United States Patent [19]

Thorne

[11] **3,772,844**

[45] **Nov. 20, 1973**

[54] **METHOD OF FABRICATING FIRE RESISTANT DUCT OR SHAFT**

[76] Inventor: **Parker R. Thorne,** 2839 Sheridan Pl., Evanston, Ill.

[22] Filed: **May 24, 1972**

[21] Appl. No.: **256,573**

[52] **U.S. Cl.** **52/741,** 52/443

[51] **Int. Cl.** **E04f 13/04**

[58] **Field of Search** 52/741, 443, 447, 52/448, 449, 450, 344, 238, 241, 30

[56] **References Cited**

UNITED STATES PATENTS

2,156,027	4/1939	Preble	52/452 X
2,405,116	8/1946	Cullen	52/448
2,805,633	9/1957	Naulin	52/448

OTHER PUBLICATIONS

Construction Method & Equipment 10–1937, page 60.

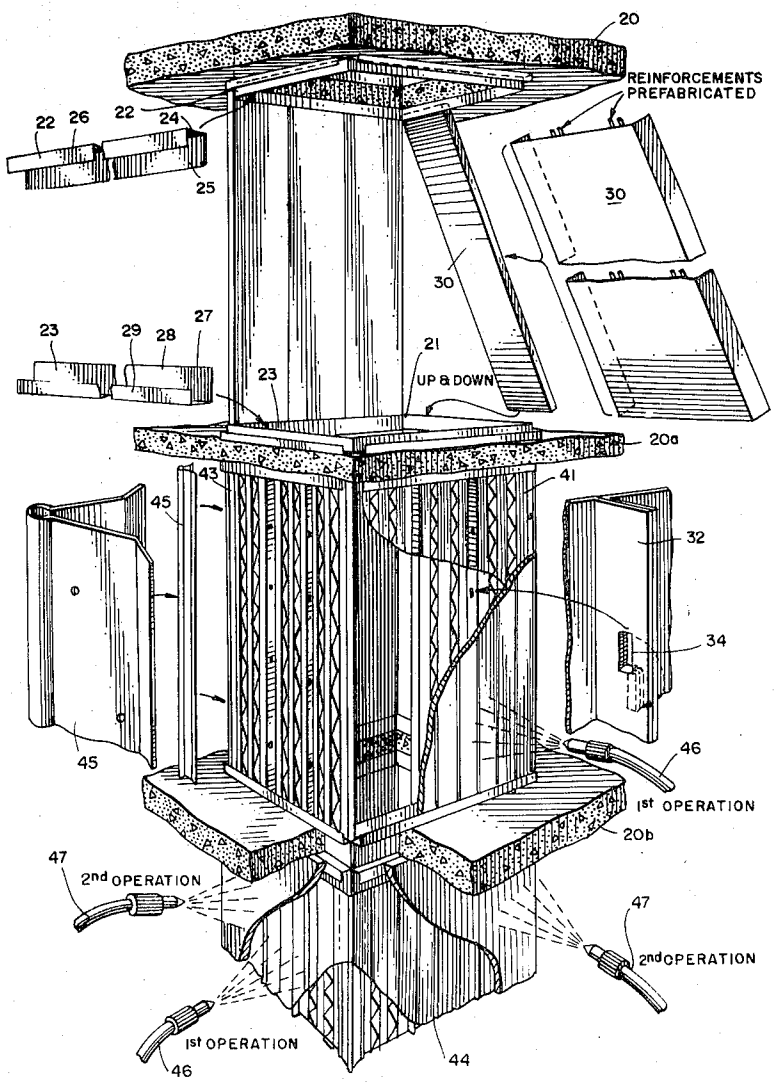
Lath and Plaster Construction for Walls and Ceiling by National Gypsum Co., Dec. 1966, pages 20 & 21.

Primary Examiner—John E. Murtagh
Attorney—Dawson, Tilton, Fellon & Lungmus

[57] **ABSTRACT**

A method of fabricating a fire resistant duct or shaft wherein channel shaped runners are installed on the floor and ceiling about aligned openings therein, assembling a plurality of elongated panel blanks to extend vertically beween the floor and ceiling runners, each panel being equipped with longitudinally extending edge flanges and central studs, securing the flanges together and applying a mesh to the studs and thereafter covering the exterior of the panel blanks with at least two layers of plaster.

5 Claims, 12 Drawing Figures



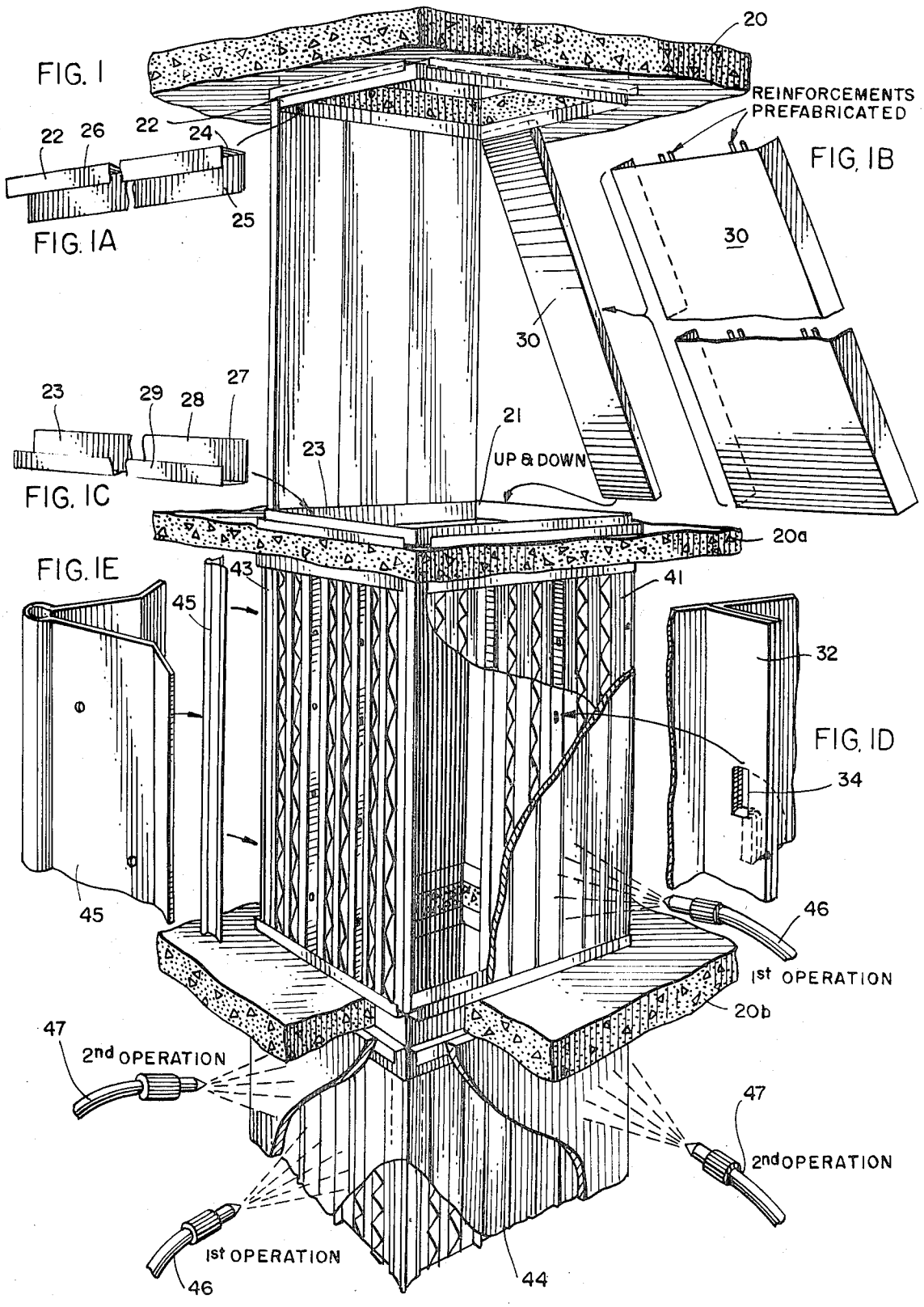

FIG. I
20
REINFORCEMENTS PREFABRICATED
FIG. IB
22
26
22
24
25
FIG. IA
30
30
23
29
28
27
21
23
UP & DOWN
FIG. IC
20a
FIG. IE
43
41
45
32
FIG. ID
34
45
46
1st OPERATION
20b
47
2nd OPERATION
47
2nd OPERATION
1st OPERATION
46
44

FIG. 2

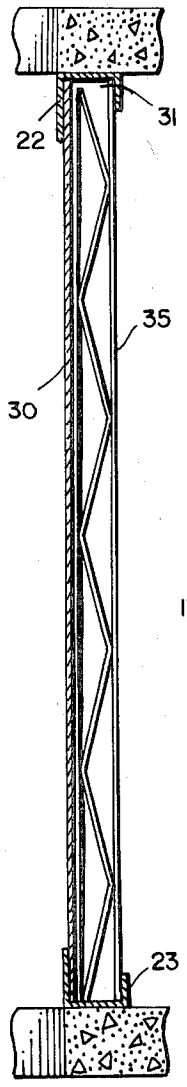


FIG. 3

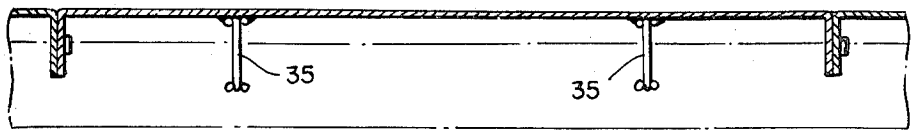


FIG. 7

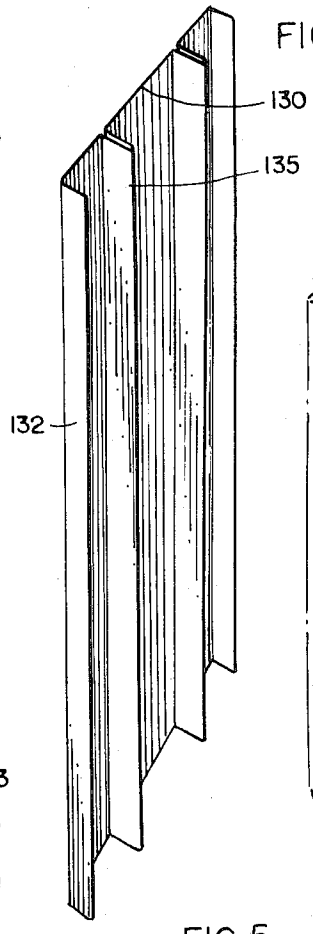


FIG. 4

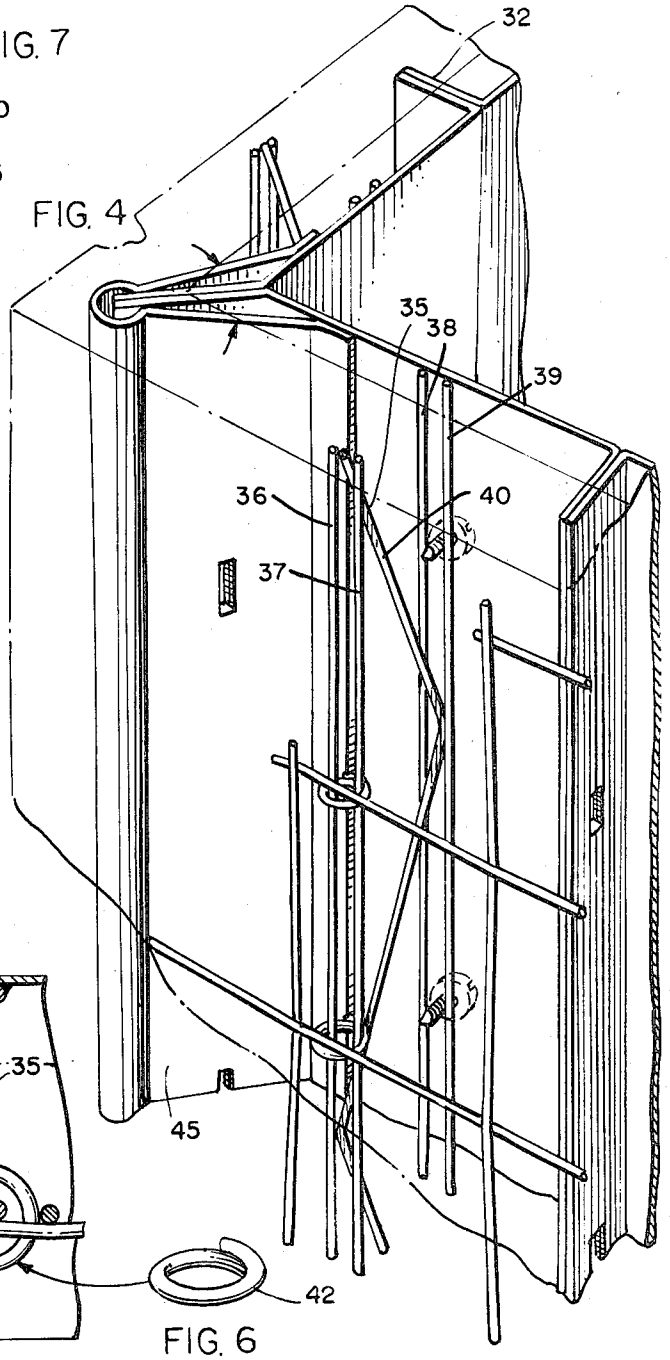


FIG. 5

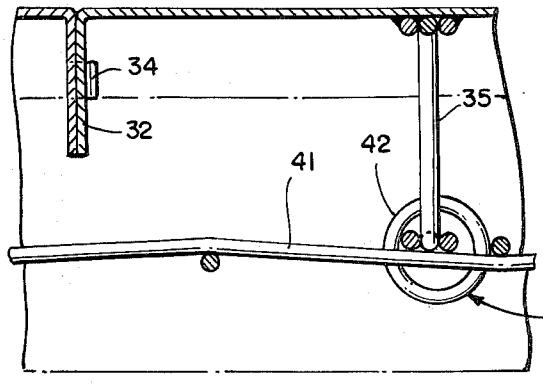


FIG. 6

METHOD OF FABRICATING FIRE RESISTANT DUCT OR SHAFT

BACKGROUND AND SUMMARY OF INVENTION

In tall buildings, it is necessary to provide large cross sectional area ducts or shafts — to conduct conditioned air and return the same, house elevators, etc. It is not unusual to have duct dimensions of 15 feet to 30 feet on a side. Two normally conflicting objectives must be achieved in such an installation. First, it must achieve a predetermined fire rating — generally at least 2 hours. Secondly, it must be relatively light weight. It will be appreciated that the greater the thickness to achieve the predetermined fire rating, the heavier the partition wall of the duct and the greater area used by the duct or shaft.

In the past, 4 inch solid masonary blocks have been utilized to achieve a 2 hour fire rating but these weigh 36 pounds per square foot. On the other hand, drywall type panels even framed with suitable steel channeling and the like have a substantially lower weight (of the order of about 10 pounds per square foot) but require a substantial thickness, viz., of the order of 3¾ inches. Further, the drywall type duct work is subject to the disadvantage of employing paper facing which might constitute a fire hazard notwithstanding the nominal fire rating.

As against the unsatisfactory expedients outlined above, the instant invention develops a duct-forming wall system on the site by virtue of utilizing special stud-equipped panel blanks augmented by a wire network so as to uniquely support plaster of a thickness sufficient to achieve the predetermined fire rating.

Further details including objects and advantages of the invention may be appreciated from the detailed description in the specification which follows.

DETAILED DESCRIPTION

The invention is described in conjunction with an illustrative embodiment in the accompanying drawing, in which

FIG. 1 is a perspective view of a fragment of a tall building interior showing the inventive method in the process of usage, various sections being broken away to illustrate various stages in the practice of the method;

FIG. 1A is a fragmentary perspective view of an isolated portion of FIG. 1 in showing one of the ceiling runners;

FIG. 1B is a fragmentary perspective view of an isolated portion of FIG. 1 and showing one of the panel blanks;

FIG. 1C is a fragmentary perspective view of an isolated floor runner of FIG. 1;

FIG. 1D is a fragmentary perspective view of a portion of FIG. 1 on enlarged scale and showing the interconnection between adjacent panel blanks;

FIG. 1E is a fragmentary perspective view of a portion of FIG. 1 and showing on enlarged scale a corner bead;

FIG. 2 is a fragmentary vertical sectional view through one story of the duct of shaft in an initial stage of fabrication;

FIG. 3 is an enlarged transverse sectional view of the panel blank of FIG. 2;

FIG. 4 is a fragmentary perspective view of the supporting framework of the duct in assembled condition but less the plaster which is normally applied thereto;

FIG. 5 is an enlarged fragmentary sectional view of the central portion of FIG. 4 showing the interconnection of the wire mesh to the studs;

FIG. 6 is a perspective view of a retainer which is employed to fasten the wire mesh to the stud-providing portion of the panel blank; and

FIG. 7 is a perspective view of a modified form of panel illustrating a method fabricating the panel and studs from one piece of metal.

In the illustration given, the numeral 20 designates a floor of a tall structure (not shown). Also seen in FIG. 1 are other floors 20*a* and 20*b*. Each floor is equipped with a generally rectangular opening 21 therein which communicates one space with the level immediately above or below, as the case may be. The invention is concerned with providing a duct which extends from a floor of one level to the ceiling of that level, i.e., connecting vertically aligned openings 21. In some instances, the duct may be built horizontally to carry conditioned air, pipes, etc. For the purpose of supporting and aligning the walls or partitions of the duct work to be installed, I provide a frame work of runners 22 and 23 which are secured by suitable fastenings to the floor and ceiling about each opening 21. The channel type character of the runners 22 and 23 can be readily appreciated from a consideration of FIGS. 1A and 1C.

As can be most readily appreciated from a consideration of FIG. 1A, the runner 22 is essentially J-shaped. For example, the upper runner 22 includes a bight 24 interconnecting depending legs 25 and 26. In like fashion, the lower runner 23, i.e., the one secured to the floor, also includes a bight portion 27 interconnecting upstanding legs 28 and 29. The bight portions 14 and 18, in the illustration given, are about 1⅝ inches wide while the legs 25 and 26 are respectively 2 inches and 1¼ inches and three-eights inches in height. The vertical distance between the floor and ceiling may vary between nine feet and twenty-one feet or more. The panel blanks 30 will be of appropriate lengths to fill the opening as shown between 20 and 20a. Installation therefor is facilitated by disposing the panel blank 30 in the fashion seen in FIG. 2. The mode of installation is seen in FIG. 1 wherein the upper portion of the blank is inserted within the channel of the upper runner 22 and the lower blank portion moved inwardly toward the lower runner 23. Thereafter the panel blank 30 is lowered to seat within the runner 23. This results in the space 31 (see FIG. 2).

Each panel blank 30 is of an advantageous width such as 32 inches and is equipped along each longitudinal edge with an integral flange 32 (see FIG. 1D). Optimally, each flange 32 projects outwardly of the final duct assembly about one-half inch (see FIG. 5). Adjacent flanges are secured together by "tonguing" as at 34 (again see FIG. 1D). Alternatively staples, screws or other fasteners may be advantageously employed. In one preferred form of the invention, the generally planar panel blanks are constructed of 30 gauge hot dipped galvanized sheet lath. I have found it advantageous to provide the panel blanks of a substantially imperforate nature — as contrasted to using conventional expanded or punched metal lath because the plaster ultimately sprayed on is precluded from entering into the duct.

Each panel blank 30 additionally includes at least two studs 35 (compare FIGS. 2–5). In the illustration given, the studs 35 are spaced inwardly of the flanges

32 a distance of the order of about 8 inches. Eact strut 35 is essentially truss-like, being made up of four longitudinally extending rods 36, 36, 38 and 39 which are integrated as by welding with a zigzag folded rod 40 (see FIG. 4). Advantageously, the studs 35 are secured to the associated panel blanks 30 before assembly into the rails 22 and 23. This may be done by welding, stapling, hog rings, screws or like attachment. Alternatively, the studs may be provided integrally with the sheets making up the blanks 30 — as by rolling V-shaped ribs into the blanks. Panel blanks also may be made of asbestos board or similar non-combustible material.

Secured to the studs 35 is a wire network 41 which again may be secured through rings, welding, tie wire, or the like (compare FIGS. 1 and 5). In the illustration given, I employ for the wire mesh 41 a metal rodding network having two inch openings in the mesh which may be of any extent which is readily handleable by the artisan installing the panel blanks 30. For example, the mesh may be wide enough to span several blanks 30.

After the mesh 41 has been installed in the fashion seen in FIG. 5 using the rings 42, I apply a first coat of plaster to the assembly. The runner-panel blank — mesh assembly prior to plastering is seen in FIG. 4. This is advantageously achieved through the use of commercial plaster spraying equipment. Alternatively, the plaster may be hand applied. For the purpose of achieving a suitable coating, I employ a relatively "stiff" mix using vermiculite as the aggregate in a gypsum plaster formulation.

During the plaster application I prefer to have the initial coat somewhat rigid for build up at the corners as at 43. Corner beads are installed prior to applying the first coat.

Optimally, the plaster thickness is of the order of 2½ inches which yields a fire rating of 2 hours. All of this is achieved without the need of any special bonding agent or objectionable paper liners while at the same time providing a light weight barrier having a weight of the order of 10 pounds per square foot.

OPERATION

In the practice of the invention, the runners 22 and 23 are installed about the perimeters of the generally rectangular shaped openings 21. This can be readily appreciated from the very upper portion of FIG. 1. Thereafter, the panel blanks 30 are installed in place — this step being readily appreciated also from a consideration of the upper portion of FIG. 1. A panel blank 30 is seen in the process of being pivoted into place between the floors 20 and 20A. Thereafter the longitudinally extending edge flanges 32 of adjacent panels 30 are secured together as by tonguing 34 — this being seen in FIG. 1D and also in the central part of FIG. 1.

The central portion of FIG. 1 illustrates intermediate stages of the inventive procedure. For example, the upper portion of the duct extending between the floors 20A and 20B is seen to have the mesh network 41 secured to the studs 35. This is advantageously achieved through the use of rings 42 in the fashion indicated in FIGS. 5 and 6. Thereafter the first coat of plaster is sprayed on in the manner designated 46 in the lower right hand portion of FIG. 1.

A suitable mix for the plaster shaft wall is as follows:

2 Bags (200 lbs.) gypsum neat cement

1 Bag (4 cubic feet) Vermiculite

Water 70–80 quarts (depending upon desired density, and pumping distance).

Each panel blank may have studs 35 attached by means of hog rings or similar devices in a factory. This permits shipping of panels 30 with studs 35 in a flat position laying essentially parallel to the panel to achieve economy in transportation. When set into position in runners 22 and 23, the studs 35 can be snapped into a position 90 degrees to the panel 30. Wire mesh 41 is then applied to the studs 35 and plaster applied to the assembly to the proper thickness. I prefer the use of hot dipped galvanized metal to prevent or minimize deleterious action upon the metal by any gases being conducted.

Referring now to FIG. 7, an alternative form of panel blank 130 is depicted. This can be achieved by rolling a sheet of light gauge hot dipped galvanized metal approximately 36 inches wide. By passing through the roll forming machine, integral studs 135 are provided as are the edge flanges 132.

Certain important advantages accrue from the inventive arrangement. The shaft wall will not shrink after installation as concrete block does and in this manner assures an air tight duct if the shaft is used as a return air duct. It may easily fit around metal ducts, beams, conduits, etc. by merely cutting the metal around the obstruction, filling in the voids with conventional metal lath and spraying the entire assembly. The inventive duct or shaft has greater resistance to air pressure created by high speed elevators than does concrete block. The metal lining causes less resistance to air than do other materials when used as a return air duct. The inventive duct or shaft occupies less floor space than either concrete block or dry-wall shaft. Further, it weighs less than other shaft systems thus permitting a reduction in structural steel in the building, important in effecting economies in building. The inventive system has a two-hour fire rating and eliminates the use of any paper or other cellulosic material and also has a high resistance to the transmission of sound.

I claim:

1. In a method of fabricating a fire resistant vertical duct, the steps of

installing in vertically aligned generally rectangular arrays a plurality of generally channel shaped runners about openings in the floor and ceiling of a space in which a duct is to be located,

assemblying a plurality of elongated panel blanks in side-by-side relation within said runners and extending between said floor and ceiling,

each panel blank including a generally planar substantially rigid imperforate sheet having its longitudinal margins formed into outwardly facing integral flanges and securing the flanges of adjacent blanks together,

each panel blank further including at least two elongated studs spaced from but parallel to said flanges and securing a wire network to said studs to dispose the same parallel to said blank,

applying a first coat of plaster to said assembled blanks, and

after the first coat has set applying a second coat of plaster to said assembled blanks to achieve a thickness of plaster sufficient to overlie said network and provide a predetermined fire rating.

2. The method of claim 1 in which the application of said plaster is achieved through spraying.

3. The method of claim 1 in which said plaster is a gypsum plaster containing perlite as an aggregate with the plaster mix being relatively stiff.

4. The method of claim 1 in which said runners include essentially J-shaped members spaced apart a distance slightly greater than the height of each panel blank whereby each panel blank is installed by introducing the same into the upper runner, pivoting said

panel blank into position above the lower runner, and thereafter lowering said panel blank into position within said lower runner.

5. The method of claim 1 in which said blank has integral studs provided therein by rolling to provide generally V-shaped projections extending parallel to said outwardly facing integral flanges.

* * * * *