Sept. 20, 1960 J. WENZL 2,952,922

APPARATUS FOR VACUUM-DRYING TEMPERATURE-SENSITIVE GOODS

Filed Jan. 4, 1956 2 Sheets-Sheet 1

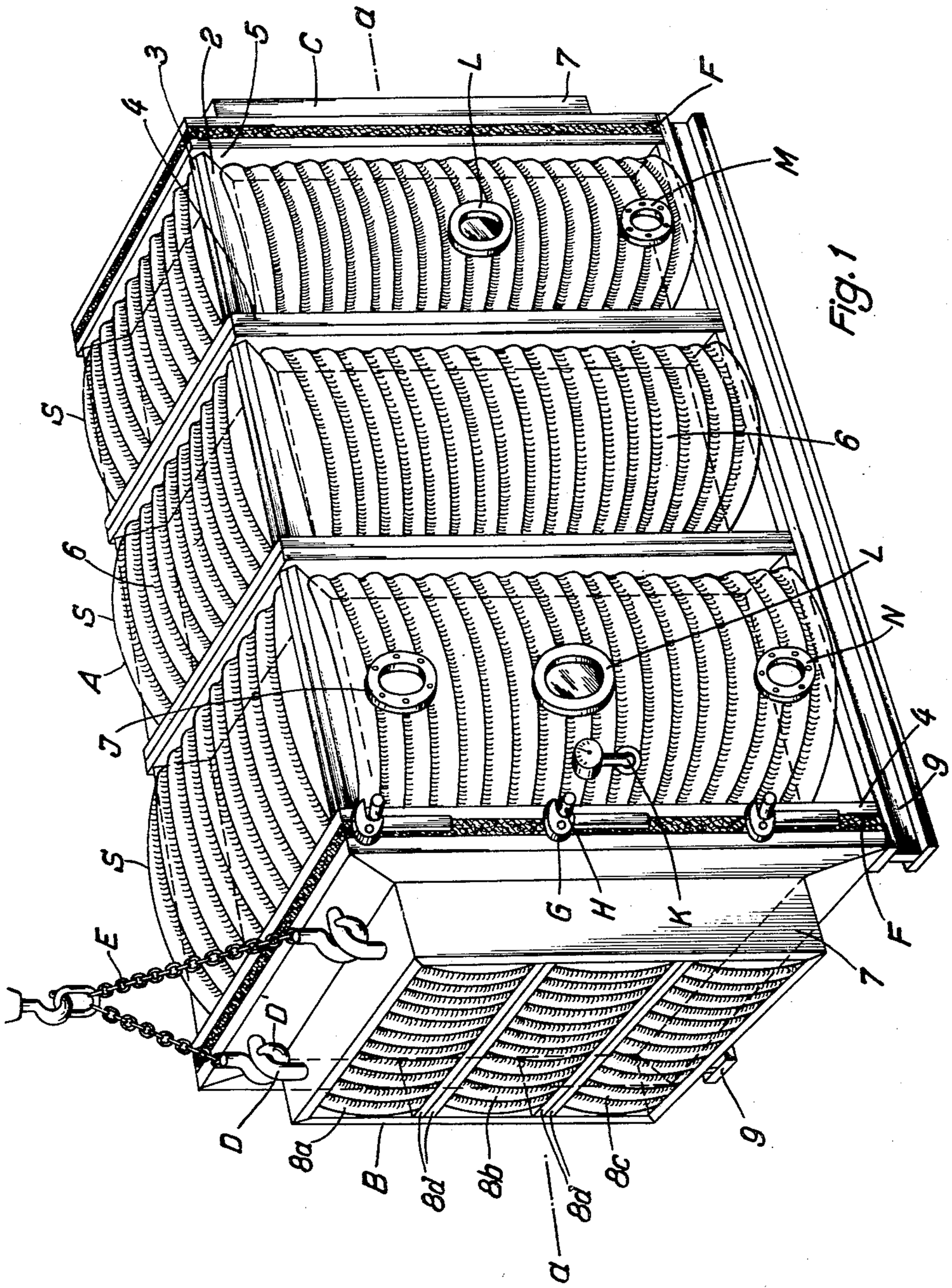

Fig. 1

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Fig. 2

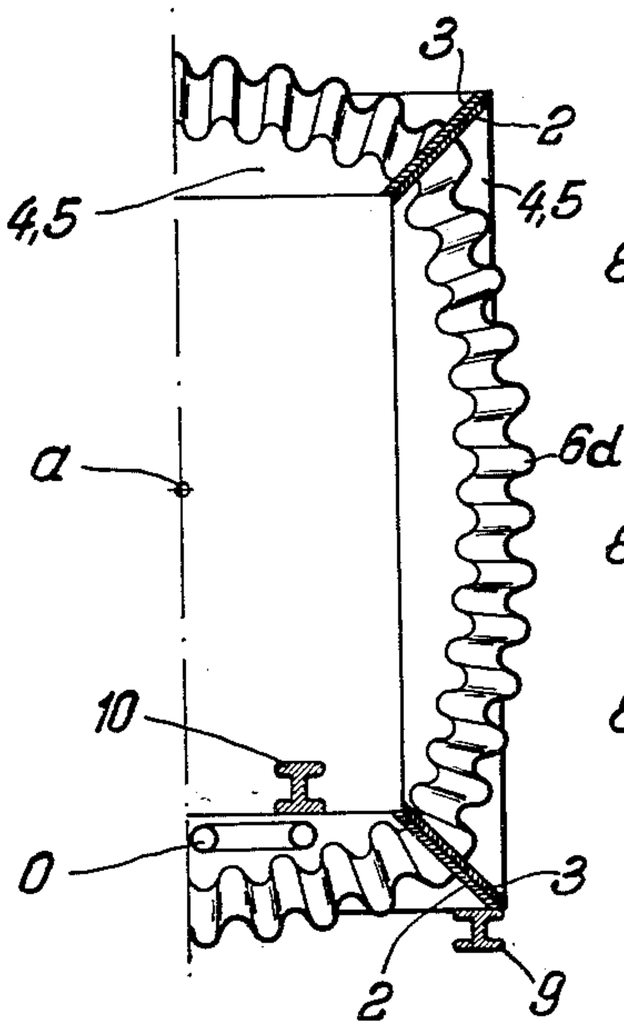


Fig. 3

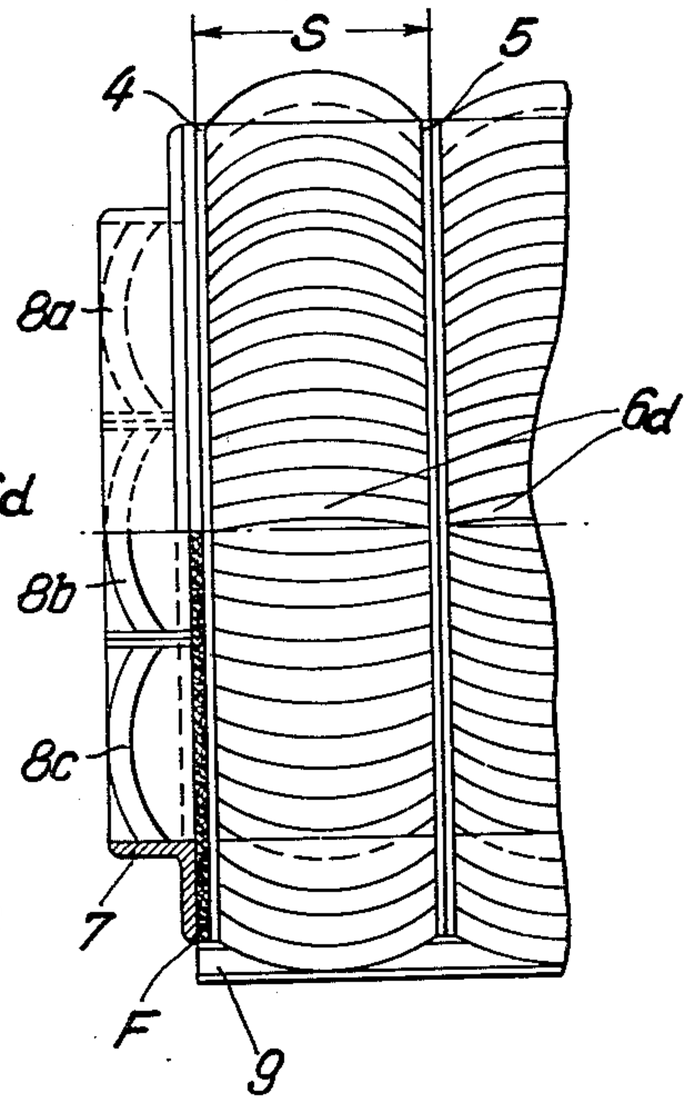


Fig. 4

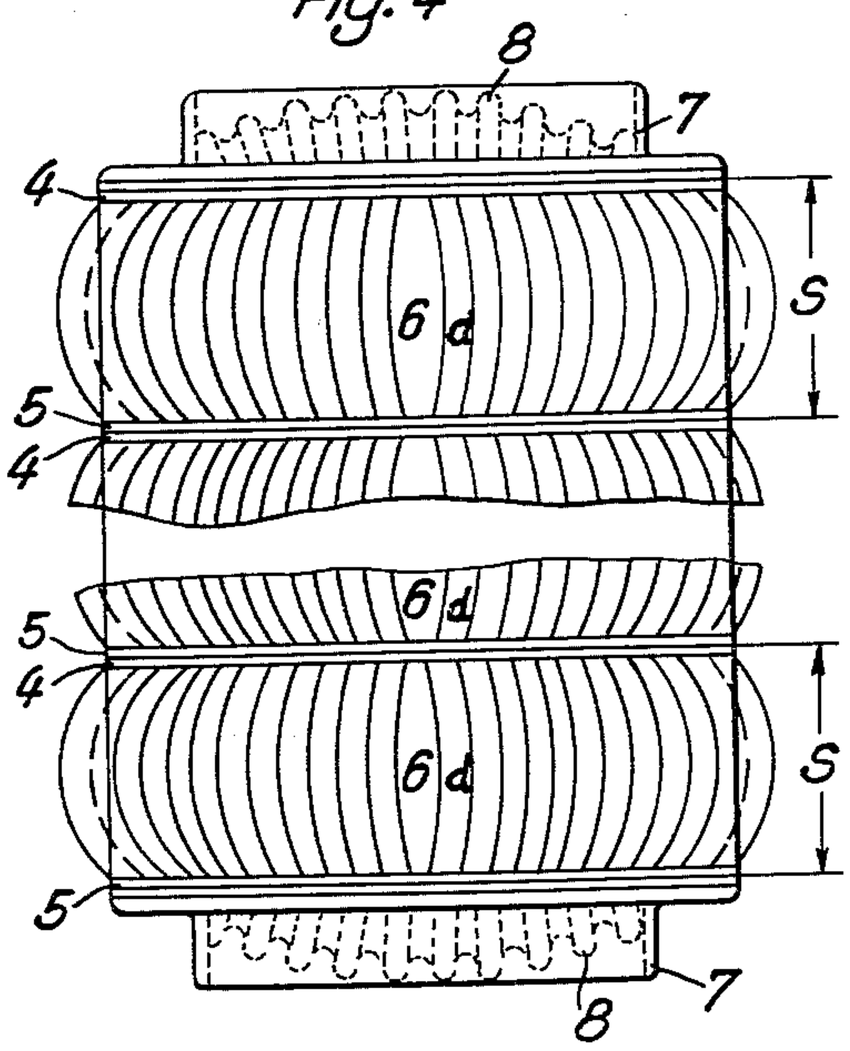
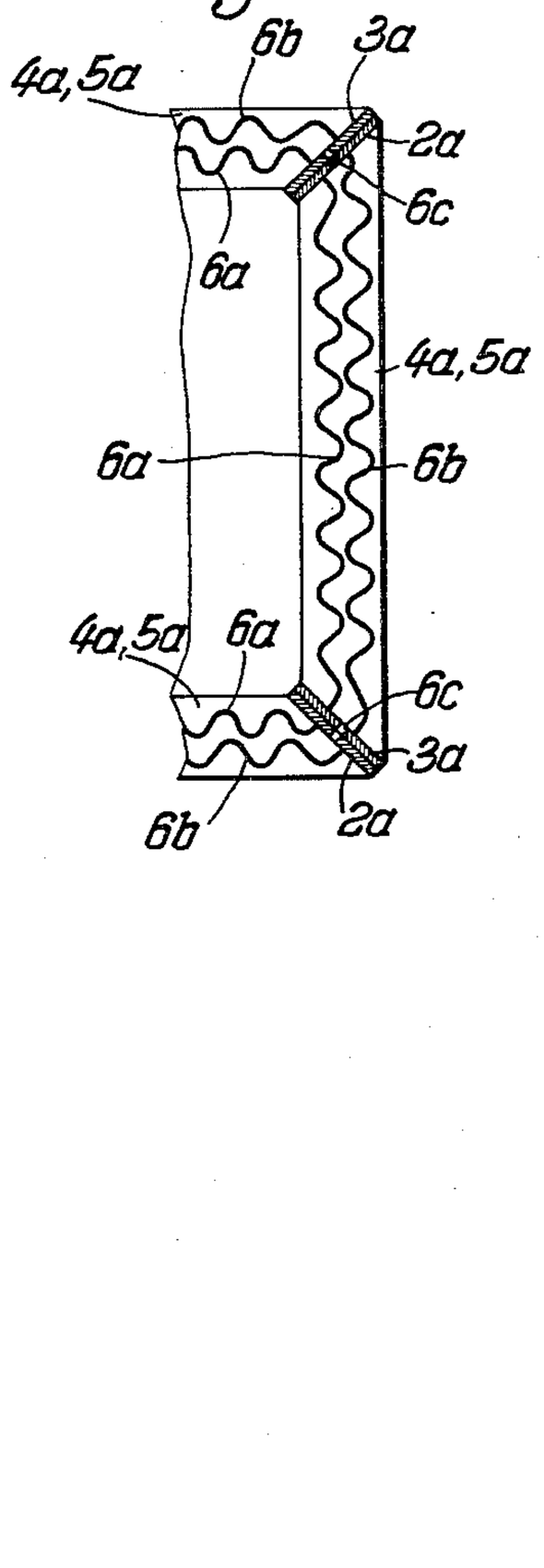


Fig. 5



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APPARATUS FOR VACUUM-DRYING TEMPERATURE-SENSITIVE GOODS

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The present invention relates to a novel construction of a chamber of high strength and light weight. Such a chamber is of particular advantage in an apparatus for vacuum-drying temperature-sensitive goods. Such goods are, for example, foam rubber, windings of electric condensers, and so on, which should only be exposed to temperatures below a certain degree. In order to be able to complete the drying process for such substances or goods in an economical manner and within a short time, as high a vacuum as possible is created in the drying apparatus, by withdrawing continuously the moisture driven out of the goods in the form of steam.

The invention, however, is not limited to vacuum chambers, but may advantageously find application in connection with other devices, such as cooling installations, etc., where high strength and light weight are important.

In installations requiring high vacuum, the large walls of the apparatus, which consists of an all-enclosed housing, are subjected to considerable strain caused by the external atmospheric pressure. For that reason, the known apparatuses of this kind are of very sturdy construction and need a foundation of masonry. This foundation and the considerable amount of material necessary for the apparatus proper, raise the expenses for construction and transportation, and also the mounting of such a vacuum apparatus.

It is the object of the present invention to provide a chamber construction defining a vacuum chamber which is free of the above mentioned shortcomings. More particularly, to provide a chamber, in which the ratio of effective space to the weight of the apparatus, particularly large apparatus, is more advantageous.

This can be accomplished by decreasing the weight of the apparatus as compared to known devices of this kind. By so doing, considerable amounts of material are saved, whereby the expenses for building and transporting the apparatus to the place, where it is to be used, as well as the mounting expenses will be decreased accordingly.

According to one embodiment of the invention these objects are achieved by providing a chamber construction for a vacuum apparatus which comprises a hermetically closed housing provided with equipment for heating and evacuating, as well as with control elements. The housing is formed of channel-like sections sealed to each other by airtight connections; each section is composed of separate walls, hermetically joined, and each wall comprises a frame built of a pair of oppositely arranged parallel flanges extending parallel to the longitudinal axis of the housing and disposed in its diagonal planes, and another pair of mutually opposed flanges lying in planes perpendicular to the longitudinal axis of the housing. These latter flanges have mitered ends corresponding to the inclination of the first pair of flanges, and welded thereto. The walls are made of corrugated sheet metal, filling the frames consisting of the flanges and being welded thereto.

When the apparatus or the housing thereof is in the form of a square, there will be four walls connected by welding to each other at the flanges arranged at an inclination with respect to the longitudinal axis of the housing, or which are connected by means of screws with interposition of packing means. One section of the housing is thereby formed as a square-shaped channel-like unit. Depending on the desired total length of the apparatus, a larger or smaller number of such units are combined in an air-tight manner by welding or screwing with interposition of packing materials, the connections being made at the flanges disposed at right angles to the longitudial axis of the housing.

The front and rear ends of the housing are likewise closed by walls, consisting of a frame made of angle irons and a filling welded to the frames, which is made of thin-walled corrugated sheet metal as more fully described hereinbelow.

The external superpressure of about 1 kg./cm.^{2} acting on the housing upon application of a vacuum, is taken up by the sheet metal extending between the flanges and transmitted to the iron frames of the housing walls. These frames combine to form a channel-like housing section, support each other by the flanges inclined approximately about 45 degrees so that in principle all the forces acting toward the interior of the housing, due to the atmospheric pressure, are taken up by these flanges placed on edge in the direction of these forces. By wall fillings consisting of corrugated sheet metal, the load is absorbed and in addition thereto the frames are placed under stress in their positions.

Furthermore the stability of the apparatus is improved with lowest expenditure of material by subdividing all wall faces into comparatively small separate wall elements, that is to say, making the sheet metal fillings of small width with respect to their enclosing frames.

By combining sections as described and built according to the invention, vacuum-drying apparatus of any desired length can be built. Practical experience has shown that in the most favorable instances the total weight of the vacuum-drying apparatus according to the invention may be reduced to one-third of the weight of a conventional drying apparatus, all other conditions being equal. Vacuum-drying apparatus according to the invention do not need any masonry foundation and they may be mounted in a very appropriate manner on longitudinal beams, a factor which simplifies assembly and takes load off the connections of the several sections.

The separate walls can be easily manufactured and transported and are readily assembled on location.

The apparatus according to the invention will now be more fully described with reference to the accompanying drawings, but it should be understood that these are given by way of illustration and not of limitation, and that many changes in the details can be made without departing from the spirit of the invention.

In the drawings

Fig. 1 is a perspective view of the vacuum-drying apparatus built according to the invention.

Fig. 2 is a partial section of a vacuum-drying apparatus of different design.

Fig. 3 is a partial view of one end of the apparatus.

Fig. 4 is a partial plan view at the two ends of the drying apparatus shown in Fig. 2, and

Fig. 5 is a partial cross section through a vacuum apparatus built up of double walls.

Referring now to Fig. 1, the vacuum-drying apparatus is shown to comprise a more or less elongate housing A, mounted on rails 9 and which is hermetically closed at the front and rear ends by walls B and C. Depending on the length of the housing A, either only wall B is removable as a door, or both walls B and C can be so removed. For this purpose wall B is shown to comprise ears D for receiving hooks D' of chains E depending from a crane (not shown), so that the wall can be moved by the crane into the closed position as shown in the drawing, or removed from this position. Between wall B and the end wall of casing A, a packing F is inserted against which wall B is pressed by atmospheric pressure in hermetical sealing relationship, as soon as a vacuum is set up in the casing A. The door B is provided with pivotally mounted hooks G engaging with pins H mounted at the end wall of casing A, thereby forming a mechanical connection between B and the end of casing A. The substances or goods to be dried may for instance be rolled into the casing by carriages (not shown in the drawing) and rails **10** (Fig. 2), are provided for this purpose in the casing.

For creating and maintaining a vacuum, the housing A is provided with a short pipe J, to which may be connected the suction line of a suction pump (not shown). A pressure gauge K mounted on the housing walls serves for the control of internal pressure within the housing, and view glasses L in the wall allow the observation of the goods during the drying procedure.

As a drying means, I may use steam or hot air which is entered into a heating coil system O at the bottom of housing A by means of a pipe N and a connecting line, (not shown in the drawing), while it is allowed to escape by means of a short pipe M and a pipe system, likewise not shown in the drawing.

Instead of using the heating system as described, gas heating or electrical resistance heating may be used. Since the type of heating is not part of the invention, a further description thereof as well as an illustration of the heating system is omitted.

When needed, a coolant can be entered by N and drained by M from the casing.

According to the invention the housing A of the vacuum apparatus is composed of several sections S, in the case illustrated in Fig. 1, of three sections which may be joined in an airtight manner by welding or by screw connection with interposition of a packing.

Every individual section S consists, according to the invention, of separate walls and each wall comprises a square frame consisting of a pair of parallel flanges **2, 3** extending in the longitudinal direction of the housing A parallel to the longitudinal axis *a* thereof and disposed with their transverse sides in diagonal planes containing the axis *a* of housing A. Furthermore a second pair of parallel flanges **4, 5** are placed at right angles to flanges **2, 3** having their transverse sides in planes perpendicular to the longitudinal axis *a* of housing A and having mitered ends so as to correspond with the inclination of the flanges **2, 3** with which they are connected by welding. Each section also comprises at least one wall **6**, filling the frame and consisting of thin-walled corrugated sheet metal which is welded to the frame consisting of flanges **2, 3, 4, 5**. The sheet metal filling **6** may be concave with respect to the interior of housing A, more particularly it may be either dish-shaped or cylindrical, as shown in Fig. 1, or spherical, **6***d*, as shown in Figs. 2, 3, and 4. In Fig. 5 a filling **6***a*, **6***b* is shown in which the corrugations follow a straight plane.

For a housing A with a flat cross section, four such walls are combined to a channel-like section S, in such a manner, that they are welded together with the flanges **2, 3** or screwed together with interposition of a packing material for hermetical sealing. At each end of such a section comprising four walls, the flanges **4, 5** disposed at right angles to the longitudinal axis *a* of the housing A, will form square ring flanges by which the required number of sections can be combined to a housing A of desired length, the joining being again done by welding or screwing together in hermetical sealing by interposition of packing material.

The walls B and C used for closing the ends of housing A each consist of a frame made up of four welded mitered edges. To the frames, a filling of thin-walled sheet metal **8** is likewise joined by welding. In order to increase the strength of the walls, they are formed of several pieces **8***a*, **8***b*, **8***c*, as shown in Figs. 1 and 3. In this case, the sheets **8***a*, **8***b*, **8***c* are welded together with flanges **8***d*, which in turn are welded to the angle iron frame **7**. The sides of frame **7** which lie at a right angle with respect to the longitudinal axis *a* of the housing A, form a square ring flange by means of which the walls B, C, are fastened to the corresponding ring flanges **4, 5** of the sections S forming the ends of housing A. Between the flanges of the walls B, C, and those of sections S packing material F is inserted when the walls B, C, are removable doors, otherwise the flanges of the wall C and those of adjacent sections S may be welded together.

All wall and door fillings may, as shown in Fig. 5, be composed of two frames, consisting of flanges **2***a*, **3***a*, **4***a*, **5***a* and of thin-walled corrugated metal sheets, **6***a* and **6***b*, arranged at a certain distance with respect to each other, so that they will form a hollow space which will provide a good heat insulation for housing A, or may serve as heating or cooling space. The hollow spaces of the several walls of a section S can be brought into communication by openings **6***c*, provided in the flanges **2***a*, **3***a*.

The above described arrangement makes possible the heating of large areas with steam of low tension, sometimes even vacuum waste steam. When a coolant is used, the double walls will likewise be of use.

By building the vacuum-drying apparatus in light-weight construction, about 50% of the materials can be saved, which are usually consumed when building according to conventional methods.

What I claim is:

1. A high-strength, light-weight, hermetically sealed chamber-construction defining a vacuum chamber, comprising a plurality of rectangular frames including end frames hermetically connected to each other and forming a chamber, each of said frames comprising two pairs of oppositely arranged flanges, the first pair of said flanges extending parallel to the longitudinal axis of said chamber and being disposed with the transverse sides in a diagonal plane of said chamber, the second pair of said two pairs of flanges being disposed in planes perpendicular to the longitudinal axis of said chamber and having mitered ends corresponding to the inclination of said first pair of flanges and being secured thereto; at least one member of corrugated sheet metal extending between and being secured to said flanges so as to define the side wall of said chamber, a front wall member and a rear wall member hermetically connected to a respective end frame, at least one of the end walls being removably connected to its respective end frame, packing means arranged between the removable end wall and its respective frame for hermetically sealing the connection between said end wall and the frame, means on at least one of said frames for connecting said chamber to a suction pump, and a pressure gauge for determining the

internal pressure of said chamber mounted on one of said frames.

2. The chamber construction according to claim 1, wherein said members of corrugated sheet metal are disposed in a concave relationship with respect to the interior of said chamber.

3. The chamber construction according to claim 2, wherein said members of corrugated sheet metal are dish-shaped.

4. The chamber construction according to claim 2, wherein said members of corrugated sheet metal are spherical.

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