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[11] **3,633,032**

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[54] **EQUIPMENT FOR GAMMA RADIOGRAPHY OF CLOSED VESSELS AND PIPELINES**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** ..... **250/106 S,** 250/105, 250/108 R
[51] **Int. Cl.** **G21f 5/02**
[50] **Field of Search** ..... 250/108, 106, 106 S, 105

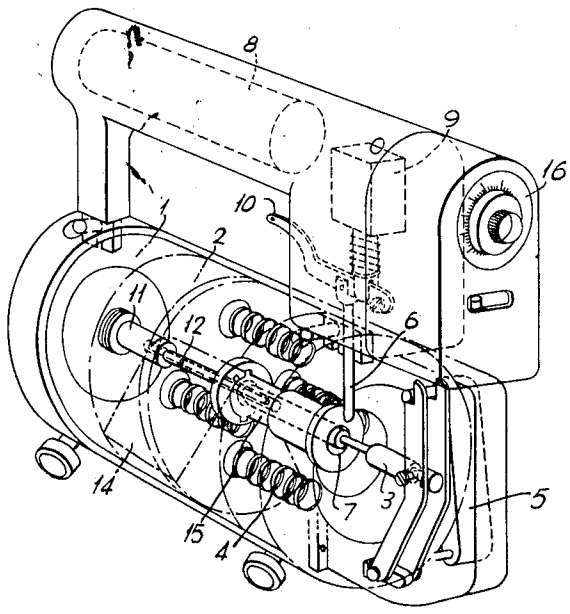
[56] **References Cited**
UNITED STATES PATENTS

2,866,905	12/1958	Yeomans	250/108 X
3,126,484	3/1964	Meeder et al.	250/106
3,316,406	4/1967	Saverwein et al.	250/108 X

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Assistant Examiner—Davis L. Willis
Attorney—Cushman, Darby & Cushman

ABSTRACT: A container for a radioactive source comprises a cylindrical two-part shield, one part being fixed and the other part movable axially with the source being located along the axis midway between the two parts of the shield when in the open position. Springs act to hold the two parts together in the closed position and a time-controlled actuating mechanism separates the two parts of the shield against the spring action for a set period of time.

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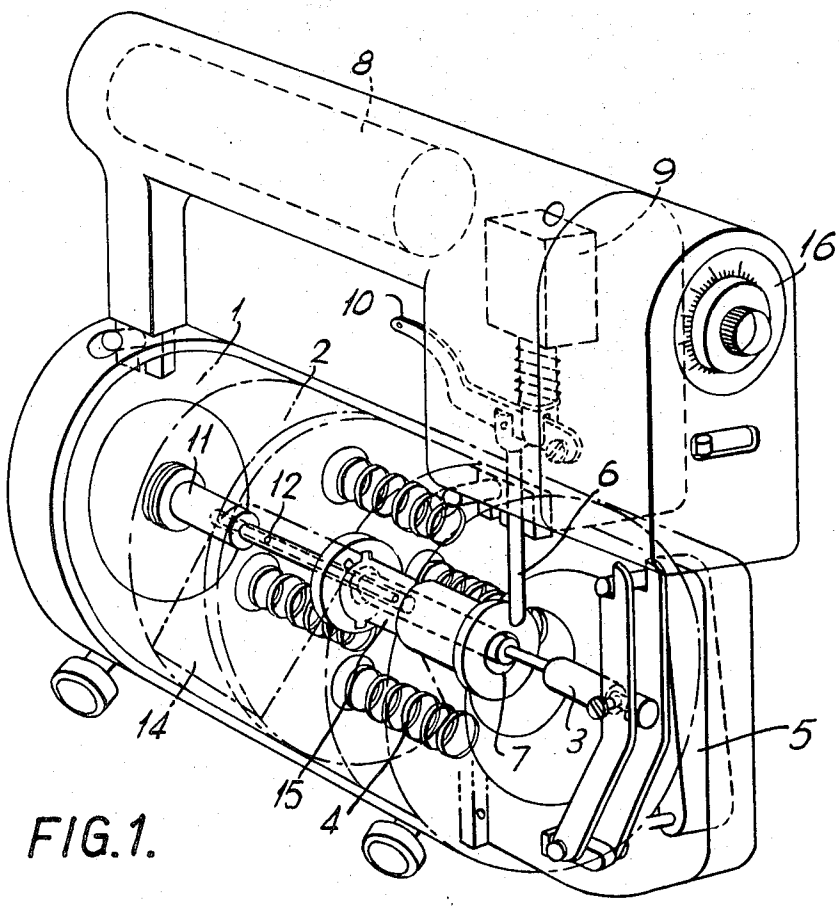


FIG. 1.

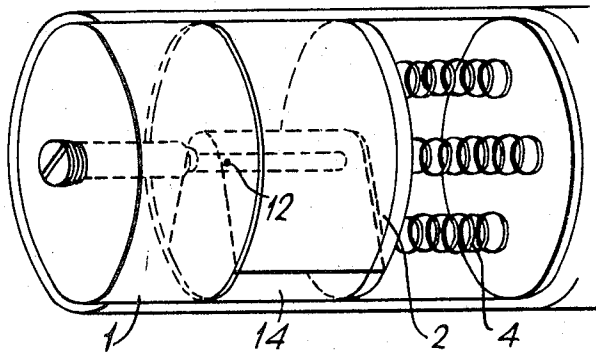


FIG. 2a.

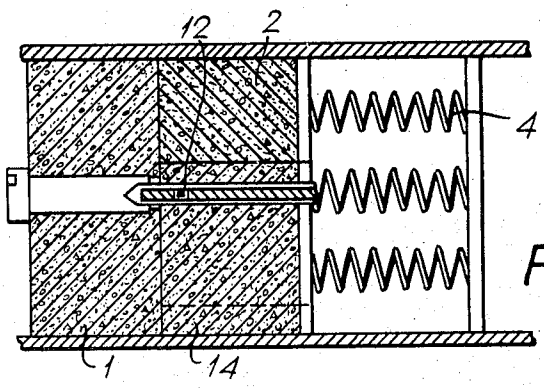


FIG. 2b.

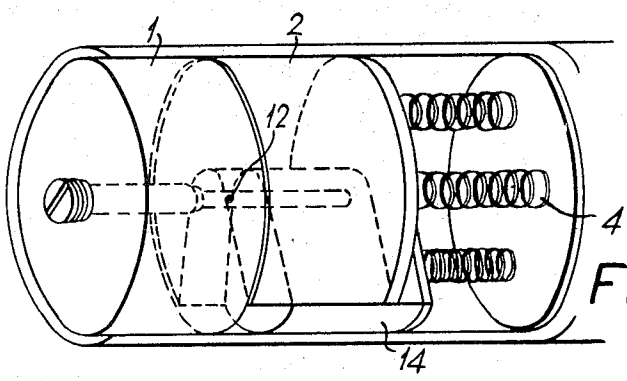


FIG. 3a.

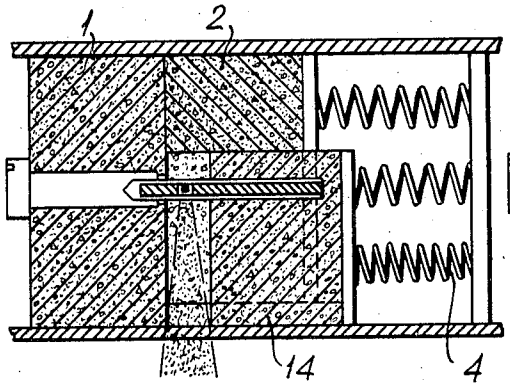


FIG. 3b.

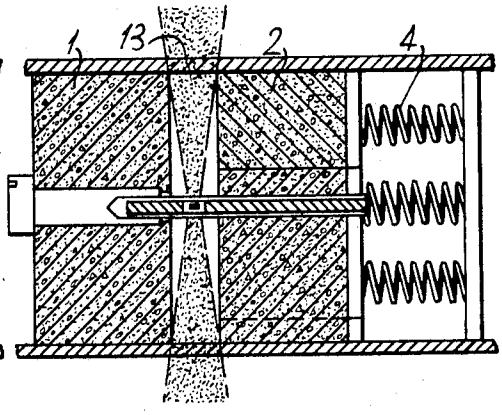


FIG. 3c.

FIG. 4a.

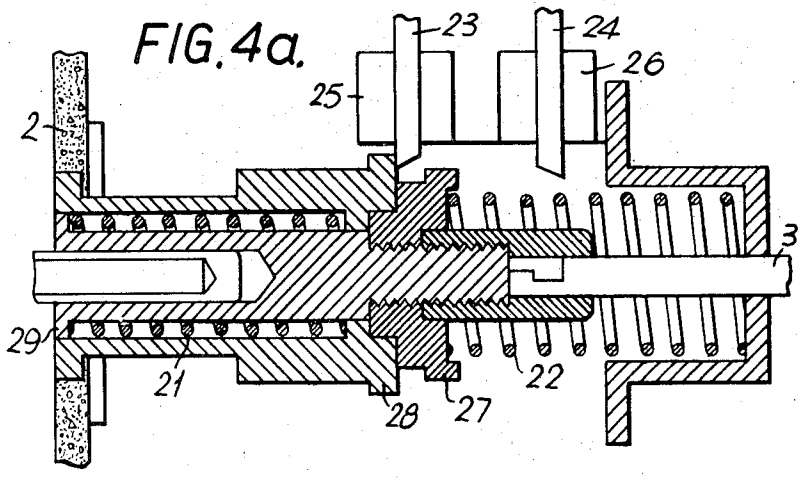
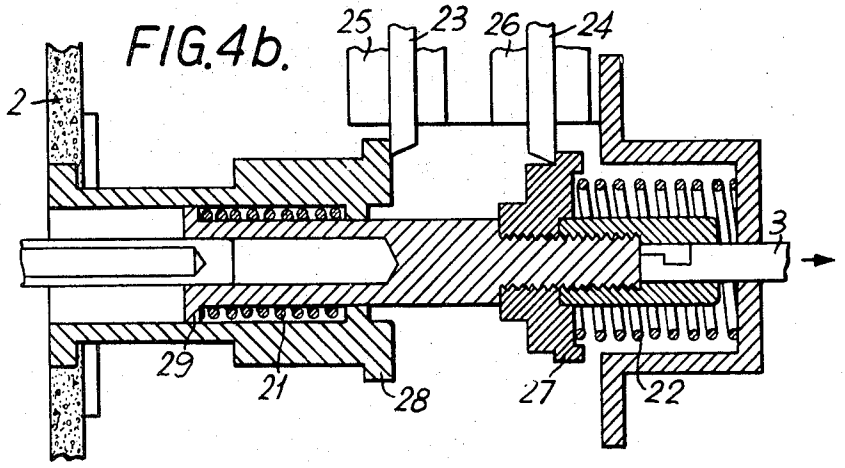


FIG. 4b.



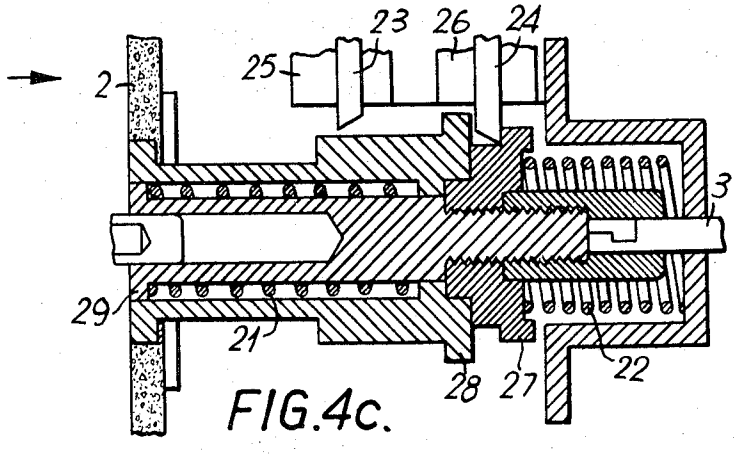


FIG. 4c.

EQUIPMENT FOR GAMMA RADIOGRAPHY OF CLOSED VESSELS AND PIPELINES

This invention relates to containers for radioactive sources and has its object to provide a container which is capable of operating automatically which has "fail-safe" properties, and which provides a radioactive beam to an accurately known position.

According to the present invention a container for radioactive source comprises a two-part shield the two parts of which are movable relative to each other between opened and closed positions, and a sourceholder at a location which is surrounded by the shield when in the closed position so that the shield absorbs substantially all of the radiation emitted by the source in the sourceholder, and when in the open position allows radiation to be emitted in predetermined directions.

Preferably the two parts of the shield are cylindrical in shape and have a common axis the relative movement between the two parts being along the common axis. The sourceholder can conveniently be located in a central bore provided along the said axis.

With such an arrangement it is sufficient for the two parts of the shield to be in butting relationship when in the closed position and the sourceholder is positioned such that the source will lie midway in the gap between the two parts of the shield when it is in the open position.

In carrying out the invention closure means are provided which act to continuously force the two parts of the shield into their closed positions, such closure means conveniently comprising spring means. The shield can be moved into its open position by electromagnetic or pneumatic means or the like which operate against the force of the closure means to open the shield. In the event of failure of the opening means then the closure means immediately operates to close the shield and shut off the radiation.

In order that the invention may be more fully understood reference will now be made to the accompanying drawings in which:

FIG. **1** is a skeleton perspective view of a radioactive source container embodying the invention,

FIG. **2***a* is a diagrammatic skeleton view of the container shield of FIG. **1** in the closed position,

FIG. **2***b* is a sectional view of the container shown in FIG. **2***a*,

FIG. **3***a* is a skeleton view of the container with one segment exposed,

FIGS. **3***b* and **3***c* are sectional views of the container with one segment exposed and with full exposure respectively, and

FIGS. **4***a*, **4***b* and **4***c* are views of a modified form of opening mechanism of the container in successive operative conditions. Referring now to FIG. **1**, there is shown therein a shield comprising two parts **1** and **2** each of generally cylindrical shape and located along a common axis in butting relationship to each other. Parts **1** and **2** are constructed of a high-density material such as uranium, tungsten or lead which is designed to absorb radiation. The part **1** of the shield is fixed while part **2** is slidable axially away from part **1** by means of an actuating mechanism positioned to the right of the container in FIG. **1**.

The actuating mechanism comprises a central rod **3** which moves part **2** of the shield against the action of springs **4**. Rod **3** is operated by a cocking lever **5** and on movement of this lever part **2** of the shield is held in the open position by means of a plunger latch **6** which acts against a ring **7** secured to rod **3**. Closure of the shield is by upward movement of latch **6** by a latch controlling mechanism contained in a handle **8** which can be detached from the container. Handle **8** carries a solenoid **9** energization of which moves latch **6** upwards to release the movable part of the shield and causes it to return to its closed position by the action of springs **4**. In addition a manual release lever **10** is coupled to latch **6** for manual closure of the shield and yet again the act of detaching handle **8** from the container withdraws latch **6** to close the shield.

Along the common axis of parts **1** and **2** of the shield there is provided a bore in which there is located a fixed sourceholder **11** for a radioactive source **12**. The position of source **12** relative to the two parts of the shield when in the closed position is shown more clearly in FIGS. **2***a* and **2***b* where it is seen that the source is out of the plane of the butt between parts **1** and **2**. When the shield is in its open position as shown in FIG. **3***c* the source lies accurately midway in the gap **13** formed between the two parts of the shield.

It will be appreciated that a very small leakage of radiation will occur in the plane of the butt and this leakage can with advantage be used to signal the presence of the container particularly where the container is at a remote position.

As an alternative to the opening of the entire part **2** of the shield it can be arranged that a sector **14** only of the shield is opened by the mechanism. Selection of a sector as distinct from the whole of the movable part of the shield is achieved by the rotation of a selector sleeve **15**. Rod **3** is connected to sector **14** and sleeve **15** is secured to move axially with the remainder of the movable part **2** of the shield Sleeve **15** carries notches which when the sleeve is in one angular position allows movement of rod **3** relative to the sleeve to carry with it sector **14** only but when sleeve **15** is in another angular position relative axial movement between rod **3** and sleeve **15** is prevented so that rod **3** carries with it all of part **2** of the shield.

Locking lever **5** may be operated manually or else by any convenient means such as electromagnetic, pneumatic or hydraulic power. However, for manual operation it may be advisable to expose a sector only of the shield. Immediately on opening of the shield a timer mechanism **16** contained in the handle starts functioning and after a preset time energizes solenoid **9** to lift latch **6** and allow the shield to close.

In the arrangement described above, the shield is opened immediately the cocking lever **5** is operated and it may be desirable in many applications to provide a two-stage timing in which both the time from the cocking operation to the opening of the shield and the time during which the shield is held open are both independently controllable. Such an arrangement is illustrated diagrammatically in FIGS. **4***a*, **4***b* and **4***c* which illustrate a modified mechanism in successive operative conditions. In these FIGS. a rod **3** is connected to be moved by a cocking mechanism similar to that illustrated in FIG. **1** and two separate springs **21** and **22** are provided together with two separate latches **23** and **24** each independently controlled by solenoids **25** and **26**. A collar **27** is attached to rod **3** while a second collar **28** is attached to the part **2** of the shield. Spring **21** acts between collar **28** and a collar **29** attached to rod **3**. In FIG. **4***a* the shield is closed and the mechanism is uncocked and both springs **21** and **22** are in the released condition. Operation of the cocking mechanism to move rod **3** to the right compresses spring **22** and this spring is then held in the compressed condition by the latch **24**. Spring **21** is also compressed against collar **28** which is held from moving by latch **23**. This condition is shown in FIG. **4***b*.

Operation of the cocking mechanism initiates the operation of a timer similar to timer **16** controlling latch **23**. After the elapse of a time determined by such a timer solenoid **25** is energized and latch **23** raised. This causes spring **21** to expand and move collar **28** and with it movable part **2** of the shield to the right to expose the radioactive source as shown in FIG. **4***c*. At the same instant a second timer commences functioning and after a further preset time energizes the solenoid **26** to raise latch **24** and release spring **22** to return part **2** of the shield to the closed position. The apparatus then returns to the condition shown in FIG. **4***a*.

While control of the single latch in FIG. **1** or the two latches in FIG. **4** is shown as being by timers, it will be understood that other control equipment for example dose rate integrators can equally well be used to control the open time of the shield.

While two parts of the shield have been illustrated as being cylindrical it will be appreciated that other shapes can equally well be used for instance each part of the shield can be hemispherical in shape.

Handle **8** together with the actuating mechanism which separates the two parts **1** and **2** of the shield can be detached

from the shield and the action of detaching these parts ensures that the shield then remains in the closed position. This facility is of advantage when the radioactive source **12** is to be changed since all that requires to be done is to remove the handle and actuating mechanism and the shield is now a completely safe closed assembly. Another shield containing a fresh radioactive source can then be fitted to the handle and actuating mechanism and the container is then immediately ready for use. The old shield can then be opened at leisure at a safe station for replacement of the source.

I claim:

1. A radioactive source container comprising:

a two-part radiation shield including a fixed part and a part movable with respect thereto, said movable part butting against said fixed part when in the closed position and being positioned in spaced-apart relationship thereto when in the open position;

a fixed sourceholder of radiation-emitting material positioned to lie wholly within the movable part of the shield when in the closed position and to be exposed when said movable part is in the open position;

continuously acting closure means tending to force said movable part of said shield towards said fixed part;

opening means for moving said movable part of said shield away from said fixed part and against the action of said closure means; and

a latching mechanism for holding said movable part in the open position against the action of said closure means.

2. The container as claimed in claim **1** in which the two parts of the shield are cylindrical in shape and have a common axis, the movement of said movable part being along said axis and the sourceholder being located in a central bore along said axis.

3. The container as claimed in claim **2** in which said movable part of said shield is in two sections, one section having a sectorial cross section whereby movement thereof exposes radiation from said sourceholder in a radially extending sector only, said opening means comprises a rod lying on said common axis and connected to said one section, and in which selection means is provided for selecting either said one section or the whole of said movable part for movement by said opening means, said selection means comprising a rotatable selector sleeve surrounding said rod and secured to move axially with the remainder of said movable part of said shield, and locking means between said rod and said sleeve which in one angular position of the sleeve locks the sleeve to the rod for axial movement of both the rod and the sleeve and in another angular position allows axial movement of the rod, and with it said one section, relative to the sleeve.

4. The container as claimed in claim **2** in which the location of the sourceholder is such that it lies midway in the gap between the two parts of the shield when the shield is in the opened position and is out of the plane of the butt when the shield is in the closed position.

5. The container as claimed in claim **1** in which a cocking mechanism and two spring means are provided, one of said spring means comprising said opening means and the other of said spring means comprising said closure means and said cocking mechanism operating to energize both of said spring means, and wherein said latching mechanism also holds said movable part in the closed position against the action of said opening means, the latching means comprising two latches, each of said two latches operating to hold a respective one of said spring means in its energized state without allowing movement of said movable part of said shield, the release of one of said latches causing the release of its associated spring means to move said movable part of said shield to its opened position and the release of the other of said latches causing the release of its associated spring means to move said movable part of said shield to the closed position.

6. The container as claimed in claim **1** in which a timing means is provided for operating the latching mechanism and which determines the time during which the shield is held open.

7. The container as claimed in claim **5** in which timing means are provided for separately operating both of the latches.

8. The container as claimed in claim **1** in which the two-part shield and closure means are detachable from the remainder of the container.

* * * * *