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3,606,404

DUCT-TO-REGISTER CONNECTOR

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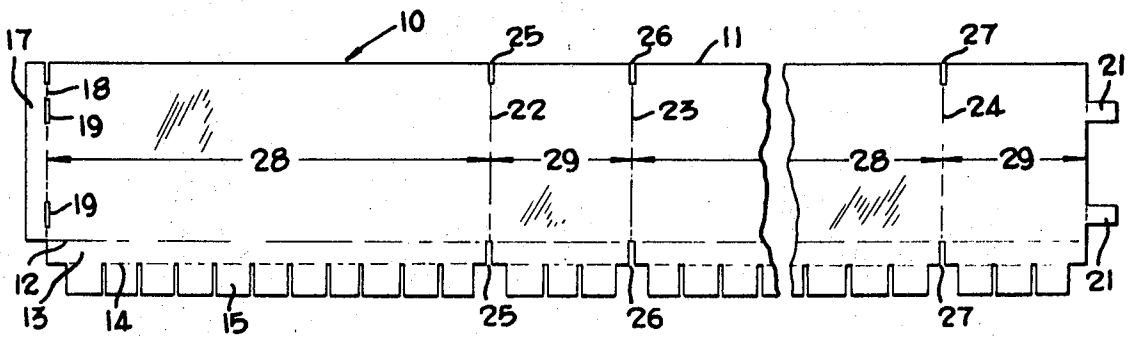


FIG. 1

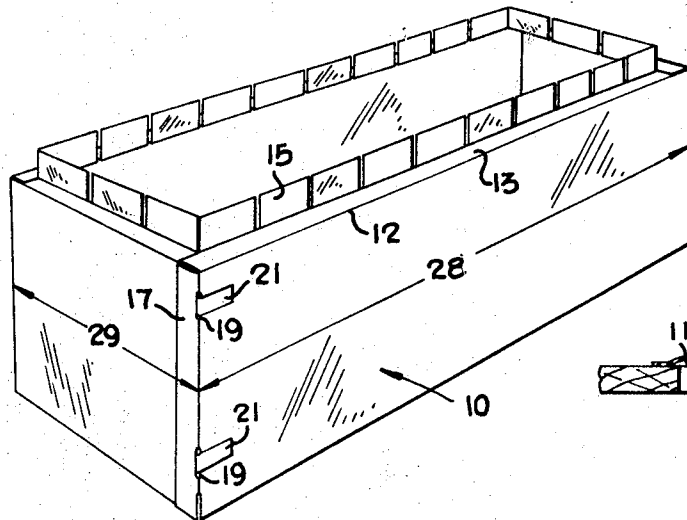


FIG. 2

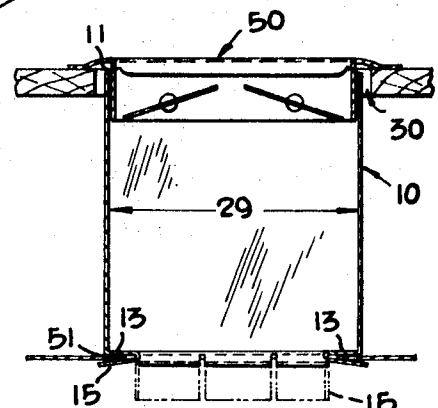


FIG. 4

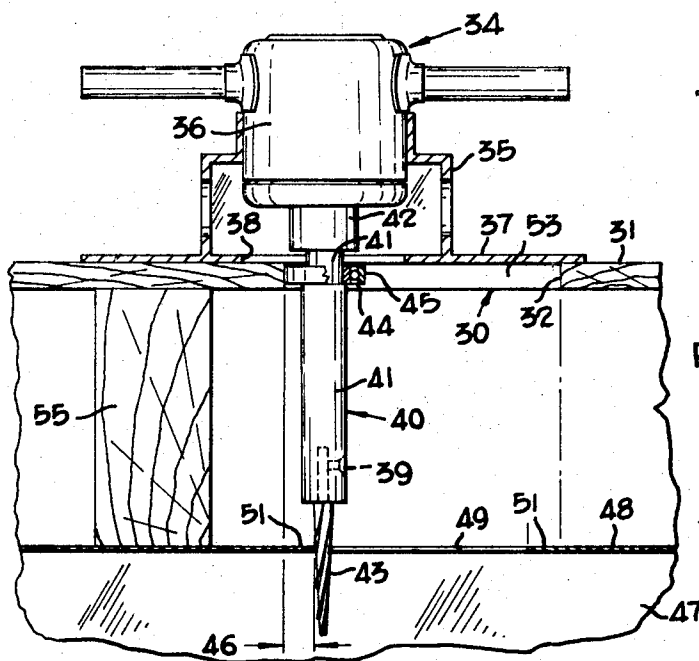


FIG. 3

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## DUCT-TO-REGISTER CONNECTOR

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2 Claims

### ABSTRACT OF THE DISCLOSURE

Openings in air ducts, beneath floor and wall surfaces, are cut by a routing process; and connected to rectangular surface register apertures by a readily installed duct connector section. Using the surface for alignment and its aperture edge for guiding a circular bearing guide, a routing tool projects through the aperture to cut a registering, smaller rectangular duct opening. Onto the margin around the duct opening is installed the inward end of a duct connector section, whose projecting tabs are manually bent into the opening for securement.

### BACKGROUND OF THE INVENTION

Air ducts, utilized for heating or air conditioning, ordinarily extend fairly closely adjacent to floor and wall surfaces, being separated from the floors or walls by supporting structures, such as joists or columns. Heretofore there has been no quick, simple and inexpensive way of locating and cutting the duct openings and making connections therefrom to surface registers. As applied to factory-fabricated housing units, such as mobile homes, which have heating ducts beneath the floor joists, this problem has interfered with rapid mass production.

A procedure heretofore employed has been to cut a rectangular opening in the floor or wall surface, and then seek to cut an opening of the same size in registration therewith, and then to install a straight duct connector section between them. It has not been possible to do this accurately in mass production.

### SUMMARY OF THE INVENTION

New sheet metal duct-to register connectors are fabricated to standard size. Preferably they are blanked and partly formed at a factory, and may be shipped stacked compactly together, for final bending at the site of installation. A sheet metal strip, foldable to a rectangular cross-section to fit within a register aperture, has a margin along one of its longer edges to bend an inward shoulder, and bendable tabs extending therefrom. The shoulder seats against the outer margin of a duct opening smaller than the room surface aperture for the register.

Also provided is a new routing tool of the type having an extension shaft with a cutter end, the tool body having supporting means which define a plane for sliding the tool perpendicular to the shaft. Guide means concentrically surround the cutter shaft. The preferred guide means is a bearing mounted on the shaft and whose radius substantially exceeds the effective radius of the cutter end, normally a replaceable bit.

In the following out the method of the invention, a rectangular aperture is first cut in the room surface. The shaft of the routing tool is inserted in it until the cutting end of the tool penetrates the wall of the duct inwardly of the room surface, while the room surface serves as a plane of reference on which the tool slides; in this way the routing tool shaft is maintained perpendicular. With the outer side of the guide bearing in contact with the rectangular edge of the aperture, the tool is guided around its four sides, thereby routing a rectangular opening in the duct. Such duct opening is perfectly centered

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in registration with the room surface aperture; and it is spacedly smaller than the aperture along each side by a margin which equals the excess of the radius of the guide means over the radius of the cutting end.

The duct-to-register connector is then inserted through the room surface aperture until its shoulder rests upon the outer margin of the duct opening and the tabs extend into the opening. The installer reaches through the connector to bend its tabs back manually under the duct wall, to receive it in place. A surface register is then installed in the connector opening.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view of a sheet strip shown in flat pattern, which is foldable to form the present duct-to-register connector.

FIG. 2 is a perspective view of the connector as folded, prior to installation.

FIG. 3 is a side view, partly in section, of the routing tool, its bearing being guided by the edge of a room surface aperture to cut a smaller, registering duct opening.

FIG. 4 is a side view, principally in section, showing the duct connector of FIG. 2 as finally installed.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Duct-to-register connectors utilizing the present invention may be blanked in quantity and preliminarily partially folded at the factory, for subsequent installation as hereinafter to be described.

A sheet metal strip generally designated 10, shown in FIG. 1, is blanked to a pattern suitable for bending the present duct-to-register connector section. The strip 10 is generally rectangular; one of its longer edges serves as the outer edge 11 against which a register, such as the register generally designated 50 and shown in FIG. 4, is to be fitted. The distance to be spanned by such a connector is the spacing from the room surface, in which the register is to be installed, to the wall 48 of a duct 47 beneath it. This distance is ordinarily within the feasible reach of a routing tool such as herein described; and may be no greater than the thickness of the floor or other room surface plus that of the joists or other support structure.

At a distance from the outer edge 11 equal to such span is a bend line 12, beyond which is a margin 13 which when bent forms an inward shoulder along one of the longer edges of the metal strip 10. From the margin 13, and extending beyond a second bend line 14, are bendable tabs 15, spaced at intervals.

At one end of the strip 10 is a closing margin 17, outward of a third bend line 18 which is perpendicular to the outer edge 11. Two slots 19 are blanked within this bend line 18. At the other end of the strip 10, two projecting tabs 21 are formed, of such width and spacing as to be insertable within the slots 19.

In order that the strip may be readily bent into a rectangular connector section, edge notches 25, 26 and 27 demark additional bend lines 22, 23, 24 perpendicular to the outer edge 11. These bend lines divide the strip 10 to define the rectangular length 28 and width 29, of the connector section to be folded. The bendable tabs 15 are spaced sufficiently away from the bend lines 18, 22, 23, 24 to provide clearance when the strip 10 is finally folded into the connector section shown in FIG. 2. As shown in FIGS. 1 and 2, clearance from the bend lines 18, 22, 23, 24 is sufficient when such spacing away from the bend lines substantially equals the width of the margin 13.

As much work shall be performed at the factory where the strip 10 is made, as is consistent with easy shipment. Accordingly, on initial manufacture its closing margin 17 is bent at 90° along the bend line 18; the margin 13 is

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bent at 90° in the same direction to form the inward shoulder, and the tabs 15 are bent back at 90° therefrom. Connector strips so bent may be shipped nested compactly together. At the time of final assembly, the configuration shown in FIG. 2 is completed by bending along the bend lines 25, 26, 27, inserting the tabs 21 inwardly of the closing margin 17 and through the slots 19, and closing them as shown.

The method of cutting a duct opening, inwardly of and centered in registration with a room surface aperture, is shown in FIG. 3. First, a rectangular aperture, generally designated 30, is cut in a room surface such as the floor 31, to predetermined rectangular dimensions, such that the longer edges 32 of the aperture 30 are slightly greater in length than the length 28 of the connector to be formed and the aperture width 33 is similarly greater than its width.

For the cutting operation, a hand routing tool, generally designated 34, is used, which includes a ventilated body 35 mounting an electric motor 36. Supporting the body 35 is a slidable base plate 37 having a large central aperture 38. A rotatable routing cutter, generally designated 40, includes an extension shaft 41 whose upper portion is mounted within a chuck 42 whose axis is perpendicular to the plane of sliding of the base plate 37. A relatively narrow cutting end or router bit 43 is mounted in the lower portion of the shaft 41 by a set screw 39. The bit 43 may be straight; or if slightly tapered, over its useful cutting portion, such taper is sufficiently small, compared with the other dimensions hereinafter referred to, that for practical purposes the radius of such cutting end 43 may be thought of as being substantially constant. The shaft 41 is of the largest diameter which the router chuck 42 will accept; its rigidity provides extended reach for the tool 34, adequate to reach the duct 47 as hereafter described.

Mounted on the extension shaft 41 is a bearing, such as the rotatable bearing 44, whose circular outer edge 45 serves as guide means which surrounds the shaft concentrically adjacent to and below the plane of sliding. As seen in FIG. 3, the radius of the circular edge 45 exceeds the effective radius of the cutting end 43 by a difference in radius 46.

A sheet metal duct generally designated 47, for carrying air from a furnace or air conditioner, is installed closely beneath or inward of joists 55 which support the floor 31. A problem met by the invention is how to cut into its upper surface 48 a rectangular opening 49, precisely aligned or centered in registration with the room surface aperture 30.

The steps followed in the present invention are as follows: the rotatable tool 40 is extended into the surface aperture 30, and its cutting end 43 penetrates the duct surface 48. The room surface 31 serves as a plane of reference, on which the base plate 37 slides, with the shaft 41 being thus guided perpendicularly to the room surface 31. Using the outer bearing surface 45 as a side guide means, which the operator maintains firmly in contact with the surface aperture edges 32, 33, the routing tool 34 is moved progressively along these edges. As it is so guided and moved, an opening 49 is routed in the duct 47, centered precisely in registration with the room surface aperture 30 but smaller along each side. The amount by which it is smaller, indicated in FIG. 3 by the margin 51, equals the difference in the guide radius 46 and the effective radius of the cutter end 43 of the routing cutter 40.

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All that remains is final assembly. The duct-to-connector section folded from the strip 10 as shown in FIG. 2, is inserted through the room surface aperture 30 so that its margin 13, bent to form an inward shoulder, rests on the margin 51 around the duct opening 49; and the connector tabs 15 extend into the opening 49 as shown in dashed lines. The installer then reaches through the connector and manually bends the tabs 15 back towards the shoulder 13, as shown by the solid lines in FIG. 4, securing the connector firmly to the duct wall 48. A surface register 50 is then installed within the top opening and overlaying the edge of the room surface aperture 30, as shown in FIG. 4.

Various detailed changes or alternatives in the construction of the duct-to-connector section such as in the configuration of the sheet metal strip 10, and of the guide around the shaft of the routing tool 34, as well as differences in the method of installation, described will suggest themselves. For example, the guide means which projects beneath the plane of sliding may be mounted onto some nonrotating part of the routing tool, and its projecting guide edge need not be circular as long as its center is substantially concentric with the shaft 41.

I claim:

1. A duct-to-register connector blank adapted for installation by folding, comprising:

a generally rectangular sheet metal strip integrally including a first bend line spaced from and parallel to one of its longer edges,

three notches extending perpendicularly from said edge to said first bend line whereby to designate other bend lines along which the strip may be folded to rectangular cross-section,

means at the ends of said strip to engage said ends to each other when said strip is folded to rectangular cross-section, and

bendable tab portions extending from said edge and terminating short of said first bend line and only a single margin contained between said first bend line and the terminating portions of said tabs, said tabs extending along those portions of the length of the strip which are spaced away from said other bend lines so designated whereby when said strip is folded to a rectangular cross-section such spacing from said other bend lines provides clearance for the tab portions when the margin portion, across which the notches extend, is bent 90° inward into such rectangular cross-section to form a small rectangle from which the tab portions extend, after bending, at substantially right angles.

2. The duct-to-register connector defined in claim 1, in which the spacing of the tab portions from said other bend lines substantially equals the width of said margin.

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