PATENT SPECIFICATION

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2772

COMPLETE SPECIFICATION

Improvements in and relating to Expansion Devices for Gases or Liquids

We, RHEINMETALL-BORSIG AKTIENGESELLSCHAFT WERK BORSIG BERLIN-TEGEL, of Berlin Tegel, Germany, a Body Corporate duly organised under the Laws of Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to labyrinth valves for regulating the expansion of gases or liquids under high pressure, more especially in the synthetic production of benzine and ammonia.

Apparatus for this purpose is subject to very high stresses when in operation, because when high pressures are throttled down to atmospheric pressure very high flow velocities arise. The known arrangements are incapable of satisfying these working conditions, and are subject to destruction in a high degree, so that they soon become useless and have to be replaced by others. Another disadvantage is that owing to the severe wear which soon shows itself, a reliable cut-off is not possible, so that in most cases a special stop valve has to be provided.

According to the present invention in a labyrinth valve for regulating the expansion of gases or liquids under high pressure, more especially in the synthetic production of benzine and ammonia, these defects are avoided by arranging a preferably cylindrical valve body, which is annularly grooved and longitudinally adjustable in the manner known *per se* and carries a shut-off cone, with a slight amount of play or clearance in a smooth bore, and by making the annularly grooved portion of the valve adjustable in a portion of the casing or bore which is provided with longitudinal grooves.

The medium which flows in past the shut-off cone flows through the annular gap between the cylindrical shut-off member and the walls of the bore, a fall of the pressure being created in consequence of the resistance of flow and the velocity energy being intermittently destroyed in the successive annular grooves. The amount of medium passing through the device is dependent on the position of the member provided with the annular grooves in the expansion bore at the particular moment. According to the number of annular grooves which are moved out of the ungrooved bore when the spindle is operated, larger or smaller quantities of the expanded medium can be passed through the device and moreover independently of the pressure at which the medium enters the expansion device.

The invention will be further described with reference to the accompanying explanatory drawings which illustrate one embodiment, and in which—

Fig. 1 is a vertical section of the expansion device,

Figs. 2 and 3 being detail views to a larger scale of the co-operating parts.

Referring now to the drawings, the valve or shut-off member 1 which is constructed in the form of a cylindrical rod is arranged in a casing 3 provided with flanges 2, or in a guide member provided in the casing which is so connected to the flange 4 of the force pipe 5 that the expansion bore 7, 12 lies in the direction of the force pipe 5. The valve or shut-off member 1 is provided with annular grooves 9 and is guided with a slight amount of play or clearance in the bore 7 as known *per se*. The shut-off member 1 is operated by a cylindrical stem 11, which is mounted in the part 12 of the bore 7 provided with longitudinal grooves 10. To the flange 2 is attached a casing 14, which receives the screw-threaded spindle 15 for operating the valve or shut-off member 1 and the latter carries on its front end a slender shut-off cone 16, which in conjunction with an interchangeable seat 13 shuts off the force pipe 5.

The medium to be expanded passes, when the valve body 1 is drawn back, through the narrow gap 6, which is formed between the annularly grooved shut-off member 1 and the bore 7, to the longitudinally grooved portion 12 of the bore 7. Under these conditions the medium is expanded down to atmospheric pressure, after which it passes into the

space 17 and out of this latter into the pipe 19 from which it is taken.

When flowing through the annular gap 6 a portion of the pressure energy is destroyed by friction and the speed energy which arises is destroyed in the annular grooves 9, which are arranged at equal distances or at distances which increase towards the outlet end. The further the valve member is withdrawn from the bore 7, the greater will be the quantity of the medium to be expanded which passes through the device. This is accomplished by the fact that the number of annular grooves 9 outside the cylindrical bore 7 becomes greater the more the valve or shut-off member 1 is drawn back and consequently only a small number of annular grooves 9 and a small length of gap will be available for the expansion of the high pressure material. The medium flowing through the device is always expanded down to the same pressure. In this method of expansion the shut-off member is protected from high speeds of the medium, so that this latter has no destructive action on the constructional parts of the expansion device.

The part of the expansion device provided with annular grooves may also be made conical, whereby a change in the quantity of medium passing through the apparatus can be effected with slight adjustment. The shut-off member provided with the annular grooves may also be built up of separate elements which may be of the same or of different diameters. By employing the construction with separate elements a close fit of the shut-off cone 16 to the seat 13 can be obtained when closing the expansion device so that a tight joint is always ensured.

The arrangement according to this invention is obviously not only capable of being used for gases and liquids which are under very high pressures, but may also be used when the medium to be expanded is under lower pressures, that illustrated being especially intended for use in the synthetic production of benzine and ammonia.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A labyrinth valve for regulating the expansion of gases or liquids under high pressure, more especially in the synthetic production of benzine and ammonia, having a valve body, which is annularly grooved and longitudinally adjustable in the manner known *per se* and carries a shut-off cone, arranged with a slight amount of play or clearance in a smooth bore and with the annularly grooved portion of the valve adjustable in a portion of the casing or bore which is provided with longitudinal grooves.

2. A labyrinth valve for regulating the expansion of gases or liquids under high pressure according to Claim 1, further characterised by the fact that the annularly grooved portion of the valve body is generally cylindrical and is located in a cylindrical bore.

3. A labyrinth valve according to either of the preceding Claims including an operating stem separate from but in mutual abutment with the annularly grooved portion of the valve body.

4. A labyrinth valve according to Claim 1 wherein the valve body is of conical or stepped form and is mounted in a correspondingly formed bore.

5. A labyrinth valve for regulating the expansion of gases or liquids under high pressure, more especially in the synthetic production of benzine and ammonia, constructed and adapted to operate substantially as described with reference to the accompanying drawings.

Dated this 17th day of June, 1937.

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FIG. 1.

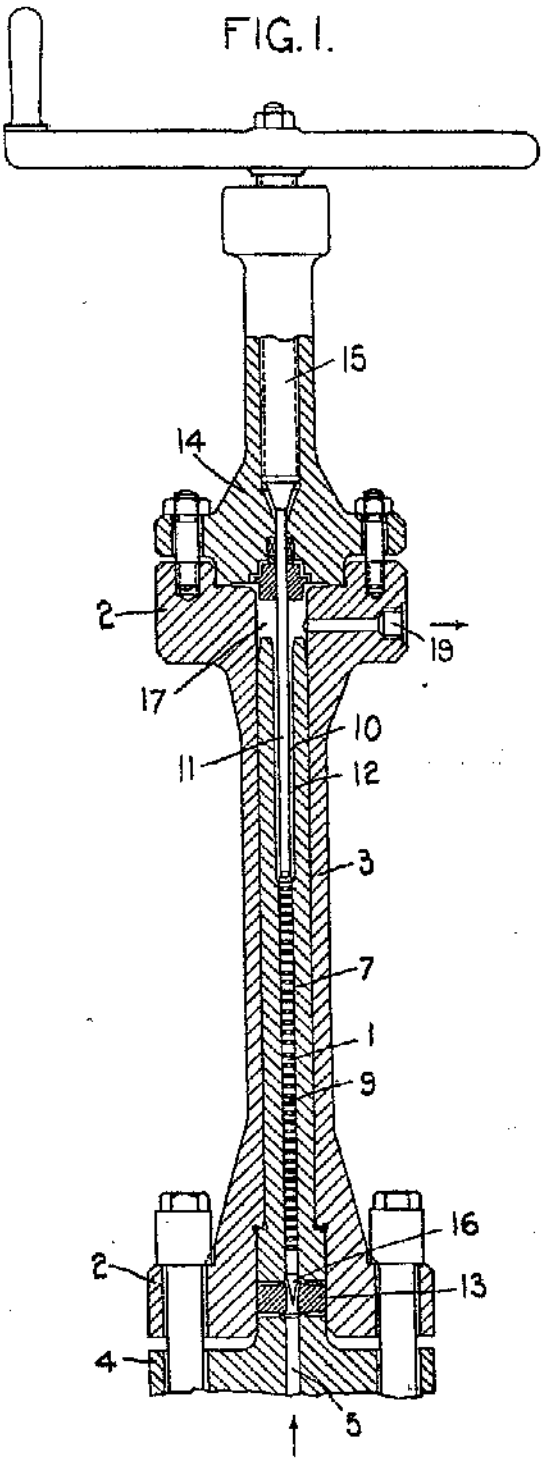


FIG. 3.

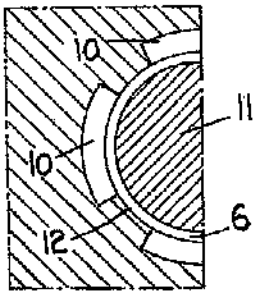
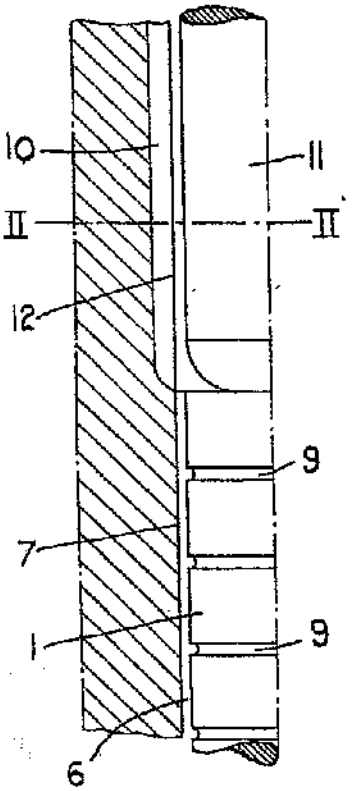


FIG. 2.



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