

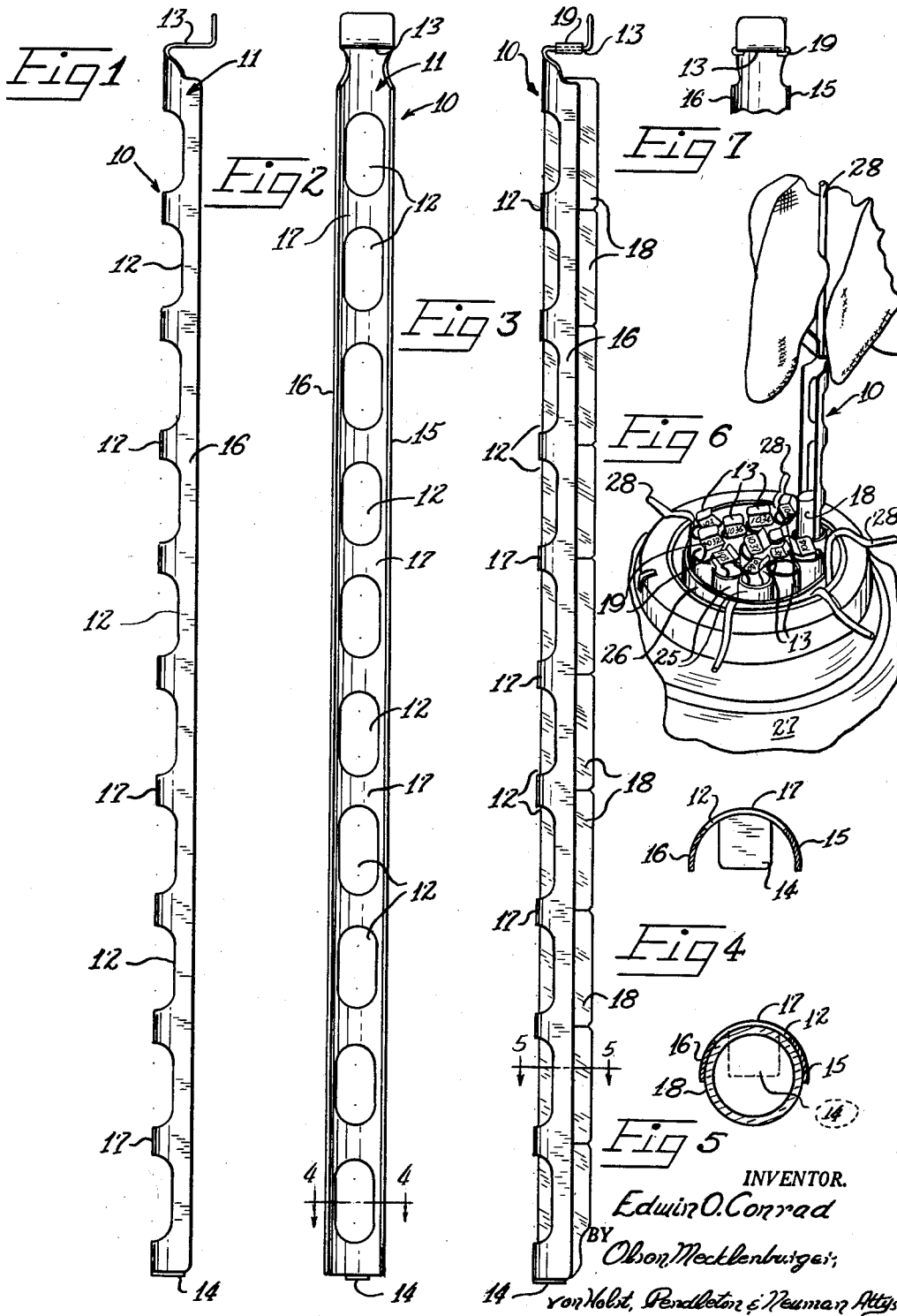
April 28, 1964

E. O. CONRAD
DISPENSING RACK

3,130,836

Filed Sept. 26, 1961

2 Sheets-Sheet 1



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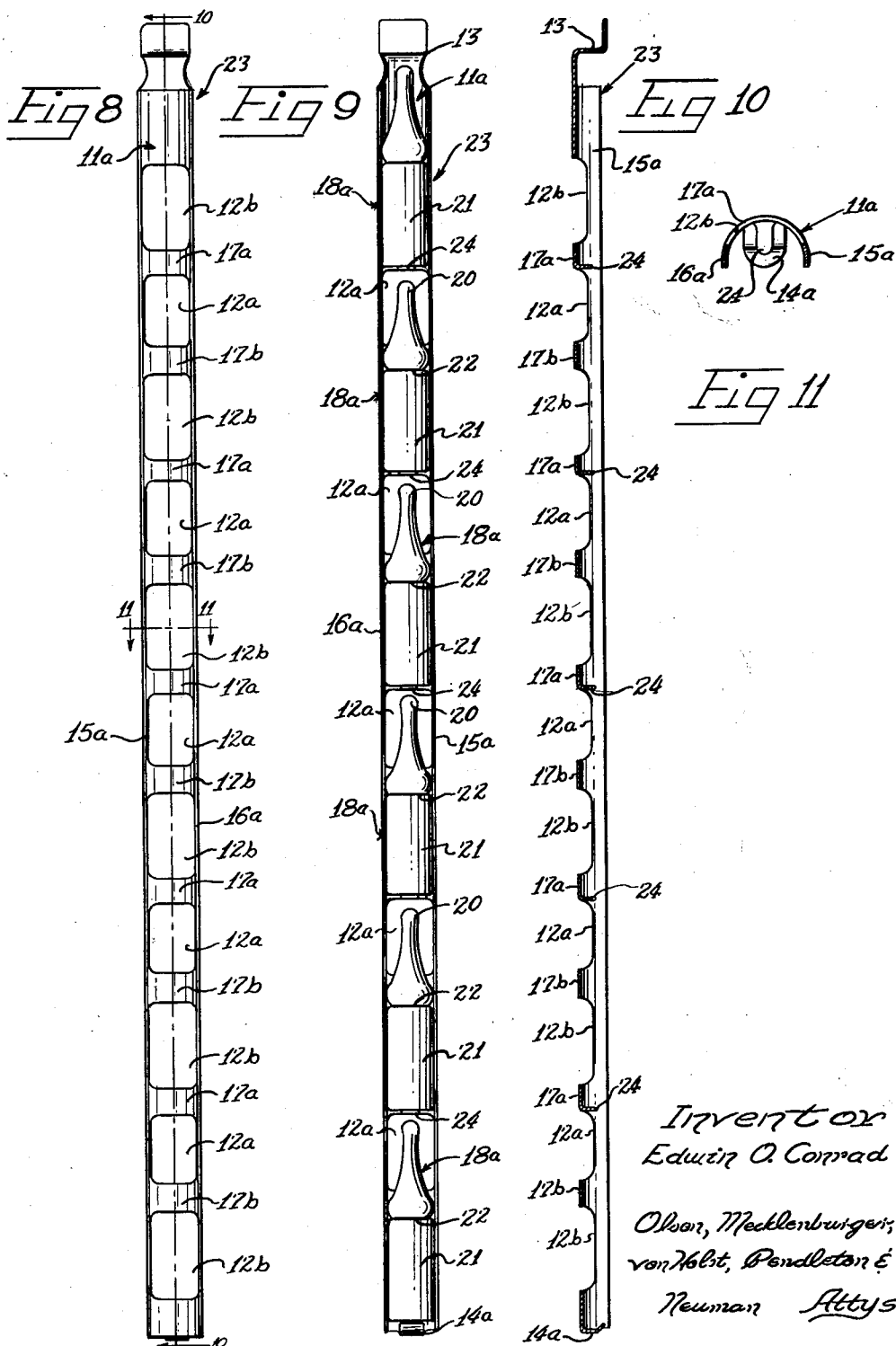
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DISPENSING RACK

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6 Claims. (Cl. 211-74)

This is a continuation-in-part of my co-pending application for Dispensing Rack; Serial No. 100,087, filed April 3, 1961, now abandoned.

This invention relates to a rack for holding and dispensing articles and more particularly pertains to a rack for holding a plurality of superposed articles in a manner permitting selective removal of the articles.

Under some circumstances, it is desirable to store articles such as small containers or ampules in elongated racks in a manner permitting selective removal of the stored articles. One such circumstance is where a plurality of filled racks are to be stored in closely spaced parallel relation in a storage space, with at least one end of the racks exposed to permit withdrawal of a rack for selective retrieval of the stored articles. An illustration of such a storage situation is in the storage of containers of biological specimens, such as ampules of frozen bovine semen, cultures, and the like, in a liquid-gas-cryogen storage vessel. This invention will be illustrated and discussed with particular reference to such a use. It will be appreciated, however, that the invention may be utilized in other circumstances, and specific reference is made to this use only to facilitate a discussion and understanding of the invention in one advantageous environment.

It has been found that one practical way for effecting retrievable storage of containers of frozen materials in a liquid cryogen is to mount a number of the containers in superposed relation on an elongated rack and to lower the entire filled rack or "cane" endwise into the cryogen. Such racks have usually consisted of an elongated support member provided with a plurality of pairs of opposed narrow gripping fingers, such as tempered wires or narrow metal strips for receiving and holding the containers by gripping them about a reduced diameter neck portion. If all the containers on one rack are identical in contents, a single container may be retrieved, without exposing the remaining containers to ambient conditions, simply by raising the selected rack out of the refrigerant only a sufficient distance to permit removal of the top-most container. Unnecessary and undesirable exposure of the remaining containers to ambient conditions is thus avoided.

Whenever a plurality of species of material is to be stored in one vessel under the foregoing circumstances, it becomes necessary to identify either the individual containers or more usually the entire filled rack. One convenient method of so marking these racks is to provide an indicium on each of the exposed rack ends.

A desirable rack for receiving and holding containers and permitting selective retrieval, particularly under the circumstances noted above, should meet several design criteria to provide a most satisfactory operation. The rack should engage the containers over a comparatively large area to assure effective gripping under all conditions, including extremely cold conditions such as might be encountered in a liquid-gas-cryogen. The gripping means should preferably extend over the whole length of the rack to facilitate gripping of a container in any position and should minimize the need for exact positioning of each individual container as it is mounted on the rack. The design of the gripping means should be such that articles placed in the rack will be effectively positioned and retained therein even under adverse circumstances without the use of expensive materials. The gripping means should also be of a type and extent to avoid en-

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tanglement with the gripping means of other racks, and should not increase the space occupied by the rack when in storage. The rack should be of simple construction and inexpensive to manufacture to justify disposal of used or deformed racks and thereby to avoid the problems of reforming or reshaping the gripping means for subsequent uses and to omit the necessity and expense of replacing or changing the identifying indicium as would often be necessary for subsequent uses. A further very important criterion for a desirable rack is that it should permit ready selective dispensing of the retained articles from any position, so that they may be dispensed one at a time from the top of the rack downward or, in some circumstances, in any desired order. For some uses, such as with glass ampules, provision should also be made for preventing movement of the ampules longitudinally of the rack and for positively preventing contact between adjacent ampules.

Accordingly, it is an object of this invention to provide an improved dispensing rack which meets the aforementioned requirements.

It is also an object of this invention to provide an improved rack which provides a large-area grip of containers to be stored therein.

It is another object of this invention to provide a rack which will effectively retain a container even under adverse circumstances and regardless of the positioning of the container longitudinally of the rack.

It is an additional object of this invention to provide an improved inexpensive rack which provides large area grip and effective retention of containers, even under adverse conditions, and which supports the containers independently of one another.

It is another object of this invention to provide a rack which permits selective dispensing of containers stored therein and particularly a rack which permits dispensing of the individual containers, in the order stored, from the top downward.

It is another object of this invention to provide an improved rack with effective gripping means and which makes efficient use of available storage space and avoids entanglement problems.

It is a further object of this invention to provide a dispensing rack which meets the aforementioned objects but which is of simple inexpensive construction and which may therefore be disposed of after a single use to avoid the costs of returning and re-forming the rack and changing any identifying indicia thereon.

Further and additional objects will appear from the description, accompanying drawings and appended claims.

In carrying out this invention in one form, a disposable container rack is provided which includes a hollow, elongated, arcuate cross section body formed of a unitary piece of comparatively inexpensive sheet metal such as tin-plated steel. The body extends over an arc of slightly greater than 180° in cross section to extend slightly more than halfway around containers to be stored therein. The remaining side of the body is open to permit insertion and removal of the containers. The side of the body opposite the open side is formed with a plurality of comparatively large openings therethrough spaced and disposed so that each container to be stored in the rack will be exposed to one of these openings whereby it may be contacted from the back side to push the container out of the rack through the open side. The portions of the walls of the body extending between these openings serve as spring members resiliently resisting spreading of the portions of the body at each side of the open side. The rack is designed with a normal diameter slightly less than the diameter of the containers to be stored therein, whereby the rack will resiliently clamp or grip and retain the containers in the mounted position.

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For a more complete understanding of this invention, reference should now be had to the drawings wherein:

FIG. 1 is a side-elevation view of a dispensing rack employing the teachings of this invention;

FIG. 2 is a front-elevation view of the dispensing rack of FIG. 1;

FIG. 3 is a side-elevation view of the dispensing rack of FIG. 1 with a plurality of cylindrical containers mounted in the rack and with an indicia-clip on its upper end;

FIG. 4 is an enlarged cross-sectional view taken along line 4—4 in FIG. 2 and looking in the direction of the arrows;

FIG. 5 is an enlarged cross-sectional view similar to FIG. 4 but taken along line 5—5 of FIG. 3 and looking in the direction of the arrows;

FIG. 6 is a perspective partial view showing the top of a storage vessel and illustrating a use of the dispensing rack shown in FIG. 1, with one rack positioned for removal of a container therefrom;

FIG. 7 is a front-elevation view of the upper portion of the dispensing rack as shown in FIG. 3;

FIG. 8 is a rear-elevation view of a modified form of the rack illustrated in FIG. 1;

FIG. 9 is a front-elevation view of the rack of FIG. 8 filled with one type of glass ampule;

FIG. 10 is a cross-sectional view taken along line 10—10 in FIG. 8 and looking in the direction of the arrows; and

FIG. 11 is an enlarged cross-sectional view similar to FIG. 4 but taken along line 11—11 in FIG. 8 and looking in the direction of the arrows.

Referring now to the drawings, the rack 10 is preferably formed of a single piece of sheet material 11. This sheet is stamped or otherwise cut to form a plurality of openings 12 therethrough, the openings preferably being disposed along the longitudinal median line of the sheet 11 as shown. The sheet is also cut away at the ends to form tabs 13 and 14 at the upper and lower ends, respectively.

The body of the rack 10, between the end portions, is bent to form a hollow, elongated channel-like rack body. The sheet 11 thus becomes the side walls of the rack channel and includes side portions 15 and 16, at each side of the open side of the rack, and back portions 17 extending from one side portion to the other between the openings 12. The body is formed to extend over an arc slightly greater than 180°, thus leaving a clearance or open side, between side portions 15 and 16, slightly narrower than the inner diameter of the body, as clearly seen in FIG. 4. The body of rack 10 is formed with a normal inner diameter slightly less than the diameter of the containers 18 to be stored therein.

The containers 18 illustrated in FIGS. 3, 5 and 6 are cylindrical in shape and may be formed of plastic, glass or other suitable material.

Openings 12 are preferably uniformly spaced along the length of the rack and formed of a size and so positioned that each container stored in the rack will be exposed to at least a portion of one of these openings. In the construction of FIGS. 1-5, the longitudinal dimension of each opening 12 plus an adjacent strip 17 is equal to the height of a container 18.

The strip or back portions 17 function as spring members resisting spreading of the side portions 15 and 16. These strip portions are of sufficient length (longitudinally of the body) to firmly but resiliently resist spreading of the side portions of the body so that an ampule 18 may be forced between the side portions and into the concavity of the body in the position shown in FIGS. 3 and 5 where it will be gripped by the side portions under the influence of the resilient back portions. The walls of the rack thus grip the ampule to hold it in the rack. This grip is sufficiently tight to retain an ampule in position longitudinally of the rack under most ordinary conditions even if there is no ampule immediately therebeneath to lend vertical

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support. Tab 14 positively prevents the ampules from being accidentally discharged or dropped out the bottom of the rack.

The uniform construction of the rack illustrated in FIGS. 1-5 permits insertion and retention of an ampule in any longitudinal position, thus obviating any need for careful positioning of each individual ampule as it is placed in the rack.

Suitable identifying indicia may be placed on the rack as by clamping a marker 19 onto the tab 13 by bending its ends around the tab as shown in FIG. 3 and FIG. 7. permanent indicia may also be imprinted on or stamped into one or both of the tabs or another portion of sheet 11.

It has been found that ampules made of readily shatterable materials, such as glass, should be supported without contact between ampules to prevent breakage during handling and shipping. Such ampules are illustrated at 18a in FIG. 9 and each include a sealed end 20 joined to a main body portion 21 by a neck 22. The neck is adapted to be scribed and broken to open the ampule.

A modified rack which is adapted to provide independent support of frangible ampules, such as ampules 18a, is illustrated in FIGS. 8-11. In this construction, rack 23 is formed from a piece of sheet material 11a encompassing an arc of slightly greater than 180°, and with side portions 15a and 16a defining an open side, opposite openings 12a and 12b, and back portions 17a and 17b resiliently resisting spreading of the side portions within the range of movement necessary to receive and hold ampules 18a, all similar to corresponding parts of rack 10. Individual tabs 24 extend from back portions 17a into the open center of the rack to serve as ampule supports. The tabs 24 may be an integral part of sheet 11a, as by being cut from the portion of the sheet normally removed to form openings 12a and then being bent into supporting position as illustrated. The spacing between adjacent support tabs 24, and between the lowermost tab 24 and the bottom tab 14a, is slightly greater than the height of an ampule to be placed in the racks. This provides a slight clearance between each tab 24 and the subjacent ampule which permits ready insertion and removal of the ampules and insures that the ampules will be supported in spaced relation to one another. Openings 12b are disposed opposite the position normally assumed by the main body portion of ampules supported on the respective tabs and constitute the most convenient openings for forcing removal of the ampules 18a.

Tabs 14a and 24 terminate short of a line between the distal edges of side portions 15a and 16a, thereby minimizing or obviating any problems of entanglement of adjacent racks and insuring that the racks, empty or filled, will occupy a minimum of space.

As ampules 18a are longer than a simple cylindrical ampule 18 of the same volume, the spacing between tabs 24, in racks designed for these ampules, permits the provision of two openings 12a and 12b. Alternatively, only one opening may be provided for each ampule with each tab 24 being struck from the material normally removed from this single opening, or the tabs may be struck from the remaining back portions of the rack body, or may be separately formed and attached.

Ampules 18a may be placed and stored in racks such as rack 10, without tabs 24, whenever the filled racks will not be subjected to vibration and shock loads. Containers such as ampules 18 may be placed and stored in racks such as rack 23 when these racks are formed with back portions 17a and 17b of less height than the length of an ampule 18 so that each ampule will be exposed through at least a portion of one opening for ready removal.

FIG. 6 illustrates one use of the present racks in storing frozen biological specimens such as bovine semen in a vacuum vessel refrigerator. The individual racks are filled with ampules and the racks catalogued and identified by markers 19 clamped on upper tabs 13. All ampules on a given rack normally contain the same type specimens.

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The filled racks or "canes" are placed in individual cardboard guard tubes 25 in storage canisters as at 26. Each canister 26 receives several of the racks in side-by-side relation as shown in this figure. The canisters are normally stored in the vessel 27. At such time as it is desired to retrieve a given ampule, the correct canister is selected and raised to a position approximately as shown in FIG. 6 by a handle 28. Observing the indicia on the upper ends of the racks, the technician selects that rack containing the desired specimens. The selected rack is then withdrawn longitudinally upward, as shown, normally only that distance required to gain access to the topmost ampule. This prevents unnecessary exposure of the remaining ampules to ambient temperature conditions. The desired ampule is then removed by applying force, such as finger pressure, through the opening adjacent the ampule. The rack is immediately returned to a normal storage position and the canister returned to its storage location within the vessel 27.

Openings 12 and 12b are preferably of sufficient size to permit entry of a person's finger or other simple removal device for forcing the ampules out of the rack against the gripping forces of the side portions.

By providing an extensive gripping area and extensive resilient "spring" portions of the body, sufficient gripping force is available to receive and retain the ampules in the rack even under extreme cold conditions without the use of expensive tempered materials. For instance, tin-plated sheet steel has proven quite satisfactory in racks constructed according to this invention even when storing objects in liquid nitrogen. Thus, an inexpensive construction is facilitated which permits one-use-throw-away utilization of the racks while still providing adequate strength to insure retention of the ampules in the rack. This obviates many problems such as re-forming of individual grippers or an entire rack for re-use, and removal and replacement of the identifying indicia for re-use. Also, by providing an extensive gripping area, any alignment difficulties in racking the containers are minimized. The presence of openings 12, or 12a and 12b disposed over the full length of the rack, insures that the topmost remaining ampule may always be readily removed without moving it to a special discharge position and without the use of special tools. Alternatively, the openings also permit removal of any ampule in the rack without removing or otherwise disturbing the remaining ampules. Thus, a selection of ampules may be stored in one rack and a given ampule may be retrieved without rearranging or disturbing the remaining ampules. Protruding gripping fingers or strips and attendant entanglement problems are also eliminated, and minimum outside rack dimensions are obtained thereby insuring efficient use of available storage space.

With the modification of FIGS. 8-11, most if not all of the aforementioned objects and advantages of this invention are met, and the ampules are also supported without contact between adjacent ampules, thereby removing one major cause of breakage of frangible containers under rough handling conditions.

It will be obvious that certain modifications of the specific embodiment shown may be made within the teaching of this invention. For example, other identifying indicia may be utilized, and the rack may be formed with other configurations to suitably engage containers of other geometrical designs.

It will thus be seen that a dispensing rack has been provided which is of simple and inexpensive construction, which provides a large-area grip on containers to be stored therein and accomplishes a firm resilient gripping of these containers even under adverse conditions. Further, the rack effectively retains containers placed therein without regard to precise alignment of parts and permits convenient selective dispensing of stored containers.

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While particular embodiments of this invention are shown above, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made in light of the teachings contained herein. It is contemplated, therefore, by the appended claims to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. An ampule rack resilient under cryogenic conditions comprising a hollow elongated unitary sheet metal body extending over an arc of slightly greater than 180 degrees in cross section and having an open side delimited by opposed edge portions of said body, said edge portions being spaced apart a distance slightly less than the maximum inner transverse dimension of said body, said body formed with a plurality of longitudinally spaced access openings therethrough generally opposite said open side and distributed over substantially the full length of said rack, portions of said body extending between said openings and resiliently resisting spreading of said edge portions from one another transversely of said body at least within a range of movement corresponding to enlargement of the clearance between said edge portions to a width equal to such maximum inner transverse dimension, whereby ampules may be retained in said rack by said edge portions and may be ejected through said open side by pressure applied through said openings.

2. A container rack as in claim 1 and including a plurality of mutually spaced support tabs extending transversely of said rack within said hollow body.

3. A container rack as in claim 2 and wherein said support tabs are disposed entirely within said body.

4. An ampule rack resilient under cryogenic conditions comprising a hollow elongated unitary sheet metal body extending over an arc of slightly greater than 180 degrees in cross section and having an open side delimited by opposed continuous edge portions of said body extending substantially the full length of said rack, said edge portions being spaced apart a distance slightly less than the maximum inner transverse dimension of said body, said body formed with a plurality of longitudinally spaced finger access openings therethrough generally opposite said open side and distributed over substantially the full length of said rack, portions of said body extending between said openings and resiliently resisting spreading of said edge portions from one another transversely of said body at least within a range of movement corresponding to enlargement of the clearance between said edge portions to a width equal to such maximum inner transverse dimension, whereby ampules may be retained in said rack by said edge portions and may be ejected through said open side by finger pressure applied through said openings.

5. A plurality of ampules and an ampule rack, said ampules being generally uniform in cross section and height and each including a main portion, said rack being resilient under cryogenic conditions and comprising a hollow elongated unitary sheet metal body extending over an arc of slightly greater than 180 degrees in cross section to normally engage said containers over slightly greater than one-half of their circumference and having an open side delimited by opposed edge portions of said body, said edge portions being spaced apart a distance slightly less than the transverse dimension of the main portion of said ampules, said body formed with a plurality of longitudinally spaced access openings therethrough generally opposite said open side and distributed over substantially the full length of said rack, portions of said body extending between said openings and resiliently resisting spreading of said edge portions from one another transversely of said body at least within a range of movement corresponding to enlargement of the

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clearance between said edge portions to a width equal to the transverse dimension of said main portions, whereby ampules may be retained in said rack by said edge portions and may be ejected through said open side by pressure applied through said openings.

6. A plurality of ampules and an ampule rack as in claim 5, and said rack including a plurality of support tabs extending transversely of said rack within said hollow body, said tabs being spaced from one another, longitudinally of said rack, a distance greater than the height of said ampules.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,130,836

April 28, 1964

Edwin O. Conrad

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 10, for "clampng" read -- clamping --;
line 12, for "permanent" read -- Permanent --; column 5,
line 32, for "-throw-away" read -- -throwaway --; column 8,
line 11, for "Austria" read -- Australia --.

Signed and sealed this 14th day of July 1964.

(SEAL)

Attest:

ESTON G. JOHNSON
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents