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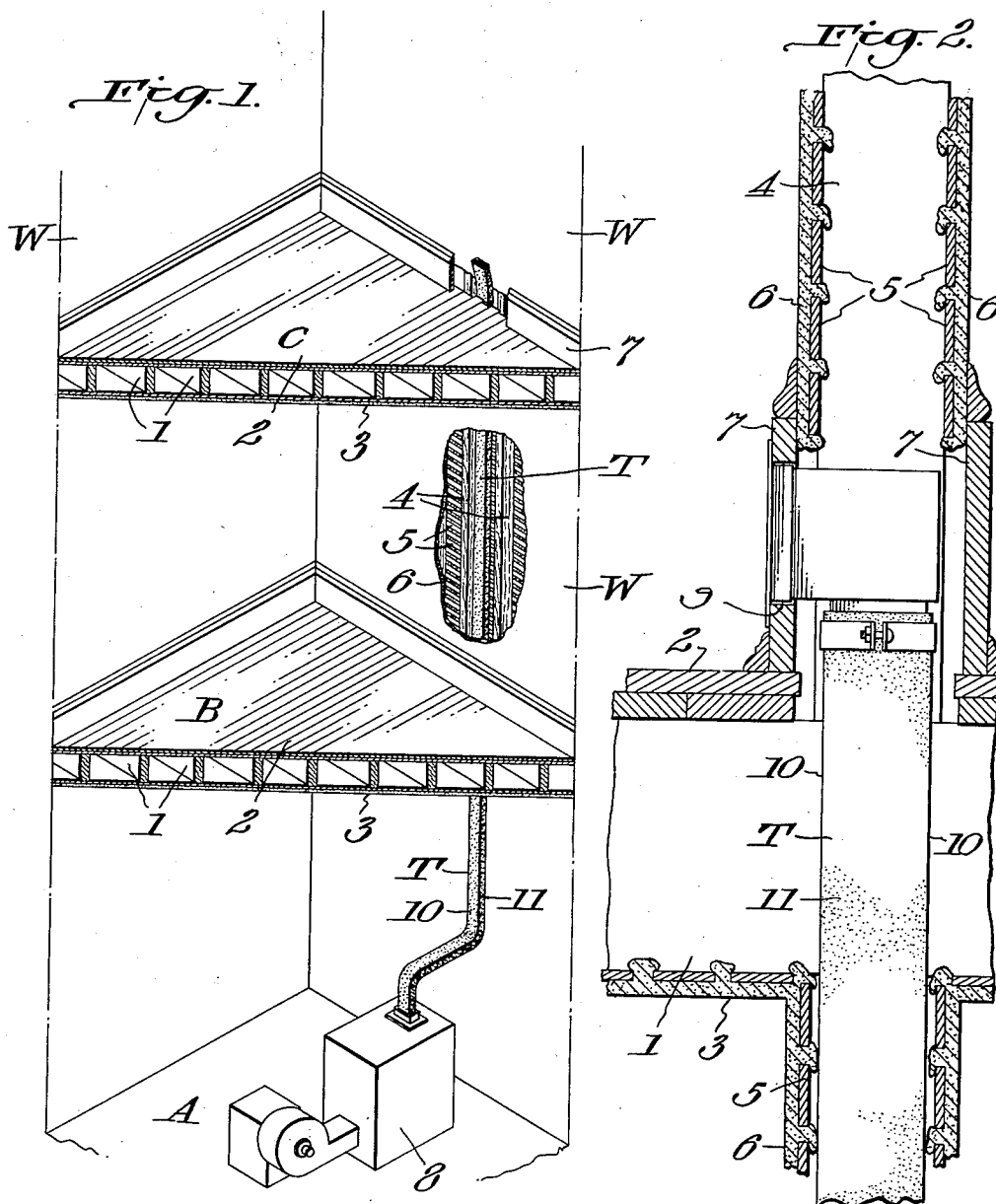
T. H. TISE

2,032,103

AIR CONDITIONING CONDUIT

Filed Sept. 25, 1933

3 Sheets-Sheet 1



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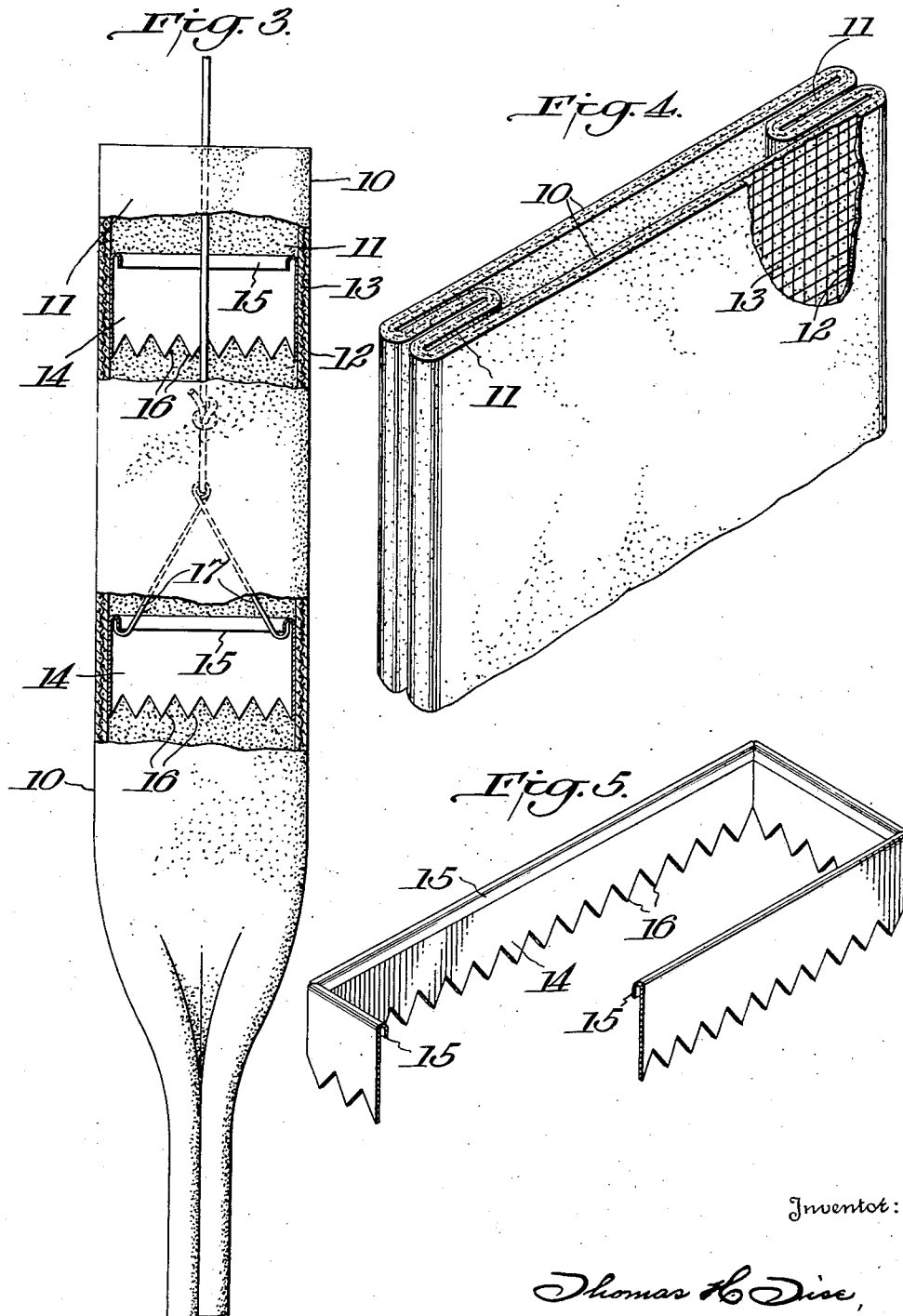
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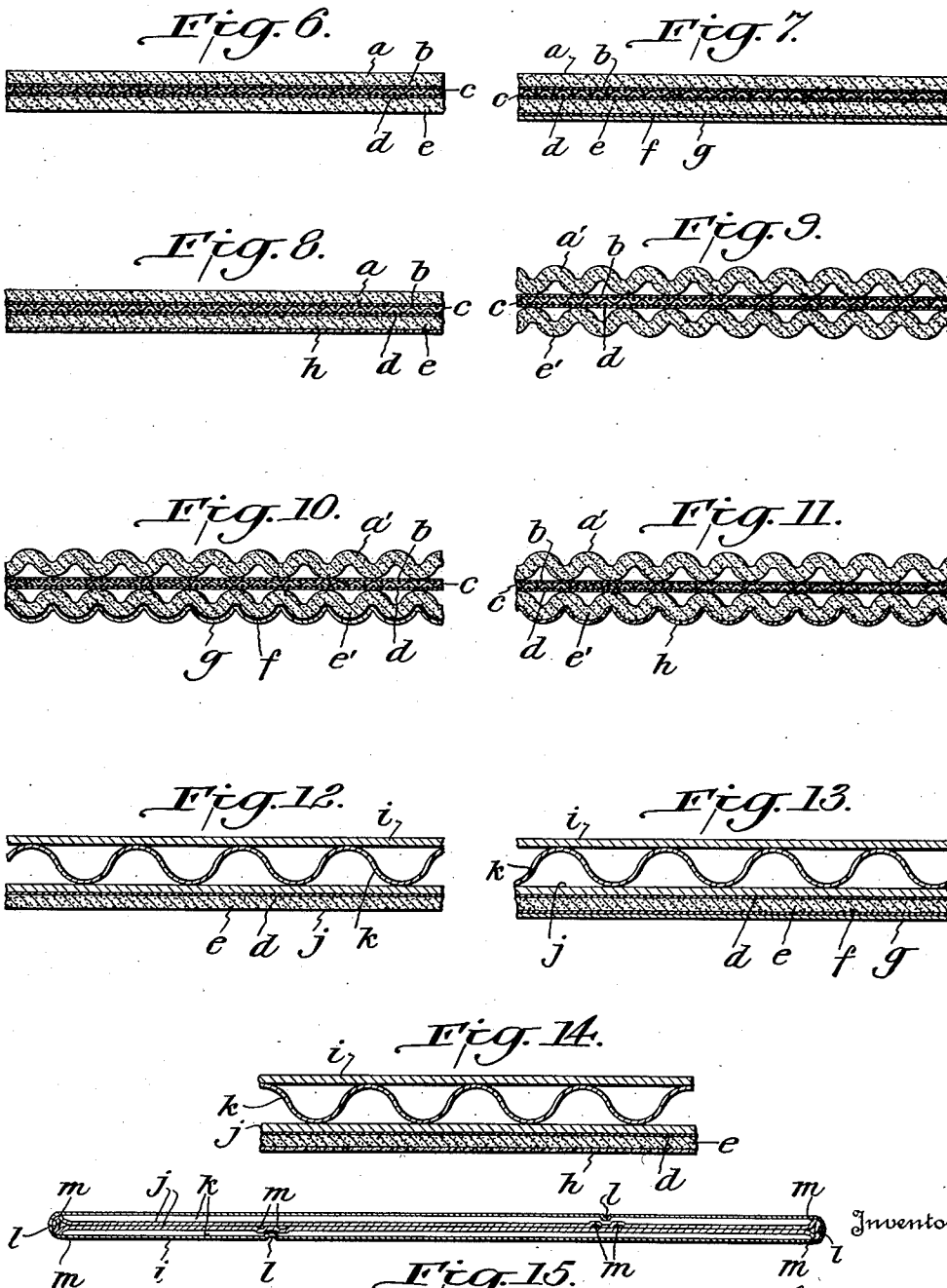
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,032,103

AIR CONDITIONING CONDUIT

Thomas H. Tise, Winston-Salem, N. C.

Application September 25, 1933, Serial No. 690,913

20 Claims. (Cl. 138—53)

This application is a continuation-in-part of my application for patent for "Air conditioning conduits", filed October 10, 1932, Serial No. 637,155.

The invention relates to air conditioning conduits, and particularly to conduits adapted to be installed, with a minimum of expense and labor, in finished dwellings and other buildings which are to be equipped with air conditioning apparatus, although the invention is not so limited as it also contemplates the provision of conduits which may be installed in dwellings and other buildings during the construction of same.

The successful use of small air conditioning units in dwellings has resulted in an increasing demand for equipment that may be installed in existing dwellings without cutting into the walls to conceal the conduits. In bungalows and relatively small dwellings, it is a comparatively simple matter to install air outlet openings or registers in the floor, and to connect these with the air conditioning apparatus by ducts which are located in the cellar of the dwelling. The problem becomes quite complicated, however, when the dwelling is of such size and design that conditioned air must be piped from the cellar to an upper floor. Many home owners object to the cutting of the walls to conceal the conduits and also object to the location of conduits within the rooms.

It has been proposed to construct metal conduits in small sections of from two to about six or eight inches in length, but considerable time is required to install the sectional conduits through small openings located behind the base board in the room and it is not practical properly to insulate this type of installation to meet some building code requirements nor to make it efficient in operation.

An object of this invention is to provide a conduit, of relatively flexible construction, which may be made in comparatively long lengths for installation in small spaces between the walls of a dwelling.

An object is to provide a flexible conduit which may be collapsed to facilitate the "threading" of the conduit through a small opening, and expander units which may be drawn into the conduit, from one end, to hold the conduit in open or expanded condition.

A further object is to provide a conduit, for air conditioning apparatus, which is formed of reinforced asbestos and coated or treated with a high grade, high melting point asphalt.

A still further object is to provide a relatively

flexible, or comparatively rigid, conduit, for air conditioning apparatus, the walls of which are of laminated construction and include asbestos in flat or corrugated sheets, woven or fibrous reinforcing material, corrugated board of ordinary commercial type, adhesive binders, and sheet, foil, or impregnated metallic coatings, all in various associations and combinations.

These and other objects and advantages of the invention will be apparent from the following specification when taken with the accompanying drawings, in which,

Fig. 1 is a schematic, perspective view illustrating, in general, the type of installation contemplated by the invention;

Fig. 2 is an enlarged, fragmentary sectional detail showing one end of the conduit and the equipment with which it is associated;

Fig. 3 is an enlarged sectional side elevation illustrating the method of inserting the expander sleeves within the conduit;

Fig. 4 is an enlarged, fragmentary, sectional perspective view of one end of a collapsed conduit;

Fig. 5 is a perspective view, partly in section, of one of the expander sleeves;

Figs. 6 to 11, inclusive, are enlarged fragmentary transverse sectional views illustrating six different combinations and arrangements of laminae for forming the walls of relatively flexible conduits as contemplated by the invention;

Figs. 12 to 14, inclusive, are enlarged fragmentary longitudinal sectional views illustrating three different combinations and arrangements of laminae for forming the walls of comparatively rigid conduits as contemplated by the invention; and

Fig. 15 illustrates, on a reduced scale, and in transverse section a conduit formed, for example, of laminated material such as shown in any of Figs. 12, 13 and 14, and folded or collapsed for shipping, storage and installation purposes in a manner different from that of the conduit of Figs. 2 to 4.

In the drawings, the reference character A identifies the cellar floor of a dwelling which has a first or ground floor B and at least one upper floor C. The floors B and C are formed of floor beams or stringers 1 which carry the wooden flooring 2 and, in the case of the upper floor C, the usual lath and plaster ceiling 3. The floor stringers 1 are supported by the outer walls of the dwelling and by partition walls W which are formed by spaced vertical studs 4 carrying lath 5, of wood or expanded metal, and plaster 6.

The outer walls may be formed of stone or masonry but the partition walls in dwelling houses are customarily of the illustrated type, and the spaces between adjacent studs provide bays or vertical channels in which the water, gas and electrical conduits are placed. The cross-section of these vertical channels is usually about three by fourteen inches and it will be apparent that only the most economical use of this restricted space will provide adequate capacity, in a single conduit, for the distribution of the conditioned air.

In accordance with this invention, extended lengths of conduit material may be introduced, in folded condition, into these small bays or spaces without cutting into the exposed surfaces of partition walls, and may then be expanded to form a conduit of approximately the full cross-section of the space between adjacent wall studs. Access is had to this space by cutting openings in the flooring 2, but these openings are concealed by the partition walls W and therefore are not objectionable. Such openings are readily made in the ground floor B by working from the cellar, and are made in the flooring 2 of the upper floor C by first removing a section of the base board 7.

As illustrated, the conduit T for connecting the air conditioning apparatus 8 with a register or outlet opening 9 takes the form of an elongated tube which, while collapsed to decrease its width, is threaded into and through a bay of a wall to extend from one floor level to the next in a single continuous tube.

The tube T is preferably of rectangular cross-section when expanded, and includes side walls 10 and end walls 11 which, as originally formed, are folded inwardly to lie between the side walls, thus reducing the width of the collapsed tube T to the approximate width of but four times the thickness of the wall of the tubing. The tube T may be formed of thin metal, or may comprise relatively heavy side walls of metal and thinner end walls, but, as illustrated, is formed of a fabricated material comprising asbestos 12 on a woven reinforcement 13 of cords or flexible wire, the material being rendered waterproof and air tight by impregnation with high grade, high melting point asphalt.

A metallic thimble or guide, not shown, may be secured to the end of the collapsed conduit to facilitate the introduction of the conduit into, and its passage through, the bay between adjacent studs. When the conduit T is in place, it is expanded into normal position by means of a plurality of short expander sleeves 14, of rectangular outline which have one edge rounded off, as by the beading 15, and the opposite edge provided with projections or wide saw teeth 16. The expander sleeves 14 are drawn into conduit T by grappling hooks 17, which engage beneath the beading 15, and, when in place, the sleeves are retained by the engagement of the projections 16 with the wall of the conduit.

The expander sleeves at the opposite ends of the conduit may serve as the couplings for joining the conduit to similar conduit sections, to metal conduits or to the outlet boxes at the registers.

Impregnated asbestos tubing is well adapted for use as conduits for air conditioning apparatus as it is perfectly stable at the pressures and temperatures which are encountered. The impregnated material is comparatively stiff but possesses sufficient flexibility to permit bending of the collapsed tube during installation. In form-

ing the tubing, the corners or edges which form the joints of the folded wall sections are suitably thickened and shaped to prevent any tearing of the tubing during the folding in or opening out of the end wall sections.

While the novel conduit material may be placed in buildings under construction, it is particularly advantageous in the installation of air conditioning apparatus in existing buildings. The collapsed tubing may be made up in several stock lengths of, for example, from nine to twelve feet, or in long lengths that are printed along one edge with foot and inch graduations to facilitate the cutting off of any desired length. With either of these arrangements, the tubing may be made in different sizes, such as from 3" x 10" to 5 1/2" x 14". As compared with the previously known conduits formed by assembling short sections, the cost per foot is substantially lower and the time required for the installation of a continuous length of conduit is only a small fraction of the time required to assemble and install the sectional conduit. Furthermore, the novel conduit is properly insulated and affords a free, clear and efficient passage for the conditioned air.

As noted above, the conduit may be formed of materials other than impregnated asbestos fabric and, to meet the building code requirements of different cities, the conduit may consist of metal, of fabricated material comprising asbestos on a woven reinforcement and rendered waterproof and air tight by coating or impregnation with asphalt, of impregnated asbestos tubing, or it may be formed of various types of laminated material, as illustrated in Figs. 6 to 14, inclusive, the choice of material being made in accordance with the conditions of installation and service encountered.

As already stated, the types of laminated material illustrated in Figs. 6 to 11, inclusive, are relatively flexible, and thus are suited particularly for the formation of conduits adapted for installation in finished buildings, where relatively tortuous threading of the conduits through the wall bays is required. The types of laminated material illustrated in Figs. 12 to 14, inclusive, are, however, comparatively rigid and are best suited for the formation of conduits adapted for installation in buildings in course of construction, or where threading of the conduits is unnecessary, or where the work is exposed.

The material of Fig. 6 comprises an outer layer or sheet of asbestos paper or other suitable fire-resisting material *a*, a coating of an adhesive binder *b*, such as asphalt, a sheet of reinforcing material *c*, either woven or fibrous, such as tough heavy paper, cloth, wire mesh or felt, an adhesive coating *d*, and an inner layer or sheet of material *e* similar to the layer or sheet *a*, these laminae *a*, *c* and *e* being cemented together by the adhesive coatings *b* and *d*.

The material of Fig. 7 comprises laminae similar in all respects to those of Fig. 6, as indicated, but includes, in addition, a coating of adhesive binder *f* which serves to affix to the inner face of the material a sheet or foil *g* of aluminum or other suitable metal which serves as a lining for the interior of the conduit and acts, by reflection, to prevent radiation of heat through and deterioration of the conduit.

The material of Fig. 8 is substantially similar to that of Fig. 7, but the metallic inner sheathing *h* is formed by depositing a coating of flake or powdered aluminum or other suitable metal in such manner that, preferably with, but with or with-

out an incorporated binder, it will penetrate and adhere to the surface of the material of the inner layer *e*.

The materials of Figs. 9, 10 and 11 are similar, respectively, to those of Figs. 6, 7 and 8 but the outer layers or laminae *a'* and *e'* are provided with relatively fine corrugations so disposed as to extend longitudinally of the conduit. The vertical corrugations prevent stretching or cracking on the outside of the folds and take up the surplus on the inside in an orderly way without puckering or distortion and they also add very materially to the insulating properties of the walls.

The material of Fig. 12 comprises a sheet or layer of the ordinary corrugated board of commerce, comprising top and bottom liners *i* and *j*, respectively, of heavy paper, fiber board, or the like, and an interposed layer of corrugated paper *k*, a coating of adhesive binder *d* and an inner layer *e* of asbestos paper or the like.

The material of Fig. 13 is similar to that of Fig. 12, but the layer *e* is sheathed with the metal foil or the like *g* applied by means of adhesive *f*.

The material of Fig. 14 is similar to that of Fig. 13, but the sheathing of metal *h* is similar to and applied in the manner of that of Figs. 8 and 11.

The corrugated board forming a part of the material of Figs. 12, 13 and 14 is intended to be so arranged that, when the material is formed into conduits, the corrugations will extend transversely of such conduits. This lends to the conduits thus formed a stiffness not present in the conduits hereinbefore particularly described, and makes them best suited for use in buildings under construction, where no threading is necessary, or in exposed or unconcealed locations. Moreover, where the outer or top liner *i* is of fiber board, the exposed surfaces of the conduit may most readily be painted, papered or otherwise decorated or treated.

Where the material of the conduit is of such a nature that it may not readily be folded into compact form as illustrated particularly in Fig. 4, such as would be the case with respect to conduits made of the relatively stiff materials of Figs. 12 to 14, inclusive, the conduit may be provided with scorings *l* and *m*, such as are used in cartons and other containers made of corrugated board, and folded flat as indicated in the double walled conduit shown in Fig. 15.

Obviously, conduits made of the other materials described may also be similarly scored and folded.

Asphalt has been mentioned as an adhesive binder suitable for uniting the laminae of the conduit forming materials described, and this substance is considered to be most desirable because of its adhesive, damp-proofing and flexible properties. However, in materials such as those illustrated in Figs. 9 to 14, inclusive, other adhesives such as water glass (sodium silicate) may be effectively used.

I am aware that various types of laminated materials are known, some of such materials including in their structure asbestos sheets, fabric, metal foil and other substances united by suitable adhesive binders, but I am not aware of such laminated materials ever having been used heretofore in the construction of conduits for installation in air conditioning systems.

Although the laminated materials shown in the drawings and hereinbefore described are of various forms, it is to be understood that they are illustrative only, and that the claims following are not

to be interpreted as specifically limited thereto, except such claims as read directly thereon.

I claim:

1. A conduit for air conditioning apparatus comprising a tube having opposed side walls, and flexible, foldable walls joining said side walls, said flexible, foldable walls being initially folded upon themselves to bring the opposed side walls into closely spaced relationship, said tube adapted to be expanded to conduit-forming condition, the width of said tube when folded being no greater than when expanded.

2. A conduit comprising an elongated tube, opposite portions of the side walls of said tube being turned inwardly and folded upon themselves to bring the intermediate portions of said tube into closely spaced relationship, and means normally separate from said tube and adapted to be drawn through said tube to force said inwardly turned folded portions outwardly to increase the cross-section of the tube.

3. A conduit for air conditioning apparatus, comprising a tube of rectangular cross-section when open, selected opposed sides of the tube being flexible and foldable to permit the tube to be collapsed, and means normally separate from said tube and adapted to be drawn into the tube from one end to expand the same to its maximum cross-section.

4. A conduit for air conditioning apparatus, comprising a relatively rigid tube of fabricated material having limited flexibility permitting portions of said tube to be bent out of axial alignment, and one longitudinal strip of said tube being formed by two relatively rigid wall portions reversely folded inwardly upon each other between and closely adjacent the adjoining portions of said tube, whereby the tube may be collapsed upon itself in relatively flat condition.

5. The invention as set forth in claim 4 wherein said fabricated material comprises asbestos impregnated with asphalt.

6. The invention as set forth in claim 4 wherein said fabricated material comprises asbestos impregnated with asphalt and reinforced with a woven fabric.

7. In air conditioning apparatus, a conduit comprising an air tight and fire resistant tube of asbestos on a reinforcing fabric and impregnated with asphalt, diametrically opposed portions of said tube being initially collapsed inwardly to decrease the thickness of said tube, and a plurality of short expander sleeves adapted to be drawn into said tube to retain the same in expanded condition to form a conduit.

8. The invention as set forth in claim 7, wherein each of said sleeves has one rounded edge and an edge provided with projections for engagement with said conduit to prevent relative displacement thereof.

9. A conduit for air conditioning apparatus and adapted to be drawn into the space between the studding of an existing wall, said conduit comprising an elongated tube of fabricated material impregnated to render the same waterproof and air tight, opposed portions of said tube being folded inwardly to collapse said tube to permit the same to be inserted into said space through a small opening, and a plurality of short tubular elements of rectangular outline normally separate from said tube and adapted to be drawn into the collapsed tube from one end thereof to progressively expand said tube, said elements being ultimately positioned within said tube at in-

tervals in spaced relation to maintain the tube in expanded condition.

10. The invention as set forth in claim 9, wherein one edge of said tubular elements is smooth to slide along the inner surface of said tube, and the opposite edge is roughened for engagement with said tube to prevent reverse movement of the tubular element.

11. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including a layer of fire-resistant material and a layer of reinforcing material united by an adhesive binder.

12. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including a layer of asbestos and a layer of reinforcing material united by an adhesive binder.

13. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including a layer of fire-resistant material and a layer of reinforcing material united by an adhesive binder of asphalt.

14. A conduit for air conditioning apparatus comprising a tube of laminated construction, said tube including a layer of non-metallic fire-resistant material, a layer of reinforcing material, and an inner metallic heat-reflecting coating.

15. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including a layer of non-metallic fire-resistant material, a layer of reinforcing material, and an inner metallic coating applied to the surface of said fire-resistant material and providing a reflective lining for the interior of the tube.

16. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including a layer of corrugated fire-resistant material and a layer of reinforcing material united thereto.

17. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including a layer of corrugated fire-resistant material and a layer of reinforcing material united thereto, the corrugations of said first mentioned layer extending longitudinally of the tube.

18. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of laminated construction and including an inner layer and an outer layer of fire-resistant material, and an interposed layer of reinforcing material united thereto.

19. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of transversely rigid laminated construction and including a layer of corrugated board of commerce and a layer of fire-resistant material united thereto.

20. A conduit of substantially rectangular cross-section for air conditioning apparatus, comprising a tube having a wall divided into longitudinally extending wall sections flexibly connected by longitudinally extending hinge sections, each wall section being of transversely rigid laminated construction and including a layer of corrugated board of commerce and a layer of fire-resistant material united thereto, the corrugations of said corrugated board extending transversely of the tube.

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