This invention relates to knockdown sectional air conduits, particularly conduits for conveying air in air-conditioning, ventilating and heating systems and the like, and it especially pertains to knockdown sectional conduits comprised of standard metal panels lined with insulating material, preferably inorganic, that is securely fixed thereto for sound and thermal insulation of the conduit sections and the ventilating, heating and air-conditioning systems in which the sections are installed.

The panels of the knockdown conduit sections are flat and can be stacked for packaging, handling and shipping to be readily assembled at the place of use into rectangular or square conduit sections that are in turn readily jointed in end to end relation for installation of conduit systems.

While these panels may, of course, be of any dimension they are preferably of such length made in certain selected standard widths and of a construction to be combined into larger panel assemblies of any desired greater widths by adapters or connectors of the general construction and length as the standard panels, disposed between and interengaged with the longitudinal edges of two adjacent standard panels. Such panel assemblies permit the formation of conduit sections of any desired sizes and rectangular shapes.

Heretofore, insulated and acoustical conduit systems for ventilating, heating and air-conditioning have been made from conventional sectional metal conduits wrapped with insulating material or from sectional conduits made entirely from insulating materials. The latter type conduit sections are made from asbestos paper wound about a mandrel to be built up to desired form and size. Both types are cumbersome and bulky to handle, package and ship. The type made from insulating material has the further objection of shrinking, thereby opening the joints between said sections to cause an unsightly appearance, more especially when painted, and more often than not to cause leakage. Moreover, the insulating material used for making the conduits does not have a high degree of wet strength and hence the conduit sections cannot be exposed to the weather without being damaged. Therefore, installation of these asbestos conduit systems should not be installed until they are weather protected. This naturally delays progress of the job with consequent loss to the contractor. Furthermore, organic fibers are usually incorporated with asbestos fiber to improve the felting qualities of the fibrous stock, and the organic fibers are highly water absorbent.

Accordingly, one of the principal objects of my invention is insulated and acoustical metal sectional air conduits made from knockdown flat panels of standard sizes.

Another object of the invention is insulated and acoustical metal air conduits of varying sizes made from assemblies of the standard flat panels.

Another object of the invention is insulated and acoustical conduits having insulating and acoustical material lining a protecting metal wall and with said lining securely fixed thereto.

Still another object of the invention is insulated and acoustical air conduits composed of sections readily detachably connected in end to end relation.

A still further object of the invention is knockdown insulated and acoustical metal air conduits which are simple in construction and efficient in operation.

A still further object of the invention is knockdown insulated and acoustical metal conduits composed of flat panels which are provided with longitudinal edges for interlocking them together without requiring accessory means.

Further objects, and objects relating to details of construction and economies of operation, will readily appear from the detailed description to follow. In one instance I have accomplished the objects of my invention by the device and means set forth in the following specification. My invention is clearly defined and pointed out in the appended claims. Structures constituting preferred embodiments of my invention are illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a perspective view of two lengths of an insulated sectional air conduit disposed end to end.

Fig. 2 is a similar perspective view of a larger size conduit having two of its opposite walls formed by an assembly of a plurality of standard panels with an adapter or connector piece between two adjacent standard panels.

Fig. 3 is a perspective view of one of the side panels with the insulating lining and the opposite removable end pieces removed.

Fig. 4 is a perspective view of one of the end pieces which is detachably fitted to each of the opposite ends of the panel.

Fig. 5 is a perspective view, similar to Fig. 3, with both opposite end pieces assembled and the insulation installed on the underside in the recess formed by the opposite flanged ends and sides of the panel.

Fig. 6 is a cross-sectional view taken along the plane of line 6--6 of Fig. 1 of two side panels of like size interlocked for forming two adjacent sides and one corner of a conduit section.

Fig. 7 is a cross-sectional view taken along the plane of line 7--7 of Fig. 2 of one of the assembly panels, without the insulation, formed with two standard panels of unlike size connected by an adapter panel interposed between adjacent longitudinal edges.

Fig. 8 is a perspective view of the adapter panel, with parts exploded.

Fig. 9 is a perspective view of a tear drop brace or strut which fits inside adjacent assembly panels to prevent sagging of the upper side of the conduit system.

Fig. 10 is a detail cross-sectional view taken along the plane of the 10--10 of Fig. 1 through an end joint between sections of duct.

Fig. 11 is a perspective view of an end connector used in conjunction with the adapter panel.

Referring specifically to the drawings in which like numerals are used to designate like parts, the panels are preferably made in several standard sizes, all of equal length but with the panels of one standard size differing in width from the panels of the other standard sizes. Accordingly, the same or different standard sizes can be selected for being assembled into conduits having all sides equal to be perfectly square or have two opposite sides unequal in width with respect to the other opposite sides for one dimension of the conduit to be wider than the other. Two standard sizes of panels are illustrated, one being wider than the other. The narrower standard
size panel is designated A, and the wider standard size is designated B. However, these two panels are of the same construction, differing only as to width, and, therefore, conduits can be assembled from panels of either standard size, or both, or with assembly panels combining both sizes, for the construction of conduits of any desired size and rectangular shape.

The panel comprises a sheet metal sheet 6 having one opposite longitudinal margin bent at a right angle into a vertical flange 19 and terminating in a retrotroverted flange 20 to provide a double ply flange from which lugs 31 are cut to be bent to overhang the insulation receiving recess. An intermediate part of the vertical flange is bent outwardly and backwary upon itself into a tongue 13 in which spaced apart bayonet slots 15 are provided with a hook portion 21 overhanging a part of the slot, adjacent the open side of said slot, and having their bottom edges 22 slightly tapered. The opposite longitudinal margin of sheet 6 is bent into a vertical flange 23, at a right angle to sheet 6, and terminating in another flange 24, parallel with sheet 6, having a channel groove 3 formed therein, between opposite sidewalks 25, opening outwardly from the top side. Rivets or screws 11 are fitted into the opposite sidewalks 25, transversely to and spanning the channel groove 3 and in longitudinally spaced apart relation to fit into the bayonet slots 15 and beneath the bottom portions 21 of an adjacent panel to be detachably interfitting therewith. With the sheet constructed as above described, flanges 19 and 23 are formed on the two opposite longitudinal edges with one of the flanges 19 provided with a tongue 13 on the edge of the sheet and the other flange 23 provided with a mating groove 3 on the same side as the channel groove 3, said wall 26 being at right angles to a vertical flange 30. The top edge of the vertical flange 30 is bent back inwardly upon itself to leave upwardly extending lugs or ears 31' that have been cut away therefrom along their side edges. The extended ears 31' of the end pieces are bent inwardly at right angles in the same direction as the wall portions 28 and 29 to overhang the recess in the face of sheet 6 and abut against the margin of the herewith described insulation material inserted to fill the recess. These end pieces are assembled to the open ends of the above described sheet 6 with the end of said sheet fitting within the groove 27 and the ears or lugs 2 on the sheet 6 projecting through the slots 26 of said end pieces, after which the ears or lugs 2 are bent downwardly against the outside face of the end pieces to hold them in assembled relation with the sheet 6. The bent extended ears or lugs 32 of the end pieces will lie against the inside faces of the longitudinal flanges 19 and 23 on sheet 6 to lap the corners. The opposite end pieces cooperate with said longitudinal flanges to form a flange surrounding a recess in one side of sheet 6 which is filled with suitable insulating material 4, preferably of such inorganic materials as mineral or glass fibers. A preformed slab of the insulating material is preferably used, and it is strongly adhered to the metal sheet with water-insoluble adhesive. The marginal edges of the insulating material are engaged by the overlapping-facing flanges having lugs 31 of the bent longitudinal edges of sheet 6 and the bent over lugs or ears 31' of the end pieces. Thus, the insulating material is not only securely bonded by the adhesive material but it is more positively secured by the overlapping parts of the metal panel. There will be a slot formed in each of these end pieces 1 in registration with channel groove 3.

The insulated panels are fitted together in edge to edge relation into rectangular conduit sections, each of the panels comprising one of the sidewalls of the conduit section. The conduit sections can be made up from standard panels of equal width into square conduit or from standard panels of unequal width with rectangular conduits of unequal dimensions (Figs. 2). The insulating material is on the inside of the conduit lining the metal exterior and protected by it.

It will be noted that when the conduit section is formed from four of the panels, each panel forming one of the sides, the terminal side walls 29 of the groove portion on the removable end section will be oppositely disposed at the ends of the adjacent ends of the conduits on all four sides, and, accordingly, they may be advantageously locked in end to end relation by channel clips 7 having bent over side edges 33 which provide a channel into which the opposite terminal side walls are received (Fig. 10).

In order to effectively seal the end joints formed by the end to end connection of the conduit sections, a compressible gasket 14 of any suitable elastic material may be inserted, and the gasket and the adjacent ends of the conduit sections may be advantageously painted with water-insoluble cement for more effectively sealing the joint.

Larger conduits may be formed by connecting two or more of the standard size panels in assembly panels (Fig. 2) by a connector or adapter panel comprising parts 16 and 17 (Figs. 2, 7 and 8). The part 17 comprises a metal blank bent upwardly in a vertical plane with a slot 35 and rectangular conduit section. The slot 35 is formed by inserting a channel clip 17 into a vertical wall 35 with its top edge turned outwardly into a terminal flange 36, generally parallel with the bottom 37 of a channel 58, for receiving the groove 3 of a standard panel. The opposite side of channel 38 is formed by the flange 17' bent upwardly and reversed parallel to the vertical wall 35. Bayonet slots 15' are formed in the vertical wall 13' similar to the bayonet slots in the standard panels and for the same purpose. Ears or lugs 40 are cut from the bottom 37 to be bent over to retain insulation 4.

The part 16 of the adapter or connector is formed from a metal blank having a longitudinal vertical wall 41 with a channel or groove 3' formed therein and the spaced-apart rivets or screws 11' fixed to the opposite walls 42 of the channel 31 similar to and for performing the same functions as the rivets or screws 11 in the standard panel. Ears or lugs 43 are provided in spaced-apart relation on the bottom edge of wall 41 for being bent over the marginal edge of an insulating slab 4' fitted between the said ears or lugs 43 and the top side of part 16. An intermediate portion of this top side of part 16 is doubled back upon itself at 44 and then extended into a terminal end 45 to provide a channel 46 between it and the double ply back portion 44. This channel 46 receives the terminal flange 36 which is overlapped by the terminal end 45 that also extends to overlap the marginal edge of the standard panel that is fitted to the part 45. Screws holes 48 are formed in the terminal end 45 to register with the corresponding holes 49 formed in the outer face of the standard panel to receive the screws 12. Metal pieces 47 (Fig. 11) are fitted to the ends of the part 16 to cover the ends of the insulation and have ears or lugs 48 for being bent over the marginal edges of the insulated conduit. Ears or lugs 48 may also be provided on these end pieces 47 as a unitary item on the side edge walls. Holes 49 are aligned with the marginal tongues on the detachable end pieces of the standard panels for also being engaged by the channel strips 7 for securing the assembled conduit sections in end to end relation.

When a conduit is formed of two or more panels for one side of a conduit, a tear drop support 18 (Fig. 9)
is inserted into the conduit spaced longitudinally about every four feet at a joint where the adapter panel is installed. This tear drop support 18 is constructed from a metal blank bent into a hollow body portion having a concavo-convex longitudinal side edge 50 opposite to the triangular edge 51. A flat ear 9 is formed on one end and another flat ear 10 is formed on the opposite end, these ears being of the thickness of the sheet metal from which the support 18 is formed. The ears are adapted to fit in the joint between the ends of the conduit sections with the ends of the hollow body in contact with and abutting the inside of the assembly panels to prevent sagging of the upper side of the conduit system.

From the foregoing description, the construction of the panels and the adapters or connectors are readily apparent as well as their assembly to form the conduit sections which are assembled in end to end relation for any desired length systems. It will also be apparent that reducer conduit sections can be made of the same general construction, these being but tapered conduit sections for connecting conduit lines of smaller and larger cross sections.

I am aware that there may be various changes in details of construction without departing from the spirit of my invention, and, therefore, I claim my invention broadly as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by United States Letters Patent, is:

1. An insulated knockdown air conduit comprising conduit sections composed of separate flat thermo-insulating wall panels having readily detachable interfitting longitudinal edges, means carried by the panels for wedging them into interlocking relation, each of said panels being of metal having a surrounding marginal flange to provide a recessed side face, an insulating slab filling the recess, and lugs stamped from the surrounding flange for locking the insulating slab in the recess.

2. The insulated knockdown air conduit of claim 1 in which the insulating slab is adhesively bonded to the metal.

3. The insulated knockdown air conduit of claim 2 having sealing means applied to the interengaging edges.

4. An insulated knockdown air conduit comprised of the conduit sections of claim 3 detachably connected in end to end relation.

5. The insulated knockdown air conduit of claim 4 in which the adjacent ends of the conduit are sealed.

6. A rectangular knockdown conduit composed of at least four wall panels interlocked together at their corners, each of said panels comprising a metal plate having a surrounding angular flange disposed about the opposite edges to provide a recess on one side face of the plate, an insulating slab in the recess, portions on the flanges for overhanging the marginal edges of the insulating slab for holding it in the recess, a tongue extending from one side of the panel with bayonet slots therein, a channelled wall along the margin of the face of the panel, opposite to the tongue side, and means on the channel wall for detachably engaging the bayonet slots of the tongue to a similar panel fitting within the channelled wall.

7. An insulated knockdown air conduit comprising conduit sections composed of separate flat metal panels, each having a surrounding flange to provide a recess on one face, insulating material filling the recess and secured therein, a mating tongue and groove formed on the opposite longitudinal edges of the panels, bayonet slots formed in the tongue, and means formed in the groove for engaging the bayonet slots of a similar constructed panel.

8. The insulated knockdown air conduit of claim 7 in which the engaging portion of the slot is inclined for causing the adjacent edges of the panels to be drawn in closely abutting relation.

9. The insulated knockdown conduit of claim 8 in which the abutting edges of the panels are coated with non-metallic material.

10. The insulated knockdown conduit of claim 9 in which the coating material is water-insoluble cement.

11. A knock-down conduit comprising rectangular metal wall panels having their opposite longitudinal edges bent into flanges to provide a recess on one side, a detachable end flange fitting between the longitudinal flanges and secured to each of the opposite ends of the panel for closing the ends of the recess, insulating material filling the recess, and channeled means carried by the end flanges for receiving a locking clip for fastening sections of said conduit end to end.

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