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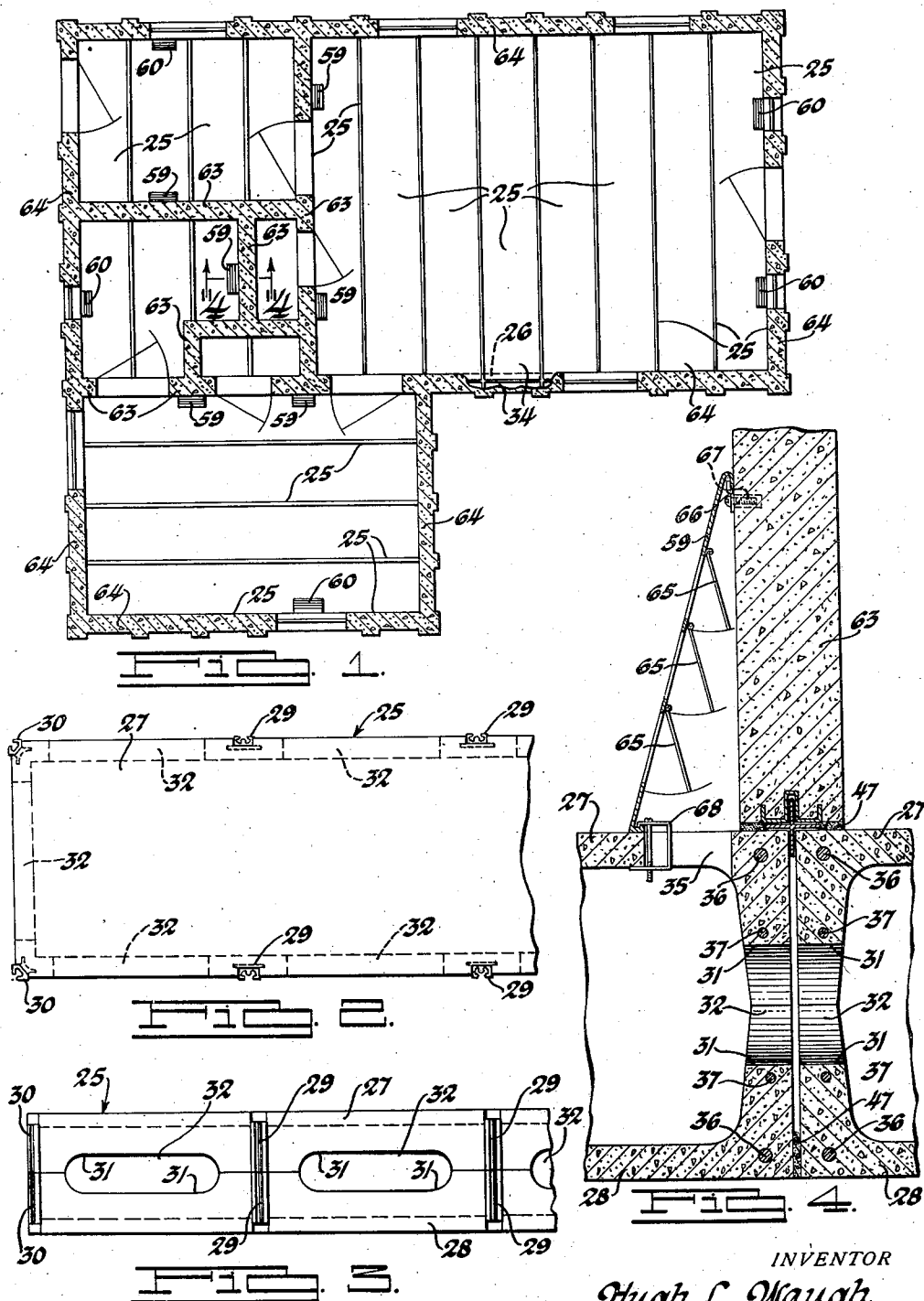
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2,192,567

BUILDING CONSTRUCTION

Filed July 26, 1937

5 Sheets-Sheet 1



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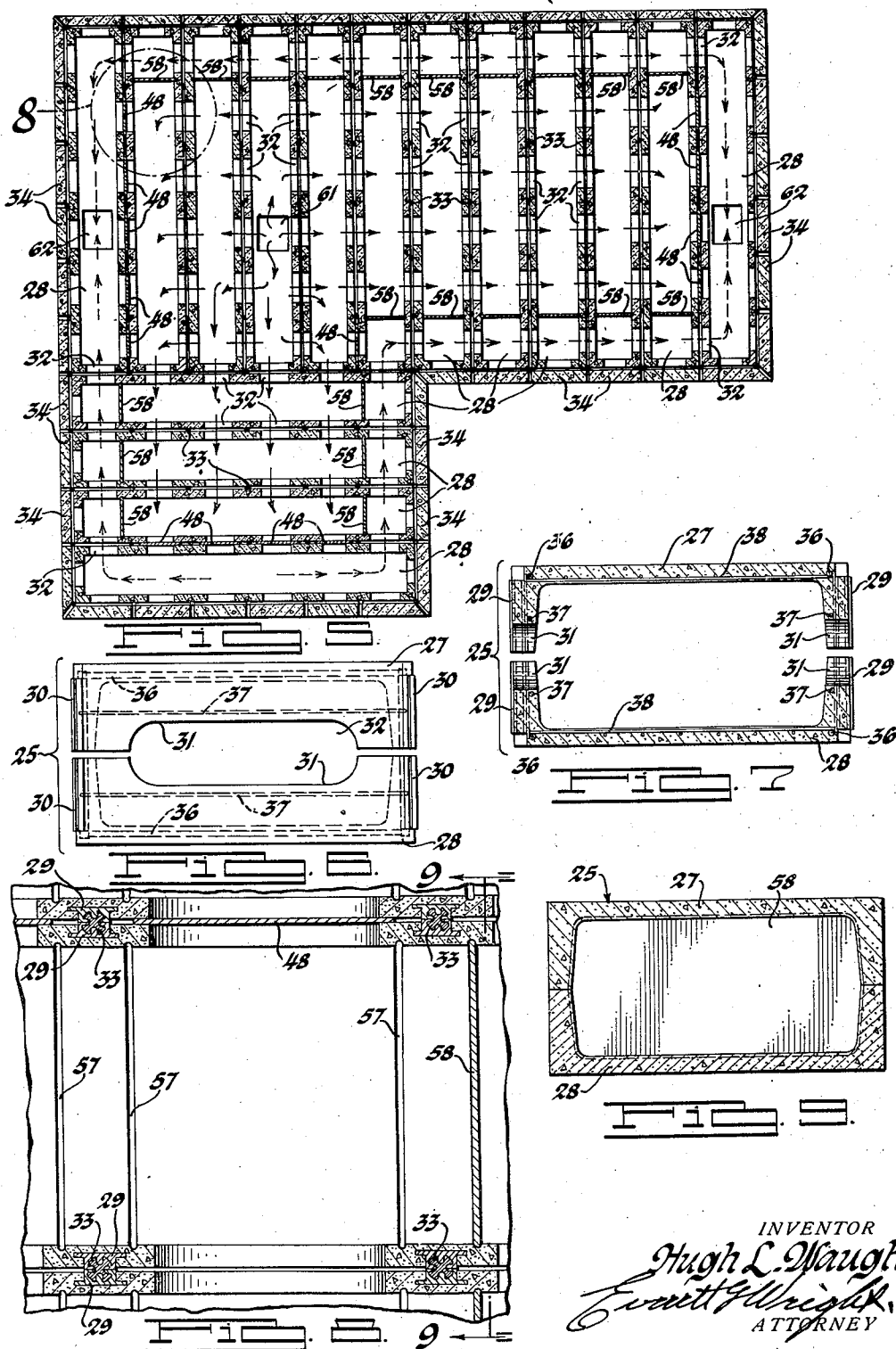
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BUILDING CONSTRUCTION

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5 Sheets-Sheet 2



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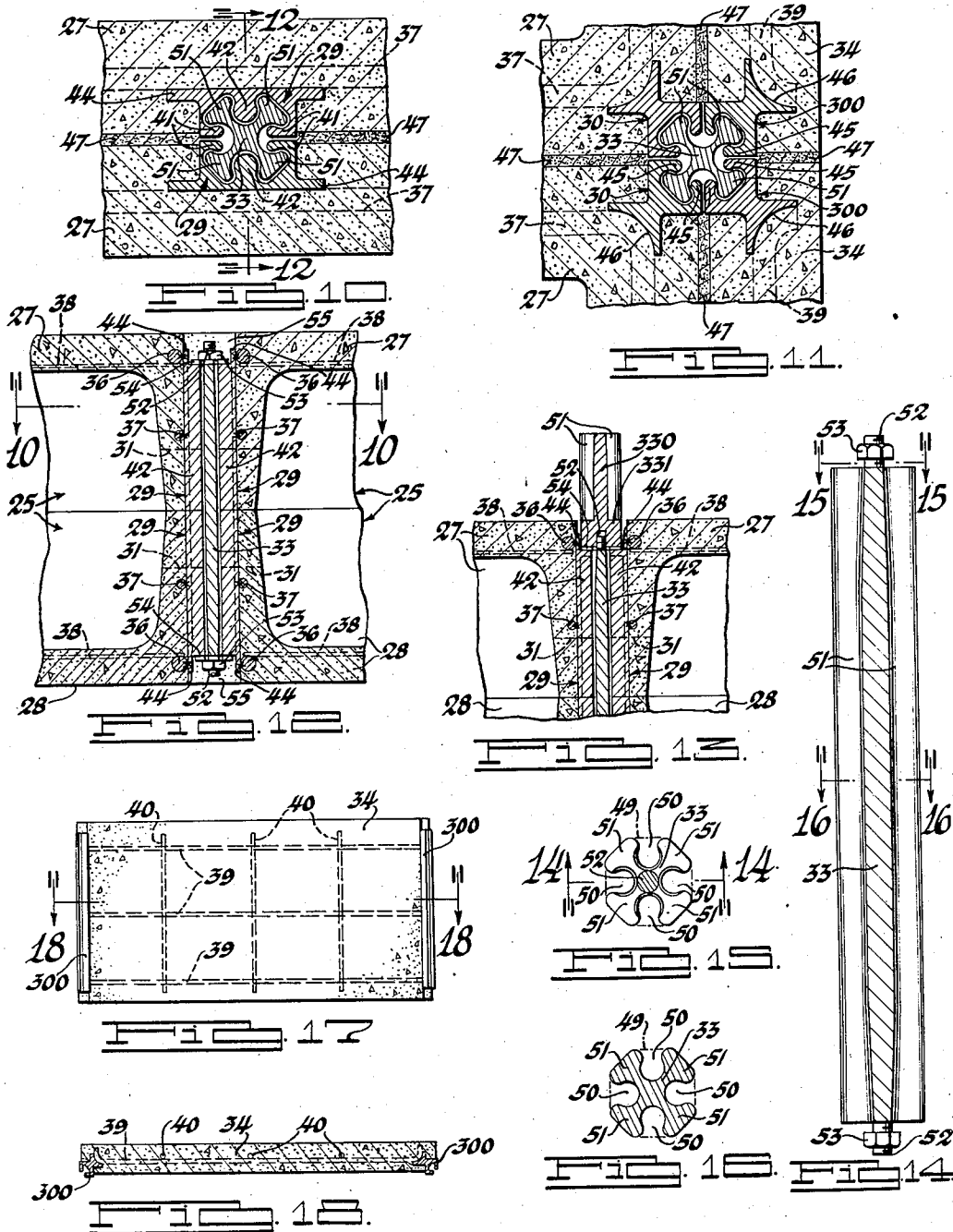
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BUILDING CONSTRUCTION

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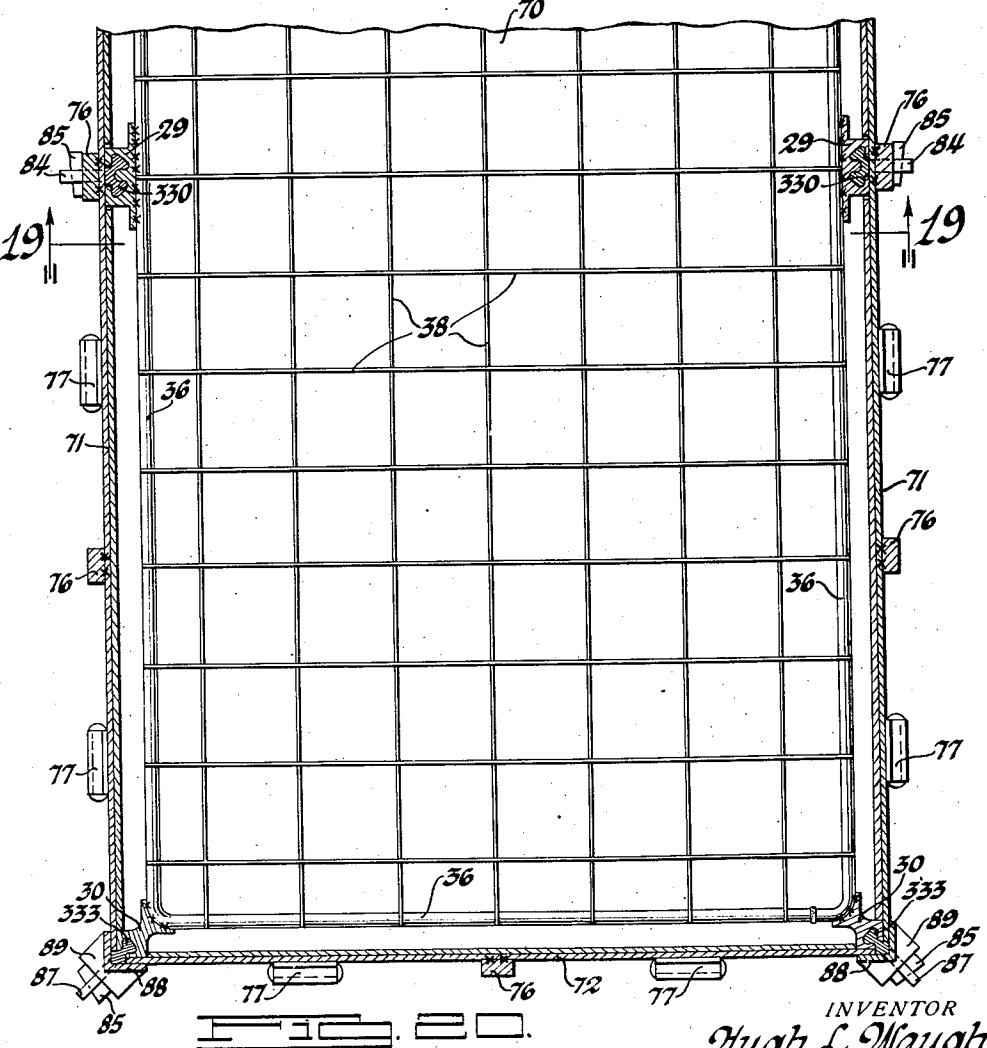
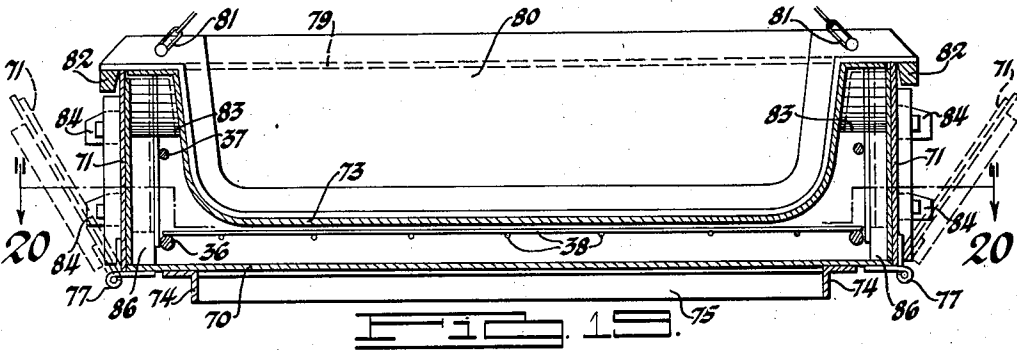
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BUILDING CONSTRUCTION

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5 Sheets-Sheet 4



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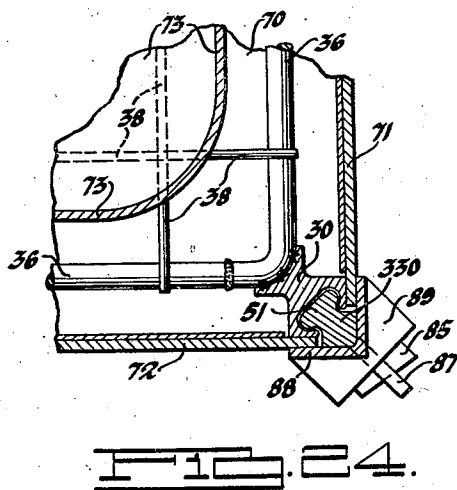
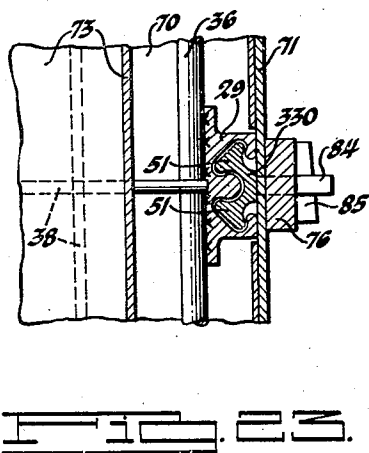
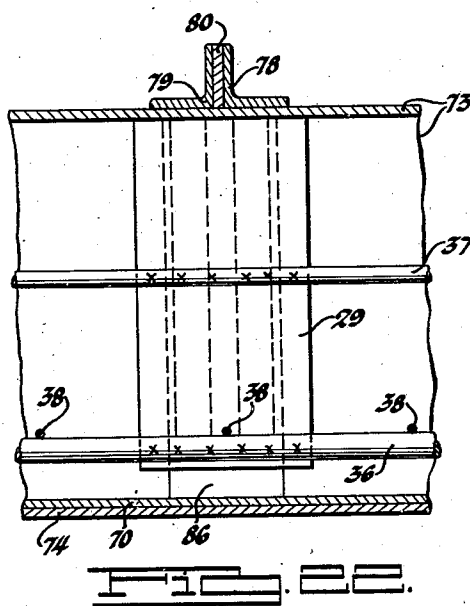
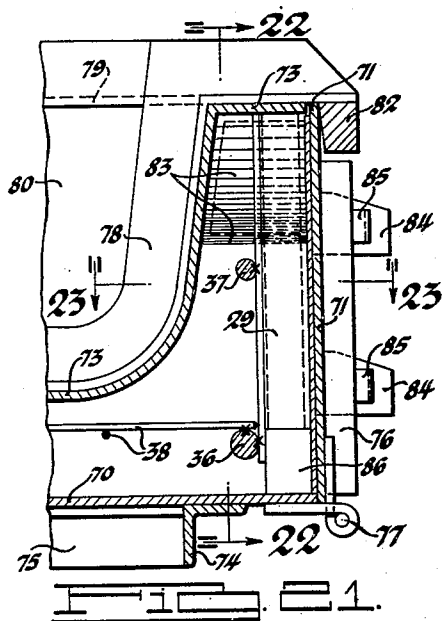
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BUILDING CONSTRUCTION

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5 Sheets-Sheet 5



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BUILDING CONSTRUCTION

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Application July 26, 1937, Serial No. 155,582

10 Claims. (Cl. 72-68)

This invention relates to building construction and in particular to structural unit panel floor construction including structural floor panels therefor and the method of manufacturing said floor panels and erecting the same.

One object of this invention is to provide structural panel floor construction composed of channel shaped half floor panels superimposed in pairs including means for securing the same into unitary box shaped floor panels capable of resisting flexural stresses as a single structural unit including tension, compression, vertical shear, and horizontal shear.

Another object of this invention is to provide structural panel floor construction composed of channel shaped half floor panels superimposed in pairs including means for securing the same into a unitary whole and forming an air supply plenum chamber and return air duct system through which fresh hot or cold air may be supplied to and vitiated air withdrawn from space thereabove or therebelow.

Another object of this invention is to provide structural panel floor construction composed of a plurality of channel shaped half floor panels superimposed in pairs and means for securing the same into a unitary whole whereby a completed floor system having fresh air supply and vitiated air return ducts therein may be erected into buildings of various size and configuration from pre-fabricated structural half floor panel units.

Another object of this invention is to provide structural panel floor construction composed of channel shaped half floor panels superimposed in pairs including means for securing the same into unitary box type floor panels simultaneous with securing said floor panels to laterally adjacent floor panels and aligning the same into a unitary whole.

Another object of this invention is to provide structural floor panel construction composed of pairs of superimposed reinforced half floor panels pre-cast of cementitious material having connecting strips along the sides thereof adapted to be engaged by connectors for securing the said superimposed pairs of half panels together vertically into a unitary whole capable of resisting flexural stresses as a single structural unit, the said connecting strips being accurately spaced by the reinforcement of the said structural half floor panels.

Another object of this invention is to provide structural floor panel construction composed of a plurality of juxtaposed lower channel half pan-

els having upwardly disposed scalloped flanges and like juxtaposed upper channel shaped half panels having downwardly disposed scalloped flanges positioned in registry with each other and means for securing the said upper and lower scalloped channel half panels together into unitary box shaped panels having communicating ports therebetween through which electric conduits, piping and like utilities may be run preferably before positioning the said upper channel shaped half panels in registry over the said lower channel shaped half panels, the said means for securing the upper and lower scalloped channel shaped half panels together into unitary box shaped panels being adapted to simultaneously secure juxtaposed panels together laterally and to vertically align the said box shaped panels with respect to each other.

Another object of this invention is to provide structural panel floor construction composed of upper and lower superimposed pre-cast structural half panels reinforced to permit the handling thereof during erection adapted to be mechanically secured together into a unitary whole capable of resisting flexural stresses as a single structural unit.

Another object of the invention is to provide channel shaped half floor panels adapted to form floor and ceiling surfaces by being superimposed in pairs and secured together into a unitary whole capable of resisting flexural stresses and be aligned by said securing means level with respect to adjacent panels.

Another object of the invention is to provide structural panel floor construction composed of pairs of superimposed pre-cast structural half floor panels having connecting strips spaced along the sides thereof adapted to be engaged by connectors for mechanically securing the same together vertically in superimposed pairs and laterally to adjacent panels, the said connecting strips being accurately spaced by the reinforcement of the said half panels.

Another object of the invention is to provide a method of pre-casting structural panels having connecting strips along the sides thereof accurately spaced by the reinforcement of the said panels comprising the holding of said connecting strips accurately spaced in the forms into which the said panels are cast during the pouring and setting of the cementitious material from which the said panels are cast.

Another object of the invention is to provide a method of pre-casting structural panels having connecting strips along the sides thereof com-

prising the accurate spacing of connecting strips of the said panels by the reinforcement thereof and the holding of the said connecting strips accurately spaced in the forms of the said panels during the pouring and setting of the cementitious material from which the said floor panels are cast, the said connecting strips serving as means for holding the reinforcement of the said panels accurately spaced from the said forms.

Another object of the invention is to provide a method of pre-casting structural panels having connecting strips along the sides thereof accurately spaced by the reinforcement of the said panels comprising the use of inner and outer forms and the holding of the said connecting strips accurately fixed with respect to the said outer form during the pouring and setting of the cementitious material from which the said panels are cast thereby permitting shrinkage of the said cementitious material away from the inner form during the setting thereof.

Other objects of the invention will become apparent by reference to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of the first floor of a small house having its floor constructed of structural floor panels embodying the invention showing the general adaptability of the invention to house construction.

Fig. 2 is an enlarged fragmentary plan view of a pair of superimposed half channel shaped floor panels embodying the invention.

Fig. 3 is an enlarged fragmentary elevational view of a pair of channel shaped half panels superimposed with the connecting strips thereof in alignment showing how the said half panels are scalloped to provide communicating ports through the sides of the box shaped floor panels formed by superimposing the said half panels in pairs.

Fig. 4 is a detailed sectional view taken on the line 4—4 of Fig. 1 showing the typical construction of a fresh or vitiated air register preferably used with the structural panel floor system embodying the invention.

Fig. 5 is a horizontal sectional view of the floor construction of the small house disclosed in Fig. 1 showing how the said hollow box type floor panels may be partitioned off to provide an air supply plenum chamber and return air duct system through which fresh hot or cold air may be supplied to and vitiated air withdrawn from space thereabove or therebelow.

Fig. 6 is an enlarged exploded end elevational view of a box shaped floor panel embodying the invention showing the reinforcement of the ends of the half panels thereof and how the end of the half panels are scalloped to provide a communicating port through the end of the said box shaped floor panel.

Fig. 7 is an exploded cross sectional view through a typical box shaped floor panel embodying the invention showing the reinforcement thereof.

Fig. 8 is an enlarged detailed horizontal sectional view of the construction within the dot and dash circle designated by the numeral 8 in Fig. 5 showing how baffles are provided to separate the space within the box shaped floor panel construction embodying the invention into a desired plenum chamber and duct system.

Fig. 9 is a cross sectional view taken on the line 9—9 of Fig. 8.

Fig. 10 is an enlarged detailed horizontal sectional view of a typical joint between the sides of

the floor panels taken on the line 10—10 of Fig. 12.

Fig. 11 is an enlarged detailed horizontal sectional view similar to Fig. 10 showing a typical joint between the ends of floor panels and the band course panels.

Fig. 12 is a detailed vertical sectional view taken on the line 12—12 of Fig. 10 showing a joint between the sides of superimposed pairs of channel shaped floor panels and how superimposed pairs of channel shaped floor panels are vertically secured together.

Fig. 13 is a detailed vertical sectional view similar to Fig. 12 showing how stub connectors adapted to engage partition panels may be fixed with respect to the floor panels connectors.

Fig. 14 is a detailed vertical sectional view of a typical connector taken on the line 14—14 of Fig. 15.

Fig. 15 is a horizontal sectional view taken on the line 15—15 of Fig. 14.

Fig. 16 is a horizontal sectional view taken on the line 16—16 of Fig. 14.

Fig. 17 is a rear elevational view of a typical band course panel.

Fig. 18 is a horizontal sectional view taken on the line 18—18 of Fig. 17.

Fig. 19 is a cross sectional view taken on the line 19—19 of Fig. 20 showing the method of holding the reinforcement and connecting strips of half panels embodying the invention in a pair of forms during the pouring and setting of the cementitious material from which the said half panels are cast.

Fig. 20 is a horizontal sectional view taken on the line 20—20 of Fig. 19.

Fig. 21 is an enlarged fragmentary detailed sectional view similar to Fig. 19.

Fig. 22 is a detailed longitudinal sectional view taken on the line 22—22 of Fig. 21.

Fig. 23 is a detailed horizontal sectional view taken on the line 23—23 of Fig. 21.

Fig. 24 is a detailed horizontal sectional view similar to Fig. 23 except that it shows the means for holding the reinforcement of a half panel embodying the invention at the corner of a form during the pouring and setting of the cementitious material from which the said half panels are cast.

Although the invention has been disclosed in the drawings as applied to house construction, it is contemplated that structural panel floor construction embodying the invention may be used in other types of buildings and structures. The structural panel floor construction embodying this invention is particularly adapted for use with the novel structural panel unit building construction disclosed and claimed in my co-pending application for patent entitled Building construction, Serial No. 88,791, filed July 3, 1936.

It is also contemplated that the invention may be suitably modified and applied to roof and wall construction and wherever else it may be found desirable and advantageous.

Referring now to the drawings wherein like numerals refer to like and corresponding parts throughout the several views, Fig. 1 shows a more or less diagrammatic first floor plan of a small house built of structural panel floor construction embodying the invention composed of channel shaped half floor panels superimposed in pairs and secured together and to adjacent panels in the novel and facile manner as hereinafter described. Fig. 5 shows how the interior of the floor construction of the small house shown in Fig. 1 may be readily partitioned off to provide an air

supply and return duct system for heating and ventilating the space thereabove or therebelow.

The invention is not limited to the use of any particular materials from which the channel shaped half structural floor panels may be pre-cast or pre-fabricated, it being contemplated that a cementitious material such as light weight concrete having a comparatively high compressive and bonding strength may be used. The said structural half panels are preferably reinforced with suitable structural grade reinforcing steel and welded wire mesh or the like preferably as hereinafter described in detail.

Structural panel floor construction embodying the invention disclosed in Fig. 1 comprises a plurality of box shaped structural floor panels 25 erected on basement, foundation or other walls 26 and are composed of pairs of upper and lower suitably reinforced channel shaped structural half panels 27 and 28 respectively as best shown in Figs. 2, 3, 6 and 7. Each of the said channel shaped half panels 27 and 28 are provided with vertically disposed accurately spaced side connecting strips 29 and corner connecting strips 30 welded to the reinforcement thereof and cast integral therewith, which connecting strips 29 and 30 are positioned in accurate vertical alignment when the said channel shaped floor panels are superimposed in pairs to form the box shaped floor panel 25 as indicated in Figs. 2, 3, 6 and 7.

The said channel shaped half panels 27 and 28 are preferably scalloped as indicated by the numeral 31 throughout the drawings to provide communicating ports 32 through the sides and ends of the box shaped structural floor panels 25 formed by superimposing and securing together pairs of upper and lower structural scalloped half panels 27 and 28 respectively.

The said superimposed upper and lower channel shaped half panels 27 and 28 respectively are secured together vertically in pairs by means of connectors 33 as hereinafter described, which connectors also engage adjacent pairs of superimposed panels as shown in Figs. 10 and 12 and simultaneously align said adjacent pairs of superimposed panels and secure them together into a unitary whole.

Band course panels 34 are preferably used to provide bearing for walls above the said box shaped floor panels 25 and to provide a suitable end closure for the communicating ports 32 at the ends of the said box shaped floor panels at the exterior walls, the said connectors 33 also engage the said band course panels and secure the same in proper juxtaposed alignment with the said box shaped floor panels 25 as hereinafter described and best shown in Fig. 11.

It will be noticed that each of the channel shaped half floor panels 27 and 28 and the band course panels 34 are provided with connecting strips 29 and 30 and 300 respectively adapted to be engaged by suitable connectors 33 which secure the said channel shaped half floor panels 27 and 28 which are superimposed in pairs into unitary box type floor panels 25 capable of resisting flexural stresses as a single structural unit, and, at the same time, the said connectors 33 secure adjacent floor panels in alignment with each other all as hereinafter described.

In order to minimize the number of different sizes of channel shaped structural half floor panels 27 and 28 and band course panels 34 required to be pre-cast, it is preferable and desirable to standardize on a certain width and various lengths of panels. For example, a nominal 24

inch width and 6 inch height of channel shaped half floor panels in standard length of 6, 8, 10, 12, 14, 16, 18, 20, 22 and 24 feet may be adopted; in which case nominal 12 inch high by 24 inch wide by 3 inch thick band course panels would also be adopted. If the foregoing sizes of panels were adopted, a house or other structure in which the use of structural panel floor construction embodying the invention was contemplated, would be laid out with the center line of walls and partitions thereof as working points located at two foot increments and at right angles to each other.

As hereinbefore described each typical box shaped floor panel 25 is composed of a pair of upper and lower channel shaped half panels 27 and 28 respectively. The said upper and lower channel shaped half panels 27 and 28 are substantially identical, the only difference being that the upper channel shaped half panel 27 is occasionally provided with register apertures 35 therethrough as shown in Fig. 4 over which fresh or vitiated air registers are mounted as hereinafter described.

The upper and lower channel shaped half panels 27 and 28 respectively are each suitably reinforced by reinforcing rods 36 and 37 formed into continuous loops which are welded to the side and corner connecting strips 29 and 30 respectively, the sides of the said reinforcing rod loops 36 and 37 extend along the sides of the said channel shaped half panels 27 and 28 and the ends of the said reinforcing rod loops 36 and 37 extend across the ends of the said channel shaped half panels 27 and 28. The larger reinforcing rods 36 formed into continuous loops are positioned at the top of the upper channel shaped half panel 27 and at the bottom of the lower channel shaped half panel 28 so that when the said channel shaped half panels are secured together into a unitary box shaped floor panel 25 that the greatest portion of the reinforcement of the half panels 27 and 28 is located at the point of greatest moment possible for the resistance of tensile and compressive flexural stresses when the said half panels 27 and 28 act together as a unitary box shaped floor panel 25. The back of the said upper and lower channel shaped half panels 27 and 28 are each reinforced with a suitable wire mesh 38 preferably welded to the reinforcing rod loops 36 thereof as best shown in Figs. 7, 19 and 20.

The band course panels 34 are preferably reinforced as indicated in Figs. 17 and 18 with horizontally disposed reinforcing rods 39 and vertically disposed reinforcing rods 40 welded together into a grid which in turn is welded to the corner connecting strips 300 cast integral with the said band course panels 34. The band course corner connecting strips 300 are identical to the corner connecting strips 30 of the upper and lower channel shaped half panels 27 and 28 respectively with the exception that the said band course corner connecting strips 300 are twice as long as the said corner connecting strips 30.

The side connecting strips 29 are formed of a generally T-shaped strip and are of a length somewhat shorter than the depth of the flange of the channel shaped half panels 27 and 28 into which they are cast and have one end thereof spaced inwardly with respect to the back of the said channel shaped floor panel into which they are cast as best indicated in Figs. 10 and 12. The said side connecting strip 29 comprises two oppositely disposed semi-bulbous connecting strips 41

having the flat sides thereof forming the exposed face of the said connecting strip 29 and one bulbous connecting strip 42 disposed at 90 degrees to the said semi-bulbous connecting strips 41 and spaced with respect to the said connecting strips 41 so as to form two vertically parallel flutes each slightly larger than a T-shaped retainer strip 51 of the connector 33 so as to accommodate one of the T-shaped retainer strips 51 of the said connector 33 with a reasonable amount of clearance. The said side connecting strips 29 are anchored in the said channel shaped half panels 27 and 28 by means of the reinforcing rod loops 36 and 37 to which they are welded at accurate intervals, for example, 24 inches center to center.

The head 44 of each of the said T-shaped side connecting strips 20 protrudes slightly above the semi-bulbous and bulbous connecting strips 41 and 42 respectively thereof as indicated in Fig. 12 to permit the said reinforcement 36 welded thereto to be positioned as near to the back of the channel shaped half panel 27 and 28 as possible and practicable without extending the semi-bulbous connecting strips 41 and the bulbous connecting strip 42 of the said connecting strips 29 so close to the back of the said channel shaped half panels 27 and 28 as to cause the ends of the connector 33 to protrude above or below the top and bottom of the box shaped floor panels 25 formed by superimposing and securing the said upper and lower half panels 27 and 28 into a unitary whole.

The corner connecting strips 30 are preferably formed of two semi-bulbous connecting strips 45 disposed at 90 degrees to each other and spaced with respect to each other so as to form a single vertical corner flute slightly larger than a T-shaped retainer strip 51 of the connector 33 so as to accommodate the said T-shaped retainer strips of the connectors 33 with a reasonable amount of clearance. The rear of the said connecting strip 30 is preferably formed into a vertically disposed arcuate anchorage 46 to which the rounded corners of the reinforcing rod loops 36 and 37 are welded. The band course corner connecting strips 300 are similar in every respect to the corner connecting strips 30 except that they are twice as long.

The said corner connecting strips 30 are also of a length somewhat shorter than the depth of the flange of the channel shaped half panels 27 and 28 into which they are cast and have one end thereof spaced inwardly with respect to the back of the said channel shaped floor panel into which they are cast as best illustrated in Figs. 3 and 6. Also, the arcuate anchorage 46 at the rear of each of the said corner connecting strips 30 protrudes slightly above the semi-bulbous connecting strip 45 thereof as best indicated in Fig. 6 to permit the corner of the reinforcing rod loops 36 welded thereto to be positioned as near to the back of the channel shaped half panels 27 and 28 as possible and practicable without extending the semi-bulbous connecting strips 45 of the said corner connecting strips 30 so close to the back of the said channel shaped half panels 27 and 28 as to cause the ends of the connector 33 to protrude above or below the top and bottom of the box shaped floor panels 25 formed by superimposing and securing the said upper and lower half panels 27 and 28 into a unitary whole.

The flat side of the semi-bulbous connecting strips 41 of the side connecting strips 29 and the flat side of the semi-bulbous connecting strips 45 of the corner connecting strips 30 extend

slightly beyond the flanges of the upper and lower channel shaped half panels 27 and 28 respectively, likewise the flat side of the semi-bulbous connecting strips 45 of the band course corner connecting strips 300 extend slightly beyond the sides and ends of the said band course panels 34, all as best shown in Figs. 2, 10, 11 and 18 which permits box shaped floor panels 25 composed of pairs of upper and lower channel shaped half panels 27 and 28 and band course panels 34 to be juxtaposed laterally with respect to each other so that a vertically disposed open joint is provided therebetween. The open joints so formed are either filled with a mastic or caulking compound or other suitable material as indicated by the numeral 47 in the drawings. Longitudinal baffle plates 48 may be positioned in the said open joints between the said box shaped panels 25 as best indicated in Figs. 5 and 8.

The typical connector 33 shown in Figs. 14, 15 and 16 may be described as an octagonal member as indicated by the dot and dash lines 49 in Figs. 15 and 16 having oppositely disposed re-entrant flutes 50 formed therein, the walls of the said flutes 50 being slightly larger in diameter than a segment of a circle formed by juxtaposing two semi-bulbous connecting strips 41 or two semi-bulbous connecting strips 45 of side connecting strips 29 or corner connecting strips 30 respectively as shown in Figs. 10 and 11. The walls of the said flutes 50 of the connectors 33 are preferably tapered to a larger diameter towards the ends of the said connector 33 as shown in Figs. 14 and 15 so that the said connectors 33 will pull the upper and lower channel shaped half panels 27 and 28 and the band course panels 34 laterally together when being driven into engagement with juxtaposed semi-bulbous connecting strips 41 of the side connecting strips 29, or when being driven into engagement with juxtaposed semi-bulbous connecting strips 45 of the corner connecting strips 30 and 300. The central portion of the said connectors 33 preferably extends above and below the T-shaped retainer strips 51 thereof and is threaded at 52 and is provided with a suitable nut 53 as indicated in Fig. 14.

The said connector 33 may also be described as being composed of a plurality of centrally joined integral T-shaped retainer strips 51 having the heads thereof outwardly disposed and preferably spaced at 90 degrees with respect to each other in such a manner as to form a plurality of oppositely disposed re-entrant flutes 50 therein, the said flutes 50 being preferably tapered to a larger diameter near the ends thereof, the said connectors 33 also having centrally disposed threaded protuberances 52 thereabove and therebelow formed integral therewith onto which a suitable nut 53 may be threaded.

Figs. 10 and 12 show how upper and lower channel shaped half panels 27 and 28 are secured together vertically into a unitary whole forming box shaped floor panels 25 and how juxtaposed box shaped floor panels 25 are secured laterally together and vertically aligned simultaneously with the said securing of the said channel shaped half panels 27 and 28 vertically together. A connector 33 having the T-shaped retainer strips 51 thereof slightly shorter than the length of two connecting strips 29 is inserted in telescopic relationship over the juxtaposed pairs of semi-bulbous connecting strips 41 and the bulbous connecting strips 42 of the side connecting strips 29 as best shown in Fig. 10. The said connector

33 is telescoped over the said connecting strips 29 to a position vertically with respect to the said connecting strips 29 as indicated in Fig. 12 so that the threaded central end protuberances 52 thereof extend above and below the superimposed connecting strips 29. Suitable washers 54 of a size sufficient to engage the ends of the semi-bulbous connecting strips 41 and the bulbous connecting strips 42 of the connecting strips 29 are positioned over the said threaded central end protuberances 52 of the said connector 33 and are drawn against the ends of the said connecting strips 29 by means of the nuts 53.

After the upper and lower channel shaped floor panels 27 and 28 are drawn tightly together by turning the said nuts 53 on the threaded protuberances 52 of the connectors 33, the space above and below the said washers 54 may be grouted as indicated by the numeral 55 in Fig. 12.

The means for securing the corners of floor panels and band course panels together as shown in Fig. 11 is substantially identical to the means for securing the sides of floor panels together shown in Figs. 10 and 12 and as hereinbefore described with the exception that the connector 33 engages juxtaposed semi-bulbous connecting strips 45 of corner connecting strips 30 and 300.

Whenever a partition provided with connecting strips similar to the connecting strips 29 is to be anchored over a joint between adjacent floor panels 25, a stub connector 330 having an annular lower end 331 centrally bored and threaded to engage the upper threaded protuberance 52 of the connector 33 may be used instead of the nut 53 as indicated in Fig. 13. The construction shown in Fig. 13 is identical to the construction shown in the upper portion of Fig. 12 with the exception that the stub connector 330 is substituted for the nut 53 for securing the upper and lower channel shaped half panels 27 and 28 vertically together.

Inasmuch as the reinforcement 36, 37 and 38 of the upper and lower channel shaped half panels is welded together and to the side connectors 29 and to the corner connectors 30 cast integral with the said channel shaped half panels, and inasmuch as the connectors 33 are sufficiently strong to take care of the horizontal shear between the upper and lower half panels 27 and 28, the said upper and lower channel shaped half panels 27 and 28 act together as a reinforced integral whole for resisting flexural stresses as a single structural unit including tension, compression, vertical shear and horizontal shear.

In securing the said upper and lower channel shaped half panels vertically together, the drawing of the said upper and lower channel shaped half panels tightly together by the nuts 53 threaded on the central upper and lower protuberances 52 of the connectors 33 creates a frictional value between the juxtaposed ends of the flanges of the upper and lower channel shaped half panels which aids the connectors 33 in resisting the horizontal shear between the upper and lower channel shaped half panels when the said upper and lower channel shaped half panels resist flexural stresses as a single structural unit.

As hereinbefore mentioned, the box shaped structural floor panels 25 are erected so as to span between basement, foundation, or other walls, and have the end ports 32 thereof closed by suitable band course panels 34. In erecting structural panel floor construction embodying the invention, the lower channel shaped half

panels 28 are preferably erected first as indicated in Fig. 5. In which event, it is preferable to shore up the said channel shaped half panels 28 with one line of temporary shoring in the center of the span thereof to take the deflection out of the said half panels during the erection of the remainder of the floor system.

The said structural channel shaped half panels 27 and 28 are each preferably provided with suitably spaced transverse grooves 57 cast therein as best indicated in Figs. 8 and 9 to accommodate transverse baffle plates 58 as hereinafter described.

It is contemplated by this invention that the space within the structural panel floor construction composed of a plurality of box shaped floor panels 25 having communicating ports 32 on all sides thereof may be divided into a suitable fresh air supply and vitiated air return duct system by baffling the said space within the said floor panels into the desired duct system.

Let us assume, for example, that the heating and ventilating system of the small house disclosed in Fig. 1 requires air supply registers 59 and air return registers 60 as indicated in Fig. 1, in which event, the juxtaposed box shaped floor panels 25 having communicating ports 32 therebetween would be divided off by inserting longitudinal baffle plates 48 between certain of the said box shaped floor panels 25 and by inserting transverse baffle plates 58 across certain of the said box shaped floor panels 25 as shown in Figs. 5, 8 and 9 into a central fresh air supply plenum chamber having a vitiated air return duct system therearound as best indicated in Fig. 5.

Fresh hot or cold air would be supplied to the space above the said box shaped floor panel 25 from the said centrally disposed plenum chamber through the fresh air supply registers 59 from a fresh hot or cold air supply duct communicating with the said plenum chamber at the air supply duct opening 61 preferably located as indicated in Fig. 5; the full line arrows in Fig. 5 designating generally the circulation of fresh hot or cold air through the plenum chamber from the fresh air supply duct opening 61 to the air supply registers 59.

Cold or warm vitiated air would be drawn from the space above the said box shaped floor panel 25 through the said vitiated air return registers 60 into the vitiated air return duct system located around the said plenum chamber, which vitiated air would be withdrawn from the said vitiated air return duct system through vitiated air return duct openings 62 indicated in Fig. 5; the said vitiated air circulating through the said vitiated air duct system substantially as indicated by the dotted line arrows in Fig. 5.

Although but one typical layout of a fresh air supply and vitiated air return duct system has been shown in the drawings, it will be obvious to those skilled in the art that a number of desirable layouts and arrangements of fresh and vitiated air ducts may be accomplished by placing the longitudinal and transverse baffle plates 48 and 58 respectively in other locations between and within the said box shaped floor panels 25.

After the longitudinal and transverse baffle plates 48 and 58 respectively are located as desired and positioned between the lower channel shaped half panels 28 or across the said lower channel shaped half panels 28 as the case may be, the upper channel shaped half panels 27 are accurately superimposed over the said lower channel shaped half panels 28, and the said upper and lower channel shaped half panels 27

and 28 are connected together into a unitary whole by connectors 23 as hereinbefore described in detail. After the floor system is completely erected and properly secured together so that the upper and lower channel shaped half panels will act together as a unitary whole, the temporary shoring thereunder (if used) is removed, and the upper and lower portions of the joints between the adjacent box shaped floor panels 25 are filled with mastic or caulking compound or some other suitable caulking material as indicated by the numeral 47 in the drawings.

After the floor system has been completely erected and the interior partitions 63 and the exterior walls 64 are erected thereon, the fresh air supply and vitiated air return registers 59 and 60 respectively are installed over the register apertures 35 provided through the upper channel shaped half panels 27 as shown in Fig. 4. Any suitable type of fresh air supply registers 59 and vitiated air return registers 60 may be used, the said registers being preferably provided with adjustable louvers 65. The said registers 59 and 60 may be anchored to the walls and floor panels by means of suitable clips 66 secured to the wall 63 by such means as the expansion bolt 67 and anchored to the upper channel shaped floor panels 27 by such suitable means as the U-clamps 68.

Inasmuch as the connecting strips of the upper and lower channel shaped half panels and the connecting strips of the band course panels must register with each other in both vertical alignment and adjacent alignment when the said channel shaped half panels and band course panels are juxtaposed to each other prior to securing the same into unitary structural panel floor construction as hereinbefore described, the importance of the accuracy to which the various structural panels and the connecting strips thereof are cast is obvious. In order to assure the accurate location of the connecting strips in the various pre-cast panels, and for the purpose of maintaining accurate overall dimensions of the said pre-cast panels, the connecting strips and reinforcing steel of the said panels are preferably assembled and welded together in suitable jigs which establish and maintain the spacing and alignment of the said connecting strips. The reinforcement and connecting strip assemblies are then positioned in suitable forms which are adapted to engage the said connecting strips of the said reinforcement and connecting strip assemblies and accurately hold the said reinforcement and connecting strip assemblies in the desired position with the said forms and fixed with respect to the outside form. The cementitious material from which the said panels are pre-cast is then poured or otherwise placed in the forms and the pre-cast panels are allowed to set. Any shrinkage of the cementitious material that takes place during the setting thereof does not affect the accuracy of the outside dimensions of the pre-cast panels and the location of the connecting strips thereof inasmuch as the shrinkage that does take place is only permitted to take place along the surface of the inside form by virtue of the anchorage of the connectors and reinforcement of the said pre-cast panels to the outside form.

It is therefore observed that the connecting strips of structural panels embodying the invention accomplish several functions, namely, to provide means for holding the reinforcement of

the said panels accurately in place during the pre-casting thereof, to cooperate with suitable forms during the pre-casting of the said panels and the accurate spacing of the said connectors therein for preventing uneven shrinkage of the said panels during the setting thereof and to maintain accurate overall dimensions of the said panels, and to co-operate with connectors for securing the various pre-cast panels and half panels into an integral whole as hereinbefore described.

Figs. 19 to 24 inclusive show a pair of forms comprising a lower or outside form 70 having hinged sides and ends 71 and 72 respectively, and an upper or inside form 73 adapted to be placed over the upstanding edges of the said hinged side and end forms 71 and 72 respectively into which forms a typical channel shaped half panel 27 or 28 may be pre-cast. The said forms are adapted to cooperate with a reinforcement and connecting strip assembly comprising side and corner connecting strips 29 and 30 to which reinforcing loops 36 and 37 are welded, the said reinforcing loop 36 having the reinforcing mesh 38 welded thereto all as hereinbefore described as the reinforcement of a typical channel shaped half panel 27 or 28 and as shown in Figs. 6, 7, 10, 12 and 19 through 24 inclusive.

The lower or outside form 70 is preferably constructed of a thin steel plate of sufficient size to form the back of a channel shaped half panel 27 or 28 and is reinforced against bending by suitable longitudinal and transverse angles 74 and 75 respectively. Each side form 71 and each end form 72 is composed of a pair of thin steel plates reinforced with suitable vertical bars 76, the said side and end forms 71 and 72 respectively are hinged to the lower form 70 by a plurality of hinges 77 as indicated in the drawings.

The inside plate of the side forms 71 is omitted at intervals therealong to accommodate the side connecting strips 29 of a channel shaped half panel to be pre-cast therein. The inside plates of the side form 71 and the end form 72 are also omitted adjacent to the ends of the said side and end forms 71 and 72 respectively to accommodate the corner connecting strips 30 a said channel shaped half panel to be pre-cast therein, see Fig. 20.

The upper or inside form 73 is preferably constructed of a generally U-shaped steel plate reinforced at suitable intervals with a U-shaped angle 78, a transverse angle 79 and a gusset 80 as best shown in Figs. 19, 21 and 22. Suitable chain slings 81 are preferably secured to the said U-shaped angle, transverse angle and gusset of the said upper form 73 near the ends thereof by means of which the said upper form 73 may be readily handled by an overhead trolley system or the like when the said forms are being made ready for casting channel shaped half panels or when the forms are being stripped after the said channel shaped half panels are pre-cast and set. The said upper form 73 is preferably provided with a retainer strip 82 therearound which is spaced slightly from the outer horizontally disposed edge of the said upper form 73 to accommodate the upper edge of the said side forms 71 and end forms 72 as best indicated in Figs. 19 and 21, the said retainer strip 82 having the inwardly disposed vertical side thereof beveled as indicated in the drawings to permit the said retainer strip 82 to urge the side and

end forms 71 and 72 laterally against the outer horizontal edge of the upper form 73 as best indicated in Figs. 19 and 21. The sides and ends of the said upper forms 73 are provided with suitable inserts 83 of a curved shape to cause the flanges of the said channel shaped half panel pre-cast in the said outside and inside forms 70 and 73 to be scalloped as indicated by the numeral 31 in Figs. 3, 4, 12 and 13.

Suitable half connectors 330 which are similar to the connector 33 as hereinbefore described with the exception that the said half connectors 330 are provided with only two T-shaped retainer strips 51 removably secure the side connecting strips 29 of the connecting strip and reinforcement assembly of a channel shaped half panel to the side forms 71 as best indicated in Figs. 19, 20 and 21. The said connectors 330 are provided with two laterally disposed vertically spaced rectangular tongues 84 preferably having a rectangular transverse aperture there-through, the said tongues 84 being adapted to be positioned through vertically disposed slots provided in alternate vertical bars 76 of the side forms 71 whereby to accommodate suitable wedges 85 which removably secure the said connectors 330 and the connecting strips 29 engaged thereby to the said side forms 71. A suitable block 86 is positioned under the said connecting strips 29 and connectors 330 as shown in Figs. 19 and 21 to prevent the cementitious material from which the channel shaped half panels are cast from filling the space between the end of the said connecting strips 29 and the back of the said channel shaped half panels 27 and 28.

Suitable quarter connectors 333 which are similar to the connector 33 as hereinbefore described with the exception that the said quarter connectors 333 are provided with only one T-shaped retainer strip 51 removably secure the corner connecting strips 30 of a connecting strip and reinforcement assembly to the side and end forms 71 and 72 respectively as best indicated in Figs. 20 and 24. The said connectors 333 are provided with two laterally disposed vertically spaced rectangular tongues 87 preferably having a rectangular transverse aperture there-through, the said tongues 87 being adapted to be positioned through vertically disposed slots provided through vertically disposed corner closure angles 88, which corner closure angles 88 are adapted to close the vertical space between the side forms 71 and the end forms 72 of the outside form 70. The said apertured tongues 87 accommodate suitable wedges 85 which bear against the V-blocks 89 on the said closure angles 88 and removably secure the said quarter connectors 333 and the corner connecting strips 30 engaged thereby to the said side and end forms 71 and 72 respectively and tightly close the vertical open joints therebetween at the corners of the said lower or outside forms 70. A suitable block (not shown) similar to the block 86 is positioned under the said connecting strips 30 and quarter connectors 333 to prevent the cementitious material from which the channel shaped half panels are cast from filling the space between the end of the said corner connecting strip 30 and the back of the said channel shaped half panels 27 and 28.

Because of the fact that the reinforcement of the channel shaped half floor panels is welded to the connecting strips thereof, and inasmuch as the said reinforcement thoroughly anchors the said connecting strips into the said channel

shaped half floor panel, and since the said reinforcement is bonded to the cementitious material from which the said channel shaped half panels are pre-cast after the said pre-cast floor panels have taken their final set, any stress, particularly horizontal shearing stress, that may be transferred by the connectors 33 to the connecting strips 29 and 30 after the said channel shaped half floor panels are superimposed in pairs, secured together by the said connectors into unitary box shaped floor panels 25 and subjected to vertical loading including their own dead weight, is evenly and immediately transferred by the said reinforcement of the said channel shaped floor panel all along the entire length thereof which assures the said unitary box shaped floor panels 25 of being capable of resisting flexural stresses as a single structural unit including tension, compression, vertical shear and horizontal shear.

It is readily observed that the novel method of pre-casting structural panels and half panels having connecting strips along the side thereof comprising the accurate spacing of the said connecting strips of panels about to be pre-cast by the reinforcement of the said panels and the anchorage of the said connecting strips having the reinforcement of the said panels welded thereto to the forms into which the said panels are to be pre-cast by suitable connectors, will produce accurately dimensioned finished pre-cast panels having the reinforcement thereof perfectly located; the said reinforcement being anchored to the outside form of the forms into which the said panels are pre-cast localizes whatever shrinkage that does occur during the setting of the said pre-cast panels to the inner portion thereof, thus assuring that the finished overall dimensions of the said pre-cast structural panels and the location of the connecting strips thereof are of such accuracy as to permit the said pre-cast structural panels to be easily and quickly erected into pre-cast panel construction embodying the invention.

By the use of structural panel floor construction composed of channel shaped half floor panels superimposed in pairs and connected together in such a manner as to cause the unitary box shaped floor panels formed thereby to be capable of resisting flexural stresses as a single structural unit including tension, compression, vertical shear and horizontal shear, the structural advantages of unitary box shaped floor panels are obtained without the necessity of handling the cumbersome weight of the box shaped floor panels and without the necessity of using expensive collapsible interior forms which would be necessary for the pre-casting of box shaped floor panels. The invention, therefore, overcomes the cumbersomeness heretofore encountered when dealing with structural unit panel construction by providing means for securing properly reinforced structural half panels into unitary box shaped floor panels capable of resisting flexural stresses as a single structural unit, by providing a method of accurately pre-casting the said structural half panels with a high degree of overall dimensional accuracy and with the reinforcement thereof perfectly located within the said half panels, and by providing a floor construction adapted to be divided into fresh air supply and vitiated air return ducts at a fraction of the cost of the usual supply and return ducts of a heating and ventilating system.

Although but one embodiment of the invention

had been shown in the drawings and described in detail, it is to be understood that many changes including the size, shape, arrangement and detail of the various parts thereof may be made without departing from the spirit of the invention, and it is not intended to limit the scope of the invention other than by the terms of the appended claims.

I claim:

1. Structural panel floor construction comprising, in combination, channel shaped half floor panels superimposed in pairs forming box shaped floor panels, the flanges and ends of the said channel shaped half floor panels being scalloped to provide communicating ports through the sides and ends of the box shaped floor panels formed when said channel shaped panels are superimposed in pairs, baffles adapted to partition off a floor system composed of a plurality of said box shaped floor panels juxtaposed to each other into an air supply and air return duct system, and means for securing said box shaped panels into a unitary whole capable of resisting flexural stresses as a single structural unit.

2. Structural panel floor construction comprising, in combination, channel shaped half floor panels superimposed in pairs forming box shaped floor panels, the flanges and ends of the said channel shaped floor panels being scalloped to provide communicating ports through the sides and ends of the said box shaped floor panels formed when said channel shaped half floor panels are superimposed in pairs, baffles adapted to partition off a floor system composed of a plurality of said box shaped floor panels juxtaposed to each other into a central air supply plenum chamber and return air duct system therearound, and means for securing said box shaped panels into a unitary whole capable of resisting flexural stresses as a single structural unit.

3. Structural panel floor construction comprising pairs of superimposed reinforced channel shaped half panels pre-cast of cementitious material, vertically disposed connecting strips fixed to the reinforcement of the said channel shaped half panels spaced along the sides of said half panels, connectors adapted to engage said connecting strips and secure said superimposed pairs of half panels into unitary reinforced box shaped floor panels capable of resisting flexural stresses as a single structural unit.

4. Structural panel floor construction comprising pairs of superimposed channel shaped half panels precast of cementitious material, reinforcement cast in said half panels, vertically disposed connecting strips along the sides of the said half panels secured to and spaced by the said reinforcement, and connectors adapted to engage said connecting strips and secure said superimposed pairs of half panels into unitary box shaped floor panels capable of resisting flexural stresses as a single reinforced structural unit.

5. Structural panel floor construction comprising pairs of superimposed channel shaped half panels precast of cementitious material, reinforcement cast in said half panels, vertically disposed connecting strips along the sides of said half panels secured to and spaced by said reinforcement, and connectors adapted to engage said connecting strips and secure said superimposed pairs of half panels into unitary box shaped floor panels capable of resisting flexural

stresses as a single reinforced structural unit, the said connectors being also adapted to secure adjacent pairs of superimposed channel shaped half panels laterally together and align adjacent unitary box shaped floor panels into a common horizontal plane simultaneously with securing the said superimposed pairs of channel shaped half panels together into unitary box shaped floor panels.

6. Structural panel floor construction comprising a plurality of juxtaposed lower channel shaped half panels having upwardly disposed scalloped flanges, like juxtaposed upper channel shaped half panel having downwardly disposed scalloped flanges positioned in vertical registry with said lower channel shaped half panels, vertically disposed connecting strips spaced along the sides of said lower and upper channel shaped half panels, and connectors adapted to engage said connecting strips on said lower and upper channel shaped half panels when in vertical alignment with each other whereby to secure said upper and lower scalloped channel shaped half panels into unitary box shaped floor panels having communicating ports therebetween, the said connectors being adapted to secure juxtaposed panels together laterally and to align said box shaped panel in a common horizontal plane simultaneously with securing the said superimposed pairs of scalloped channel shaped half panels into unitary box shaped floor panels.

7. Structural panel floor construction comprising pairs of superimposed pre-cast structural half floor panels having vertically disposed connecting strips spaced along the sides thereof, connectors adapted to engage said vertical connecting strips of said superimposed half floor panels and adjacent superimposed half floor panels and mechanically secure said panels together vertically in superimposed pairs and laterally to adjacent superimposed pairs of half floor panels.

8. Structural panel floor construction comprising pairs of superimposed pre-cast structural half floor panels having vertically disposed connecting strips along the sides thereof, reinforcement in said half floor panels welded to said connecting strips whereby said connecting strips are accurately spaced by said reinforcement, connectors adapted to engage the vertical connecting strips of the said superimposed half floor panels and of the adjacent superimposed half floor panels and mechanically secure the said panels together vertically in superimposed pairs and laterally to adjacent panels whereby said floor construction is caused to act as an integral whole when resisting flexural stresses.

9. Structural panel floor construction comprising reinforced channel shaped half floor panels superimposed in pairs, vertically disposed side connecting strips spaced along the sides of the said half panels and fixed to the reinforcement thereof composed of two oppositely disposed spaced bulbous connecting strips having the flat sides thereof parallel to the sides of the said half panels and one intermediate connecting strip therebetween, and fluted connectors adapted to engage said connecting strips when said half panels are juxtaposed whereby said half panels are laterally secured together, the said connectors being of sufficient length to engage both the upper and lower channel shaped half floor panels when superimposed in pairs and adapted to vertically secure said channel shaped half floor panels together into box shaped floor

panels capable of resisting flexural stresses as an integral whole.

5 10. Structural panel floor construction comprising a plurality of channel shaped half floor panels superimposed in pairs to form box shaped floor panels, vertically disposed side connecting strips spaced along the sides of the said half panels composed of two oppositely disposed spaced bulbous connecting strips having the flat sides thereof parallel to the sides of said channel shaped half floor panels and one intermediate bulbous connecting strip therebetween, reinforcement for said structural channel shaped

half floor panel secured to said connecting strips, and fluted connectors adapted to telescopingly engage said connecting strips on said channel shaped half floor panels when superimposed in pairs whereby said channel shaped floor panels are laterally secured together, and means on the ends of said connectors adapted to engage the ends of said connecting strips and secure the said superimposed channel shaped half floor panels into unitary box shaped floor panels capable of resisting flexural stresses as single structural units.

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