March 5, 1957 H. H. WERNER 2,783,639

CONCRETE SLAB AND EMBEDDED DUCT STRUCTURE

Filed Oct. 29, 1952 3 Sheets-Sheet 1

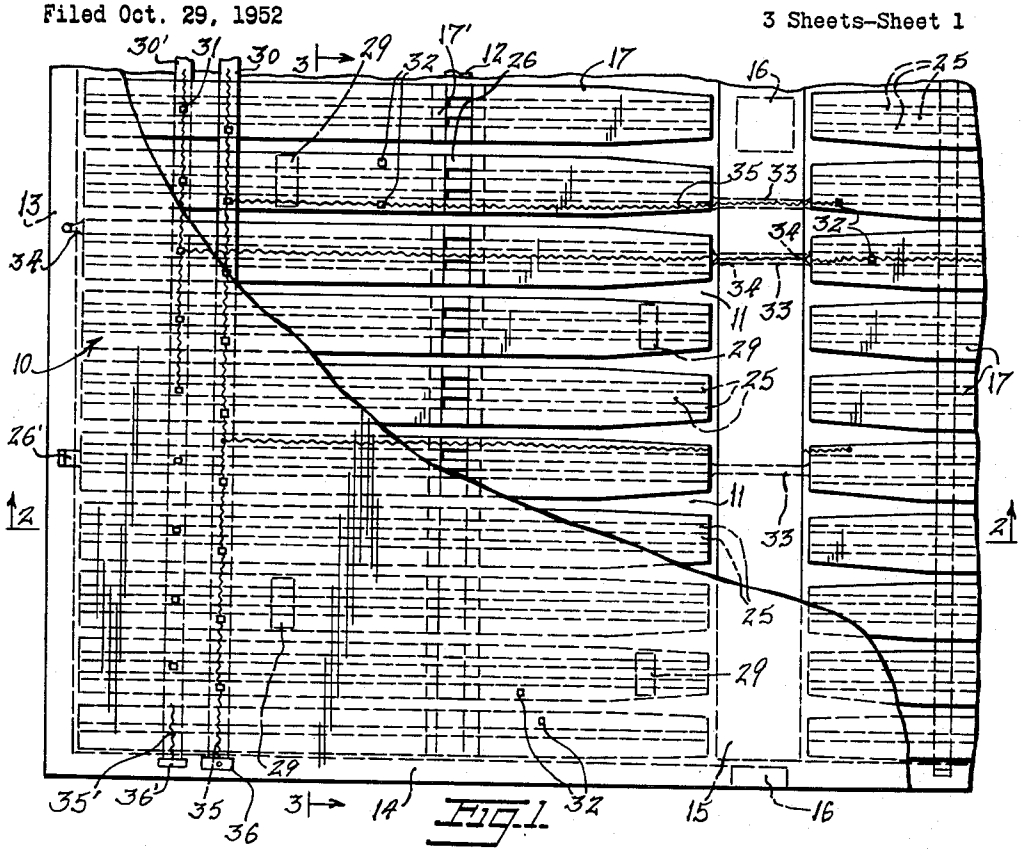


FIG. 1

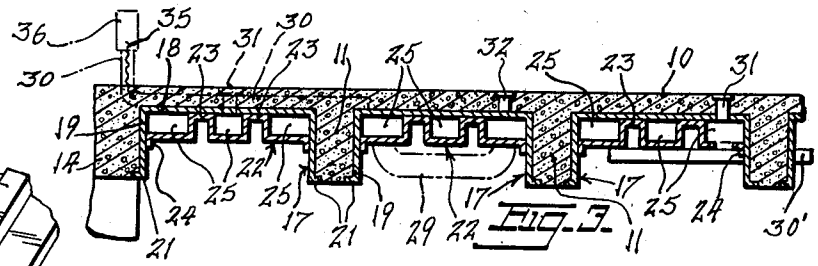


FIG. 3

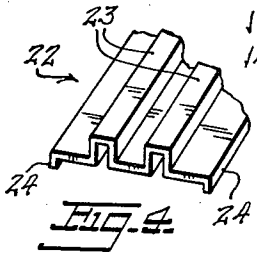


FIG. 4

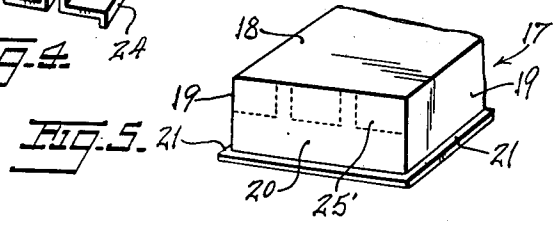


FIG. 5

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CONCRETE SLAB AND EMBEDDED DUCT STRUCTURE

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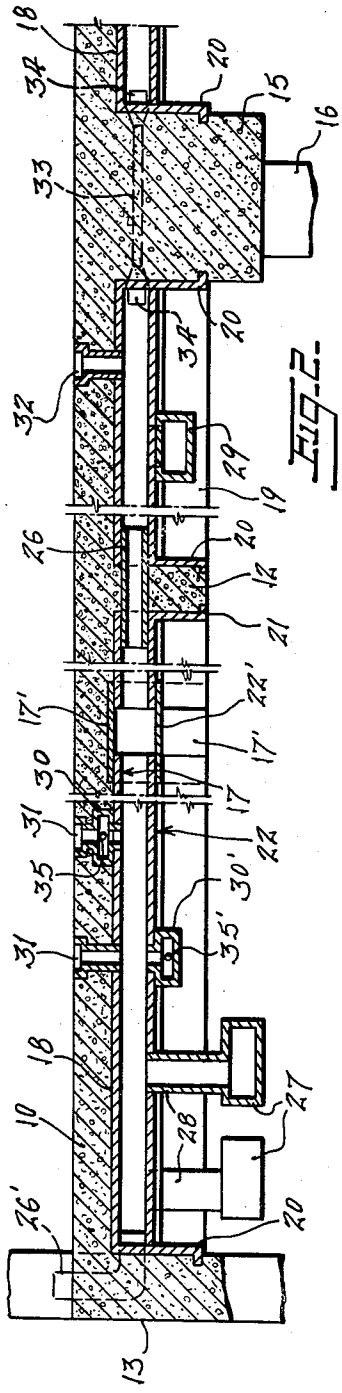


FIG. 2

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CONCRETE SLAB AND EMBEDDED DUCT STRUCTURE

Filed Oct. 29, 1952 3 Sheets-Sheet 3

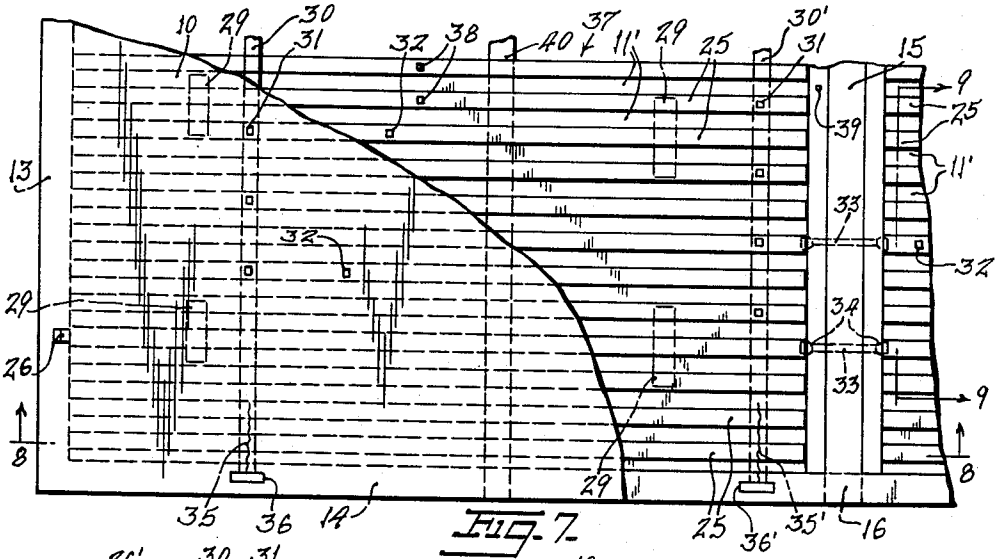


Fig. 7.

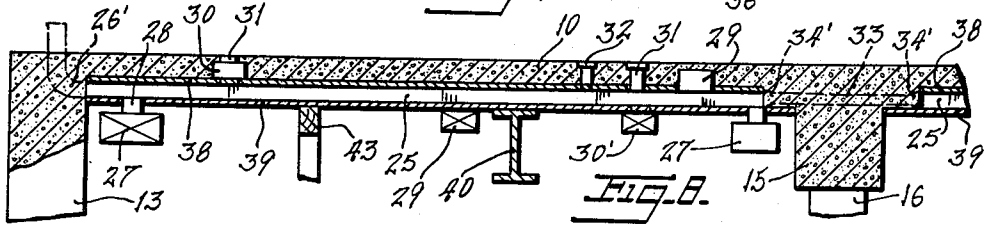


Fig. 8.

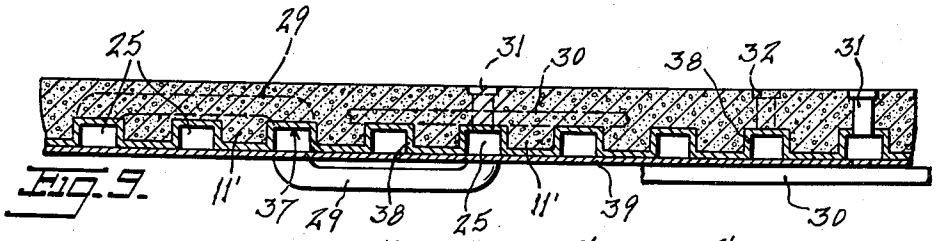


Fig. 9.

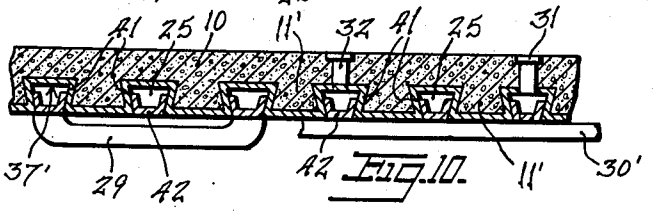


Fig. 10.

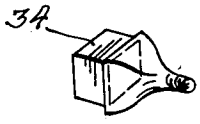


Fig. 6.

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CONCRETE SLAB AND EMBEDDED DUCT STRUCTURE

Henry H. Werner, Long Island City, N. Y.

Application October 29, 1952, Serial No. 317,387

1 Claim. (Cl. 72—16)

This invention relates generally to building constructions and more particularly to a structural unit such as the form or mold for a reinforced concrete slab.

Heretofore in building constructions employing reinforced concrete slabs as structural units for the floors and the like, in order to provide the necessary services for the building, such as electric lighting, telephones, radio, inter-communications, radiant heating and cooling, air conditioning and soundproofing and the like, many expedients have been followed. Some have resorted to the installation of an underfloor duct system in a fill on top of the structural concrete slab for distribution of the wiring. Such ducts are necessarily shallow in order to avoid excessive fill and because of the cost they are spaced considerable distances apart, for example, four to six feet. Thus they cover only a minimum of floor space, and allow minimum flexibility.

Piping for radiant heating and cooling has been installed in additional fill on top of the concrete slab or embedded within the slab. This is very costly and cumbersome.

Separate ducts have been installed to provide for air conditioning.

Soundproofing has been provided by applying acoustical material to the ceiling or by perforating it with a plurality of small holes.

Such expedients, necessitating separate installations, are costly, requiring a maximum of time, labor and material.

It is a prime object of the present invention to overcome these difficulties by providing a building construction which may be economically erected and the construction of which is adapted to enable electric service, air conditioning, radiant heating and cooling and soundproofing to be furnished to different desired locations in the building with a maximum of flexibility, simplicity, convenience and economy, this prime object being attained by the provision of a plurality of parallel ducts formed by the permanent form or mold at the undersurface of the slab.

Another object of the present invention is to provide a permanent form for a reinforced concrete slab which serves as a working platform before pouring the concrete.

Still another object of the invention is to provide a mold for a concrete slab that serves to support the duct elements.

It is a further object of the invention to provide a concrete slab form of this kind which is simple and rugged in construction and which can be manufactured at a reasonable cost, considering that the form fulfills a variety of permanent services.

For a further comprehension of the invention and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a plan view of a fragment of a building construction embodying one form of the invention, part of the concrete being shown broken away to show the interior construction, and some of the parts being shown diagrammatically.

Fig. 2 is a vertical sectional view taken on the plane of the line 2—2 of Fig. 1.

Fig. 3 is a vertical sectional view taken on the plane of the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary perspective view of the corrugated reinforcing of the mold member to form the ducts.

Fig. 5 is a fragmentary perspective view of the mold member.

Fig. 6 is a perspective view of a duct connecting element.

Fig. 7 is a view similar to Fig. 1 but showing a modification of the invention.

Fig. 8 is a vertical sectional view taken on the plane of the line 8—8 of Fig. 7.

Fig. 9 is a vertical sectional view taken on the plane of the line 9—9 of Fig. 7.

Fig. 10 is a view similar to Fig. 9 but showing a concrete slab embodying still another modified form of the invention.

Referring particularly to Figs. 1 to 6, inclusive, of the drawings, the form of concrete slab **10** herein shown is a standard reinforced concrete joint slab with its top slab **10**, joists **11** and cross-rib **12** supported at their perimeter on an end wall or beam **13** and a side wall or beam **14** and is supported interiorly by a wall or beam **15**. Beam **15** is supported by uprights **16**.

Each mold member **17**, preferably made of thin metal, is a trough-shaped pan including a top **18**, side walls **19** and end walls **20** with or without outwardly extending peripheral flanges **21**. The sizes and general arrangement of these mold pans **17** will preferably conform to the standard practice for this type of construction.

According to the present invention, a corrugated plate **22** is fastened inside the pan mold **17** as shown in Fig. 3. The plate **22** is corrugated throughout its length at spaced intervals with substantially rectangular corrugations **23** and peripheral flanges **24**. The plate **22** is fitted inside the pan **17** with its flanges **24** positioned alongside the side walls **19** of the pan. The flanges **24** are secured to the side walls **19** by welding or otherwise. The upper portions of the corrugations **23** are positioned against the top **18** of the pan and secured thereto. This construction forms a plurality of ducts **25** for receiving wiring for servicing the building and/or for passage of air. The number and size of these ducts **25** may vary according to the size of the pan or the service requirements.

The mold pan **17** with the corrugated plate **22** attached to it remain permanently in position after the concrete slab **10** and joists **11** have hardened. The corrugated plate **22** reinforces the pan **17** permitting the latter to be made of economic, thin plain sheet metal. The pan **17** may be of sheet metal or other sheet material whichever result is more economical or practical for the purpose.

Corresponding to the ducts **25**, holes or knockout provisions **25'** for such holes are provided in the end walls **20** of the mold pan **17** as shown in Fig. 5. These holes are plugged or left unopened if not required for the continuation of the ducts **25**.

Continuity of the ducts **25** through the cross-rib **12** is provided by tubular sleeves **26** which connect the open ends of adjacent opposite ducts. Continuation of

the ducts **25** into the wall or beam **13** can be provided by bent sleeve **26'**. Access from air ducts **27** to ducts **25** is provided by branches **28**. Cross branch ducts **29** serve to inter-connect the ducts **25**. Air flow for cooling, heating and airconditioning passes through a plurality of ducts **25** and sleeves **26** entering or leaving by branches **28** or sleeves **26'** and looping through cross branch ducts **29**.

Wiring for servicing the building uses the plurality of ducts **25** with the general understanding that low tension wiring may pass through the same ducts **25** which are used for the air flow described before. Communication between and access to the ducts **25** for the purpose of wiring is provided as follows: Conduits **30** of tubular rectangular cross-section extend across the top of ducts **25** or similar conduits **30'** extend across the bottom of ducts **25**. Conduits **30** or **30'** are preferably spliced by means of sheet metal sleeves located in each rib **11** for the bottom conduit **30'** or at any point for the top conduit **30**. At spaced intervals along the ducts **25** and conduits **30** and **30'** interconnecting openings are provided through the concrete slab **10** and the shells of ducts and conduits. Splice boxes **31** fitted into these openings permit access to conduit and ducts. Along any place of the plurality of ducts **25** outlet openings with fittings **32** can be located before or after the concrete has been placed.

Connection of ducts **25** for the purpose of wiring across beam **15** are made with transverse tubular conduits **33**. The ends of these conduits are connected to reducing sleeve members **34** (Fig. 6), inserted in the ends of the ducts **25**.

Great flexibility and intense coverage for wired services is achieved by the foregoing arrangement, as required for modern buildings anticipating changes in occupancy and increase in variety of services. A multitude and variety of wiring may be extended and interconnected as shown diagrammatically. Wires **35** and **35'** from panel boxes **36** and **36'** in wall **14** can pass through conduits **30** and **30'** into ducts **25** by means of splice boxes **31** and run to any outlet fitting **32**. Further extension of interconnections is provided through reducing sleeves **34** and conduits **33**.

Splices of the pans **17** with the corrugated plates **22** may be made by sheet metal covers indicated diagrammatically at **17'** and **22'** attached by spot welding or the like. Branch air ducts **28** and cross branches **29** are suitably connected to the ducts **25**.

Hot or cold air flowing through ducts **25** heats or cools the duct lining and slab producing radiant heating or cooling. This uses greater, more efficient, temperature differential and the very comfortable radiant temperature variation. The air having lost some temperature differential in the ducts **25** is released to the room for air conditioning. It may be released through conventional grills or through a number of small openings in the bottom of the ducts **25**. The latter openings would at the same time serve as sound-absorbers as employed for acoustical treatment.

If downward loss of heating or cooling is to be minimized the corrugated plate **22** is made of insulating material and/or treated inside with a refractory coating which reduces radiation.

In Fig. 7, a portion of a concrete slab construction embodying a modified form for a one-way concrete slab is illustrated. In this form the elements similar to the elements in the form of Fig. 1 are given the same reference numerals. The mold for this form of slab comprises a metal plate member **37** extending the length and width of the slab. The plate member is formed with corrugations **38** substantially rectangular in cross-section and extending the length of the plate.

A plate member **39** is welded or otherwise suitably

secured to the lower horizontal portions of the mold plate **37** thereby closing the space between the corrugations **38** of the plate **37** at their bottom ends to provide ducts **25** between the adjacent ribs **11'**. In this form also, the mold is to remain.

A transverse metal I-beam **40** is shown supporting the slab in addition to the beam or wall **15**. Figs. 8 and 9 are sectional views of Fig. 7 showing the various elements similar to Figs. 2 and 3.

The modified form of slab shown in Fig. 10 is similar to the slab of Fig. 9 except that the sides **41** of the corrugated mold plate member **37'** instead of being straight slant slightly outwardly making the space between the ribs **11'** larger at the top than at the bottom. In this form also instead of a single elongated plate **39** for closing the bottom ends of the ducts, separate plate members **42** are secured to the side walls of the corrugations **41** between adjacent ribs **11'**.

The shape and size of the ducts **25** may vary according to the slab thickness and other requirements. The accessory elements for interconnection and access of the ducts **25** are essentially the same as shown in Figs. 1 to 6 and are shown and numbered accordingly in Figs. 7, 8, 9 and 10. All joints of molds, sleeves etc., should be mortartight and essentially airtight where so required.

The bottom portions of the corrugated plate **22** shown in Fig. 3, and the bottom portions of the ducts **25** in the plate members **39** and **42** of Figs. 9 and 10 may be perforated to serve as acoustical dampers or air-outlets or may be composed of acoustical material or temperature insulating material, or may be treated on the inside surface with a refractory coating in order to diminish temperature loss downwardly by radiation.

The structural arrangement of the concrete ribbed slabs of Figs. 7, 8, 9 and 10 will conform to the standard practice and requirements of this type of construction. The forms will preferably be fabricated in such lengths as to extend from support to support. They will be made of convenient width for handling and jointed laterally by butting or lapping, closing the joint in such a manner that no mortar of the fresh concrete passes through the joint. The cellular shape of the form gives enough strength for handling and requires less intermediate supports or shoring such as **43** during the construction.

It is to be understood that the forms may be made of sheet metal, asbestos, insulating board or any kind of plastic material.

While I have shown and described several embodiments of the invention, it will be undertsood that changes in details might be made, and parts might be used without others, without departing from the principle of the invention and I desire to be limited only by the appended claim:

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

A unitary composite concrete and metal floor structure including a plurality of horizontally disposed molds disposed in spaced side by side and spaced end-to-end relationship, said molds each including an inverted elongated metal pan having depending side walls, reinforcing devices constituting corrugated plates fitted within said mold pans, said plates and molds forming a plurality of inner and outer ducts, said corrugated plates having peripheral depending flanges engaging and secured to the inner surfaces of the depending side walls of said mold pans, said mold pans including end walls having openings in alignment with each other and with the ducts of the pans, a monolithic slab of concrete covering said molds, said slab having depending cross and end beams extending into the spaces between said molds, said beams having horizontally disposed passages thereacross, sleeves in the passages in said cross beams serving to connect the ducts of each mold, and conduits in the passages in

said end beams serving to connect the ducts of one mold with those of the adjacent mold.

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