

⑫ **EUROPEAN PATENT APPLICATION**

⑲ Application number: 84304125.2

⑤① Int. Cl.⁴: **F 16 K 31/122**
F 17 C 13/04

⑳ Date of filing: 19.06.84

③① Priority: 22.06.83 JP 112435/83

④③ Date of publication of application:
02.01.85 Bulletin 85/1

⑧④ Designated Contracting States:
DE FR GB

⑦① Applicant: **Chubu Handling Company Limited**
1146, Minami-Ichibashi-cho
Ogaki-shi Gifu-Ken(JP)

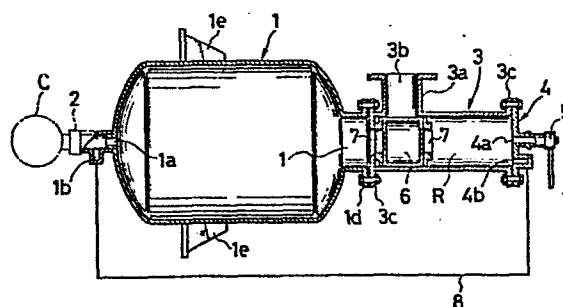
⑦② Inventor: **Masuko, Teruo**
Chubu Handling Co. Ltd 1146, Minami-Ichibashi-cho
Ogaki-shi Gifu-ken(JP)

⑦④ Representative: **Tillbrook, Christopher John**
c/o Reginald W. Barker & Co. 13, Charterhouse Square
London EC1M 6BA(GB)

⑤④ An apparatus for producing gas blast.

⑤⑦ An improved apparatus for producing gas blast is disclosed which includes a high pressure tank (1), a cylinder (3) with a blowing port (3b) opened on the side wall and a piston (6) slidably disposed in the cylinder (3). The latter is provided with a cover (4) having an introducing port (4b) formed at the open end so that the cylinder chamber (R) is in communication with the high pressure gas supply source (C) via a branch inlet port (1b), a branch piping (8) and an introducing inlet (4b). To create differential pressure between the tank (1) and the cylinder chamber (R) cross-sectional area of the branch inlet port (1b), the branch piping (8) and the introducing port (4b) determined larger than that of the inlet port (1a) on the tank (1) so that the piston (6) is held immovable in the cylinder (3) at the position where the blowing port (3b) is closed with the piston (6). When a valve (5) on the cover (4) is actuated to open, back pressure in the cylinder chamber (R) is released to the outside and thereby the piston (6) is displaced away from the tank (1) whereby the blowing port (3b) is opened to produce gas blast. The piston (6) is preferably fitted with seal members (7).

FIG.1



An apparatus for producing gas blast

The present invention relates to an apparatus for producing gas blast and more particularly to improvement of or relating to an apparatus for converting compressed gas in a tank
5 to gas blast in the form of blasting stream.

Gas blast which flows just like explosion wind has been widely utilized in many scientific and engineering fields such as experiments for the study of fluid dynamics in wind tunnel, distribution of granular material over wide area,
10 removal of bridges built in handling pulverized material stored in silo or the like building, cleaning of the interior of pipe or tube or the like.

To produce gas blast at a high operational efficiency the inventor conducted a variety of research and development
15 works and invented an apparatus for producing gas blast. A patent was later granted to him under Japanese Patent Registration No. 966267 (Patent Publication No. 46484/78). In practice, the apparatus of the invention is based on the above-mentioned prior apparatus of the inventor.

20 To facilitate understanding of the invention it will be helpful that the prior apparatus of the inventor will be briefly described below.

The apparatus of the original invention essentially comprises a tank in which pressurized gas is accumulated,
25 a cylinder integrally fitted to the tank with a blowing

0130035

port formed on the one side wall thereof and a piston slid-
ably disposed in the cylinder to normally close the blow-
ing port therewith. The piston is formed with an axially
extending hole by way of which the tank is in communica-
5 tion with the cylinder and a spring is housed in the
cylinder chamber so as to allow it to resume the closed
position after completion of one cycle of gas blasting.
However, it has been found with respect to the prior appa-
ratus that a spring tends to be broken during repeated
10 operations and this leads to interruption of operation of
the apparatus for a long time. Another drawback of the
prior apparatus is that it is not easy to be maintained.

Thus, the present invention has been made with the fore-
going drawbacks in mind and its object resides in pro-
15 viding an improved apparatus for producing gas blast which
assures that operation is performed without any necessity
for spring or the like resilient means.

To accomplish the above object there is proposed accord-
ing to the present invention an improved apparatus for
20 producing gas blast of the type based on the original
invention, wherein the improvement consists in that the
cylinder is provided with a cover having a introducing
port formed at the open end thereof which is in communi-
cation with the high pressure gas supply source via a
25 branch inlet port at the one end of the tank and a branch

5 piping extending between the branch inlet port and the introducing port, that a valve means is provided on the cover so as to release back pressure in the cylinder chamber therethrough and that cross-sectional area of the branch inlet port, the branch piping and the introducing port is determined larger than that of the inlet port on the tank so that differential pressure is created between the tank and the cylinder chamber so as to allow the piston to assume the position where the blowing port is closed with the piston under the effect of back pressure in the cylinder chamber.

15 When the valve means is actuated to open and thereby the piston is displaced away from the tank with back pressure being released to the outside from the cylinder chamber, the blowing port on the side wall of the cylinder is opened to the outside so that gas blast is produced. It should be noted that air is usually employed as working gas.

The valve means is preferably designed and constructed in the form of an electromagnetically operated valve.

20 To inhibit pressurized gas in the tank and the cylinder chamber from leaking to the blowing port, the piston is preferably fitted with seal members at both the front and rear faces thereof.

Other objects, features and advantages of the invention will become more clearly apparent from reading of the

following description which has been prepared in conjunction with the accompanying drawings.

Now, the present invention will be described in a greater details hereunder with reference to the accompanying drawings which illustrate a preferred embodiment thereof, in which:

Fig. 1 is a sectional view of an apparatus in accordance with an embodiment of the invention, schematically illustrating how the apparatus is generally constructed, and

10 Fig. 2 is a fragmental sectional view of the apparatus particularly illustrating an essential part of the apparatus at a time when gas blast is produced.

First, description will be made as to structure of the apparatus. In the drawings reference numeral 1 designates
15 a tank in which compressed air is received. The tank 1 has an inlet port 1a at the lefthand end as seen in the drawing through which compressed air is introduced, whereas it has an outlet opening 1c at the righthand end with a flange 1d being fixedly secured thereto. To firmly
20 attach the tank 1 to other structure a plurality of brackets 1e are provided on the outer surface of the tank 1. As is apparent from the drawing, the inlet port 1a and the branch inlet port 1b are in communication with a compressor C via a check valve 2.

25 Further, in the drawings reference numeral 3 designates a

cylinder which includes flanges 3c at both the ends as seen in the axial direction. The flanges 3c are designed substantially same to the flange 1d of the tank 1. A blowing pipe 3a having a blowing port 3b is projected upwardly of the cylinder 3 as seen in the drawing at the position located in the proximity of the flange 3c. Thus, the axis of the blowing pipe 3a extends at a right angle relative to the axis of the cylinder 3. The lefthand flange 3c of the cylinder is detachably connected to the flange 1d of the tank 1 by means of bolts so that the cylinder 3 is in communication with the tank 1.

On the other hand, the righthand flange 3c of the cylinder 3 has a cover 4 detachably fitted thereto by means of bolts and a discharging port 4a and an introducing port 4b are formed on the flange 4 so that compressed air is introduced into the cylinder 3 through the introducing port 4b and discharged therefrom through the discharging port 4a. It should be noted that the introducing port 4a is designed to have a cross-sectional area larger than that of the inlet port 1a on the tank 1. To establish communication between the introducing port 4b and the branch inlet port 1b there is provided a branch piping 8 which extends therebetween. The discharging port 4a is opened when a valve 5 such as electromagnetically operated valve or the like is operated.

0130035

In the drawings reference numeral 6 designates a fully closed hollow piston which is disposed slidably in the axial direction in the cylinder 6. The piston 6 serves to close the blowing port 3b when it is displaced to the
5 lefthand end of the cylinder 3 located closest to the tank 1. To inhibit occurrence of leakage of compressed air the piston 6 has seal members 7 fixedly attached to both the end faces thereof.

Next, operation of the apparatus will be described below.

10 When the apparatus is in use, the compressor C is first operated with the valve 5 on the cover 4 closed. A part of compressed air delivered from the compressor C is introduced into the tank 1 via the check valve 2 and the inlet port 1a, whereas a part of compressed air is simul-
15 taneously introduced into the cylinder chamber R via the branch inlet port 1b, the branch piping 8 and the introducing port 4b. Since each of the branch inlet port 1b, the branch piping 8 and the introducing port 4b is designed to have a cross-sectional area larger than that of the
20 inlet port 1a, back pressure in the cylinder chamber R becomes higher than accumulated pressure in the tank 1 as compressed air is simultaneously introduced into the tank 1 and the cylinder 3. As a result, the piston 6 is slidably displaced in the cylinder 3 to the lefthand
25 end of the latter at which it is held immovably under the

influence of differential pressure existent between the tank 1 and the cylinder chamber R (see Fig. 1). While the piston 6 is located at the lefthand end of the cylinder 3, the blowing port 3b is closed with the piston 6 and pressure in both the tank 1 and the cylinder chamber R increases gradually with the above-mentioned differential pressure maintained, as compressed air is introduced further into them. As described above, the piston 6 is fitted with seal members 7 at both the ends in such a manner that they come in pressure contact with the inner wall of the cylinder 3, resulting in compressed air being inhibited from leaking from both the tank 1 and the cylinder chamber R irrespective of the fact that increased pressure is existent therein as compressed air is introduced further.

When pressure in the tank 1 reaches a predetermined level, the valve 5 on the cover 4 is actuated to open whereby compressed air in the cylinder chamber R is discharged to the outside via the valve 5. This causes pressure in the cylinder chamber R to be decreased to an atmospheric level instantaneously and thereby remarkable differential pressure is created between the tank 1 and the cylinder chamber R. As a result, the piston 6 is slidably displaced in the rightward direction under the effect of compressed air in the tank 1 whereby communication is established between the tank 1 and the blowing port 3b, causing compressed air

accumulated in the tank 1 to be instantaneously discharged to the outside in the form of blast via the blowing port 3b (see Fig. 2). Incidentally, since arrangement is made such that the valve 5 is kept open for a very short period of about one second, delivering means of compressed air from the compressor C is by no means affected adversely.

After completion of blasting through the blowing port 3b pressure in the tank 1 is temporally reduced to a substantially atmospheric level, while compressed air continues to be introduced into the cylinder chamber R via the branch inlet port 1b, the branch piping 8 and the introducing port 4b. Thus, pressure in the cylinder chamber R becomes higher than that in the tank 1 and thereby differential pressure is resumed therebetween with the result that the piston 6 is returned leftwardly under the influence of back pressure in the cylinder chamber R and thereby the blowing port 3b is closed with the piston 6 again which is held immovable (see Fig. 1). Now, one cycle for producing air blast has been completed.

As will be readily understood from the above description, the apparatus of the invention makes it possible to intermittently produce a series of air blasts by repeating the steps of above-described operations as required.

In the illustrated embodiment a tank 1 is employed as means for accumulating compressed air therein but the

0130035

present invention should not be limited only to this.

Alternatively, any type of commercial high pressure gas bomb (acetylene bomb, nitrogen bomb or the like) may be used.

- 5 Since return movement of the piston 6 to the original position is carried out with the aid of back pressure transmitted into the cylinder chamber R via the branch inlet port 1b, the branch piping 8 and the introducing port 4b, air blast can be produced easily and reliably
- 10 using the apparatus of the invention regardless of how the apparatus is installed either in the horizontal direction in the vertical direction.

As described above, the apparatus of the invention includes a tank 1 and a piston 6 and the latter is adapted to re-

15 turn to the original position where the blowing port 3b is closed with the piston 6 under the effect of differential pressure existent between the tank 1 and the cylinder chamber R so that compressed air accumulated in the tank 1 is discharged to the outside through the blowing port 3b

20 in the form of blast, explosion wind or the like when the valve 5 is actuated quickly so as to establish communication between the tank 1 and the blowing port 3b. Thus produced air blast is advantageously utilized in many application fields such as experiments in wind tunnel for

25 the purpose of study of fluid dynamics, distribution of

granular material over wide area, removal of bridges built when handling powdered material stored in silo or the like building, cleaning of the interior of pipe or tube or the like. Further, since the apparatus of the invention is not
5 provided with a spring which serves as resilient means for return movement of the piston to the closed position and moreover there is no necessity for any passage hole extending through the piston to establish communication between the tank and the cylinder chamber as is the case with the
10 inventor's prior invention, the apparatus can be manufactured in accordance with conventional mass production system at a relatively inexpensive cost and it is easy to be maintained.

While the present invention has been described only with respect to a single preferred embodiment, it should be
15 understood that it should not be limited only to this but various changes or modifications may be made in any acceptable manner without departure from the spirit and scope of the invention.

Claims:

1. An apparatus for producing gas blast of the type including a tank (1) in which pressurized gas is accumulated, one end of said tank (1) being in communication with a high pressure gas supply source (C) and having an inlet port (1a) through which high pressure gas is introduced therein, a cylinder (3) integrally fitted to the other end of the tank (1) with a blowing port (3b) provided on the side wall thereof, said cylinder (3) being in communication with the tank (1) via an opening (1c) at the other end of the latter, and a piston (6) slidably disposed in the cylinder (3) to close the blowing port (3b) while it is kept immovable in the cylinder (3) at the position located closest to the tank (1), characterized in that the cylinder (3) is provided with a cover (4) having an introducing port (4b) formed at the open end thereof which is in communication with the high pressure gas supply source (C) via a branch inlet port (1b) at the one end of the tank (1) and a branch piping (8) extending between the branch inlet port (1b) and the introducing port (4b), that a valve means (5) is provided on the cover (4) so as to release back pressure in the cylinder chamber (R) therethrough and that cross-sectional area of the branch inlet port (1b), the branch piping (8) and the introducing port (4b) is determined larger than that of the inlet port (1a) on the

tank (1) so that differential pressure is created between the tank (1) and the cylinder chamber (R) so as to allow the piston (6) to assume the position where the blowing port (3b) is closed with the piston (6) under the effect of back pressure in the cylinder chamber (R).

2. An apparatus as claimed in claim 1, characterized in that the blowing port (3b) is opened to the outside to produce gas blast when the valve means (5) is actuated to open and thereby the piston (6) is displaced away from the tank (1) with back pressure being released from the cylinder chamber (R) to the outside.

3. An apparatus as claimed in claims 1 and 2, characterized in that the valve means (5) comprises an electromagnetically operated valve.

4. An apparatus as claimed in claim 1, characterized in that the piston (6) is fitted with seal members (7) at both the front and rear faces thereof to inhibit pressurized gas in the tank (1) and the cylinder chamber (R) from leaking to the blowing port (3b).

FIG. 1

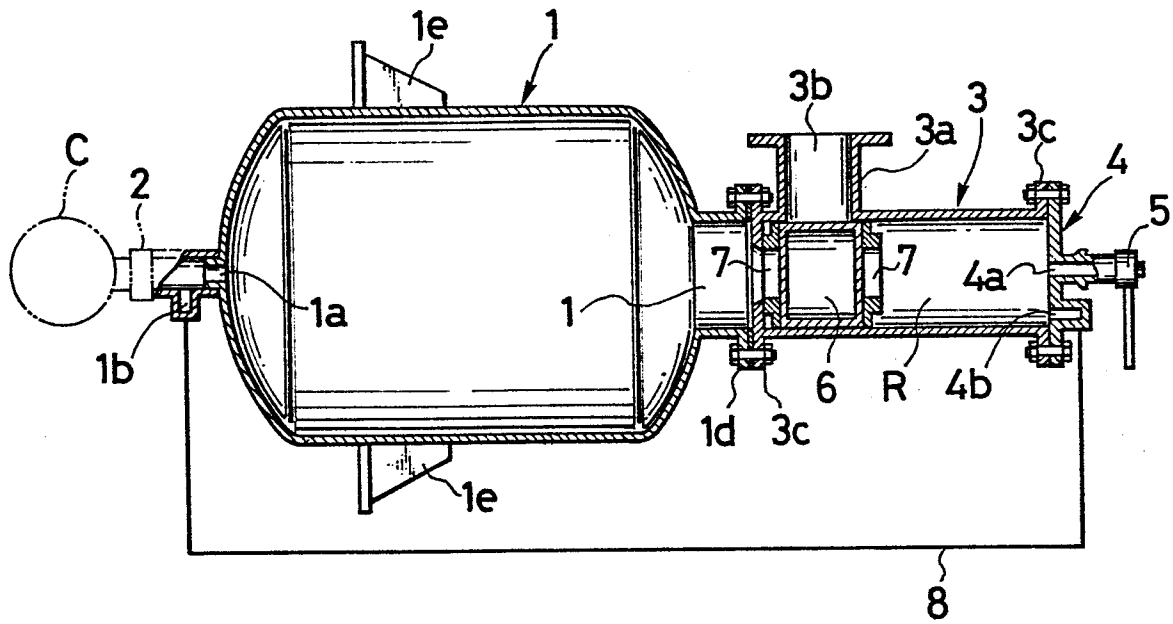
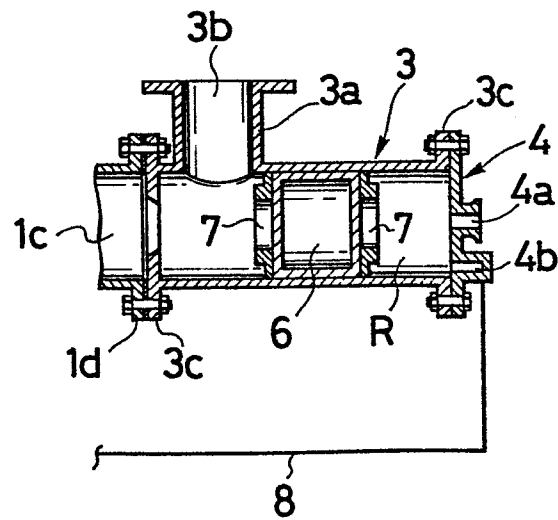


FIG. 2





European Patent
Office

EUROPEAN SEARCH REPORT

0130035

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 84304125.2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X	FR - A1 - 2 429 952 (SIMOENS) * Totality * -----	1,2	F 16 K 31/122 F 17 C 13/04
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			F 16 K F 17 C B 01 D
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 11-09-1984	Examiner MARCHART
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	