May 20, 1958 E. L. ACKERMANN ET AL 2,835,381

CRATES FOR PACKAGING AMMUNITION

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Fig. 1.

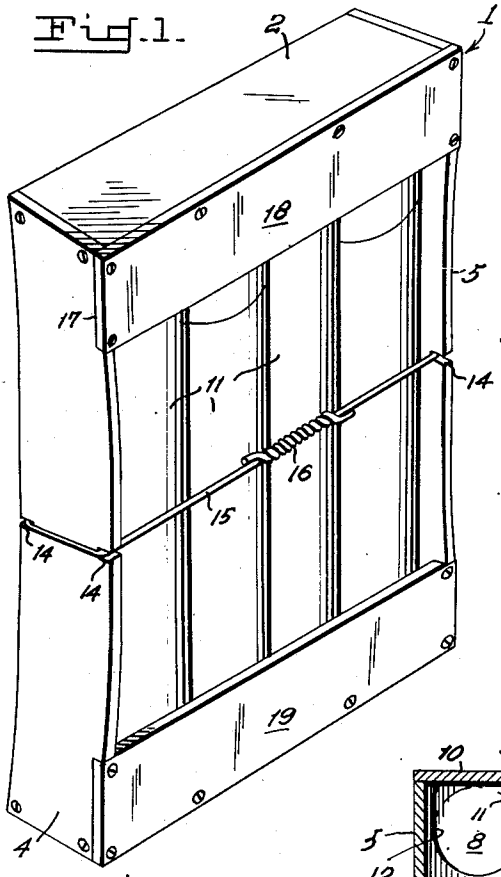

Fig. 2.

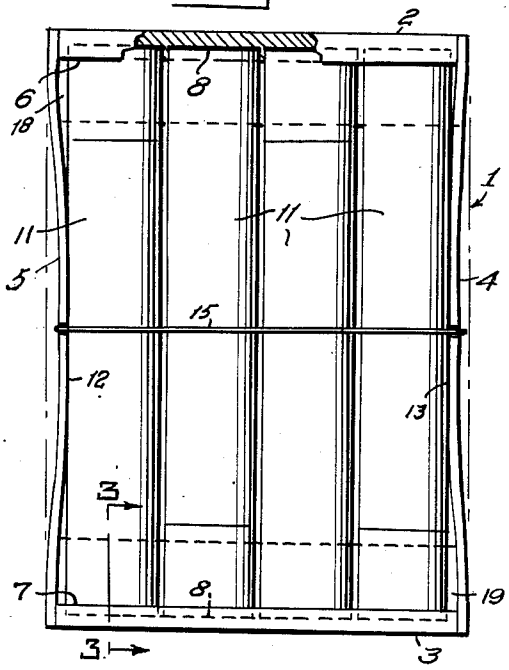

Fig. 4.

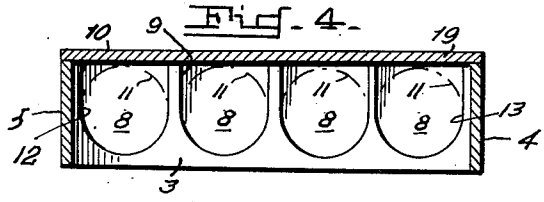

Fig. 3.

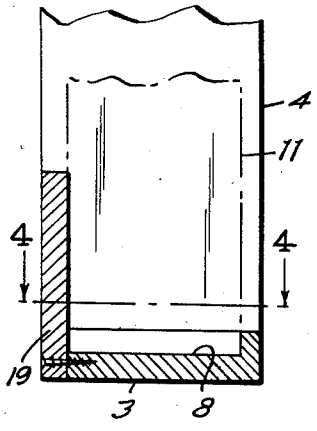

Fig. 5.

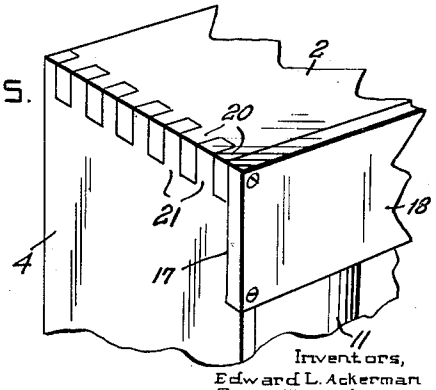

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Fig. 6.

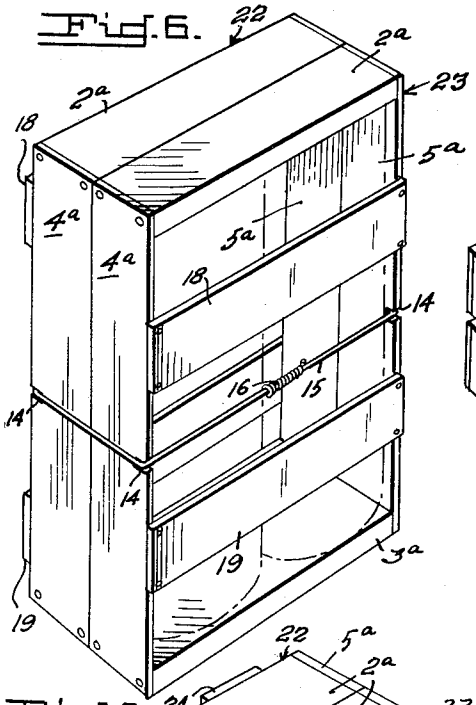


Fig. 7.

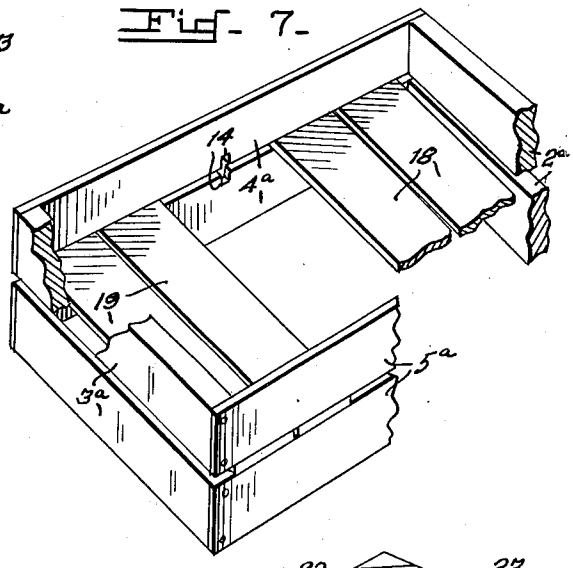


Fig. 8.

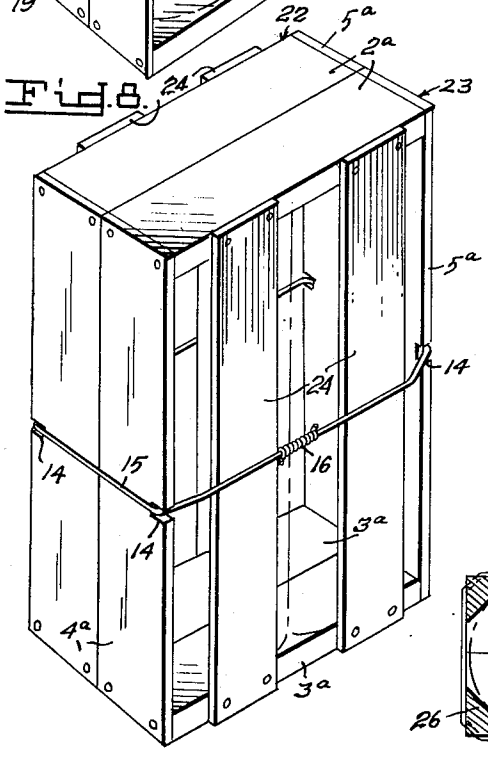
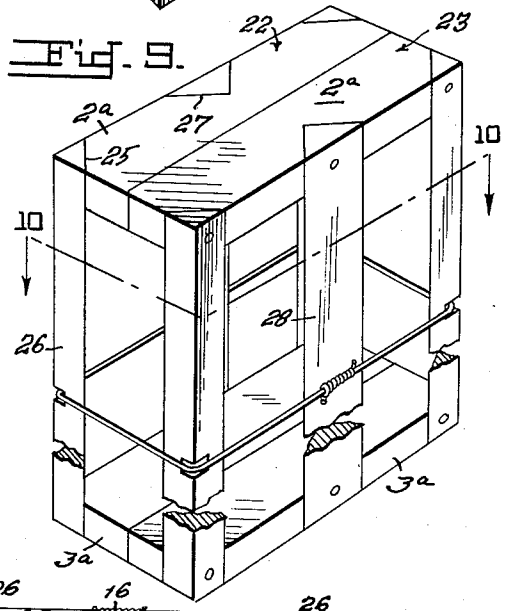


Fig. 9.



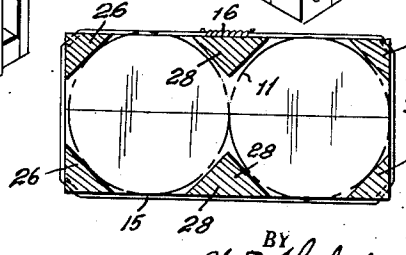


Fig. 10.

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CRATES FOR PACKAGING AMMUNITION

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Application June 29, 1954, Serial No. 440,302

4 Claims. (Cl. 206—65)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment of any royalty thereon.

The present invention relates to wooden shipping packages for projectiles, shells and other similar articles.

Primary considerations involved in the conception and design of a shipping container or package are that the package must be simple in construction, sturdy enough to support the load to be shipped therein, as light as possible within the design limits of the load to be crated, easy to assemble and economical. For an optimum design of packing crate it is deemed advisable to incorporate into the structure details or elements which, for a predetermined load, achieve maximum strength, a decrease in weight of crate as compared with total weight of crate and contents, a decrease in the volume of warehouse and shipping space occupied by the assembled crate, and a decrease in the total amount of lumber used to construct the crate. It is also important that the package be constructed so that the articles to be shipped can be securely and compactly packed and secured, and easily and quickly removed. Another desirable feature is the ready disassembly of the package in a manner to permit the re-use of the component parts of the crate or package.

Crates now in use are merely containers and aside from close fitting dimensions, often require the use of filler materials to assure compactness and to prevent shifting of the load. Some of the more common filler materials utilized are paper, cardboard, fiber board, excelsior, and supports made of the same material or of wood, the filler materials being so arranged in the crate to take up the slack occasioned by the loose fit of the material or load to be carried and/or protected.

Wire strapping and steel tension bands are also used in these prior art packages to bind the entire crate after the load has been secured in place by the usual filler material. If the wire strapping has not been carefully selected to accommodate the strain introduced by stretching and drawing of the strap or wire, the yield point and/or tensile strength of the band may be exceeded with the result that the tie may loosen or the band may break under rough handling. So also, the moisture content of the lumber may have a bearing on the ability of the tie to remain intact. If this moisture content is not closely controlled correspondingly as the proper selection of strap is made, absorption of moisture from atmosphere may again stress the tie band beyond its yield or breaking point.

For the above reasons, the tensile strength and yield point of the tie wire, as well as the moisture content of the lumber making up the crate must be carefully considered and controlled. If the side pieces or longitudinal slats connecting the crate ends are made of resilient material, and if the load usually encased in fiber or cardboard containers is so arranged in the crate as to be supported by and between the ends thereof, the strap may be drawn sufficiently taut to bow or bend the slats concavely inwardly so that their center portions engage a part of the fiber container. This results in an anchoring of the load within the box to prevent shifting, and additionally transfers pressures from the box ends to the load ends with the result that advantage is taken of the columnar strength of the load or material to be shipped thereby enabling the packed crate to better withstand stresses caused by knocking about, dropping and other rough handling. In view of the care with which the band is selected and the moisture content of the lumber in the crate is controlled, expansion or swelling of the resilient sides caused by moisture absorption will merely add to the effect produced by the transfer of stresses to the load within the crate, hence more compactness of load and strength of crate is achieved. In addition the bowed or inwardly concaved slats act as leaf springs to absorb strains occasioned by dropping and rough handling while the packaged crate is in transit.

An additional safety factor which may be introduced to insure against rough handling and to provide additional protection for the load is to make the packing crate of two half crates allochirally mated in the manner of the well known cardboard egg box. This latter construction provides several distinct advantages. The half crates may be manufactured at one location, forwarded separately to a packing depot, loaded and tied by means of the one band encircling the crate intermediate the ends, it being understood that the longitudinal slats are springy or resilient and will bend inwardly as previously discussed. The final assembly is achieved without any nailing or hinge setting since the tie wire is depended upon to hold the halves and the load together. When the crate is dropped on one end or corner, the strain is transferred to the wire or strapping but not to the other half in view of the tendency of the halves to slide with respect to one another. This is important since one of the greatest sources of failure of prior art crates is due to cracking or breaking of the end pieces. Additionally, facility in loading and unloading is achieved and reuse of the crate is possible since only the strapping wire is destroyed to unload the contents of the crate.

Accordingly, a primary need compelling the inception of this invention is the provision of a wooden packing crate for loading and shipping projectiles, shells or the like, which is stronger for a comparable weight of crate, of less weight and volume for a predetermined size of load, and containing less lumber to accommodate the predetermined load, than prior art containers or crates.

In the direction last named, the invention envisages a wooden crate which provides for an interdependence and mutual structural cooperation of three important factors contributing toward an increase in strength in the make up of the loaded crate to be shipped, namely (1) the outer wooden structure or crate, (2) the exterior strapping, and (3) the load or material to be crated or shipped.

It is a further aim to assure the before mentioned increase in strength for a lighter weight container, by supporting the load to be crated between two opposed ends of relatively heavy timber reinforced by thinner springy or resilient side pieces or wood slats connecting the ends, and which in turn are bowed inwardly to press against the outer sides of the load encased in fiber containers by a tensioned band transversely encompassing the crate intermediate the ends thereof, wherefor the stresses in the crate are partially transferred to the material crated.

In this connection yet another object of this invention is to provide a wooden shipping crate or package which is compact and sturdy to withstand rough usage in transit, yet which may be constructed of lighter materials because of the structural cooperation between load, crate and tensioned band, the entire structure resulting in a crate which is capable of ready assembly and wherein the load can be

securely and compactly packed and unpacked with equal facility.

Still another though secondary achievement sought is a shipping crate which may be easily assembled to securely and compactly load the material to be shipped, and which may be disassembled with equal facility to permit reuse of the crate if desired.

With the above and other objects in view which will become apparent as the following specification develops, reference is made to the drawing forming a part of the specification and wherein,

Figure 1 is a rear perspective view of the assembled crate fully loaded,

Figure 2 is a front elevation of the loaded crate,

Figure 3 is a section taken on line 3—3 of Figure 2,

Figure 4 is a section taken on line 4—4 of Figure 3, and

Figure 5 is a rear view of a crate in perspective and showing a modification,

Figure 6 is a modification in perspective view of a crate composed of two equally divided halves and with transverse slats.

Figure 7 is a perspective view of a manner of stacking the crates of Figure 6.

Figure 8 is another modification according to Figure 6 and showing longitudinal slats.

Figures 9 and 10 illustrate yet another modification in which longitudinal slats are dovetailed into the opposed crate ends.

Referring again to the drawing wherein the same numerals have been used to designate like or similar parts in the several views and particularly to the modification illustrated in Figures 1–4, reference character **1** designates a wood crate generally, comprising end walls **2** and **3** of comparatively heavy wood stock, and side walls or slats **4** and **5** of thinner resilient or springy wood composition fastened to the ends **2** and **3** as by nails, screws etc.

The inner faces **6** and **7** of ends **2** and **3** are machined to provide a plurality of circular or cylindrical cavities or wells **8** each merging with parallel slots or recesses **9** of equal depth as cavities **8**, and having a length equal to the diameter of cavities **8** and extending to the rear edge **10** of its respective end **2** or **3**. The cavities **8** and recesses **9** are arranged to provide easy placement of a container to be shipped, the only requirement being that each well **8** in one of the opposed ends be allochirally mated with a corresponding well in the other end so that a shipped article may be received therein and supported by the opposed ends of the crate. In the illustrations shown the articles to be shipped are cylindrical containers **11** extending between the opposed ends **2** and **3** and adapted to contain a shell or projectile (not shown) it being an important consideration to note that the outer vertical faces **12**, **13** of the containers **11** adjacent a side wall **4** or **5** be spaced slightly from the inner face of its respective wall for a reason to be later explained. It is to be understood that other shapes of containers may also be used such as square, rectangular, triangular etc., with the shape of well **8** being altered to correspond with the outer configuration of the container to be packed and shipped.

The forward and rear edges of each side wall **4** and **5** intermediate the ends **2** and **3** are provided with notches or slots **14** for receiving a transverse encircling strapping wire or tensioned band **15**. The wire is drawn tight as at **16** in any convenient manner to an extent such that the side walls **4** and **5** bow or bend inwardly concavewise until the inner faces thereof abut the center portions of surfaces **12** and **13** of the containers, wherefor a pressure is exerted against the contents of the crate to materially reduce the tendency of the load to longitudinal, transverse or fore and aft shifting within the crate. The stripping wire when pulled taut has a two fold effect in addition to anchoring the load. First the bowing of the sides decreases the inside length of the crate between the end pieces and transfers stresses to the end pieces of the containers **11** thereby taking advantage of the columnar strength of the load. Additionally the center portions of the bowed sides are pressed tightly against the opposed vertical surfaces of the two end fiber containers thereby greatly adding to the strength of the crate, and enabling the concave sides to act as leaf springs to absorb longitudinal as well as transverse blows directed thereagainst.

In order to further strengthen the crate the rear edges of side walls **4** and **5** are notched adjacent the ends **2** and **3**, as at **17**, to receive cross wise or transverse slats **18**, **19** which are secured to the side walls and ends as by nails or screws as clearly seen in Figure 1.

Figure 5 delineates a modification in which the top end **2** is provided along the edges to be joined to side wall **4** (**5** not shown) with a plurality of equally spaced tenons **20** to be received in corresponding mortises **21** formed in the top edges of side walls **4** and **5**. In this modification the upper transverse slat **18**, which is secured in place with wood screws after the strapping wire is drawn taut, may be disconnected from the top end **2** by removing the screws, thereby providing for ready removal of the end to enable one to gain ready access to the crate contents without further dismantling, after which the crate may be reloaded and reused, if desired.

In the modification illustrated in Figures 6 and 7, crate **1** is divided into matching half crates **22**, **23**, each half crate comprising opposed comparatively heavy ends **2**, **3** joined by side slats *4a*, *5a* which are springy and resilient thin slats as aforesaid.

The vertical edges of side walls *4a*, *5a* are provided with transverse slots or notches **14** to receive a tensioned band **15** drawn tight as at **16** to bend the side slats inwardly concavewise. In the same manner as in the species of Figure 1, fiber containers (not shown) are packed in side by side relation to extend between the ends **2**, **3** and after the tensioned band is tightened, transverse upper and lower slats **18** and **19** are nailed or secured in any convenient manner across the bottom and top edges of the crate. As clearly seen in Figure 7, the opposed slats **18** and **19** are provided with a lateral spacing such that when a plurality of packed crates are stowed one upon the other, each upper crate is reversed with respect to its subjacent one such that in stowing, a stowage space equal to one thickness only of slats **18** or **19** is lost. Similarly as in the modifications of Figure 1, when the tensioned band **15** is tightened, all the ends **2** and **3** are drawn closer together so that they appear against the flat ends of the fiber containers, and the sides are drawn in to bear against the vertical faces of the fiber containers, wherefor the crate is strengthened by the transfer of stresses to the fiber containers.

In the modification illustrated in Figure 8 the crate is constructed similarly as the crate in Figure 6 with the exception that longitudinal slats **24** parallel to the slatted side walls replace the transverse slats **18** and **19**. The tensioned band or wire **15** encircles the side walls as well as the slats **24**, so that all the longitudinal members are bowed inwardly to engage a corresponding vertical wall of a packed fiber container (not shown). This particular crate is not as adaptable as the crate of Figure 6 for stowing purposes, especially since a storage space equivalent to two thicknesses of slats is lost between each pair of crates placed one upon the other.

Figures 9 and 10 represent yet another modification featuring a crate **1** composed of allochirally mated half crates **22**, **23** in which the opposed ends **2** and **3** are provided with truncated corners **25** to receive triangular longitudinal support members or slats **26** so that the base thereof abuts the truncated corner **25** and the remaining two sides complete the rectangle formed by each end **2** and **3**. The opposed ends **2** and **3** are also provided in the long side of each rectangle with longitudinally parallel triangular notches **27** to receive additional elongated triangular support members **28** disposed therein so that the base of each support slat lies in the plane coincident

with the plane through the vertical edge of each corresponding end 2 and 3 to present a flush vertical surface. The crate is again encircled by the previously described transverse tensioned band 15 received in slots 14 of each corner slat 26, drawn tight as at 16 to again take advantage of the columnar strength and support of fiber containers 11 received in the crate. In the illustration shown the crate is intended to accommodate two fiber containers with the inner flat vertical faces of slats 26 and 28 arranged to form a cradle to abut the vertical sides of the container received therein. In view of the greater thickness of the support members 26 and 28 it is apparent that a stronger tensioned band is necessary to place the entire crate under stress to transfer a part of strain to the fiber containers. It is also apparent that the overall volume and especially the depth of this crate is smaller for the same diameter fiber container, than the other crates illustrated.

With the above description there has been disclosed a plurality of crates incorporating the same essential design features, and varying only in details within the purview and scope of the basic design. Each crate illustrated represents a structure which results in a tremendous saving of weight, space and amount of lumber used as compared with the packed weight of a comparable crate for packing the same weight and size of load, or packed goods, while at the same time providing a crate which is stronger to withstand rough handling and usage, dropping and knocking about in transit.

Additionally the invention contemplates the use of additional transverse tensioned bands, for example one each adjacent the ends of the packing crate after the center band has been drawn tight, and other longitudinal straps, to increase materially the strength of the crate and to insure secureness of the packed crate, and to emphasize the characteristics envisioned and described above.

Numerous other modifications and alteration of the disclosed and illustrated structure will be apparent to a person skilled in the art, and it is obvious that the same may be made without departing from the spirit and scope of the invention as defined in the following claims.

We claim:

1. In combination with a packing crate having end walls and resilient side walls, a load supported by and extending between said end walls, said load comprising a plurality of parallel elongated containers arranged in side by side relation between said side walls, there being a narrow space provided between the vertical face of an end container and its corresponding side wall, a tensioned band encircling said crate and said load intermediate said end walls, said tensioned band being drawn tight to force said end walls into intimate engagement with the ends of said containers and said side walls into abutting engagement with the vertical walls of said end containers in the vicinity of said tensioned band.

2. A shipping crate comprising a pair of rectangular box ends, a plurality of oppositely disposed resilient slats secured to the vertical edges of said box ends to form said crate, a plurality of elongated fiber containers received in said crate in side by side relation, each of said containers having opposed ends disposed in abutting engagement with the inner surfaces of said box ends, and a tensioned band transversely encircling said crate intermediate said box ends, said tensioned band being tightly drawn to force said box ends into intimate engagement with the ends of said fiber containers and said side walls into abutting engagement with an adjacent parallel surface of said fiber containers.

3. A shipping crate comprising opposed rectangular box ends having truncated corners, a first plurality of resilient triangular slats secured to each opposed pair of corners of said box ends and completing the rectangular conformation of each box end, each of said box ends having triangular notches formed centrally in one pair of opposed edges, a second plurality of resilient triangular slats received in said notches and secured to said box ends, the bases of said first plurality of slats forming with the confronting faces of said second plurality of slats a receptacle, a container snugly received in each receptacle and extending between said box ends, and a tensioned band encircling said crate intermediate said box ends, said tensioned band being tightly drawn to bend said resilient slats inwardly into abutting engagement with the sides of said containers, and to force said box ends into intimate engagement with the ends of said containers.

4. The crate of claim 3, said crate being formed of two allochirally mated half crates secured together by said tensioned band.

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