Oct. 9, 1951 A. J. REYENGA 2,570,984

AMBIENT PRESSURE-RESPONSIVE CLAMPING MEANS

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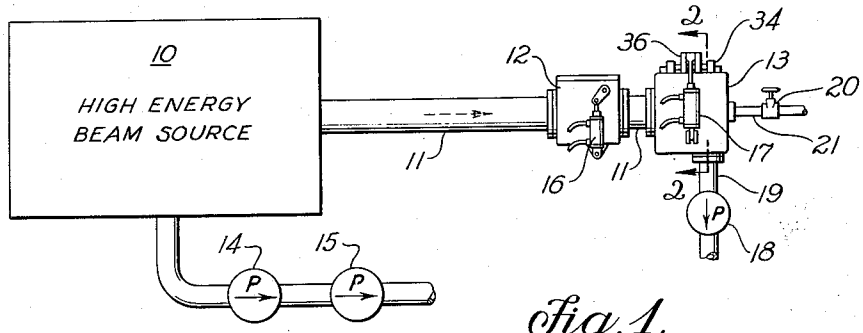



Fig. 1.

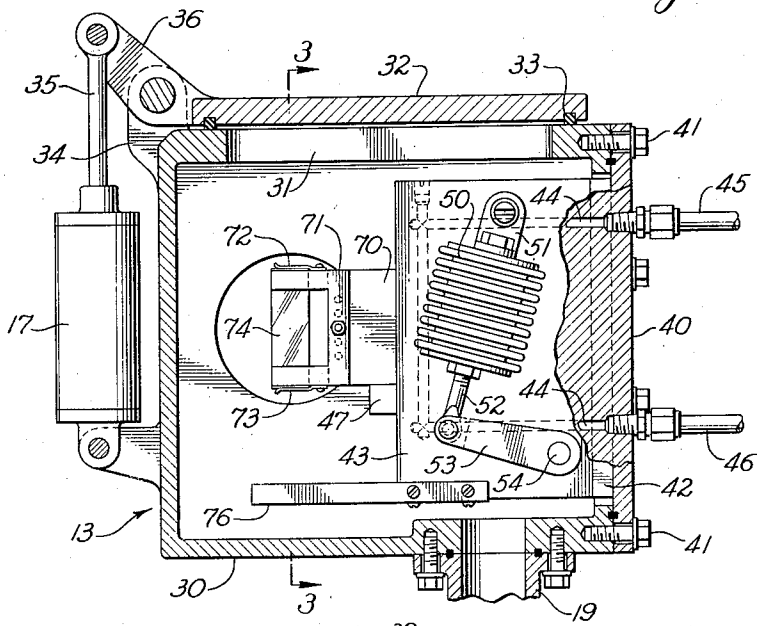



Fig. 2.

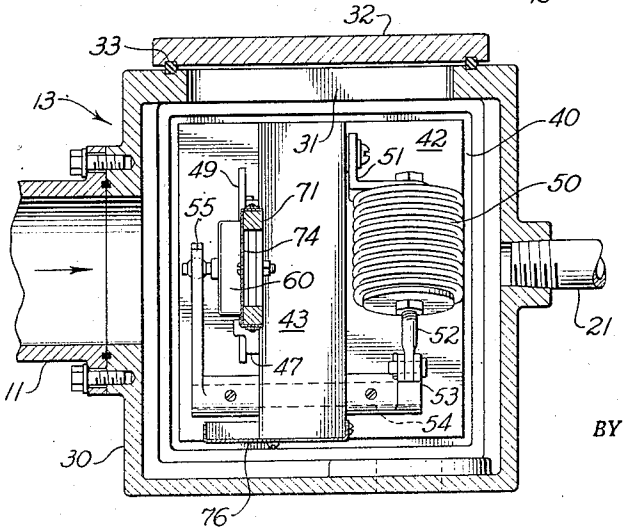



Fig. 3.

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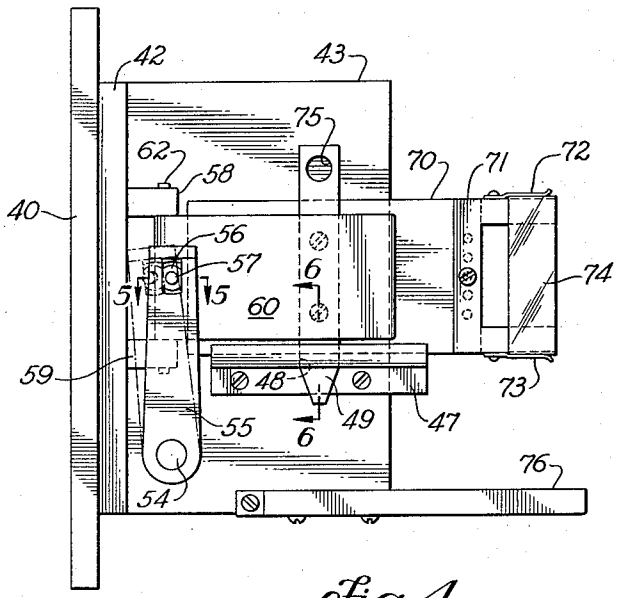



Fig. 4.

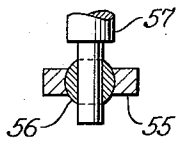



Fig. 5.

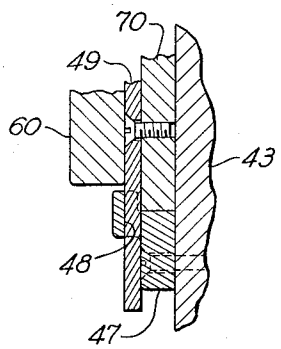



Fig. 6.

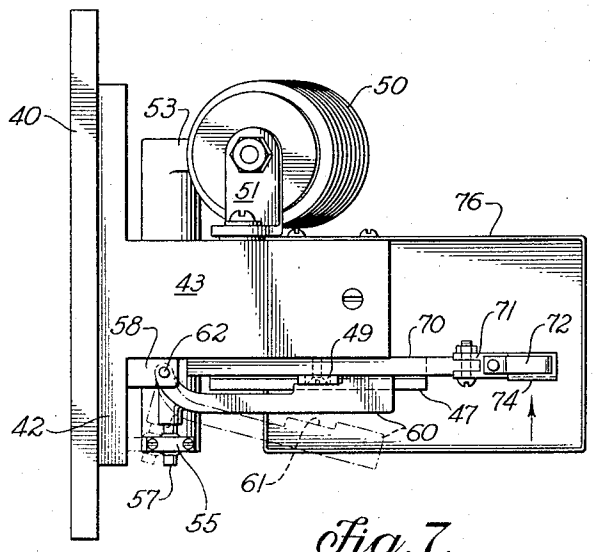



Fig. 7.

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# UNITED STATES PATENT OFFICE

2,570,984

## AMBIENT PRESSURE-RESPONSIVE CLAMPING MEANS

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9 Claims. (Cl. 250—50)

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This invention relates to a new and improved clamping means and more particularly to an automatically operable clamping arrangement, the actuation of which is made dependent upon ambient pressure changes.

As one illustration of a use for which the invention is well adapted, the clamping of a target in a beam of energetic particles or radiation may be taken as an example. When so employed in the production of radioactive materials having half-lives of the order of seconds, it is essential that a reliable, quick-releasing clamp be used in order that the target may be removed from the beam bombarding station with a minimum of delay.

Whereas the use of fluid actuated clamps, vises or the like, in order to hold a work piece detachably in a desired position is well known in the art, the mere fact that an additional separate operation is required, such as opening of a valve in order to aply or to release the pressure fluid to or from said clamp, may render a conventional means unsuitable for the exacting requirements found in nuclear physics research.

It is an object of my invention therefore to provide an improved combination of apparatus for bombarding a target releasably held in position by an improved quick-release clamping means.

Another object is to provide a new and improved quick-release clamping means actuated in dependence upon ambient pressure conditions.

A third object is to provide an improved clamping means having an improved support for a work element.

A further object is to provide an improved clamping means having means for removing heat from a work element.

A still further object is to provide an improved target retaining means for use in connection with a quick-release clamp.

Other objects and advantages will become more apparent as the description proceeds when considered in conjunction with the accompanying drawings in which

Figure 1 is a diagrammatic view showing a preferred arrangement of apparatus in which my invention may be employed when used in bombarding targets with high energy beams;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 and showing the clamping means in closed position within a target chamber;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a side elevation view of the clamping means removed from the target chamber, but having the clamping means shown in closed position;

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Fig. 5 is a fragmentary view taken on line 5—5 of Fig. 4;

Fig. 6 is a fragmentary view taken on line 6—6 of Fig. 4 and

Fig. 7 is a top view of the structure shown in Fig. 4.

As indicated in Fig. 1, a suitable arrangement of structure in which my invention may be employed for the bombardment of a target in nuclear physics studies may comprise a conventional high energy beam source 10 adapted to direct a beam successively through an evacuated passageway 11, an atmospheric pressure lock 12 and a target chamber 13. Such a beam source may comprise a conventional particle accelerator having tandem pressure reducing pumps 14 and 15 or may comprise any conventional means for producing a beam of X-rays or gamma rays.

For the purpose of closing the customary pressure barrier in the pressure lock 12 and for quickly opening an aperture on target chamber 13, any suitable fluid pressure actuating means 16 and 17, herein shown diagrammatically, may be employed. Moreover, for the purpose of evacuating chamber 13, a vacuum pump 18 connected thereto by conduit 19 is provided, while for the purpose of breaking the vacuum in chamber 13 a valve 20 disposed in a conduit 21 leading from the atmosphere into the chamber may be used. As will thus be apparent, pressure conditions ranging from a first value at the low vacuum pressure obtaining in the beam source apparatus to a second value at atmospheric pressure may thus be applied to the interior of target chamber 13.

As shown in Fig. 2 the target chamber may include a box-like housing 30 having a large aperture 31, preferably located at the top thereof, for a purpose later to become apparent, and with said aperture adapted to be selectively opened and closed by a heavy closure plate 32. This plate may be provided with a suitable sealing means 33 and is pivoted upon webs 34 affixed to housing 30. An actuating rod 35 extending from the fluid pressure actuating means 17 is journalled in an extension 36 of said closure plate and serves to raise or lower the plate quickly. At a suitable location the conduit 19 also is attached to the housing 30 in sealed relation thereto.

At one side the housing 30 is adapted to receive as a unit a removable plate 40 and its attached structure, best shown in Figs. 4 and 7.

This plate has attached thereto the apparatus serving as the clamping means for the work element, described herein as supporting a target. Plate 40 may be secured in sealed relation to housing 30 by suitable bolts 41 and when once installed in position normally remains fixed until removal for maintenance if desired, the work element meanwhile being inserted or removed through aperture 31 of the chamber.

As indicated in Figs. 3 and 7, plate 40 may be formed with a smaller plate section 42 adapted to support at a central location the massive anvil member 43. This member preferably is of a good heat conducting material, such as metal, and is provided with a cored, or otherwise formed, passageway 44 through which a cooling medium may be passed. For the purpose of circulating this cooling medium detachable conduits 45 and 46 may be attached to the external surface of plate 40.

As best shown in Fig. 6, a generally S-shaped support strip 47 is mounted upon one side of the cooled anvil and is provided with a centering aperture 48 with which a centering stake 49 attached to work element 70 is adapted to engage. In this way, the work element, which preferably is of a configuration permitting it to be held flush against the cooled anvil, may be subjected to an efficient heat transfer through conduction.

Having in mind the above described work element supporting means enclosed in a housing subjected to variable pressures, the function of the ambient pressure responsive clamping means now to be described will be readily apparent. As noted, a conventional closed expansible chamber 50, such as a bellows, containing a pressure fluid under a desired pressure, is mounted at one of its ends upon bracket 51 at one side of anvil 43. This chamber preferably is filled with air normally under atmospheric pressure, but as will be apparent to those skilled in the art any other gas may be used and normally employed under a suitable pressure. The other end of this chamber 50 is attached by connecting rod 52 to a lever arm 53 rigidly mounted to shaft 54. This shaft is journalled for substantially frictionless movement through the lower portion of the anvil 43 and at the other side of the anvil has rigidly attached thereto a second arm 55.

Adjacent its upper end the arm 55 is provided with a ball and socket means 56 through which the end of rocker arm 57 is adapted to project. Rocker arm 57 in turn serves as one portion of a bell crank assembly mounted in brackets 58 and 59 upon plate 42 and movable about a pin 62 extending between the brackets. The remaining portion of the bell crank assembly comprises a clamp member 60 adapted to swing transversely of the anvil. For convenience, the inner surface of clamp 60 may be provided with an offset shoulder or indentation 61 adapted to engage the centering stake 49 while the inner surface of the clamp is engaging the work element 70. Any suitable form of work element 70 may be used with the clamping means, but when employing the invention in the bombarding of targets it has been found that appreciable amounts of heat due to heat conduction from the target material, heat radiation from that material and scattering from nuclear sources, are transmitted to the work element. Accordingly, I prefer to employ an element made of metal and of a configuration permitting it to be held securely by clamp 60 against anvil 43 and with a large area of contact therewith. At one end the element 70 is provided with a series of spaced holes through which a C-shaped target holder or bracket 71 may be detachably secured. This holder preferably is provided with upper and lower spring clamps 72 and 73 between which a suitable target 74 may be detachably secured by frictional engagement. Since the work element 70 and its associated target 74 normally are completely removed from the target chamber at the conclusion of a bombardment run the centering stake 49 is provided with an aperture 75 through which a remote control tool, not shown, may be engaged in order to lift the same from its position on the support strip 47. For purposes of catching any molten or other material which may drop from the target 74 or its associated structure, a large pan 76 may be affixed to the lower portions of anvil 43.

In employing the above described embodiment of the invention the target to be used is first inserted in holder 71 attached to element 70 which is then positioned loosely upon support strip 47 with centering stake 49 projecting through centering aperture 48. Thereupon the closure plate 32 is lowered into sealing position upon housing 30, the atmospheric control valve 20 is closed and as soon as vacuum means 18 provides a suitable vacuum, usually substantially lower than atmospheric, within chamber 13 the pressure lock 12 is opened between the two sections of passageway 11 and the beam is directed upon the target. At or before the last-mentioned operation is effected, the lowering of the ambient pressure surrounding chamber 50 permits the pressure fluid therein to expand, thus actuating shaft 54 and forcing the clamp 60 into engagement with the work element 70. Thereafter, as soon as target bombardment is completed the pressure lock 12 is again closed, valve 20 is opened sufficiently to break the vacuum in chamber 13, the closure operating means 17 is actuated and as the closure flies open the work element 70 may be quickly lifted from the chamber 13. As will be apparent, the instant that the vacuum is broken within chamber 13 and the pressure rises to substantially atmospheric, the rise in ambient pressure contracts the chamber 50 causing the clamp 60 to be retracted automatically from contact with such work element. This automatic clamping and unclamping operation requiring no separate manipulation of apparatus other than that necessarily employed in connection with the vacuum operations thus simplifies the handling of targets and contributes to simplifying the procedures used in studying radioactive materials having short half-lives.

It is anticipated that the invention may be employed in any location wherein it is desired to hold a work element in alternate clamped and unclamped relations by means of an actuating element operable in dependence upon a variable ambient pressure. Accordingly, while the invention has been described in connection with a quick-release target holding means, it is intended that the same should in no way be considered as limited to this sole use but on the contrary should be restricted only as limited by the appended claims.

What is claimed is:

1. Apparatus of the class described including a housing having a closure movable to open and closed positions across an opening thereof, means for varying the internal pressure within said closed housing, a movable clamp and a closed, expansible actuating chamber wholly disposed

within said housing and mounted in force transmitting relation between the latter and said clamp, said chamber containing a pressure fluid with an operative volume established by the ambient pressure in said housing.

2. Apparatus of the class described including a housing having a closure movable to open and closed positions across an opening thereof, means for varying the internal pressure within said closed housing, a movable clamp and a closed, expansible actuating chamber wholly disposed within said housing and mounted in force transmitting relation between the latter and said clamp, said chamber containing a pressure fluid and being expansible to a first and clamping position when the ambient pressure in said housing is substantially lower than atmospheric and contractable to a second and released position when the ambient pressure is substantially equal to atmospheric.

3. A quick-release clamping means comprising an anvil portion, a movable clamp arm mounted for pivotal movement toward and away from said anvil portion, an enclosed expansible chamber having a portion thereof mounted in fixed relation with respect to said anvil portion and containing an internal pressure medium and adapted to expand and contract in size in accordance with the pressure on the external surfaces of the chamber, and means connecting another portion of said chamber in force transmitting relation with said clamp arm.

4. A quick-release clamping means comprising an anvil portion including a plane surface, a clamp arm pivotally mounted adjacent said surface and cooperating therewith to hold a separate work element thereagainst, an enclosed expansible chamber mounted on an opposite side of the anvil and containing an internal pressure medium, said chamber being adapted to expand and contract in size in accordance with the pressure on the external surfaces of the chamber, and rotatable shaft means extending through said anvil and connecting said chamber and said arm.

5. A quick-release clamping means comprising a stationary plate, an anvil attached to said plate, a rotatable shaft having first and second arms, a bell crank mounted adjacent one side of said anvil and having a rocker arm engaging said first arm and a clamp arm adapted to cooperate with said anvil, an enclosed expansible chamber



mounted on an opposite side of said anvil and containing an internal pressure medium, and means connecting one end of said chamber to said second arm, said chamber being adapted to expand and contract in size in accordance with the pressure on the external surfaces thereof.

6. In combination, means providing a high energy beam in a vacuum, a housing into which said beam is directed, a movable closure for said housing permitting entry and removal of a target into and from the path of said beam, clamping means for retaining the target in centered position with respect to the beam in said housing, and pressure responsive actuating means for said clamping means, said actuating means being located within said housing and serving to hold the target in clamped position while the housing is subject to vacuum and to release the target from clamped position while the closure is open.

7. In combination, a quick-release clamping means comprising an anvil portion, means for cooling said anvil, a support for a work element mounted upon one surface of said anvil, a movable clamp arm mounted adjacent said support and adapted to hold a work element against said cooled anvil, an enclosed expansible chamber containing an internal pressure medium and adapted to expand and contract in size in accordance with the pressure on the external surfaces of the chamber, and means connecting said chamber and said arm.

8. Apparatus as defined in claim 7 wherein said support has a centering aperture adapted to receive a centering projection extending from said work element.

9. Apparatus as defined in claim 7 wherein said clamp arm is pivoted and has a centering indentation adapted to contact a centering projection extending from said work element while another portion of said clamp arm holds the work element against said anvil.

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