

[54] CLOSURE APPARATUS

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Primary Examiner—Lloyd L. King

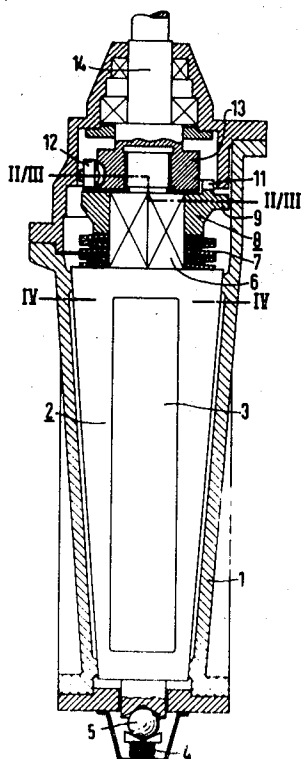
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[57] ABSTRACT

A closure apparatus is provided for passing materials therethrough into an opening of a chamber in which the pressure can range in value above or below atmospheric pressure and for sealing chamber pressure tight after the materials are placed therein. The apparatus has a conical member having a longitudinal axis. A

housing dimensioned to accommodate the conical member is also provided. The conical member has a slot extending therethrough and is journaled in the housing so as to be rotatable to open and close positions whereat the slot is aligned with the opening of the chamber and the slot is closed with respect to the latter respectively. A stud extends from the wider end of the conical member in a direction along the axis of the latter. A pressure piece is in non-rotational engagement with the stud and is slidably mounted thereon so as to be movable along this axis. A spring is seated on the stud between the end of the conical member and the pressure piece for applying a pressure force against the latter. A rotatable drive member is provided and has a bearing means in engagement with the pressure piece. A cam surface is provided on the pressure piece and supports the bearing means and presses thereagainst by the action of the spring. The housing has grooves extending to an arc corresponding to an angle of substantially 90° and a pressure piece is provided with projections extended into these grooves respectively, so that the pressure piece and the conical member are rotatable by a rotation of the drive member through an angle up to 90° between the open and closed positions. The cam is contoured to permit the bearing means to move therealong and to move the pressure piece along the axis against the spring force in response to a continued rotation of the drive member passed the closed position, whereby the conical member is seated pressure-tight in the housing.

5 Claims, 5 Drawing Figures



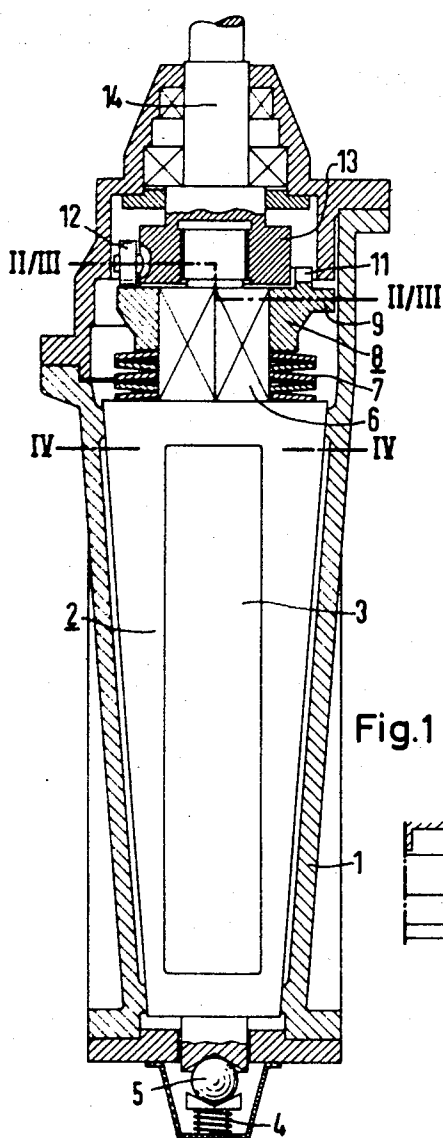


Fig. 1

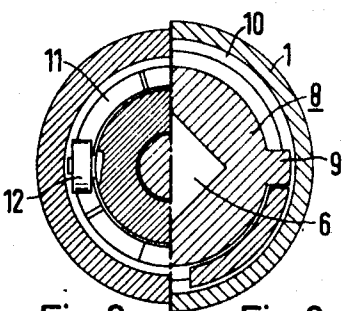


Fig. 3

Fig. 2

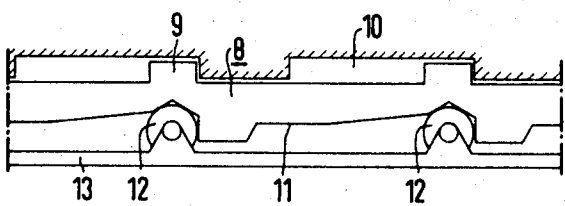


Fig. 5

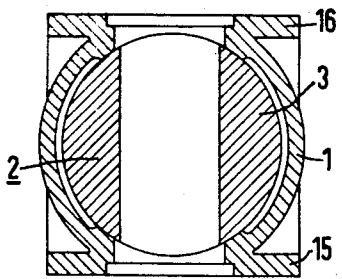


Fig. 4

CLOSURE APPARATUS

My invention relates to closure apparatus used in connection with the introduction of radioactive pellets in envelope tubes. To introduce such pellets in the envelope tubes, the tubes and the chamber in which the pellets are located must be evacuated in advance. For introducing the pellets into the chamber and to seal the chamber after introducing the pellets, a closure apparatus having a conical member can be used.

In nuclear technology nuclear fuel rods are used in many instances and comprise envelope tubes having a length of several meters. Into these tubes must be placed the radioactive material which is in pellet form. The small tolerances existing between the outer diameter of the pellets and the inner diameter of the envelope tube inhibit the simple and fast introduction of the pellets into the tubes, because the air compressed in the tubes by the insertion action cannot escape between the pellets and inner wall of the envelope tube.

In order to prevent this undesirable effect, the envelope tubes are evacuated prior to insertion of the pellets. To achieve this effect each pellet stack is placed in turn into a chamber which together with the envelope tube connected with the latter is evacuated, so that a subsequent introduction of pellets into the envelope tube can be undertaken.

It is an object of my invention to provide a closure and passage apparatus for a chamber of the kind discussed above, which receives the pellet stacks. The apparatus according to the invention must provide an opening sufficiently large to permit the introduction of the pellet stacks as well as permit the chamber to be closed air-tight against the ambient.

It is another object of my invention to provide such a closure apparatus of a construction that requires only little space for its installation, so that the channels used to introduce and remove the full and empty pellet stacks are brought as tight and close to each other as possible.

The invention relates to a closure apparatus for use of conjunction with the chamber in which the pressure can be above or below atmospheric pressure. The closure apparatus is provided with a passage suitable for passing materials therethrough into an opening of a chamber and for sealing the chamber pressure tight after the materials are placed therein. According to a feature of the invention the conical member having a slot or passage extending therethrough is journaled in a housing so as to be rotatable therein to open and close positions whereat the slot is aligned with the opening of the chamber and the slot is closed with respect to the latter respectively. The conical member is provided with a stud extending from the wider end of the latter and a pressure piece is positioned thereon in non-rotational engagement therewith as well as being slidably mounted thereon so as to be movable along the longitudinal axis of the conical member. According to another feature, a spring is seated on the stud intermediate the aforementioned end of the conical member and the pressure piece for applying a pressure force against the latter. A rotatable drive member engages the pressure piece the latter being provided with a cam surface for supporting the drive member in bearing relation thereagainst by the action of said spring. The housing is provided with grooves extending in an arc corresponding to an angle of substantially 90° and the

pressure piece has projections extending into these grooves respectively, so that the pressure piece and the conical member are rotatable by a rotation of the drive member through an angle up to the 90° between the open and closed positions. The cam surface is contoured to permit bearing the drive member thereon in a manner that renders the pressure piece movable along the longitudinal axis of the conical member and against the force of the spring, this action being in response to a continued rotation of the drive member past the closed position, whereby the conical member is seated and braced pressure-tight in the housing.

The invention will now be described with reference to the drawings wherein:

FIG. 1 is an elevation view, partially in section of a closure apparatus according to the invention;

FIG. 2 is a cross-sectional view taken at line II—II of the right hand portion of the closure apparatus illustrated in FIG. 1. The section view shows the protrusion on the pressure piece accommodated in grooves of the apparatus housing;

FIG. 3 is a cross-sectional view taken at line III—III of the left hand portion of this closure apparatus illustrated in FIG. 1. The section view is taken through the drive portion of the apparatus and shows the follower rollers.

FIG. 4 illustrates a cross-section of the apparatus taken at line IV—IV through the conical portion of the apparatus; and

FIG. 5 illustrates a development of the control cam and the grooves of the housing in which the protrusions on the pressure piece are accommodated.

Referring to FIG. 1, reference numeral 1 designates the housing 1 in which a conical pin member, 2 is rotatably journaled. The pin member 2 has a longitudinal slot 3 having dimensions that permit passing therethrough the pellet stacks containing the pellets. The pin member is journaled at its smaller end through the assistance of a bearing 5 that is acted upon by a spring 4. At its other end, the pin member is provided with a drive stud 6 upon which is seated a spring arrangement 7. In addition, a pressure piece 8 is slidably mounted on stud 6 and is in shape-constrained (non-rotationable) engagement therewith.

As seen from FIG. 2, the pressure piece 8 has two protrusions 9 positioned at respective locations 180° from each other. The protrusions 9 engage into grooves or slots 10 in the housing 1. The grooves 10 occupy such a portion of the periphery of the housing 1 that the protrusions 9 and therewith the pressure piece 8, the stud 6 and the pin member 2 joined thereto are all rotatable through an angle of 90°.

On the left side of the pressure piece 8 there is provided a control cam 11 which is engaged by follower rollers 12. Rollers 12 are secured to a drive member 13 which is joined to an actuating shaft 14, the latter being similarly rotatably journaled in the housing 1 of the closure apparatus.

The housing 1 is provided with flanges 15 and 16 at both sides respectively as illustrated in FIG. 4. One of these flanges is joined to the device that introduces the pellet stacks and the other flange is joined to the container receiving these stacks, the latter being evacuated after each introduction of these stacks. The shape of the control cam and the relative position thereof to the protrusions 9 on the pressure piece 8 is illustrated in the projection of FIG. 5. This drawing illustrates a drive

member 13 with the rollers 12. The movement of the protrusion 9 in the slots 10 of the housing 1 is likewise illustrated in FIG. 5. In viewing this drawing, the plane of the protrusions 9 with the grooves 10 must be considered as being displaced 90° with respect to the control cam 11.

In the illustrated position of the pin member 2, the pellet stacks can be either inserted or removed and the two spaces which border on the flanges 15 and 16 communicate with each other. By turning the actuating shaft 14, the drive member 13 is also turned in the sense corresponding to a leftward movement of the rollers 12 in FIG. 5. The rollers 12 are shown to lie in the illustrated position in respective recesses of the control cam 11, so that the pressure piece 8 moves likewise to the left. This movement causes a rotation of the pin member 2 in a counterclockwise direction. After turning the pin member 2 via the stud 6 and the pressure piece 8 through 90°, the protrusion 9 lies on the other side of the slot 10 so that an additional turning is no longer possible. Should the drive member 13 in FIG. 5 be turned to the left an additional amount in the same direction, the rollers 12 will wander on the control cam 11 further to the left. In this way the pressure piece is held tight and moves in dependence upon the contour of the control curve against the force of the spring arrangement 7, so that the pin member 2 is axially braced in its closed position. The axial bracing of the pin member 2 causes the latter to be seal tight in the housing 1. By means of an opening in the closure apparatus, the actuating shaft 14 and the drive member 13 are moved in the opposite direction. Since with a tensioned spring arrangement 7, the moment needed for turning the pin member 2 is very high, the rollers 12 first return to the position shown in FIG. 5 on the control cam on pressure piece 8. In this way the tension in the spring 7 releases and the bearing 5 loosens the tight seating of the pin member 2 in the housing 1 by means of the force of spring 4, the latter being greater than the force exerted by the spring 7 in its released condition. A further movement of the rollers 12 on the control cam 7 of the pressure piece 8 toward the right is not possible because of the stop, so that the projections 9 on the pressure piece 8 then move to the right until they reach the same position illustrated in FIG. 5. In this manner, the pin member 2 returns to the open position illustrated in FIG. 1. The higher adhesion force conditioned by the pin seating is more easily overcome by the dynamic action of the already moving drive member (Hammerschlag-Effect).

For the application already suggested, the described closure apparatus affords the decisive advantage over the known slider arrangements required to provide a pressure tight seal in that it affords a large space saving. This is especially true when it is considered that several closure apparatus according to the invention can be placed next to each other so that every other one of the apparatus is positioned so that its small side or small end is placed next to the large end of the next adjacent pin member. In this way, with minimal dimensioning, an optional use of the available space for construction is used and a complete sealing against the ambient is obtained with an easy movement of the apparatus.

While the invention is described by means of a specific example, I do not wish to be limited thereto, for obvious modifications will occur to those skilled in the

art without departing from the spirit and scope of the invention.

I claim:

1. Closure apparatus for passing materials there-
through into an opening of a chamber in which the
pressure can range in value above and below atmo-
spheric pressure and for sealing the chamber pressure
tight after the materials are placed therein comprising
a conical member having a longitudinal axis and having
first and second ends of wide and narrow cross-section
respectively, a housing dimensioned to accommodate
said conical member, said conical member having a slot
extending therethrough and being journaled in said
housing so as to be rotatable to open and closed posi-
tions whereat said slot is aligned with the opening of the
chamber and said slot is closed with respect to the lat-
ter respectively, said conical member having a stud ex-
tending along said axis from said first end, a pressure
piece in non-rotational engagement with said stud and
slidably mounted thereon so as to be movable along
said axis, spring means seated on said stud intermediate
said first end and said pressure piece for applying a
pressure force against the latter, a rotatable drive mem-
ber having bearing means for engaging said pressure
piece, control cam means disposed on said pressure
piece for supporting said bearing means and pressing
thereagainst by the action of said spring means, said
housing having grooves extending in an arc corre-
sponding to an angle of substantially 90°, said pressure
piece having projections extending into said grooves
respectively, so that said pressure piece and said conical
member are rotatable by a rotation of said drive
member through an angle up to said 90° between said
open and said closed positions, said cam means being
contoured to permit said bearing means to move there-
along and move said pressure piece along said axis
against the spring force of said spring means in re-
sponse to a continued rotation of said drive member
past said closed position, whereby said conical member
is seated pressure-tight in said housing.

2. Closure apparatus according to claim 1 comprising
ancillary spring means disposed at said second end of
said conical member for applying a force thereagainst
in the direction along said axis.

3. Closure apparatus according to claim 1, said bear-
ing means being rollers rotatably mounted on said drive
member to permit said rollers to be rolling contact with
said cam means.

4. Closure apparatus according to claim 1, said pro-
jections extending from said pressure piece in a direc-
tion radial of said axis, said pressure piece having a sur-
face facing drive member, said cam means being a mesa
like portion extending above said surface and defin-
ing said contour for supporting said bearing means.

5. Closure apparatus according to claim 1, said first
mentioned spring means being dimensioned to apply a
force to said pressure piece which is less than the force
exerted by said ancillary spring means on said conical
member when said drive member is positioned in the
angular range included by said open and closed posi-
tions, said first mentioned spring means being further
dimensioned to apply a force to said pressure piece
which is greater than the force exerted by said ancillary
spring means on said conical member when said drive
member is rotated past said closed position.

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