Feb. 16, 1932. T. E. MURRAY 1,845,760

FLOOR OR WALL STRUCTURE AND METHOD OF BUILDING

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Fig. 1.

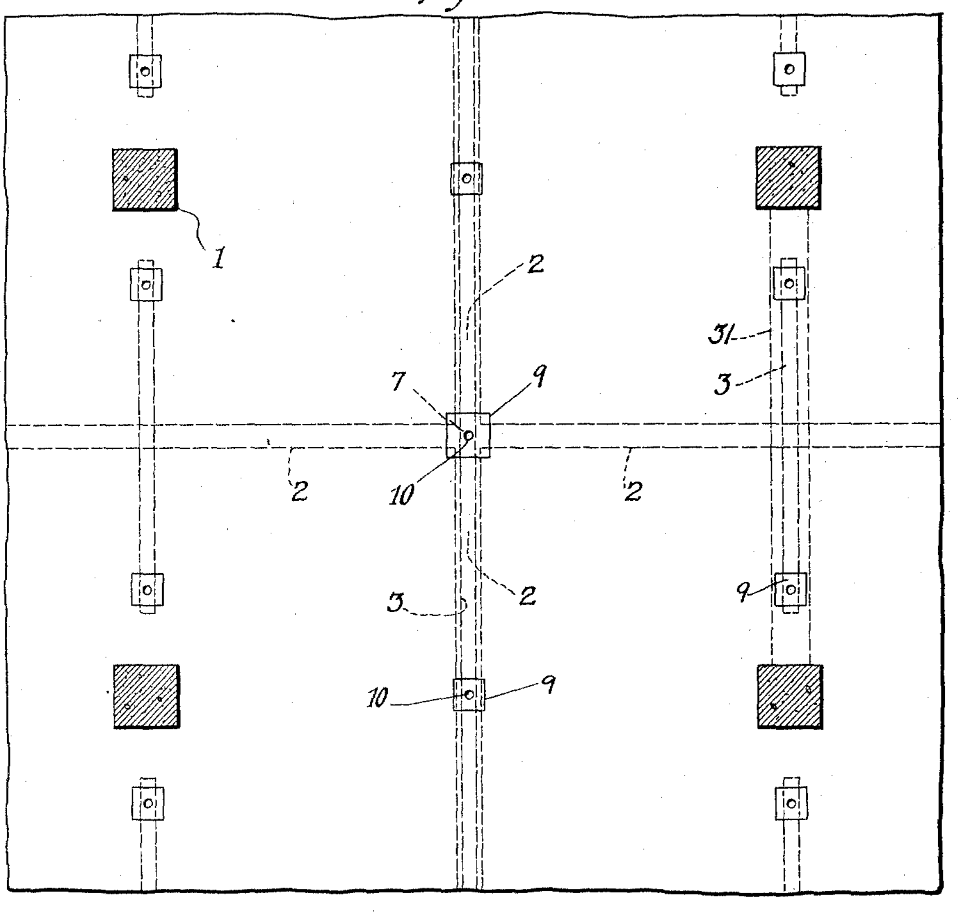

Fig. 2.

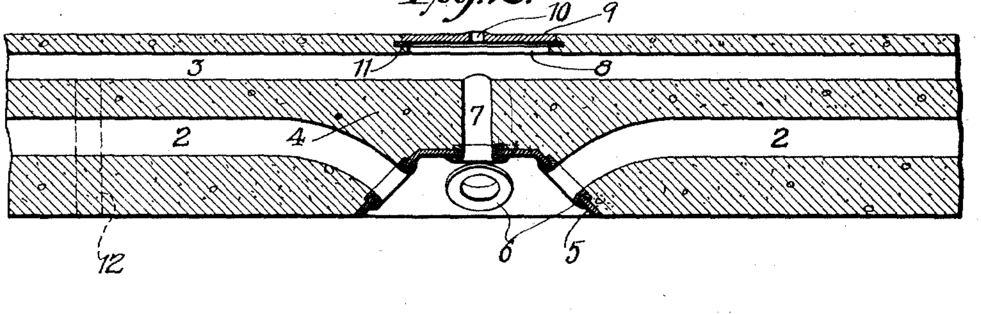

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Fig. 3.

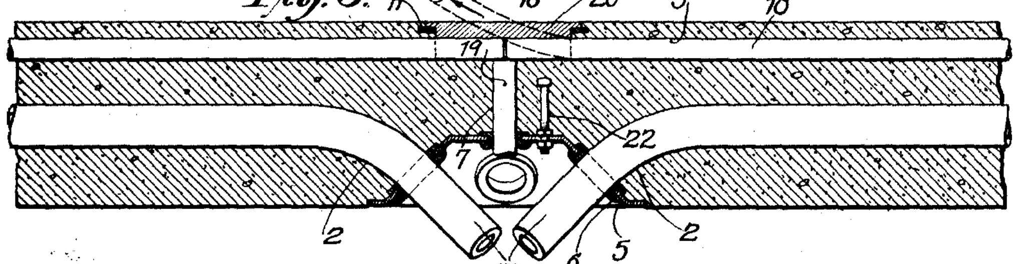


Fig. 4.

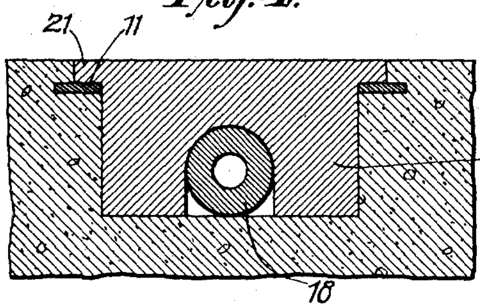


Fig. 5.

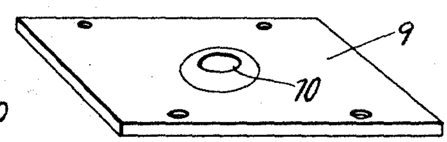


Fig. 6.

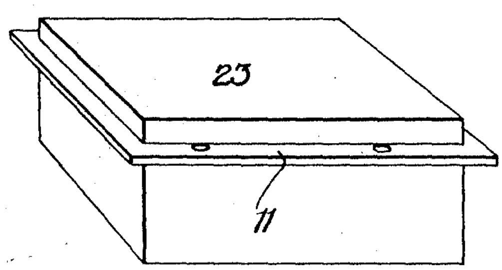


Fig. 7.

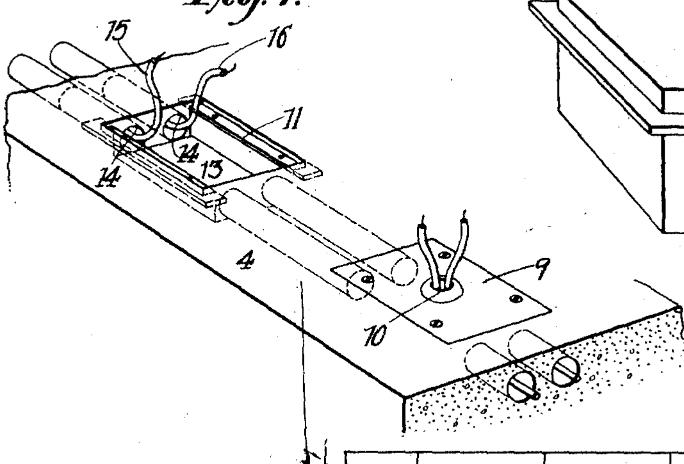


Fig. 8.

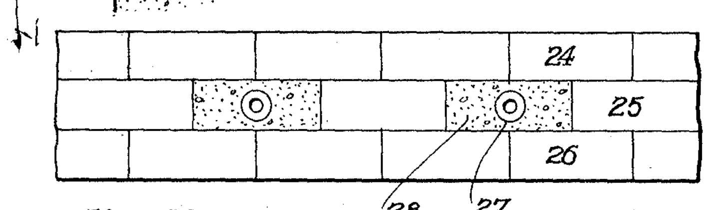
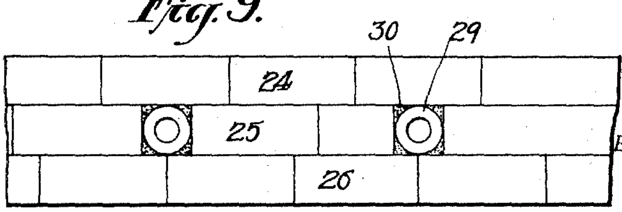


Fig. 9.



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FLOOR OR WALL STRUCTURE AND METHOD OF BUILDING

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Fig. 10.

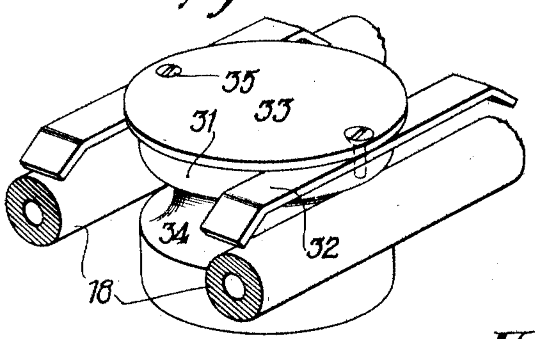


Fig. 11.

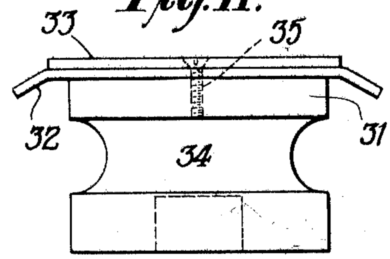
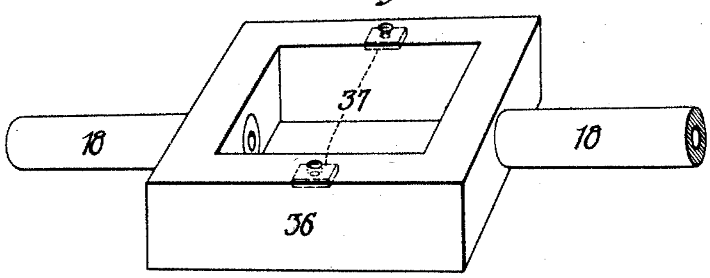


Fig. 12.



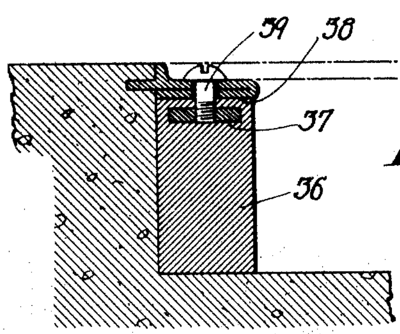


Fig. 12.a

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Patented Feb. 16, 1932

1,845,760

UNITED STATES PATENT OFFICE

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FLOOR OR WALL STRUCTURE AND METHOD OF BUILDING

Application filed January 2, 1924. Serial No. 683,888.

My invention is directed particularly to the building of floor structures with conduits therein for carrying electric wires and other things. And, though applicable to other kinds of floor, it is particularly useful in connection with concrete floors. And where the walls or partitions of a building or other structure are made wholly or partly of concrete, the invention is applicable also to such walls or partitions.

The accompanying drawings illustrate embodiments of the invention.

Fig. 1 is a plan of part of a floor;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a similar section illustrating the method of construction;

Fig. 4 is a cross-section of a core for the outlets;

Fig. 5 is a perspective view of a cover plate;

Fig. 6 is a perspective view of an alternative core or block for forming the outlets;

Fig. 7 is a perspective view illustrating a twin conductor system;

Fig. 8 and Fig. 9 are plans of walls or portions thereof with ducts for passing conductors through them;

Fig. 10 and Fig. 11 are respectively a perspective and a side elevation of an alternative core for forming an outlet;

Fig. 12 is a perspective of still another core for this purpose;

Fig. 12ª is a detail in section of a part of Fig. 12.

Fig. 1 is a plan of a concrete floor with columns 1 at intervals, partitions being omitted. We may assume that in the finished building partition walls will be set up between the columns 1. The floor is cast of concrete, generally supported at intervals by girders and beams, and generally reinforced with wire rods or netting; the supports and reinforcements being omitted from the drawings for the sake of clearness.

As shown most clearly in Fig. 2, the floor is formed with two sets of passages or ducts at different levels. On a lower level are the larger ducts 2 designed for the main feed conductors. And on the upper level it is formed with smaller passages or ducts 3 for the distributing conductors. These ducts are formed directly in the concrete 4 of the floor and are continuous for any desired length. For example, Fig. 1 shows a pair of feeder ducts 2 crossing at the center of the space between the columns and extending continuously to the outer walls of the building. A distributing duct 3 extends continuously in one direction and short distributing ducts 3 are shown in line between the columns for the purpose of carrying wires up into the partitions. Various other spacings and arrangements of the ducts may be adopted according to the desired distribution of the outlets.

At suitable points in the structure, two or more of the feeder ducts 2 open into a distributing box comprising a recess in the undersurface of the floor formed as indicated in Fig. 2 of a flaring sheet metal box 5 with openings registering with the ducts, the latter being curved at their ends as indicated. Each of the openings is surrounded by a ferrule 6, preferably of copper, to provide a smooth edge over which the cores are withdrawn in forming the floor and through which the conductors have to pass in introducing them. From such distirbuting box, vertical ducts 7 pass upward to the distributing ducts 3 so as to permit the desired connection between the feed conductors and the distributing conductors.

The distributing ducts 3 communicate at desired points with openings 8, one of which is preferably immediately above the duct 7, to provide access for making the necessary connections from the feeders and to provide outlets for conductors to lamps, motors or the like. Such outlet openings or boxes are provided with cover plates 9 having openings 10 for the passage of the necessary wire, the cover being fastened by screws to strips of brass 11 embedded in the concrete surrounding the opening. For carrying connections to ceiling lamps and the like, vertical ducts 12, Fig. 2, are provided at suitable points extending from the underside of the floor up to the distributing ducts 3.

The ducts are extended continuously for

any desired length. They are unlined. That is, the wall of the duct is formed directly of the surrounding concrete so as to permit the use of the maximum quantity of concrete for ducts of given clearance, or for conductors of given diameter. The walls of the ducts are also very smooth, it being possible by the process hereinafter described, to make them of an almost glassy smoothness, so that they oppose the minimum friction and avoid injury to the protective coating or sheath which usually surrounds the conductors. They are so arranged in two sets, for feeders and distributing conductors respectively, as to facilitate cross connections at any desired points and also outlets wherever desired. In fact even after the building of the floor, it is a simple matter to drill out the concrete to form such connections and outlets as may be desired.

In floors of sufficient thickness the feeder ducts and distributing ducts are best arranged at different levels. But where the floor is not thick enough for such an arrangement, the two kinds of ducts may lie in whole or in part in the same level with appropriate junction boxes at crossing points. In fact, the ducts may be all of one size and may be used according to circumstances for feeding or for distributing conductors.

In Fig. 7, I have illustrated a modified construction in which the floor of concrete 4 is provided with outlet boxes 13 communicating with parallel twin ducts 14. A cover 9 is used for said boxes, fastened to copper insets 11 as above described. I have shown one box with the cover in place, and the other with the cover removed for access to the conductors. With this arrangement of ducts bare copper conductors 15 and 16 may be used (or one bare and one insulated) constituting the opposite sides of the circuit and insulated from each other by the intervening concrete. This furnishes just as good protection as the usual metal casings and absolutely separates the two conductors. The feeders may be connected up to the distributing conductors at any desired point and in fact a great variety of arrangements for the ducts and conductors is possible with this invention.

For passing cables or the like through walls or partitions, I prefer also to build such walls with one or more ducts conveniently placed with reference to distributing boxes or outlets in the floors. In Fig. 1, I have indicated the positon of a partition wall in dotted lines at 31.

The preferred method of forming the floors and similar structures is illustrated in Figs. 3 to 6. For forming the feeder ducts, cores 17 are used of rubber of such composition that when extended lengthwise by pulling the projecting end, they will contract transversely sufficiently to detach them from the surrounding concrete and permit their withdrawal and when released they will resume their original shape for reuse. Generally this operation requires high grade rubber of approximately the maximum resiliency and which, therefore, easily yields under lateral pressure.

I have found, however, that such rubber cores can be made of sufficient transverse dimensions to support the pressure of the surrounding concrete and maintain the desired shape and size of the ducts, without preventing their withdrawal in the manner described. The cores 17 for the larger ducts are thus of tubes with a substantial central opening; but the cores 18 for the smaller ducts have a very small central opening as shown. And for ducts of the smallest sizes, solid rubber may be used. The vertical duct 7, for example, is assumed to be made with such a solid rubber core 19. Such vertical ducts, including for example the duct 12, Fig. 2, being of limited length, could be made also with wooden cores or any one of a variety of known styles of core.

The outlets at the top may be formed by the use of temporary cores 20 with slots (Fig. 4) on their undersides to fit over the rubber cores 18. The core is provided with flanges 21 at the top resting on the copper or other metal strips 11.

In building such a floor the centering or false work on which the concrete is to be cast is first set up and the junction boxes 5 placed, with tie-bolts 22 extending upward therefrom (and generally with wire netting spaced slightly above the centering). The cores 17 are then laid in the desired directions with their ends projecting through the ferrules 6 and their intermediate portions supported on the wire netting or on any suitable supports. The cores 19 and any other cores for vertical ducts are set in place. The concrete is then cast to the level of the bottom of the ducts 3. The cores 18 for the distributing ducts are then set in place on the concrete and extending in the direction desired.

Where an outlet box is to occur, the ends of sections of the core 18 are brought together. See Fig. 3. And a plug 20 is placed over them with the fastening strips 11 on the undersides of its flanges. The concrete is then cast up to the desired floor level. When the concrete is hardened sufficiently, the cores 17 are pulled out lengthwise and also the vertical cores. The plug 20 is lifted leaving a box in which the ends of the cores 18 are located. These ends are then lifted and the cores withdrawn in the manner indicated in dotted lines in Fig. 3. Thereafter the conductors are introduced into the openings as desired and the connections made and the covers 9 set in place and fastened down.

Instead of using a removable plug 20 for forming the outlet box, I may use a block 23,

Fig. 6, made preferably of gypsum or other comparatively soft material and shaped otherwise in the same way as the block 20. It has copper strips 11 embedded in the gypsum and entirely surrounding the same. Similarly the strips 11 of Figs. 3 and 4 may extend on all four sides of the opening. They serve to reinforce the edge of the concrete, to make ground connections and for similar uses. After the concrete is cast the core of gypsum is partially or wholly removed by digging it out, so as to leave a box in the concrete.

Rounded cores of gypsum are shown for example in Figs. 10 and 11. The gypsum 31 carries strips of copper 32 (which may be equally well in annular form) for embedment in the edge of the concrete. They are fastened to the core by an iron disc 33. The block has an annular curve 34 in which the cores 18 may lie at any angle which is convenient. When the concrete is molded the iron cover is removed by first removing the screws 35. The gypsum is then dug out leaving an outlet box as before.

Still another outlet box is shown in Fig. 12. This is a rectangular wall 36 of thick rubber with its top and bottom open and with holes in its end walls to receive the ends of the duct cores 18 during the casting operation. The core 36, after the concrete is cast, is removed and ready for re-use.

In Fig. 12ª the parts are shown after the casting of the concrete and before removal of the core 36. The rubber has embedded in it at suitable intervals small nuts 37. The metal strip has flanges 38 bent under to increase its thickness which is tapped with a screw thread at this point. Screws 39 serve to hold the strip to the rubber core during the casting operation. Thereafter the screws are withdrawn and the rubber core also withdrawn; and the cover plate for the outlet is fastened by means of other screws engaging the threaded openings in the metal strips surrounding the edge.

This figure illustrates no only the broad scheme of using a mold of rubber or similar elastic composition which is contractible to permit its separation and withdrawal from the concrete, and is expansible to resume its form; but illustrates also the application of this idea where the opening through which the core is to be withdrawn is of smaller cross-section than the core.

In this case the core can be withdrawn through the opening in the annular reinforcing strip, which is plainly smaller than the corresponding dimension of the core. The hollow character of the core permits the sides to be pulled inward and, by reason of the small axial or vertical dimension, to be gradually drawn out of the opening, working progressively from one point around the perimeter.

The same principle is applicable to openings of various sizes and shapes, and with the outlet passage therefrom more or less contracted.

In building a solid concrete wall, the method of forming ducts is similar to that described above for floors.

Where brick walls are to be built, a similar method may be employed. See Figs. 8 and 9. These are plan views of the top course finished at the end of any day of work There are three thicknesses of brick 24, 25 and 26. Rubber cores 27 are set in position in line with the center bricks 25 and as the wall is built up these bricks are laid with a space around the cores. As each course is laid, concrete or mortar is laid in the spaces surrounding the cores. Or the mortar may be introduced at longer intervals corresponding to a number of courses. At the end of a day, the core is partly withdrawn, to such a distance as to withdraw its lower end from the hardened mortar and leave a sufficient portion projecting for the contemplated height to which the work is to be carried on the next day. Or the bricklaying may be continued for several days before the withdrawal of the core.

Fig. 9 is similar to Fig. 8 except that it shows the spaces left for the ducts between the ends of adjacent bricks 25 to be just sufficient to embrace the cores 29, the corners being filled with concrete or grout 30. And in general, I use the term concrete herein to refer to any usual or suitable plastic material.

In Fig. 1, I have indicated in dotted lines at 31, a partition wall located between two of the columns 1. Such a wall would be built with two vertical ducts in line with the outlet boxes from the distributing duct 3 in the floor immediately beneath the wall.

The cores set up for forming ducts in the walls may be made initially of the full height of the wall and withdrawn only after the concrete has hardened around its entire length. In the building of the floor structures illustrated it has been assumed that the concrete will be cast around the entire length of a core before the latter is withdrawn; and this practice will serve for floors of small area which can all be cast in a single day. But for larger floors, or where ducts of considerable length are desired, the progressive method described in connection with the walls of Figs. 8 and 9, may be employed. A portion of the floor will be built around the cores, and after this has set sufficiently, the cores will be withdrawn and laid in position for the next day's work, and so on to the end of the desired length.

Instead of being pulled directly from one end only, the rubber cores shown may be pulled from an intermediate point, outlets or junction boxes being of course located at such points. Or two sections of the core can be used to make a long duct and can be separately drawn out from opposite ends. This would be convenient where the form is short and the duct long.

In a previous application, No. 670,423, for molding a core and methods, I have described cores and methods which can be used for the building of the floors and walls described herein. And in a second application, No. 679,521, I have described a specific mold and method which is similar to the mold and method described herein, and have claimed the method broadly and in its specific application to the building of underground conduits; and in still another application, No. 678,444, I have described the conduits themselves and claimed them broadly and specifically in underground structures.

In the present application, I have claimed the conduits and their method of construction specifically with reference to floors, walls and the like of buildings and similar structures erected above ground.

Though I have described with great particularity of detail certain embodiments of my invention, yet it is not to be understood therefrom that the invention is restricted to the particular embodiments disclosed. Various modifications thereof may be made by those skilled in the art without departure from the invention as defined in the following claims.

What I claim is:—

1. A building having floors formed of poured concrete and having ducts molded wholly within the poured concrete at different levels in the floor extending continuously through it with smooth faces of concrete formed directly by the surrounding body of concrete, with concrete between the upper and lower ducts and with vertical ducts extending from one to another of the first mentioned ducts.

2. A building having floors formed of poured concrete and having different sets of ducts molded wholly within the poured concrete of the floor extending continuously through it with smooth faces of concrete formed directly by the surrounding body of concrete, the ducts of one set being at a higher level and having outlets to the top of the floor and the ducts of the other set being at a lower level and separated by concrete from those at the higher level and having outlets to the lower side of the floor.

3. A building having columns and having floors of poured concrete and having ducts molded wholly within the poured concrete extending continuously through them with a smooth face of concrete formed directly by the surrounding body of concrete, said floor ducts having outlets in line between two such columns so as to register with openings in partitions which may be extended between such columns.

4. A building having floors formed of poured concrete and having ducts molded wholly within the poured concrete at different levels in the floor parallel to and in vertical alinement with each other with smooth faces of concrete formed directly by the surrounding body of floor concrete so that the floor concrete alone separates such ducts.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.