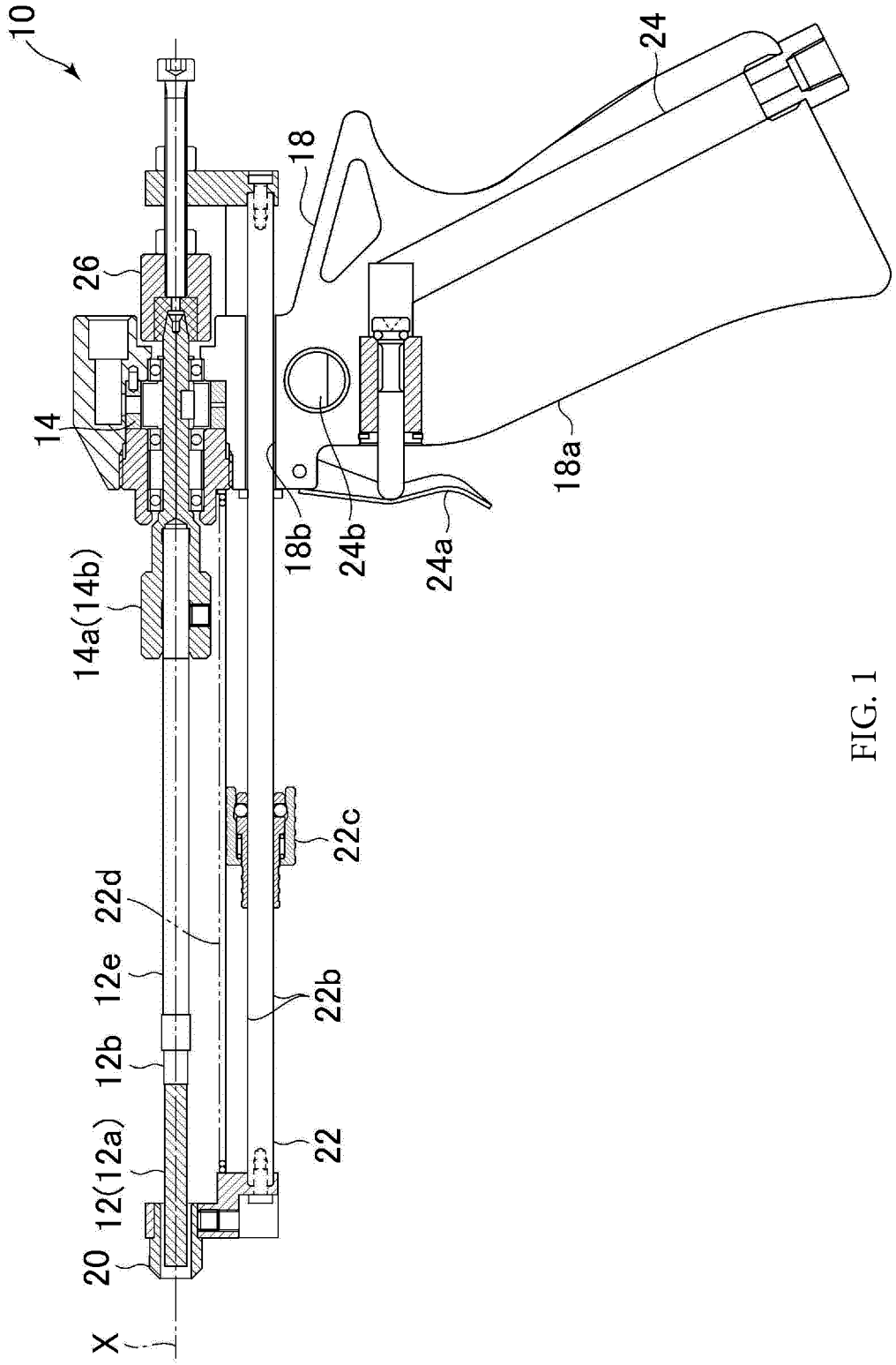
10
24
18
26
14
18a
18b
24b
24a
14a(14b)
22c
22d
12e
22b
12b
12(12a)
22
20
X

FIG. 1

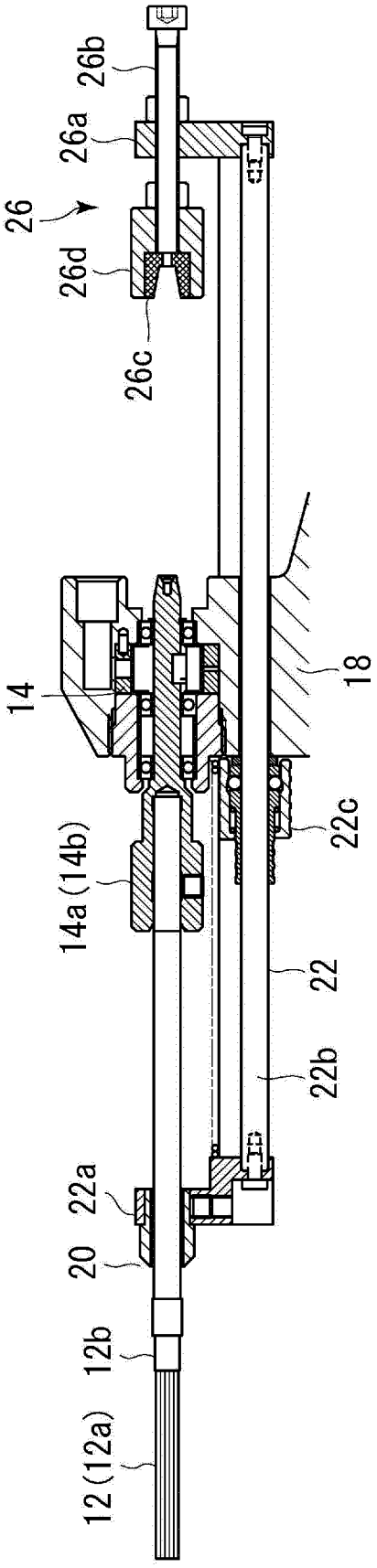

FIG. 2

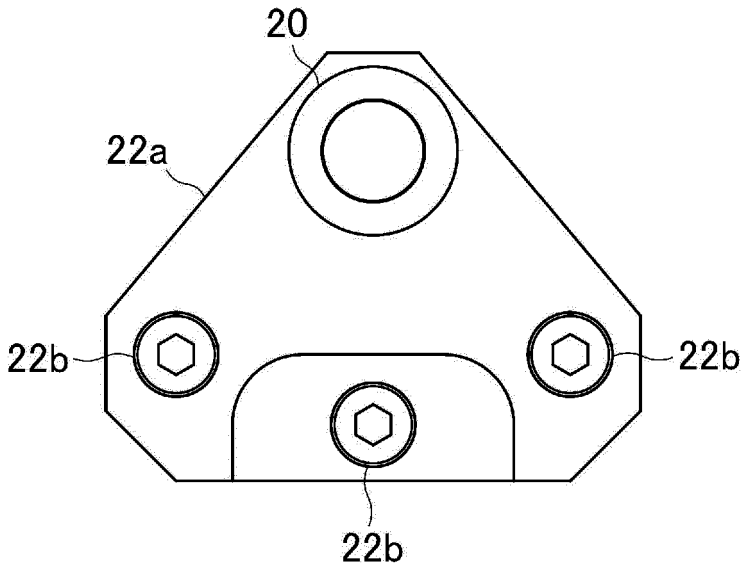

FIG. 3

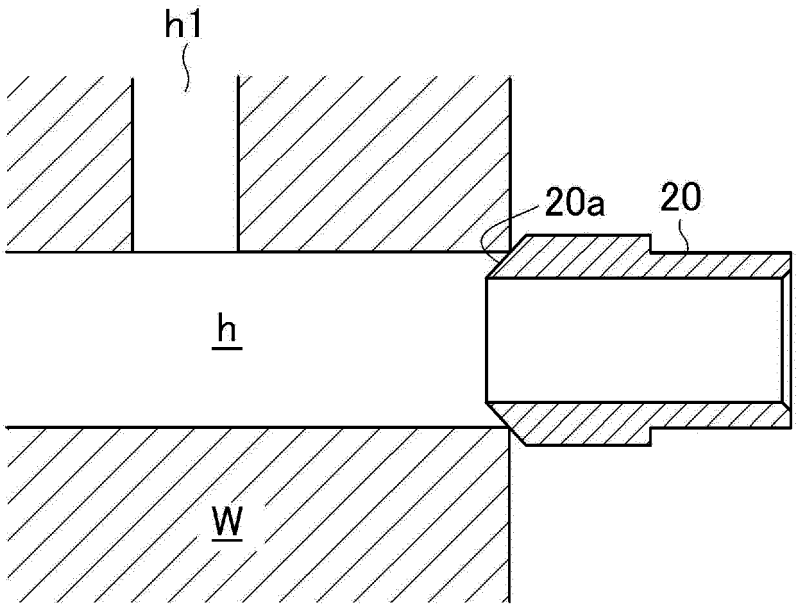

FIG. 4

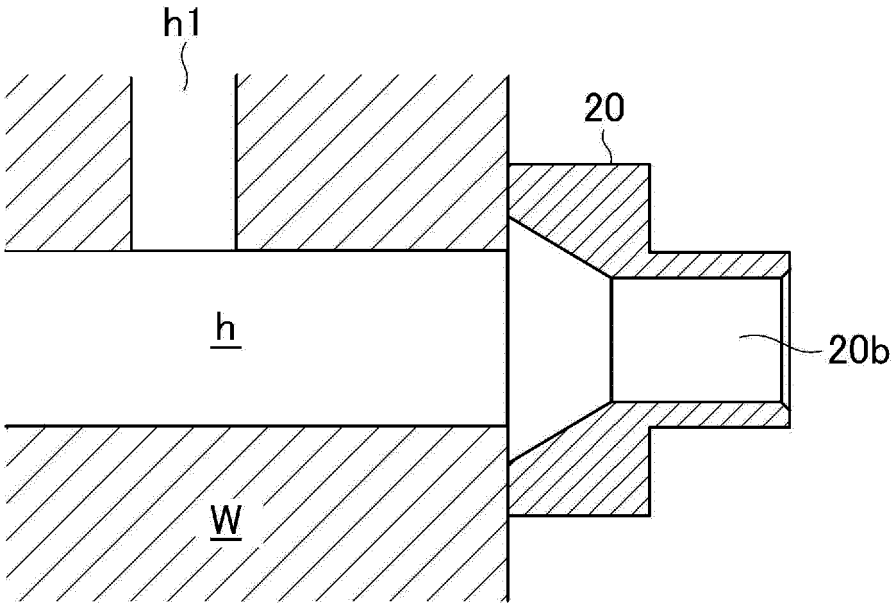

FIG. 5

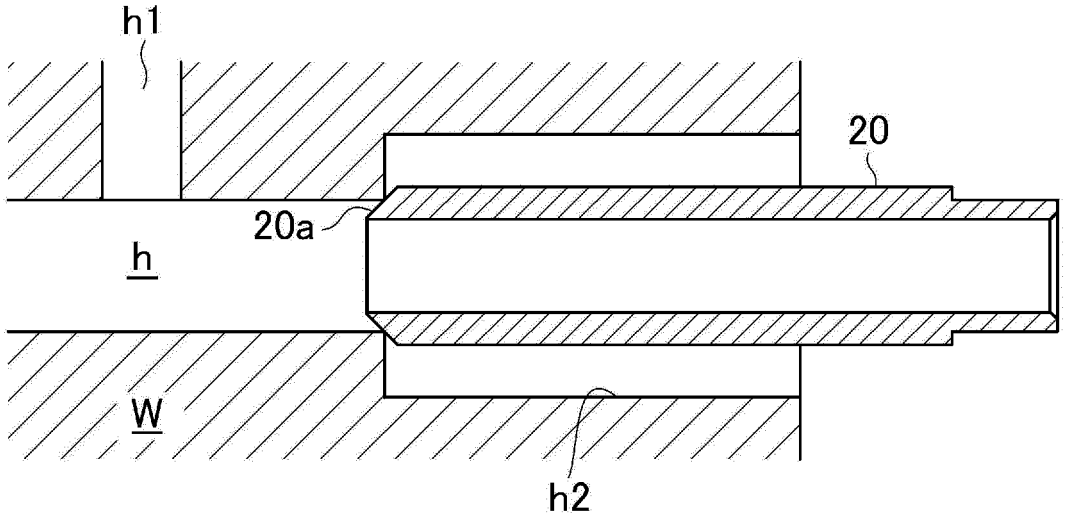

FIG. 6

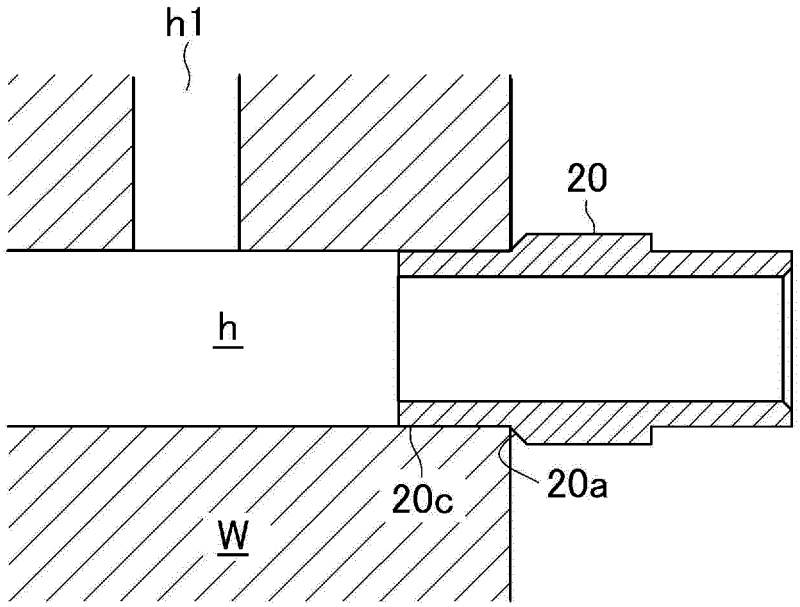

FIG. 7

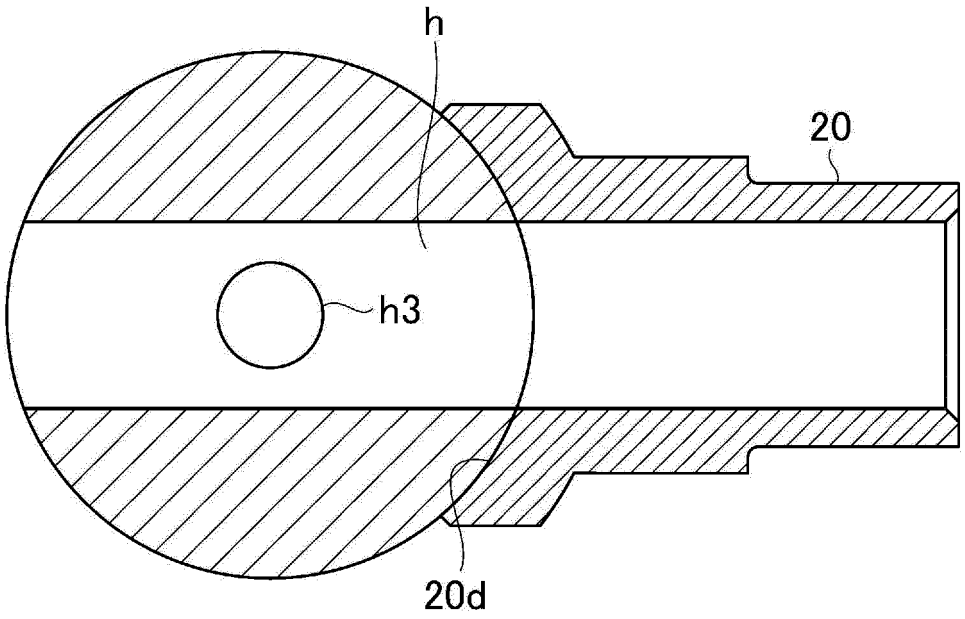

FIG. 8

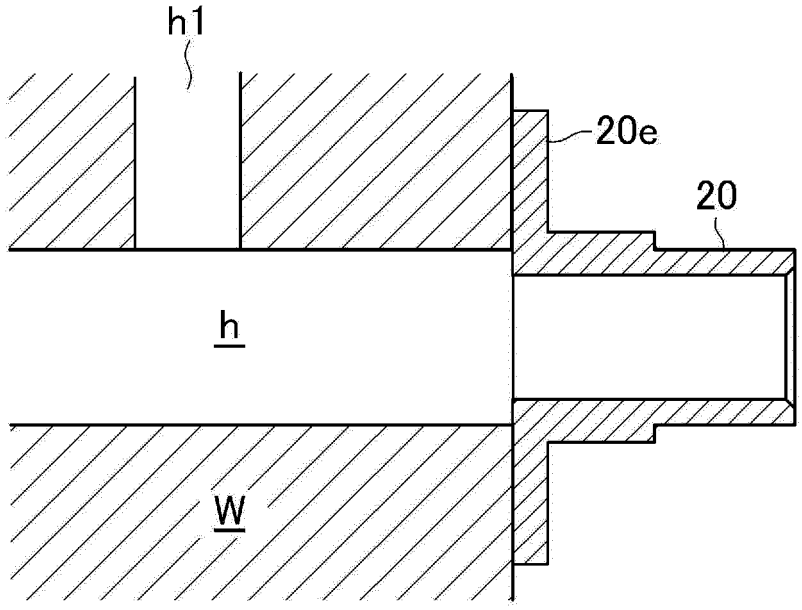

FIG. 9

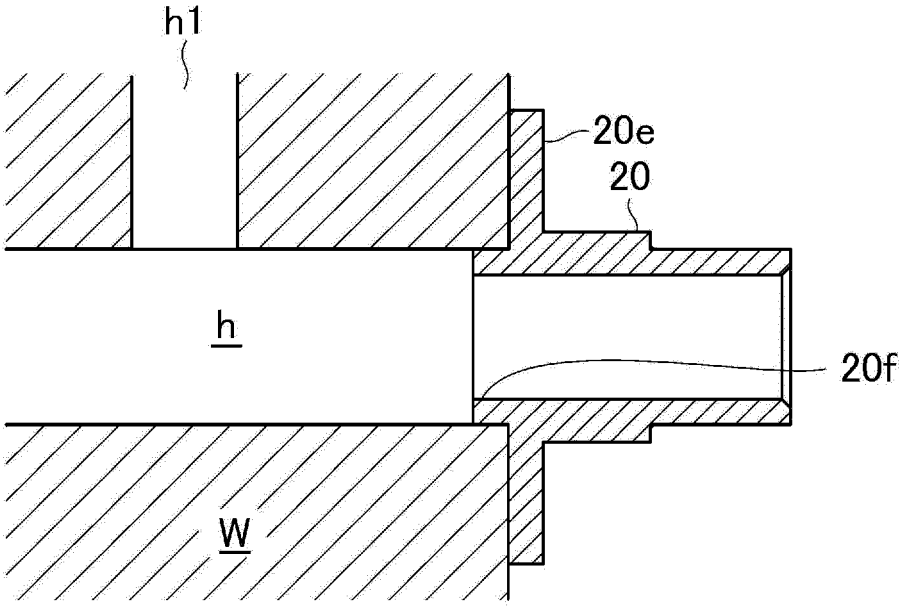

FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/011282

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. B24B23/00(2006.01)i, B24B29/00(2006.01)i

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)
Int.Cl. B24B23/00, B24B29/00

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2013-111738 A (JITSUHARA, Kenji) 10 June 2013, paragraphs [0016]-[0024], fig. 1-2, 8 (Family: none)	1-3, 5, 10-11 7-9
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 5663/1991 (Laid-open No. 102767/1992) (MITSUBISHI HEAVY INDUSTRIES, LTD.) 04 September 1992, paragraphs [0007]-[0015], fig. 1 (Family: none)	1-6 7-9

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

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Date of the actual completion of the international search	Date of mailing of the international search report
16 May 2018 (16.05.2018)	29 May 2018 (29.05.2018)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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