May 17, 1927. 1,629,255

J. S. CARROLL

INSULATION CONSTRUCTION FOR CONTAINERS

Filed Dec. 28, 1923 5 Sheets-Sheet 1

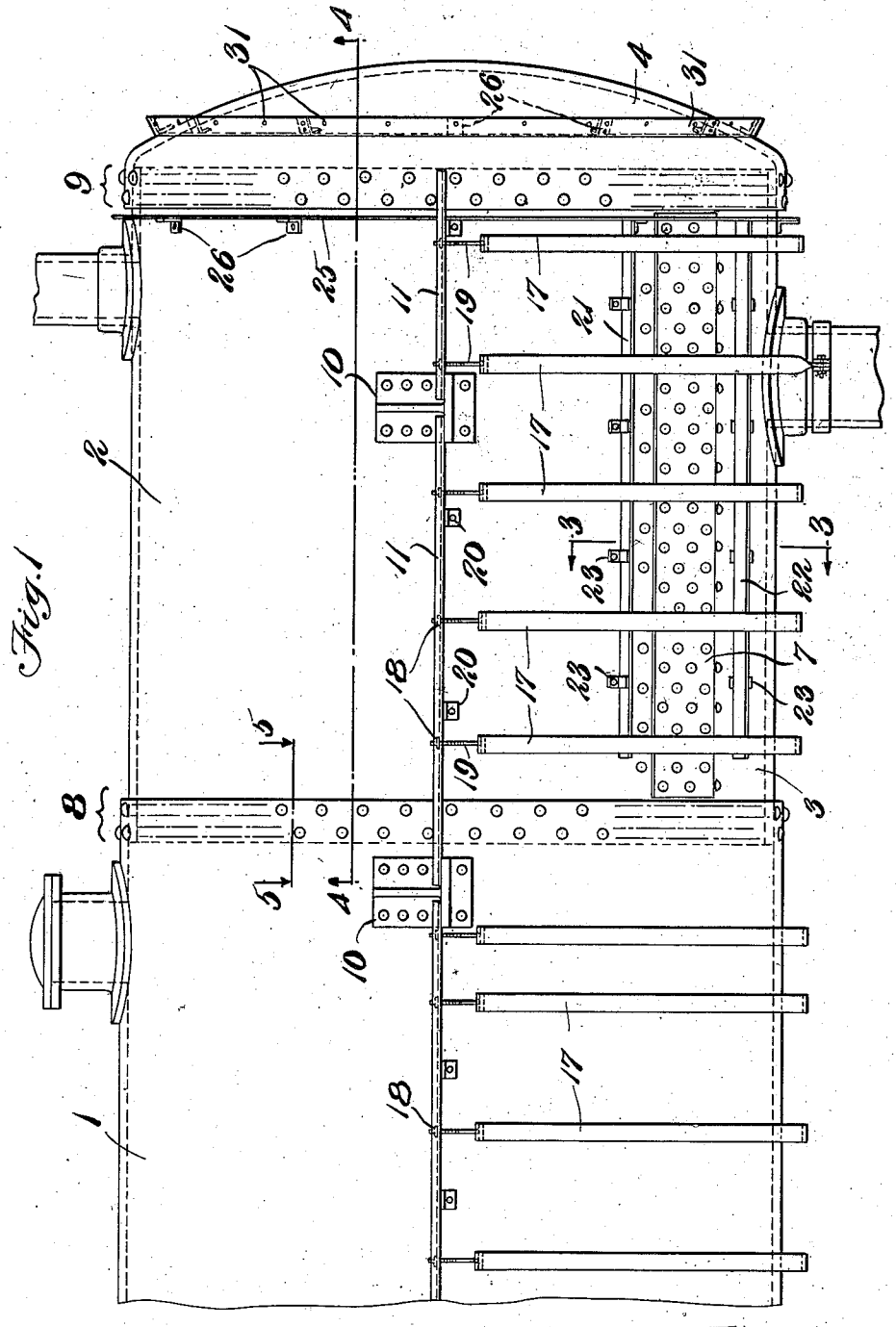


Fig. 1

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John S. Carroll
by Roberts, Roberts & Cushman
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Fig. 2

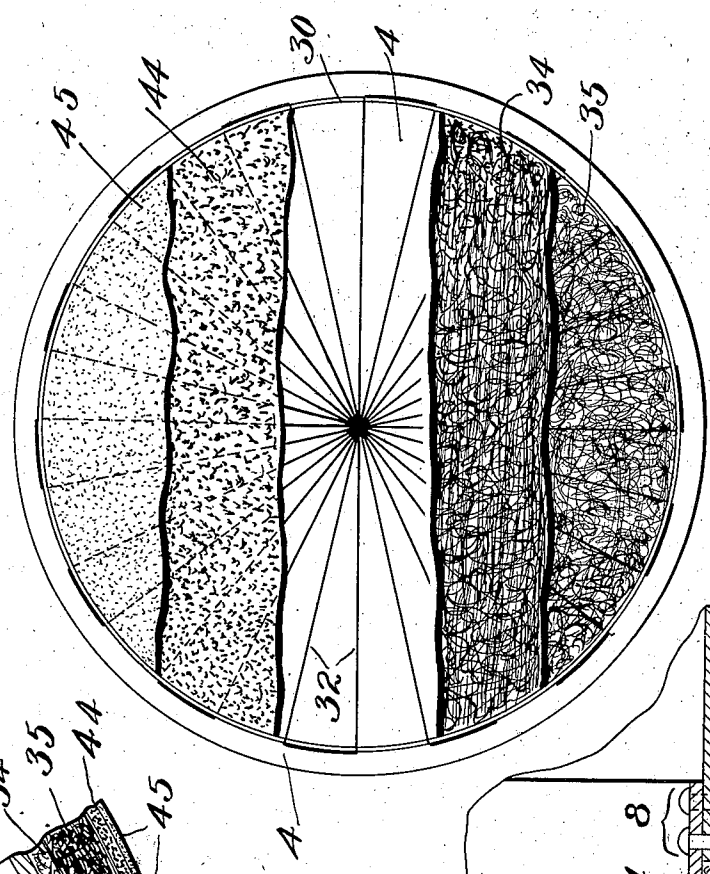


Fig. 3

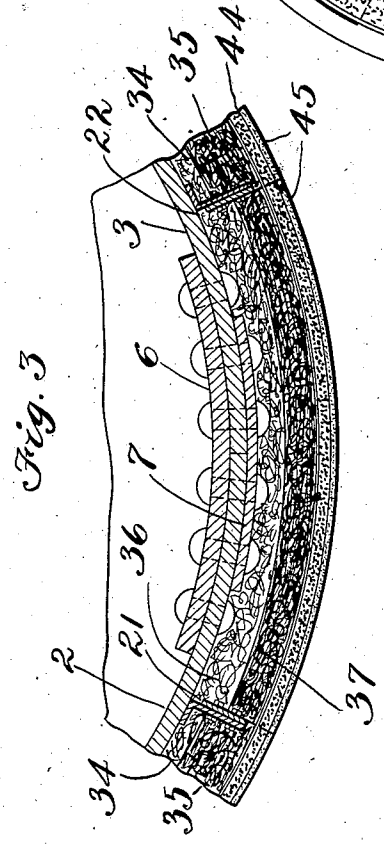
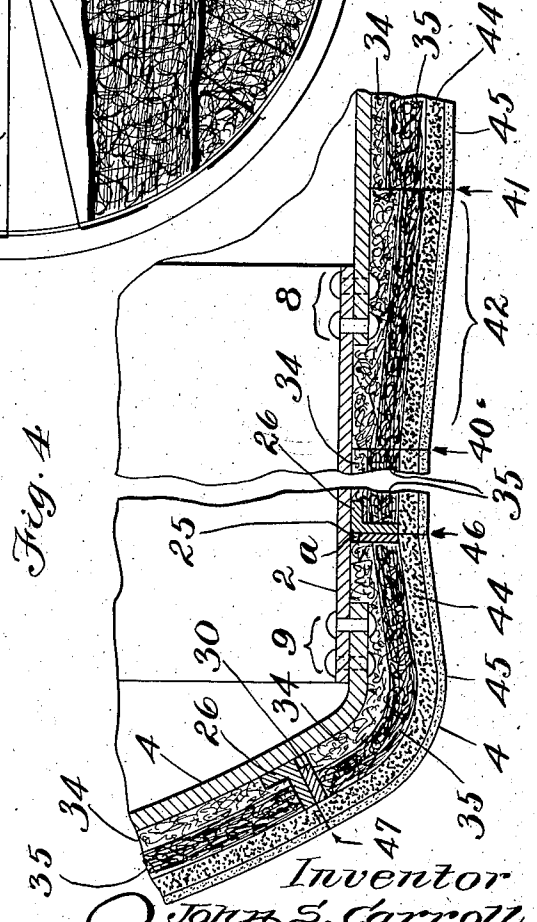


Fig. 4



Inventor
John S. Carroll
by Roberts, Roberts & Cushman
Its Att'ys

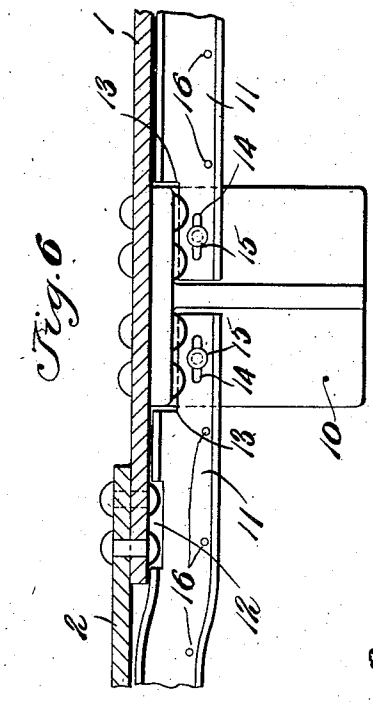
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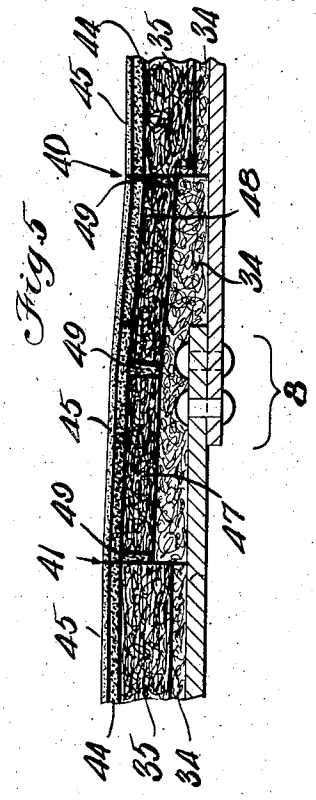
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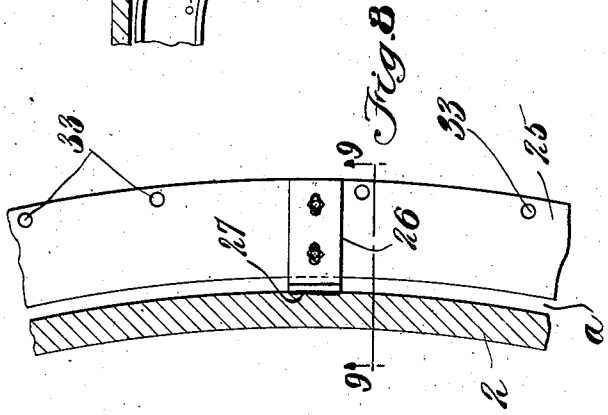
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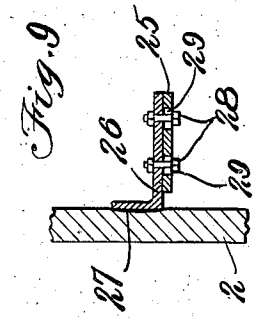
INSULATION CONSTRUCTION FOR CONTAINERS

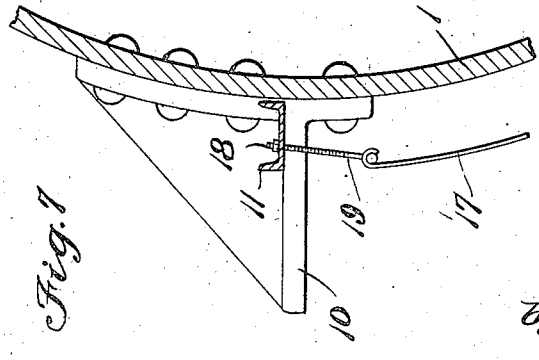
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Inventor
John S. Carroll,
by Powers, Roberts & Cushman
his Att'ys

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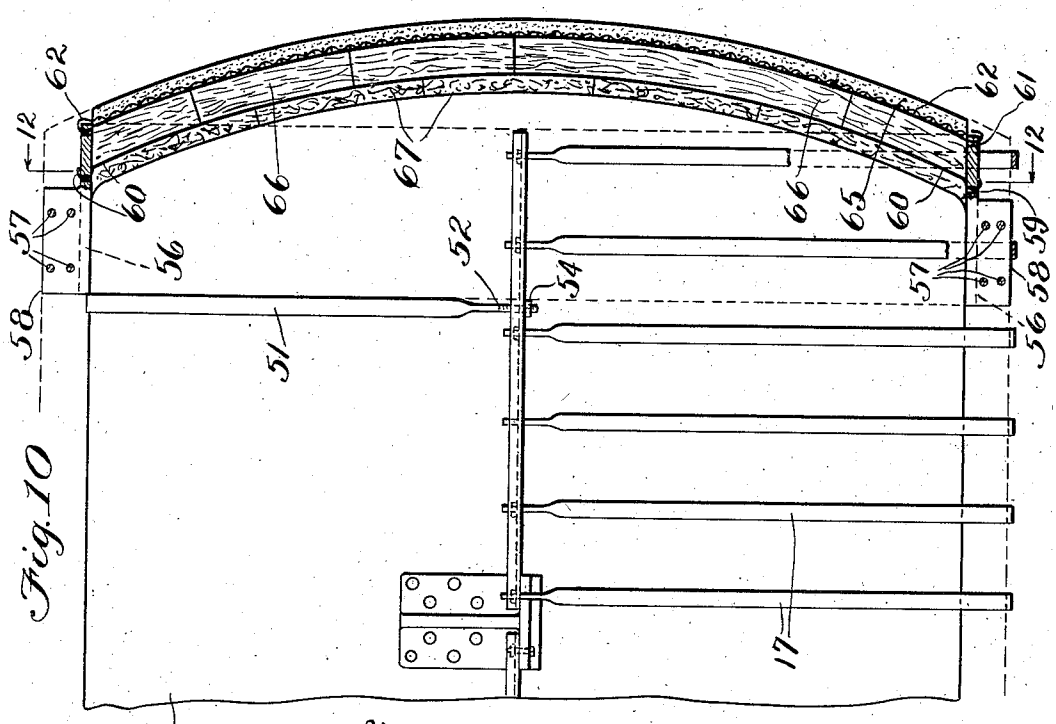


Fig. 10

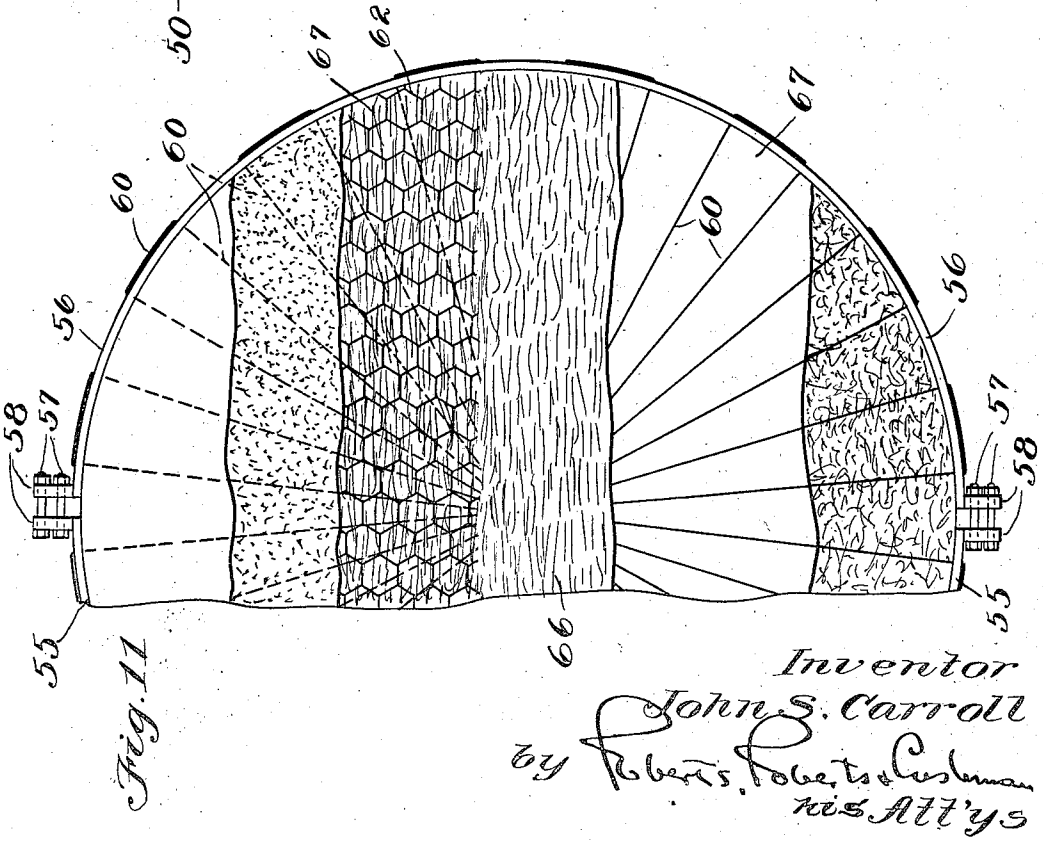


Fig. 11

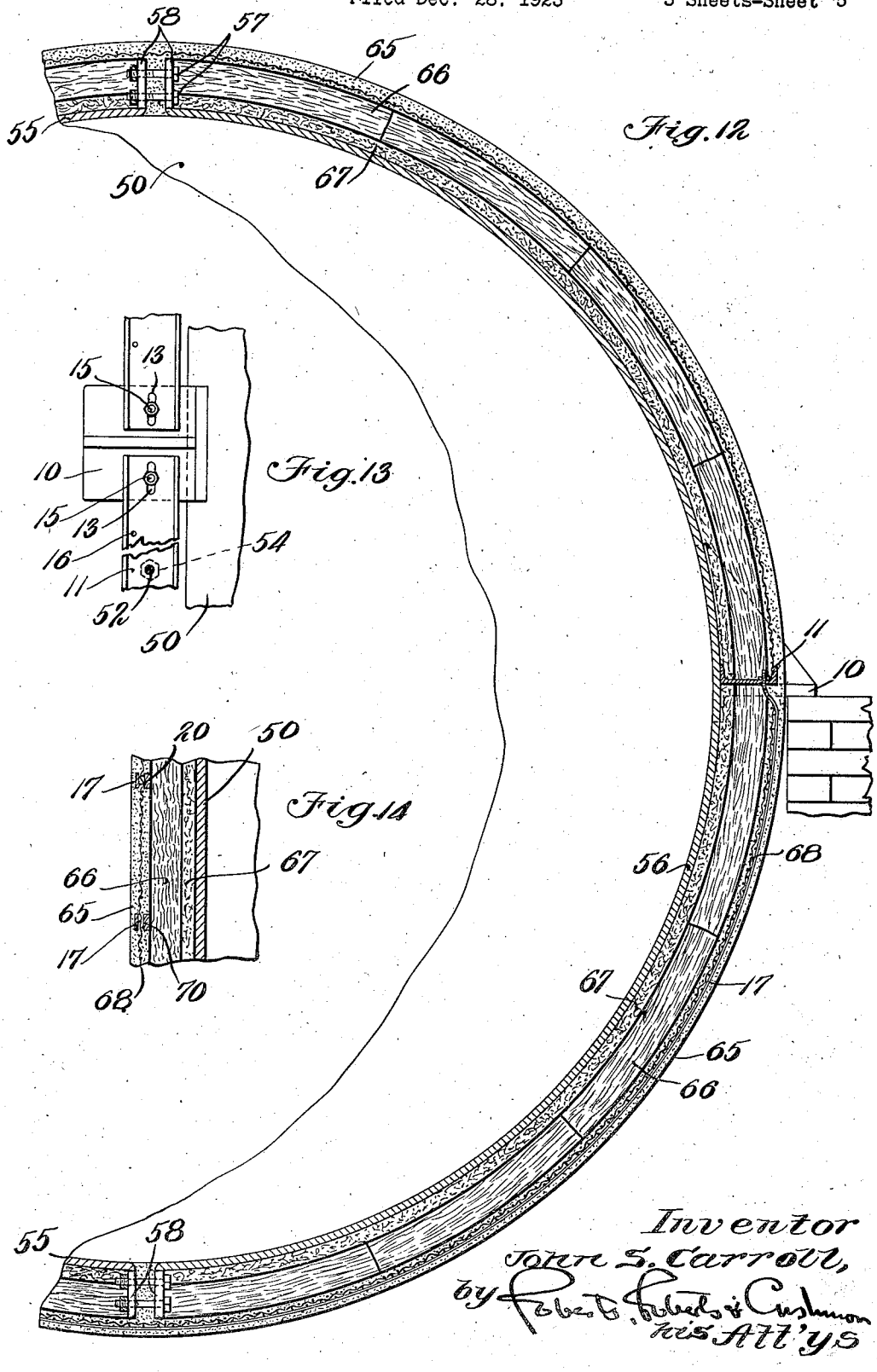
Inventor
John S. Carroll
by Roberts, Roberts & Cushman
his Att'ys

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UNITED STATES PATENT OFFICE.

JOHN S. CARROLL, OF YONKERS, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO JOHNS-MANVILLE CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

INSULATION CONSTRUCTION FOR CONTAINERS.

Application filed December 28, 1923. Serial No. 683,239.

This invention relates to heat-insulation coverings for containers such as boilers, stills and tanks.

Large drums such as steel boilers and tanks, whatever the use for which they may be intended, are usually made in sections and have seams which run longitudinally and circumferentially of the outer surface. These joints are riveted, lap-welded, butt-welded or otherwise joined to make the container gas-tight, and are regularly or irregularly disposed over the surface, as the case requires. Other forms of such containers are welded or integral, but in each instance there are hand or manholes, entrance or exit pipes and other interruptions to continuity of the body or shell of the container.

When such containers or tanks are used for holding materials which are to be maintained at a temperature above or below that of the surrounding atmosphere it is necessary to protect them with an insulating covering. It is desirable that this covering shall be resistant to wear and unaffected by expansive and contractive forces to which such structures are subjected. It is also important that the insulation be permanently retained in position and in close contact with the surface of the tank or boiler.

By the methods and materials at present employed for this purpose effective insulation is not obtained. The coverings applied are not held securely in place and frequently become loose, thus permitting the intrusion of the atmosphere and consequent undesirable loss or gain of heat. This difficulty is encountered especially with the under portion of the structure, where the insulation tends by force of gravity to separate from the surface of the container. Likewise the expansion and contraction of the container loosens and cracks the coverings.

Moreover, it often becomes necessary to inspect or repair the joints or connections of a boiler, still or tank, and for this purpose the insulation over them must be removed. In the best constructions known to me, such removal of a part or section of the insulation loosens and destroys the adjacent areas, so that the covering is weakened generally and air passages are formed therethrough. Patching or cementing over broken edges and cavities of this sort is both difficult to perform and ineffective in its results. Consequently, the operation in good practice requires the complete removal of the insulation from the boiler and the relaying of an entirely new covering in order to secure satisfactory insulation thereafter.

This requires the use of a large quantity of material and necessitates a great amount of labor in addition to the loss of time and service of the boiler or equipment while it is under repair.

Objects of the present invention are accordingly to overcome the expenditure of time, labor and materials which are thus involved by the present constructions for insulating boilers and similar containers; to provide reinforced insulation coverings, which will effectively meet the conditions to which they will be subjected in use and sections of which may if necessary be removed from predetermined portions of the container without affecting the remainder of the insulation; and to secure further advantages and provide further structures hereinafter alluded to.

In its general aspects, this invention provides separate and distinct insulating coverings for those portions of a surface to be protected which are subject to occasional inspection or repairs, and for those portions of the covering which are applied to areas of such surface not subjected to uncovering, and provides for retention of said coverings in intimate contact with and in expansible relation to the surface as a whole and in cooperative relation to each other.

The widest use of the invention is in the protection of cylindrical containers, such as boilers, still drums or the like, mounted in horizontal position, but structures within the invention are equally adaptable to other containers.

A representative instance of the inven-

tion will be now described in relation to use as an insulating covering for a horizontal pressure still, such as shown by the accompanying drawings, in which:—

Fig. 1 is a side elevation of a pressure still having means adapted to hold a layer of insulation in place;

Fig. 2 is an end view of a cylindrical container, such as shown in Fig. 1, showing the insulation thereon, partly broken away to show layers of which it may consist;

Fig. 3 is a transverse section across a riveted but seam of a still, for example on line 3—3 of Fig. 1, showing an insulating covering thereat.

Fig. 4 is a detail longitudinal, radial section on line 4—4 of Fig. 1 and across the lapped joints between the middle and end drum, and a still head, respectively, showing the insulation covering;

Fig. 5 is a detail longitudinal section of a lapped circumferential joint between drums of a container, for example on line 4—4 of Fig. 1, showing a modified structure of insulation covering;

Fig. 6 is a detail in longitudinal section and plan of side lugs and flanges on the still;

Fig. 7 is an elevation partly in section of the devices of Fig. 6;

Fig. 8 is a detail in elevation of a circumferential band mounted upon the still;

Fig. 9 is a detail section on line 9—9 of Fig. 8;

Fig. 10 is a side elevation similar to Fig. 1 showing a welded drum and a modified form of head-end insulation covering in section;

Fig. 11 is an end view of the devices of Fig. 10, the layers of the insulation being broken away;

Fig. 12 is a vertical section on line 12—12 of Fig. 10 showing the insulating covering in place;

Fig. 13 is a detail plan showing the construction of certain flanges and

Fig. 14 is a detail horizontal section of the insulation covering and still cover of the construction of Fig. 10.

Referring now to Figs. 1 to 9, the drawings show a familiar form of container, e. g., a pressure still, having an end drum 2 of its body portion made up of steel plates 3 bent into segmental cylindrical form, abutting at their longitudinal edges, and having inner and outer butt-straps 6, 7, Fig. 3, copiously riveted at each side of the longitudinal seams so formed.

An end drum so built is telescoped into the end of a similarly constructed middle drum 1, to which it is held by the riveted transverse seam 8, and into a built-up segmental, integrally-cast or pressed metal shaped head 4 having an annular rim fitting over the drum 2 and riveted to it at the seam 9, Figs. 1 and 4.

Such constructions are typical of horizontal pressure stills, boilers and tanks in which seams or the joints are riveted. The riveted or other plate joint spaces ought to be capable of being frequently inspected, for safety, but heretofore this has involved the practical destruction of the lagging or insulation, if any, applied to the container, and inspection is often neglected because it is too difficult to expose the seams.

In order to removably retain the improved type of insulating covering herein described, this invention provides a system of supports projecting from the container and suitable retaining means. For example, referring now to Figs. 1, 6 and 7, the usual heavy castings 10 riveted to the container at its opposite sides are caused to support longitudinal flanges 11, 11, which may, as shown in Fig. 6, be channel-irons suitably bent at the transverse riveted seams to conform to the surface of the container, may be cut away at 12 to pass rivet-beads, may be recessed, as at 13, to fit around the lugs 10, and may be provided with longitudinal slots 14 for holding bolts 15 in holes in lugs 10, to allow for expansion of the container. A system of holes 16 near the margins of the flanges 11 provide anchorages for nuts 18 (Fig. 7) on the reduced threaded ends of shackles 19 for the retaining straps 17 extending from the flanges 11 on one side around the bottom of the container to the flanges 11 on the other side of the container. If desired, the channel-bars constituting the flanges 11 may also be supported by angle-lugs 20 riveted or welded to the container.

At intervals on the surface of the container, and particularly at places on either side of the plate-joint spaces, openings, connections or other parts of the container which should be capable of frequent inspection, flanges, such as the longitudinal flanges 21, 22 (Fig. 1) are erected by any suitable construction, for example by attachment to angle lugs 23 screwed, riveted or welded to the container.

The container is further provided with transverse or circumferential exterior flanges 25, Figs. 1, 8, and 9, near and spaced from transverse plate-joint spaces or other parts of the surface desired to be exposed for inspection. A preferred construction for the flanges 25 as shown in Figs. 1, 8 and 9 comprises angle lugs 26 spot-welded at 27 to the metal container and having holes for bolts 28 adapted to enter radial slots 29, 29 in the segmental or circular metallic flange 25. Flange 25 may be provided with holes 33 for lacing wires.

In relation to the plate-joint space 9 at

the point between the head 4 and end drum 2, a preferred construction comprises a flange 25 and a conical flange 30, Figs. 1, 2 and 4, on and concentric with the head 4 near its periphery. Flange 30 may also be mounted on attached angle lugs 26, and may be provided with holes 31 near its outer edge to receive lacing wires 32, Fig. 2, or other tension members adapted to hold layers of insulation material on the surface of the container head 4.

The purpose of the system of flanges will now be manifest. These structures respectively constitute strong divisions defining and independently supporting sections of applied insulation, within which sections the insulating substances may be removed and replaced without disturbing adjacent sections to any substantial degree. The divisions or flanges moreover constitute convenient supports for tension members adapted to hold the sectional insulation on the convex surfaces to be protected by it.

The surface of a container thus equipped is entirely covered with an insulating material, preferably a porous and flexible material adapted to conform thereto. The specific material or composition employed may be selected with respect to the particular conditions of use, but ordinarily it will be found advisable to use a heat-resisting material which will form an intimate contact with the container and which will adhere more or less firmly thereto, such as an asbestos felt, or any plastic refractory cementitious and fibrous aggregate, or laminæ of felted asbestos or the like. The further covering of each section so provided may consist of a single layer, but preferably of two or more layers, applied over the initial layer, and of a material having less resistance to high temperatures than the material of the first layer. This makes possible the satisfactory use of a wide range of materials, including those of greater insulating properties but of less resistance to the higher temperatures than the materials recommended for contact with the container. In practice, the outer layer or layers may be added, without regard to the heat resisting quality of their materials, so long as these are chosen with respect to their low heat conductivity. Such insulating material is preferably in the form of flexible porous sheets or molded shapes adapted to conform to the first layer. An outer coating preferably of a cementitious material capable of being finished with a hard, stiff surface, and substantially unaffected by wear, weather and such other conditions, as may be incidental to its intended service, may be employed.

In relation to containers like the pressure still shown by the drawings, before applying or after removing the bands 17, a layer 34 of temperature-resisting insulation material, preferably of the flexible fibrous character described, is laid over the upper portion of the body of the still. This layer 34 may comprise sheets, preferably butt-jointed, or singly sufficiently long to extend from the flange 11 on one side to the flange 11 on the other side. This layer may cover the area from the annular flange 25 to plate joint 8 (or a dividing flange, not shown, near this joint, if desired) and in the preferred construction at least a portion of the layer 34 is formed in the spaces, such as *a*, Figs. 4 and 8, between the container and the flanges, to avoid substantial conductive transfer of heat by the metal of the flanges.

Upon layer 34 a layer or sheets of insulating material 35, not necessarily so resistant to high temperatures as layer 34, may now be laid. Layer 35 may consist of any porous or fibrous material having low effective heat conductivity; for example, the material may be cellular aggregate of asbestos and magnesia, an asbestos felt, a sponge felt, a fibrous mat or felt, or any other material having low heat conductivity. If sheets are used, they are laid smoothly and firmly against the first layer and are co-extensive therewith, with broken joints as between layer and layer.

A layer 36, Fig. 3, which may be of fibrous asbestos admixed with a cement binder, or other suitable plastic, may be formed over the outer butt strap 7 of the longitudinal joint in the section between flanges 21 and 22. A second layer 37 of strips of a suitable felt, such as sponge or fibre, may be laid upon layer 36 butting firmly against flanges 21 and 22 at their edges. In each division of the surface between the partitions or flanges an independent section of multi-layer non-conductive substance may thus be built up.

If desired, the procedure resulting in a divided sectional non-conducting covering may be resorted to without the provision at every place where the covering is discontinuous of the supporting divisions or flanges. For example, as shown in Fig. 4 at 40 and 41 in relation to a section 42 covering the plate joint 8, the various layers of the insulation may merely cease at a line of division, such as will result by building up the layers with the aid of temporary forms at the surfaces 40 and 41. Such a section as 42 may be taken out and replaced with minimum damage to neighboring sections. As shown in Fig. 5, removal of the section applied in such a situation may be further facilitated by therein building up the layer 35 of many separate pieces, as 47, 48, of the intermediate insulating material, the joints, as at 49, being filled with an

easily-broken cement. Such constructions of removable sections represent feasible practice except at places, such as the bottom and ends of the container, where mechanical support for the sections should be provided to resist special strains.

In the preferred construction, every section of the applied non-conductive layer is provided with a hard cementitious shell, such as the layer 44 of a plastic bonding material admixed with asbestos, and an outer surface coating 45 of asbestos fibre and Portland cement, which may be painted if desired. The layers 44, 45, may be applied when the layers 34, 35 have been built up to the thickness defined by the several flanges 11, 21, 22, 26, etc., and thus may overlap these flanges; but preferably planes of division, e. g., at 46, 47, Fig. 4, are formed between the sections of the covering in line with the several flanges.

Such parts of a container as the head 4 and the annular region of the plate joint 9 present special difficulties, heretofore frequently causing no adequate insulation to be provided. But having provided the annular flange 30, the head 4 may have applied to it, within the space defined by flange 30, layers 34 and 35 corresponding to the remainder of the structure; these are preferably held on by lacing the wires 32 through the holes 31, Figs. 1 and 2, and diametrically across the convex end. The annular section between the flanges 25 and 30 may be formed similarly, the layers 34 and 35 being laced on by wires passed through holes in the partitions. The whole annular and convex end portion may then be covered with the cementitious coatings 44, 45.

Under the severe requirements for pressure stills, often operating at temperatures reaching to 700° to 750° Fahrenheit, the sectional constructions mentioned are of particular advantage because they permit operation with the plate-joints and points of doubtful strength of the still exposed, and enable the insulation to be completed neatly and effectively after a test run or runs with these danger points under observation.

The same principles of construction may be applied, with appropriate structural modification, to the somewhat different situation presented by a container without riveted seams, such as the welded pressure-tank or still shown at 50, Figs. 10 and 14. There is not here the same necessity for sectional construction; usually replacement will be confined to the ends of the container or to its longitudinal bottom or top halves. The device of the lateral flanges 11 is retained, in the form shown in Fig. 13, but their support is confined to that afforded by the lug 10 and bolts 15, and suspension straps 51 having reduced threaded ends 52 in holes 53 in the flanges 11, on which they are held by nuts 54.

An annulus in halves 55, 56 is clamped about the ends of the container by bolts 57 in holes in upturned lugs 58, and provides a projecting annular flange at each head end of the container. This annular flange is provided with inner holes 59 for lacing wires 60, and with outer holes 61 for the wires of a wire net 62, serving to reinforce a protective cementitious coating 65 covering and confining a layer of insulation mat or felt 66 superimposed on asbestos felt or sheets 67 held in place by the lacing wires 60.

The cylindrical body of the container 50 is similarly covered by an asbestos or asbestos-containing layer 67, in turn covered by insulation mat or belt 66 and a cementitious outer layer 65 laid on and in the meshes of wire netting 68 stretched from flange 11 to to flange 11 about the upper and lower halves of the container, and preferably resting upon spacers 70, Fig. 14, applied circumferentially on the layer 66.

The supporting straps 17, as above described, preferably are covered with the cementitious layer 65.

As so constructed, the insulation is sufficiently yielding not to be damaged by expansion and contraction of the container, and effective support, with capacity for removal and inspection, is effected for the end section, and the top and bottom halves of the insulation.

I claim:

1. In a container of the character indicated comprising a body and a head having overlapped edge portions secured together to form a plate-joint, a layer of insulating material over said head consisting of preformed pieces shaped to fit said head, means holding said layer in place on the head comprising a plurality of radial bands, a layer of insulation on said body consisting of preformed pieces shaped to fit said body, a plurality of bands holding said body-layer in place, each provided with take-up means, insulating pieces covering said plate-joint, and means holding said pieces in place and permitting ready removal thereof without disturbing the insulation either of the body layer or the head layer.

2. In a container of the character indicated, comprising a cylindrical body and a head having overlapping edge portions secured together to form a plate-joint, said head having a spherical outer surface, a layer of insulating material over said head and consisting of preformed pieces shaped to fit said spherical surface, means holding said pieces in place, comprising a ring secured to said head adjacent said plate-joint and a plurality of bands connected at one end to said ring and extending radially to-

ward the center of said head, a layer of insulating material on said body consisting of preformed pieces shaped to fit the cylindrical surface of said body, a plurality of circumferentially extending bands holding said pieces in place and provided each with take-up means, insulating pieces covering said plate-joint and means holding said last mentioned pieces in place and permitting ready removal thereof without disturbing adjacent body or head insulation.

Signed by me at New York city, N. Y., this 26th day of December, 1923.

JOHN S. CARROLL.

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