Nov. 28, 1950 H. PFENNINGER 2,532,035

BLOWER FOR COMPRESSED COMBUSTIBLE GASES

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Fig. 1.

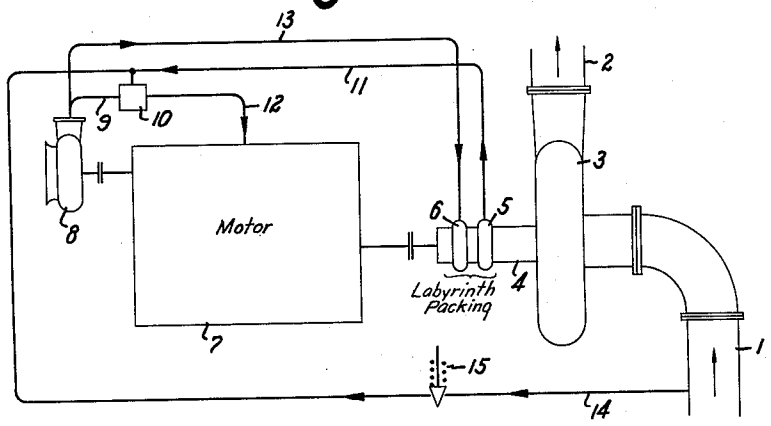
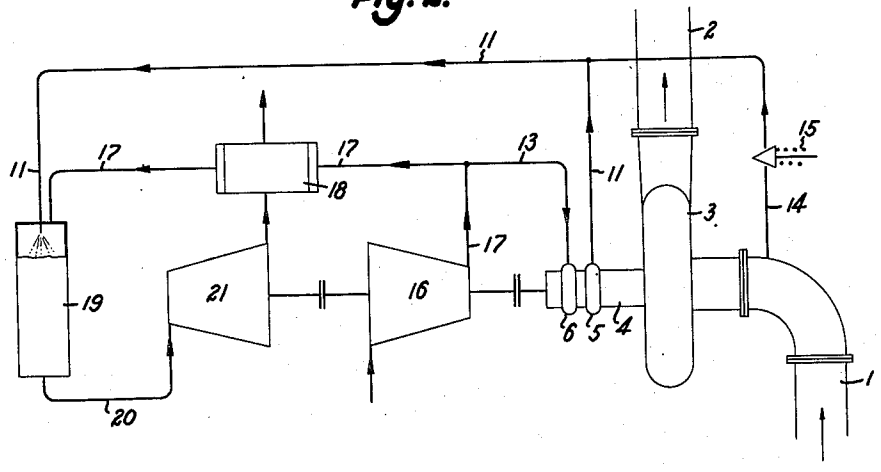


Fig. 2.



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Fig. 3.

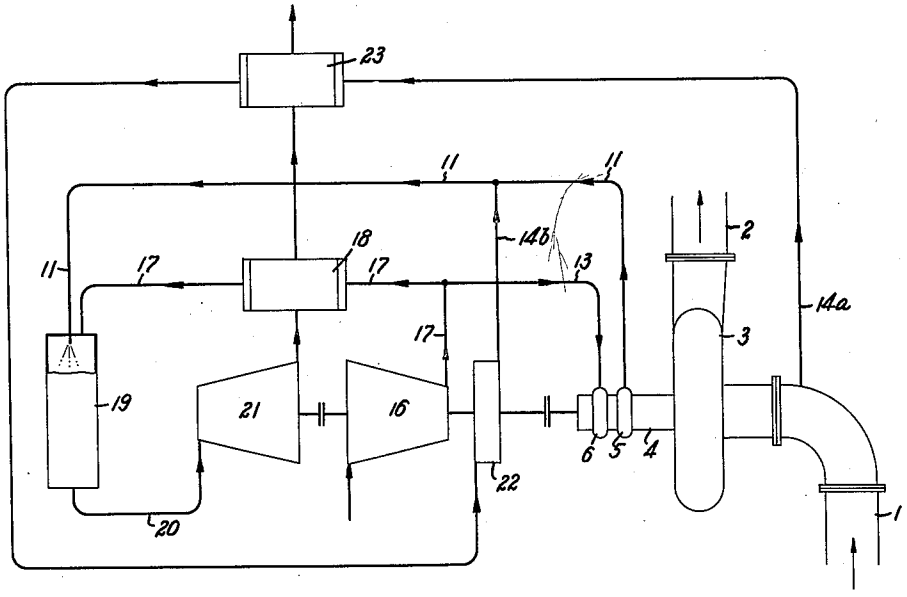
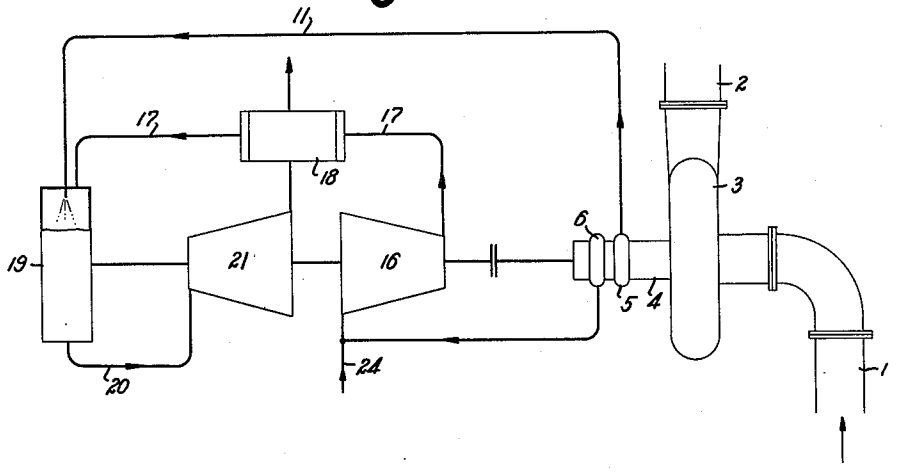


Fig. 4.



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BLOWER FOR COMPRESSED COMBUSTIBLE GASES

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6 Claims. (Cl. 230—48)

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It is often necessary to convey combustible gases great distances, because the places of production, for instance coking plants or gas wells, frequently are at great distances from the places of consumption. In order that the pipe lines shall not be too large and the conveying work shall remain within reasonable limits, the gas is first fairly highly compressed—to about 40–60 kg./cm.²—and in order that this pressure shall be maintained along the pipe line, conveying blowers are interposed in the pipe line at suitable intervals, which compensate the drop in pressure. Electric motors, petrol or Diesel engines may be used as the source of power and, for conveying large quantities, turbine blowers may be used.

On account of the high speed of revolution labyrinth stuffing boxes only are employed as a rule for these turbine blowers; when they are of good construction, the gas losses will remain decidedly low in spite of the high pressures, so that they are regarded as unimportant.

It would seem, however, that hitherto the fact has been overlooked, that the usual gas losses through stuffing boxes, small as they may appear, when compared with the quantity conveyed, in many cases suffice to cover the amount of fuel required for driving the conveying blower. It is therefore proposed, according to the invention, to collect the quantity of gas escaping through the stuffing box of the conveying blower and to use it as fuel for the driving motor of the conveying blower. That this must be advantageous is obvious.

An arrangement for carrying out the method is characterised, in its simplest form, by a conveying blower which is driven by means of an internal combustion engine and has at least one stuffing box connected by a pipe with the internal combustion engine.

When a supercharged motor is used as the driving motor, the gas would first have to be compressed. The present invention can, however, be still further improved. For, as the gas in the conveying pipe is under high pressure, it is possible to tap the stuffing box at a suitable intermediate pressure and to withdraw the gas from the stuffing box at such a high pressure that it can be supplied directly to the supercharged motor. A fractional part of the gas will, it is true, still be lost through the outer part of the stuffing box.

This loss may, however, also be avoided, if the outer part of the stuffing box be sealed with sealing air. As sealing air the supercharging air

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which is present in any case may be used. Instead, however, of using sealing air, the leaking gas may be drawn by suction from the stuffing box by means of a suction blower. In most cases, however, it will suffice, if the suitable place of the stuffing box be connected with the suction branch of the blower or the suction pipe of the driving motor. The sucked-off gases will thus pass to the combustion chamber of the power unit and are thus usefully consumed.

When a gas turbine is used as the machine for driving the conveying blower, the gas blower normally used to deliver gas to the turbine may also be omitted. The stuffing box of the conveying blower will then be tapped at a pressure corresponding to the pressure in the combustion chamber of the gas turbine; in this way the gas turbine requires no gas blower, but only an air blower for the combustion air. In this case as well the compressed combustion air can also be utilised for sealing the stuffing box and thus all the stuffing box gas can be conveyed to the gas turbine.

Should the stuffing box loss be greater than the consumption of the driving motor, the excess can be used for other purposes or blown off. Should the stuffing box loss be insufficient, additional gas under pressure can be withdrawn from the conveying pipe.

As this gas under pressure is highly compressed, it may pay in certain circumstances to use up its expansion work and not to throttle the gas, but to let it work in an expansion motor, for instance an expansion turbine. Should the pressure gas be additionally heated before expansion by waste heat of the main motor, the expansion work can be substantially increased. If the pressure ratio in the expansion turbine be very great, heating the gases before the expansion is even necessary, so as to avoid an excessive cooling down of the gases during the expansion.

The method shall now be more particularly described with reference to several examples of arrangements for carrying it into effect.

In Figure 1 of the accompanying drawings, 1 is the suction side, 2 the pressure side of the conveying blower 3. 4 is the stuffing box, 5 the tapping point and 6 the sealing channel. The motor 7 is charged by the charging blower 8 which is driven either by the motor 7 (as shown) or for instance by an exhaust gas turbine. The pipe 9 conveys the compressed air to the mixing valve 10. Through the pipe 11 the gas flows from the tapping point 5 of the stuffing box 4 also under pressure to the mixing valve 10, from

where the pipe 12 conveys the mixture to the motor 7.

If the outer part of the stuffing box 4, that is the part nearest the place where the shaft emerges, is to be sealed with pressure air, compressed air is conveyed by a pipe 13 to the sealing channel 6.

The motor 7 can also be operated without supercharging, in which case the blower 8 and the pipes 9 and 13 are not required. The sealing by air at 6 can then be effected by a separate sealing blower.

Should the quantity of gas from the stuffing box be insufficient as fuel for the motor 7, additional gas can be supplied from the pipe 1 through a pipe 14 with a reducing valve 15 to the mixing valve 10.

Figure 2 shows an installation, in which the drive for the conveying blower 3 is supplied by a gas turbine. 1 is the suction side and 2 the pressure side of the conveying blower 3. 4 is the stuffing box with the tapping channel 5 and the sealing channel 6. The air blower 16 compresses atmospheric air which flows through the pipe 17 and the preheater 18 to the combustion chamber 19. A portion of the air passes through the pipe 13 as sealing air to the channel 6 of the stuffing box 4. The gas is conveyed from the tapping channel 5 through the pipe 11 also to the combustion chamber 19. The driving gases flow through the pipe 20 to the gas turbine 21, where through expansion to atmospheric pressure they perform so much work that the gas turbine 21 drives both the blower 16 and the conveying blower 3. The expanded waste gases will then in the preheater 18 give off heat to the pressure air.

Should the stuffing box loss be insufficient as fuel for the gas turbine, then through the pipe 14 with the reducing valve 15 additional gas may be conveyed from the pipe 1 into the pipe 11.

The preheater 18 can also be omitted, when more importance is attached to simplicity of the installation than to a low fuel consumption.

Figure 3 shows the same installation as Figure 2, but amplified by the expansion turbine 22 for the additional gas. The additional gas is withdrawn from the suction branch 1 of the conveying blower 3 through the pipe 14*a*, is preheated in the preheater 23 by the waste gases and is then expanded in the turbine 22. From there the expanded gas passes through the pipe 14*b* into the pipe 11 which conveys the stuffing box gas.

Figure 4 shows an installation which also has a gas turbine 21 as the driving motor for the conveying blower. In this case the provision of a separate suction blower is avoided through the part 6 of the stuffing box 4 being connected with the suction branch 24 of the blower 16.

It is thus possible to draw air by suction from the outer part of the stuffing box 4 from the outside inwards to the sealing channel 6 and leaking gas from the inside outwards to the same sealing channel 6 and to convey the mixture to the combustion chamber 19, by conducting it into the suction pipe 24 of the blower 16.

I claim:

1. Apparatus for conveying a combustible gas under pressure comprising a conveying blower having an inlet thereto for the gas to be conveyed and an outlet therefrom for said gas, said blower having a stuffing box, an internal combustion engine connected to drive said blower, and a conduit communicating between the interior of said stuffing box at a point at which the gas is at a substantial superatmospheric pressure and said engine.

2. Apparatus as defined in claim 1 in which the internal combustion engine is a gas turbine and the apparatus comprises a blower for delivering gas to said gas turbine, said conduit communicating between said stuffing box at a point at which the gas therein is at a substantial superatmospheric pressure and the inlet of said gas turbine and a second conduit communicating between said stuffing box at a point at which the gas therein is at a lower pressure and the inlet of said blower.

3. Apparatus as defined in claim 2 in which the second conduit communicates between the stuffing box at a point at which the gas therein is at a lower pressure and the outlet of the blower.

4. Apparatus as defined in claim 2 comprising a second conduit, communicating with the interior of the stuffing box at a point at which the gas therein is at a lower superatmospheric pressure than at said first named point; and means for supplying gas under superatmospheric pressure to said second conduit.

5. Apparatus for conveying a combustible gas under pressure comprising a conveying blower having an inlet thereto for the gas to be conveyed and an outlet therefrom for said gas, said blower having a stuffing box, an internal combustion engine connected to drive said blower, a conduit communicating between the interior of said stuffing box at a point at which the gas is at a substantial superatmospheric pressure and said engine, a charger for the internal combustion engine and a second conduit communicating between said charger and said stuffing box at a point at which the gas is at a lower pressure.

6. Apparatus for conveying a combustible gas under pressure comprising a conveying blower having an inlet thereto for the gas to be conveyed and an outlet therefrom for said gas, said blower having a stuffing box, an internal combustion engine connected to drive said blower, a conduit communicating between the interior of said stuffing box at a point at which the gas is at a substantial superatmospheric pressure and said engine, means for creating subatmospheric pressure and a second conduit communicating between said means and said stuffing box at a point at which the gas is at a lower pressure.

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