Aug. 22, 1939. J. L. STECHER ET AL 2,170,353

COMBINATION VALVE AND ENCLOSURE PLATE FOR HIGH PRESSURE REACTION VESSELS

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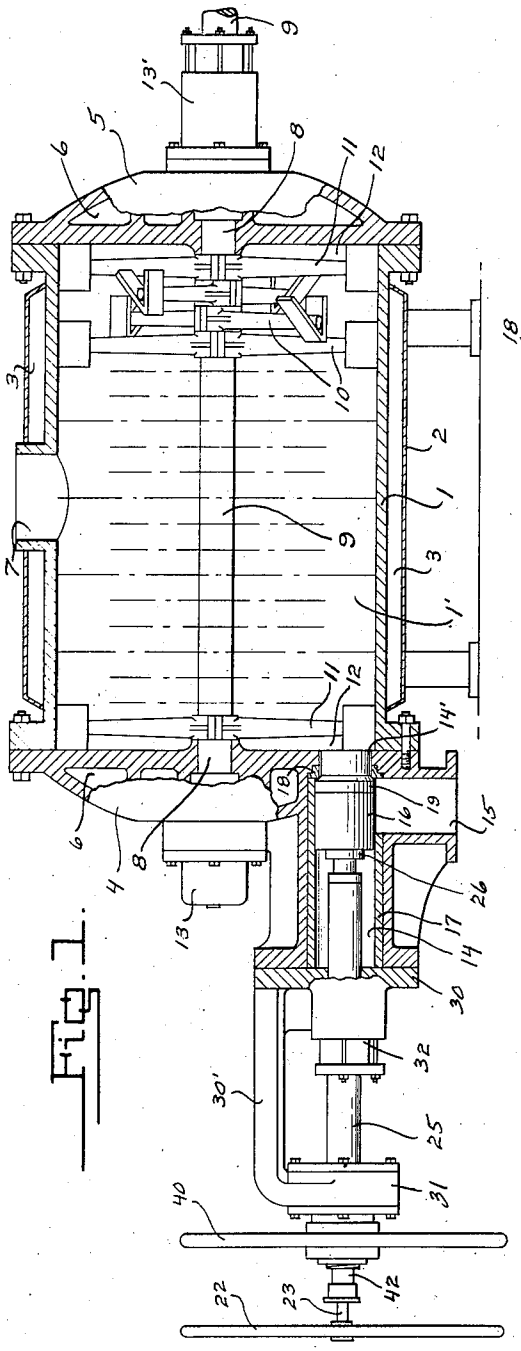


Fig. 1.

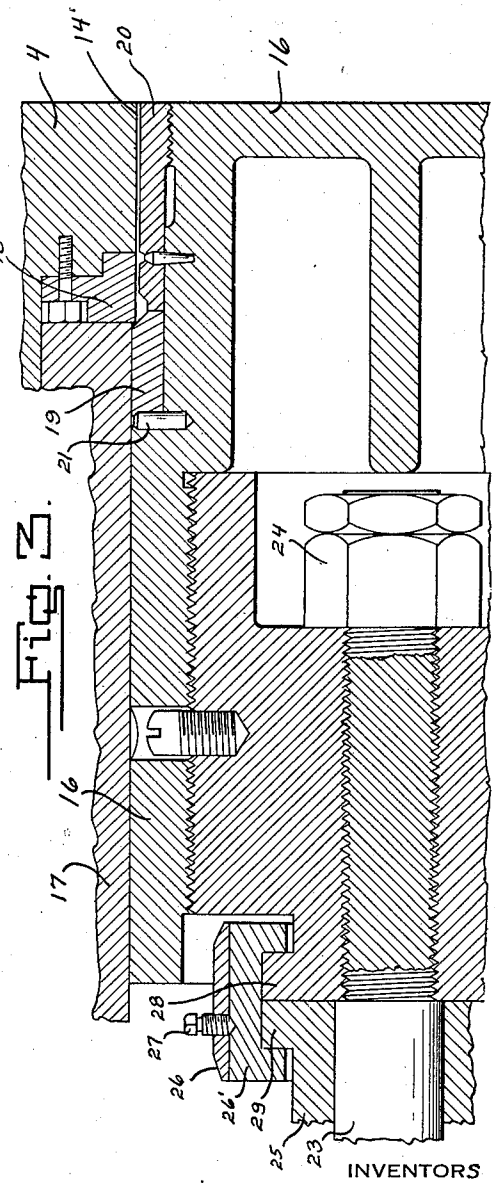


Fig. 2.

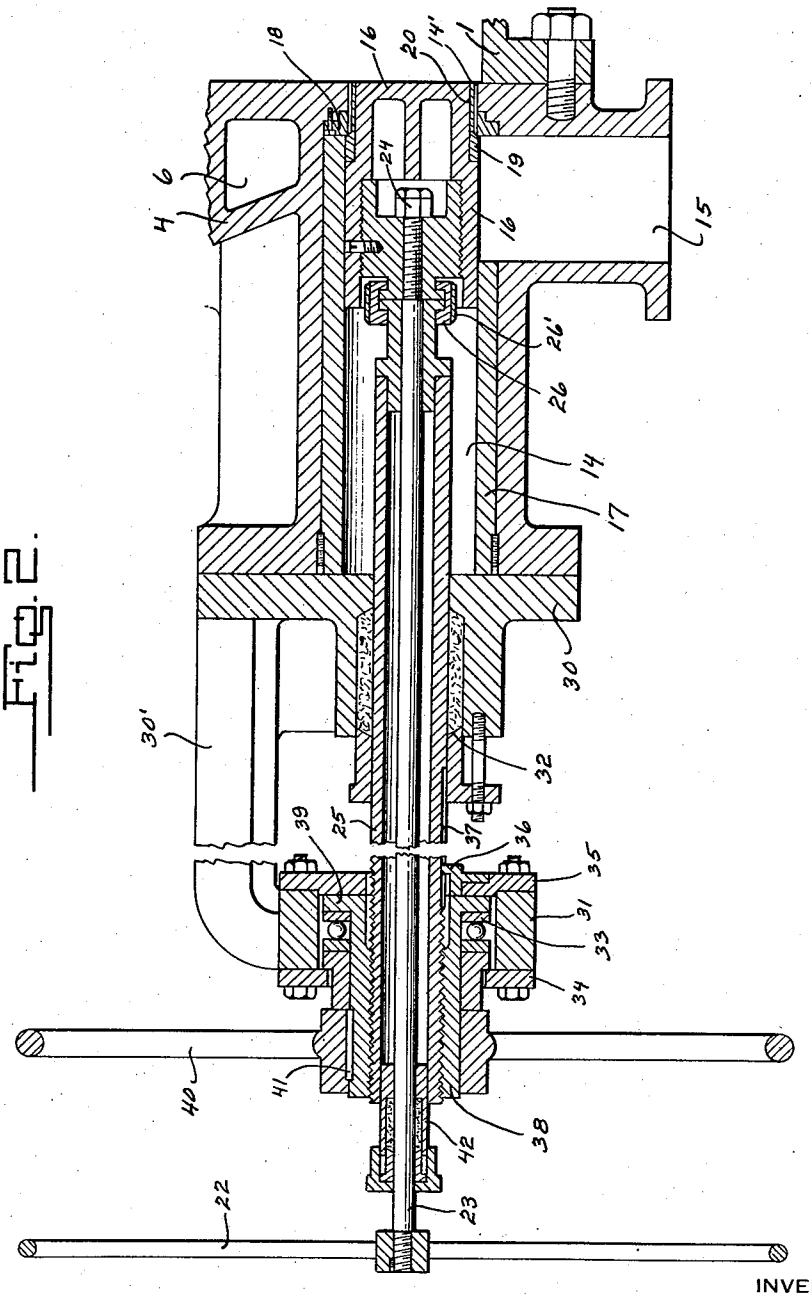
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Fig. 2.



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COMBINATION VALVE AND ENCLOSURE PLATE FOR HIGH PRESSURE REACTION VESSELS

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Application November 19, 1937, Serial No. 175,536

3 Claims. (Cl. 137—21)

This invention relates to a high pressure reaction vessel and to a valve mechanism for controlling the discharge of materials from the vessel. More particularly it relates to a high pressure reaction vessel in which toxic, volatile and granular reactants and products may be safely handled. Still more particularly it relates to the discharge features of such vessels. In its preferred embodiment, the invention pertains to a combined closure plate and valve mechanism for a high pressure reaction vessel.

It is an object of this invention to provide a high pressure reacting vessel with closure elements which prevent the escape of volatile substances and which can be operated to permit the discharge of liquid and granular solid substances. A further object is to provide a reaction vessel with a combined enclosure plate and valve mechanism. A still further object is to provide a valve mechanism and port construction which when in a closed position will eliminate the formation of a dead pocket. A still further object is to provide a valve in which the seating surfaces may be easily cleaned during a closing operation so that a perfect joint may be insured. Other objects will appear hereinafter.

The above and other objects are accomplished by the device described below and illustrated in the accompanying drawings wherein similar reference numerals refer to similar parts throughout the several views.

Fig. 1 is a cross sectional view of a reaction vessel showing our improved valve construction in a closed position.

Fig. 2 is an enlarged view of the discharge port and the valve mechanism associated therewith.

Fig. 3 is an enlarged sectional view of the piston valve and seat structure.

Referring now more particularly to the drawings, the reaction vessel comprises a horizontally disposed cylindrical member 1 forming a chamber 1', which is surrounded by a spaced cylindrical shell 2 to form a space 3 for the circulation of a heat exchange medium. The chamber is provided with end plates 4 and 5 which are internally constructed with jacket spaces 6 to allow for the flow of heat exchange medium. A charging port 7 is placed in the upper central part of chamber 1 and the end plates 4 and 5 have openings at their center portions which contain antifriction bearings 8 for supporting the respective ends of agitator shaft 9.

The agitator shaft 9 may contain a series of flight arms 10 for agitating the contents of the vessel. The arms are preferably equally spaced both radially and along the shaft to form a broken spiral. The arms may be of any design but preferably are of the type described in U. S. Patent 210,491 to Brightman. Such flight arms have an agitating action when shaft 9 is turned in one direction and a conveying action when the shaft is turned in the opposite direction. The end flight arms 11 are provided with a scraping portion 12 which keeps material from collecting upon the end closure plates 4 and 5. A cap 13 is placed over one end of the shaft 9 and is attached to closure plate 4 and a stuffing box 13' is placed over the other end of the shaft 9.

The end closure plate 4 at its bottom exterior edge has an outwardly extending portion which contains a cylindrical valve chamber 14. The valve chamber communicates with the reaction chamber 1' at 14'. A conduit portion also communicates with the chamber 14 as shown at 15 and forms an outlet from the valve chamber.

As will be apparent from Fig. 2, the valve chamber opening 14' to the reaction chamber is sealed by piston 16 which is shown in a closed position within sleeve 17. The sealed surfaces comprise an annular seat 18 which is mounted near the inner end of the valve chamber 14 and an annular seating sleeve 19 which is mounted upon the outer end of the piston 16 and held in place by collar 20 and locked in position by pin 21. The annular seat 18 and seating sleeve 19 are hardened. It will be noted that the piston is reduced in diameter just beyond the annular seating sleeve 19 and snugly fits within the chamber opening 14'. A hand wheel 22 is rigidly fixed to valve rod 23 which in turn is rigidly connected to piston 16 by means of the nut 24. The piston is also connected to a tubular valve stem 25 through an interlocking collar 26 and 26' and annular ridges 28 and 29 formed upon the piston 16 and tubular valve stem 25 respectively. The collar 26 consists of an annular ring which snugly fits over a slit annular ring 26', the ring 26' being diametrically split for convenience in assembly. Rings 26 and 26' are locked in close fitting relationship by means of the set screw 27. The annular ridge member 29 may be integral with the tubular valve stem 25 or separate and rigidly connected thereto. The tubular valve stem 25 is supported in the respective legs 30 and 31 of yoke member 30' which is mounted upon the outwardly extending portion of the end closure plate 4. A stuffing box 32 is formed in an enlarged portion of the leg 30 of the yoke member, and an antifriction bearing assembly 33 is mounted in the outer leg 31 of yoke

member 30'. The bearing assembly is maintained in place by annular plates 34 and 35 which are bolted to the leg 31. A key 36 is formed on plate 35 which fits into slot 37 of valve stem 25 and prevents the same from turning during operation. The outer end of the tubular sleeve 25 is externally threaded to cooperate with the internal threads of the annular member 38 which has an annular ridge 39 at its outer edge. A hand wheel 40 is fixedly attached to the annular member 38 by means of key 41. A stuffing box 42 is firmly attached in the end of the tubular valve stem 25 and provides a bearing surface for the valve rod 23.

The operation of the device is somewhat as follows: Materials are charged into the reaction chamber 1' of the vessel 1 and the desired process is started. If necessary, a heat exchange medium is circulated through the annular spaces 3 and 6 to bring the contents of the vessel up to some predetermined temperature. During the processing the agitator shaft is continuously rotated to keep the contents of the vessel in a uniform state of agitation. Thus a reduction gear assembly (not shown) may be operatively connected to the outer end of the shaft 9. The gear assembly should have a reversing mechanism. After the contents of the vessel have been processed to the desired degree, the agitation is stopped and the hand wheel 40 is rotated to remove the piston valve 16 from its closed position. The shaft 9 is thereupon rotated in the reverse direction so that the flight arms 10 have a conveying action and move the material toward the discharge opening 14'. As soon as all the material has been forced out of the reaction vessel the piston valve is then moved to closure position by turning the hand wheel 40 in the opposite direction. As soon as the annular seating ring 19 is in approximate seating position, the hand wheel 22 is turned. This causes the entire piston valve assembly to rotate and any solid particles which are maintained upon the valve seating surfaces are dislodged. Thus, during the final stage of the closing operation both hand wheels 40 and 22 may be rotated to bring the seating surfaces into a tightly sealed position.

The apparatus above described is of general utility in the arts and may be used for other purposes than chemical reaction vessels. Thus the apparatus may be used in driers, agitating vessels, high pressure cooking vessels, for rendering fats, etc. Due to the novel construction which permits cleaning of the seating surfaces during the closing operation, this invention is especially adaptable where the material handled contains granular particles. Pressures up to 100 lbs. and higher may be successfully maintained with a valve of 8 inch size.

While the form of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms may be adopted without departing from the spirit and substance of the broad invention, the scope of which is commensurate with the appended claims.

We claim:

1. A piston valve comprising a cylindrical valve chamber, an axially disposed inlet port communicating with said chamber, a valve seat juxtaposed about said port, a radial discharge port communicating with said chamber, an axially and rotatably movable piston valve snugly fitting in said chamber, a threaded sleeve connected to said piston valve and a hand wheel operatively attached thereto for axially moving the valve, a rod attached to said valve extending through said sleeve and a hand wheel attached thereto for rotating said valve.

2. A combination valve and enclosure plate for a reaction vessel comprising an end plate having an outwardly extending cylindrical valve chamber, an axial inlet port communicating therewith, a radial discharge port in said chamber, an annular valve seat disposed near said inlet port, a piston valve snugly fitting in said chamber, means for moving said valve axially in said chamber and separate means for rotating said valve for cleaning said seat, the seating surfaces comprising a hardened annular ring upon said valve and a hardened annular ring in said chamber.

3. A piston valve comprising a cylindrical valve chamber, an axially disposed inlet port communicating with said chamber, a valve seat juxtaposed about said port, a radial discharge port communicating with said chamber, an axially and rotatably movable piston valve snugly fitting in said chamber, a threaded sleeve connected to said piston valve, and a hand wheel operatively attached thereto for axially moving the valve, a rod attached to said valve extending through said sleeve and a hand wheel attached thereto for rotating said sleeve, the sleeve being supported in a U-shaped yoke member attached to the valve chamber.

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