PATENT SPECIFICATION (11) 1 576 437

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(21) Application No. 26283/77 (22) Filed 23 June 1977 (19)
(31) Convention Application No. 700 289 (32) Filed 28 June 1976 in
(33) United States of America (US)
(44) Complete Specification published 8 Oct. 1980
(51) INT. CL.³ E04B 5/55
(52) Index at acceptance
E1W JDB

(54) CEILING SUPPORT GRID SYSTEM

(71) We, JOHNS-MANVILLE CORPORATION, a corporation organized under the laws of the State of New York, United States of America, having a place of business at Ken-Caryl Ranch, Jefferson County, Colorado, mailing address P.O. Box 5723, Denver, Colorado 80217, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The present invention relates to ceiling support grid systems including individual support runners and more particularly to a specific manner in which the runners are interlocked together.

Suspended ceiling systems are well known in the art. A typical suspended ceiling system includes a plurality of longitudinal runners which interlock together to form an overall grid for supporting ceiling panels or tile, light fixtures and the like. While most of the suspended ceiling systems of the prior art typically include interlocked runners, the runners themselves and the specific manner in which they are interlocked together vary from system to system. In one known system, adjacent ends of collinear runners are interlocked together through transverse runners by means of separate interlocking clips. In another prior art system runners are interlocked together in groups of four perpendicular runners by means of a separate central connector. In another known prior art system an end of one given runner is interlocked to an intermediate section of a second runner by means of an upwardly extending tongue. The tongue of the one runner is inserted up into a slot in the second runner and bent back so as to remain in the slot.

While such prior art systems may be generally satisfactory for their intended purpose, they all have certain drawbacks relating to the way in which the individual runners are interlocked together. For example, as noted above, some known systems require separate connector or interlocking arrangements which must be assembled with the runners. Moreover, once all of the runners in these systems are interlocked together, it is very difficult if not impossible to separate an individual runner from the system without separating a number of the runners.

Furthermore, there is a disadvantage with those known systems which utilize interlocking tabs which are bent back upon themselves since such bending tends to weaken the tab. In addition, removal of a runner (bending the tab back to its original position) and reusing it (again bending the tab) further weakens the tab. Another drawback in such a system is that any given runner is supported at its interlocked runners only by the bent over tabs.

An object of the present invention is to overcome the disadvantages of the prior art ceiling grid systems by producing a ceiling grid system which includes a number of longitudinally extending support runners and means for interlocking the runners together in a rapid reliable and uncomplicated manner which requires no tools nor bending of any of its components to interlock the support runners together.

With the interlocking means of the present invention, it is relatively easy to remove an individual support runner, for example, one which becomes damaged, after the entire system of runners has been installed.

Accordingly, the present invention provides a ceiling support grid system including a plurality of longitudinally extending support runners, each of which includes a pair of horizontally spaced apart and aligned vertical sidewalls having respective outer surfaces and confronting inner surfaces, a base joining said sidewalls together, said base extending between the inner surfaces of the sidewalls adjacent the bottom edges thereof, and a pair of support flanges respectively connected with bottom edges of said sidewalls and extending horizontally out from the outer surfaces thereof; means for connecting one end of the first of said runners to a second

runner at an intermediate point along the length of said second runner, said means comprising a first interlocking member connected with one of the sidewalls of said second support runner at said intermediate point, said interlocking member including an upwardly extending segment having a top edge portion which is spaced outwardly from the outer face of said one sidewall and which is located above the horizontal support flange connected with said one sidewall, and a second, vertical interlocking member connected to one end of said first runner, said second interlocking member extending inwardly from the inner surface of one of the sidewalls of said first runner and having a bottom edge portion which is spaced above the sidewall connecting base of said first runner, said bottom edge portion being adapted for vertically downward insertion into the space between the top edge portion of said first interlocking member and the sidewall to which the first interlocking member is connected and an arrangement separate from said first and second interlocking members and located at and connected to said one end of said first runner in a horizontal plane including said support flanges of said first runner, said arrangement being interlocked with a support flange of said second runner at said intermediate point for interlocking said end of said first support runner to the second support runner at said intermediate point along the length of said second runner for preventing said first runner from moving away from said second runner in said horizontal plane and for preventing said first runner from rotating in said plane relative to said second runner.

FIG. 1 is a partially exploded perspective view illustrating a portion of a ceiling grid system constructed in accordance with the present invention.

FIG. 2 is a plan view illustrating a portion of one runner comprising part of the system of FIG. 1 and particularly illustrating one component of an interlocking arrangement constructed in accordance with the present invention and provided for interlocking together the runners of the ceiling grid system.

FIG. 3 is a side elevational view of the runner illustrated in FIG. 2.

FIG. 4 is a cross-sectional view of the runner illustrated in FIG. 2 taken generally along line 4–4 in FIG. 2.

FIG. 5 is a vertical sectional view illustrating a portion of one of the runners in FIG. 1, taken generally along line 5–5 in FIG. 1.

FIG. 6 is a perspective view of a support runner end cap which is constructed in accordance with the present invention and which may comprise part of the overall system illustrated in FIG. 1.

FIG. 7 is a perspective view of a particular aspect of the system of FIG. 1.

FIG. 8 is a perspective view of another particular aspect of the system of FIG. 1.

FIG. 9 is a sectional view taken generally along line 9–9 in FIG. 8.

Referring to the drawings, wherein like components are designated by like reference numerals throughout the various figures, an overall ceiling support grid system, specifically a suspended grid system, is illustrated in FIG. 1 and generally designated by the reference numeral 10. The ceiling support grid system 10 includes a plurality of longitudinally extending main support runners 12 and 12′, preferably identical runners, which are interlocked together to form an interlocking grid, preferably a basketweave type of grid, for supporting ceiling panels or tile, indicated generally at 14, light fixtures (not shown) and the like. These runners may of course be interlocked together in a linear type of pattern and the system may and probably would include secondary runners (not shown) extending across the main runners. Inasmuch as these secondary runners form no part of the present invention *per se*, a detailed discussion is not provided. It should be noted that any conventional secondary runner can be utilized and conventionally interlocked into the system, such as one having a T-shaped cross-section. As illustrated in FIG. 1, the main runners 12 and 12′ (hereinafter referred to merely as "runners") are interlocked in pairs, that is, the end of one runner 12 is interlocked to a second runner 12′ at an intermediate section along the length of the second runner 12′. Actually, in order to better illustrate the various components of each runner, two runners 12 have been illustrated in FIG. 1. Of course, as just stated, all three runners illustrated are preferably identical. In accordance with a preferred embodiment of the present invention, the runners are interlocked by means of two separate but cooperating interlocking arrangements associated with the runners to be interlocked together. These arrangements are generally indicated at 16 and 18 in FIG. 1.

In addition to the foregoing, the ceiling support grid system 10 includes suitable means (not shown) for suspending the runners to a fixed overhead support (also not shown). For example, the runners may be supported by means of overhanging wires attached to the runners and to the overhead support. In addition, the system or specific runners (see FIGS. 8 and 9) may include suitable means (not shown) for connecting cross runners to the vertical

end walls defining a room or area in which the system is located.

Each of the longitudinally extending support runners may be constructed of any suitable material (various metals including aluminium are suitable), preferably of rolled or stamped sheet metal or the like, and is preferably an integral unit, that is, it is preferably formed and shaped from a single piece of sheet metal.

Inasmuch as the runners 12 and 12′ are identical, a description of the components of one such runner will be applicable to the others. Corresponding components will be designated by like reference numerals and the use of a "prime" will distinguish those components of runner 12′ and from runner 12. As illustrated in FIG. 1, the support runner includes a pair of horizontally spaced apart and aligned vertical side walls 20a and 20b having respective outer surfaces 22a and 22b and respective confronting inner surfaces 24a and 24b. These sidewalls are joined together by a horizontal base 26 connected with and extending between the inner surfaces 24a and 24b of the sidewalls at the bottom edges of the confronting inner surfaces. Each support runner also includes a pair of support flanges 28a and 28b respectively connected with and extending horizontally out from the outer surfaces of sidewalls 20a and 20b at the bottom edges of the outer surfaces. Each of these flanges includes a vertically upwardly extending out edge portion 30a and 30b respectively. The outer edge portion 30a is in horizontal alignment with and uniformly spaced along its length from the bottom edge portion of the outer surface 22a and both the outer edge portion 30a and this bottom edge portion of surface 22a are preferably located below the base 26. This is also true of the outer edge portion 30b and the bottom edge portion of surface 22b. Moreover, the outer surfaces 22a and 22b preferably respectively include outwardly protruding, longitudinal ribs 32a and 32b which are horizontally aligned with portions 30a and 30b of flanges 28a and 28b.

Because of space limitations, the entire length of support runner 12 and, for that matter, support runner 12′, have not been illustrated. With certain exceptions to be discussed hereinafter, each support runner is preferably identical at opposite ends, which ends are generally designated by the reference numeral 34 (or 34′). As illustrated in FIG. 1, the sidewalls 22a and 22b and the base 26 extend the entire length of the support runner from one of its ends 34 to the other. Of course, while not shown, the base may include suitable openings for the passage of conduits, for air flow or the like. However, the support flanges 28a and 28b do not extend the entire length of the support runner between the ends 34. As will be seen hereinafter, the support flanges includes discontinuations along their length for actually separating the support flanges into two sections, and they terminate short of ends 34, both for the purpose of providing the interlocking arrangement 18.

As illustrated in FIG. 1 and FIG. 4, the sheet metal is turned on itself at the outer edge portions 30a and 30b of support flanges 28a and 28b to provide a double thickness at these outer edge portions. The sheet metal is also turned on itself at sidewalls 20a and 20b, except along the lower edge portions of the sidewalls. Hence, each of the sidewalls with the exception of its ribbed bottom edge, is also of double thickness. This configuration not only adds strength to the support runner but facilitates manufacturing the runner into an integral unit.

Having described a support runner 12 and therefore identical support runner 12′, attention is now directed to the manner in which two such runners are interlocked together. The interlocking arrangement 16 is provided for interlocking an end 34 of one runner 12 in FIG. 1, to a second runner, for example, runner 12′, at an intermediate section along the length of the runner 12′. The arrangement 16 includes a pair of interlocking flange members 36a′ and 36b′ which are illustrated in FIGS. 1–4. These flange members are connected with one of the sidewalls of the runner 12′, specifically the sidewall 20b′ at the intermediate section of the runner 12′. These flange members are aligned with one another a predetermined distance above the support flange 28b′ and are horizontally spaced from one another a distance less than that distance spanning the sidewalls 20a and 20b of runner 12. The interlocking members respectively include upwardly extending segments 38a′ and 38b′ at least the top edge portions of which are spaced outwardly from outer face 22b′ of the sidewall 20b′. These pair of flange members are preferably integrally formed with the sidewall 20b. In fact, they are preferably punched or stamped out segments of the sidewall (i.e. both thicknesses of the sidewall) by means of, for example, a suitable punch press. As shown in FIG. 2, the interlocking segments 38a′ and 38b′ define upwardly opening pockets 39a′ and 39b′ between segments 38a′ and 38b′ and surfaces 20a′ and 20b′.

The arrangement 16 also includes a pair of second, vertical interlocking flange members 40a and 40b which are respectively connected with an end 34 of the runner 12. These second interlocking

members respectively extend inwardly towards one another from the inner surfaces 24a and 24b of the sidewalls 20a and 20b of the runner 12 and have respective bottom edge portions which are spaced above the horizontal base 26. These second flange members are preferably integral with the sidewalls 20a and 20b and, as illustrated in FIG. 1, are bent in 90° from the sidewalls so as to face one another.

As also illustrated best in FIG. 1, an end 34 of the runner 12 is interlocked with runner 12', specifically with the sidewall 20b' of runner 12', by vertically downwardly inserting the flange members 40a and 40b, at least the bottom edge portion of these flange members, into the spaces or pockets 39a' and 39b' between the flange segments 38a' and 38b' and the sidewall to which these latter flange members are connected, at least between the top edge portions of these latter flange members and the sidewall to which they are connected.

It should be apparent that the interlocking arrangement 16 requires no tools and no bending of any components. This arrangement prevents the interlocked support runners from separating horizontally. To prevent the runners from separating vertically, that is, to lock the flange members 40a and 40b in pockets 29a' and 29b', the flange members may include respective outwardly and upwardly extending locking tongues 42a and 42b which are constructed and positioned to first compress in as their associated flange members 40a and 40b are inserted into the pockets and against outer surface 22b' and snap out through the spaces formed by the flange members 36a' and 36b' beyond the inner surface of sidewall 20b'. While these locking tongues prevent the vertical separation of runners 12 and 12', they, of course, make it more difficult to separate the runners if this is subsequently desired.

Having described the interlocking arrangement 16, attention is now directed to the interlocking arrangement 18 which, as stated previously, cooperates with the arrangement 16 for interlocking the end 34 of the runner 12 to runner 12', particularly to the sidewall 20b' of runner 12'. The arrangement 18 includes a discontinuation 44b' in support flange 28b', as best illustrated in FIGS. 2 and 3. This discontinuation is located at the point of connection between the two runners, that is, at the aforesaid intermediate section, directly below the flange members 36a' and 36b'. The discontinuation separates the support flange 28b' into two sections which are spaced apart a distance equal to the discontinuation, specifically a distance approximately equal to the width of the runner 12 from one outer edge portion 30a of the runner 12 to the other outer edge portion 30b. Actually, as best illustrated in FIG. 2, this is the maximum distance of the discontinuation as indicated by points 46' in FIG. 2. The two flange sections defining the discontinuation are preferably mitered inwardly at about 45° from these two points, also illustrated best in FIG. 2.

Returning to FIG. 1, it can also be seen that the arrangement 18 includes a pair of interlocking flange segments 48a and 48b located at the end of 34 of the runners 12 and respectively connected with the support flanges 28a and 28b thereof. These flange segments extend horizontally out from the outer surfaces of the sidewalls 22a and 22b of runner 12 and include respective outer edge segments 46a and 46b which are located outwardly beyond the outer edge portions of the support flanges to which they are connected. These outer edge segments are approximately equal in length to the horizontal space between each of the sidewalls of the runner 12' and flange edge portions connected therewith. In this way, the outer edge segments can be respectively inserted within these spaces. For example, flange segment 48a can be seen in this position in FIG. 1.

With the flange segments so positioned, one end of each segment 48a and 48b (not shown) engages against edge portion 30b' of the flange 28b' and the other end engages against the outer surface 22b' of the runner 12' directly under the rib 32b'. This prevents runners 12 and 12' from separating horizontally and it aids in preventing the runners from twisting horizontally. Moreover, once runner 12' is suitably supported, the two sections of the support flange 28b' of this runner actually aid in supporting the end 34 of the runner 12. In this regard, to properly align the uppermost edge of the runner 12 with the uppermost edge of the runner 12', it is necessary to locate the flange segments 48a and 48b a slight distance vertically above the horizontal portions of the support flange 28b'. This is, of course, because the flange segments rest on the support flange.

As stated previously, the flange segments 48a and 48b are connected to support flanges 28a and 28b. In fact, they are preferably integral parts of the support flanges. More specifically, segments 48a and 48b may be formed by first cutting suitable lengths of upper edge portions 30a and 30b and bending these cut portions out to form outer edges 46a and 46b and then embossing the triangular sections illustrated in FIG. 1, that is, the entire flange segments to provide their upwardly recessed locations.

Having described one interlocking arrangement 16 and cooperating arrangement

18 for interlocking together one end 34 of one runner 12 to one side of runner 12', it is to be understood that all of the runners may be interlocked in this manner. For example, the unassembled runner 12 in FIG. 1 can be readily interlocked to the other side of runner 12' by utilizing identical arrangements 16 and 18. These arrangements are illustrated in FIG. 1 in alignment with the arrangements discussed above so that all three of the runners could be connected together to form a cross. It is to be understood however that the points of connection between the various runners could be provided at any point along the length of the runners, of course, assuming that this is taken into account during the manufacture of the runners.

Referring to FIG. 6, attention is now directed to an end cap which may comprise part of overall system 10 and which is constructed in accordance with the present invention. This end cap, which is generally designated by the reference numeral 50, is used where it is found necessary or desirable to shorten a runner in the field. More specifically, where the installer wishes to shorten a given runner in the field, he merely cuts away one end section of the runner so that the remainder of the runner is of the desired length. However, by doing this, one interlocking end 34 of the runner no longer exists. The end cap 50 is used to replace this missing end.

As illustrated in FIG. 6, the end cap 50 includes vertical sidewalls 52a and 52b which are horizontally spaced from one another and connected together at their top edges by a horizontally extending top plate. The end cap also includes horizontal flanges 56a and 56b which respectively extend outwardly from sidewalls 52a and 52b at the bottom edges thereof.

The sidewalls 52a and 52b are approximately the same length as the sidewalls 20a and 20b of any given runner and they are spaced apart from one another a distance slightly greater than the sidewalls of the runner. Flanges 56a and 56b extend out from sidewalls 52a and 52b a distance slightly less than the width of support flanges 28a and 28b of the runner. In this way, the end cap can be tightly fitted over a portion of the cut runner, at its cut end, so that top plate 54 extends across the top of sidewalls 20a and 20b of the runner and so that flanges 56a and 56b fit within the support flanges of the runner between the runners' sidewalls and its outer flange portions 30a and 30b.

As also illustrated in FIG. 6, end cap 50b includes flange members 58a and 58b which for all practical purposes are identical in structure and function to the flange members 40a and 40b to provide part of an interlocking arrangement 16. While not shown, end cap 50 could include flange segments similar in structure and function to previously described segments 48a and 48b. These segments would connect to flanges 56a and 56b and project out and beyond these flanges. While the end cap 50 may be constructed of any suitable material, like the support runners, it is preferably an integral unit and preferably shaped and formed from a single piece of sheet metal.

FIG. 7 illustrates another way in which a cut runner may be interlocked at its shortened end to one side of another runner. In this preferred embodiment, an end cap is not required. Rather, two clips 60 are used. Each clip includes two inverted U-shaped sections 62a and 62b disposed 90° from one another and integrally formed together by means of an intermediate section 64. This latter section is bent 90° to dispose section 62a and 62b at the same angle relative to one another.

As illustrated in FIG. 7, the field cut end of a runner 12', is positioned against a runner 12' in the same way as runner 12 in FIG. 1. Note that the flanges 28a'' and 28b'' rest against the sidewall 20b' of the runner 12'. With the two runners positioned in this manner, the sections 62a and 62b of each clip 60 snap over the adjoining sidewalls, as shown in FIG. 7. At the same time, the cut end rests on the mitered section of runner 12', which mitered sections define the extent of discontinuation 44b'.

FIGS. 8 and 9 show a main runner 70 which would be utilized directly against a wall. The runner 70 in certain respects is identical to the previously described main runners. For example, it includes a sidewall 72 identical to sidewall 20b' (or 20b) and a support flange 74 identical to support flange 28b'. It includes interlocking arrangements (not shown) identical to the arrangements 16 and 18 at some predetermined intermediate point along the length of sidewall 72. Moreover, it includes end arrangements 76 and 78 identical to one-half, for example, the right half of the arrangements 16 and 18. In this regard, each end of the sidewall 72 includes an interlocking flange segment such as 76 identical to one of the segments 38a' or 38b', which cooperates with one of flange members 40a or 40b, or in the case of a shortened runner, one of flange members 58a or 58b.

The runner 70 is different than the other runners in that it does not include an opposite sidewall and associated components. Rather, as illustrated in both FIGS. 8 and 9, runner 70 includes a longitudinally extending horizontal base 80 one-half the width of base 26 and a wall connecting

plate 82. This plate extends vertically up from base 80 and, of course, is spaced from the sidewall 72. As seen best in FIG. 9, it is positioned against a wall 84 and the entire runner is held in place against the wall by means of screws 86.

WHAT WE CLAIM IS:—

1. A ceiling support grid system including a plurality of longitudinally extending support runners, each of which includes a pair of horizontally spaced apart and aligned vertical sidewalls having respective outer surfaces and confronting inner surfaces, a base joining said sidewalls together, said base extending between the inner surfaces of the sidewalls adjacent the bottom edges thereof, and a pair of support flanges respectively connected with the bottom edges of said sidewalls and extending horizontally out from the outer surfaces thereof; means for connecting one end of a first of said runners to a second runner at an intermediate point along the length of said second runner, said means comprising a first interlocking member connected with one of the sidewalls of said second support runner at said intermediate point, said interlocking member including an upwardly extending segment having a top edge portion which is spaced outwardly from the outer face of said one sidewall and which is located above the horizontal support flange connected with said one sidewall, and a second, vertical interlocking member connected to one end of said first runner, said second interlocking member extending inwardly from the inner surface of one of the sidewalls of said first runner and having a bottom edge portion which is spaced above the sidewall connecting base of said first runner, said bottom edge portion being adapted for vertically downward insertion into the space between the top edge portion of said first interlocking member and the sidewall to which the first interlocking member is connected and an arrangement separate from said first and second interlocking members and located at and connected to said one end of said first runner in a horizontal plane including said support flanges of said first runner, said arrangement being interlocked with a support flange of said second runner at said intermediate point for interlocking said end of said first support runner to the second support runner at said intermediate point along the length of said second runner for preventing said first runner from moving away from said second runner in said horizontal plane and for preventing said first runner from rotating in said plane relative to said second runner.

2. A ceiling support grid system according to Claim 1 wherein said first interlocking member is an integral punched out segment of said one sidewall of said second runner and wherein said second interlocking member is integral with said one sidewall of said first member.

3. A ceiling support grid system according to either of Claims 1 or 2 wherein said means for connecting said runners includes an additional first interlocking member connected with said one sidewall of said second support member, said additional first interlocking member being spaced horizontally from said first interlocking member and being substantially identical thereto, and wherein said connecting means includes an additional second interlocking member connected to said one end of said first runner, said additional second interlocking member extending inwardly from the inner surface of the other sidewall of said first runner and having a bottom edge portion which is spaced above the sidewall connecting means of said first runner, said last-mentioned bottom edge portion being adapted for vertically downward insertion into the space between the top edge portion of said additional first interlocking member and the sidewalls to which the additional first interlocking member is connected.

4. A ceiling support grid system according to any of Claims 1–3 further comprising a discontinuation in one of the support flanges of said second runner at said intermediate section, said discontinuation separating said one support flange into two sections which are spaced apart a distance approximately equal to the width of said first runner from the outer edge of one support flange of said first runner to its other support flange, and a pair of interlocking flange segments located at said end of said first runner and respectively connected with the sidewalls of said first runner adjacent the support flanges thereof, said segments respectively extending horizontally out from the outer surfaces of said last-mentioned sidewalls and including respective outer edge segments which are located outwardly beyond the outer edge portions of adjacent support flanges, said outer edge segments being approximately equal in length to the horizontal distance between the sidewalls of said second runner and the flange outer edge portions connected therewith.

5. A ceiling support grid system according to any of Claims 1–4 wherein said interlocking flange segments are respectively integral segments of said adjacent support flanges.

6. A ceiling support grid system according to any of Claims 1–5 wherein said interlocking flange segments are located slightly vertically above the horizontal

portions of said adjacent support flanges.

7. A ceiling support grid system according to any of Claims 1–6 wherein the sidewalls, base and support flanges of said first runner all terminate in a vertical plane at the opposite end of said first runner and wherein said system further includes an end cap adapted for connection with said opposite end of said first runner, said end cap including means for connecting said opposite end of said first runner to an intermediate section of a third runner having interlocking members identical to said interlocking members integrally connected with said second member.

8. A ceiling support grid system according to any of Claims 1–6 wherein the sidewalls, base and support flanges of said first runner all terminate in a vertical plane at the opposite end of said first runner and wherein said system further includes a pair of clips for joining said opposite end to or intermediate section of a third runner each of said clips including two inverted U-shaped sections disposed 90° from one another and means joining said sections together, one section of each of said clips being interlocked over a respective sidewall of said first runner at said opposite end and the other section of each clip being interlocked over one of the sidewalls of the third runner at said intermediate section of said third runner.

9. A ceiling support grid system substantially as herein described and as illustrated with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1980.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

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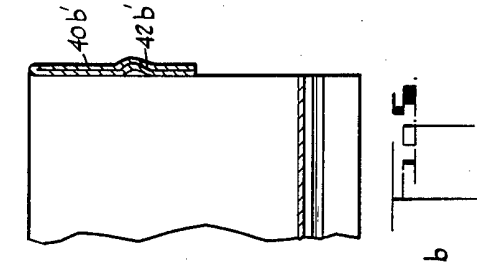

FIG. 5.

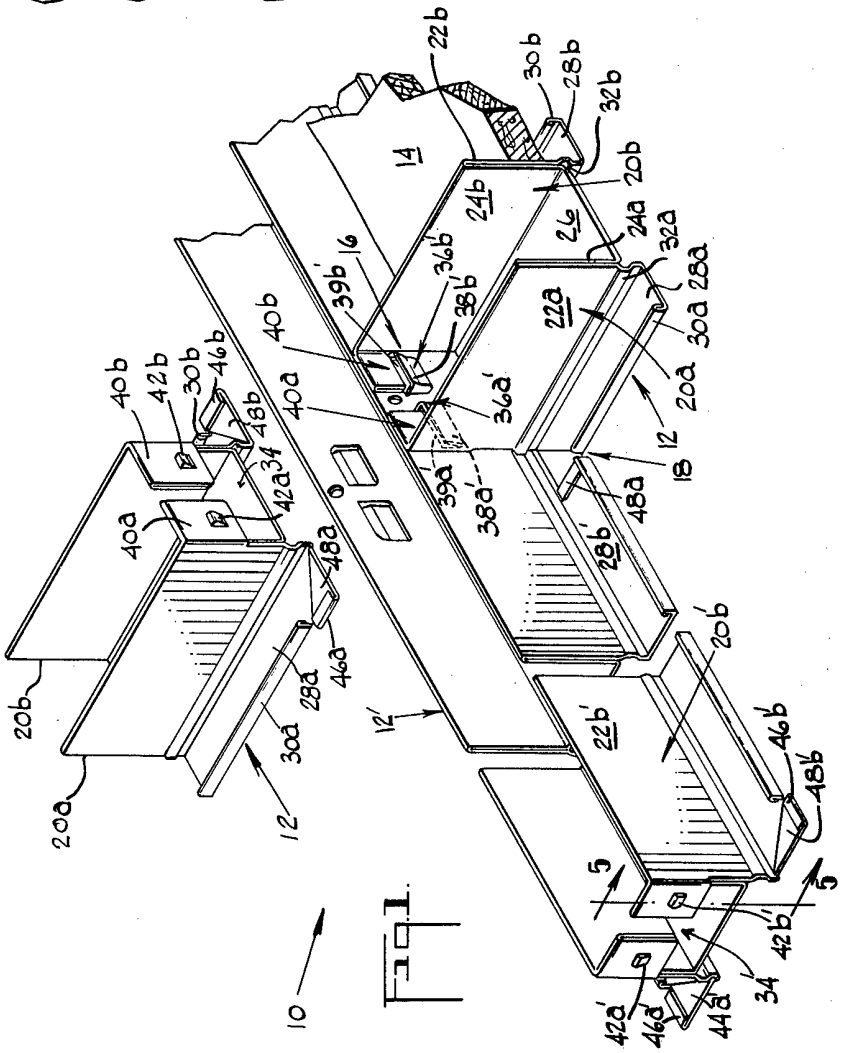

FIG. 1.

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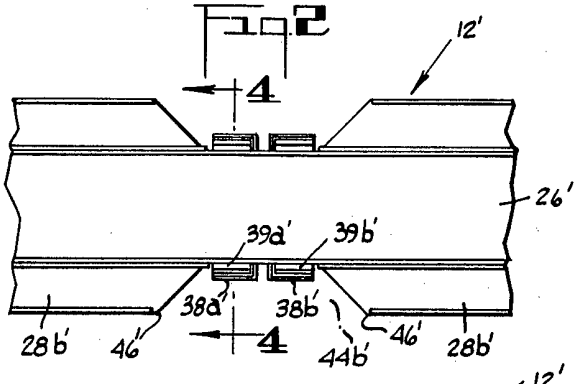
Fig 2



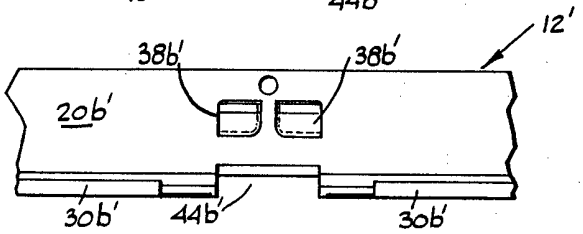
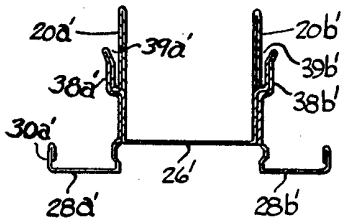


Fig 3.

Fig 4.



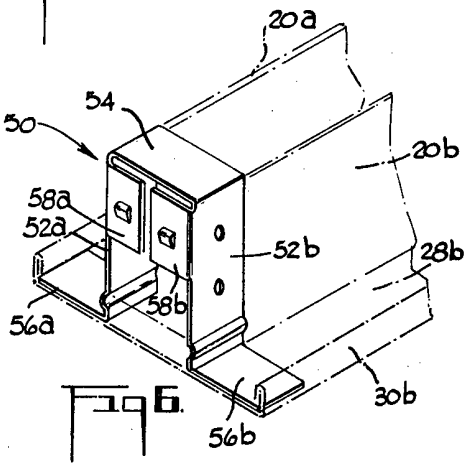


Fig 6.

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Sheet 3

Fig.7.

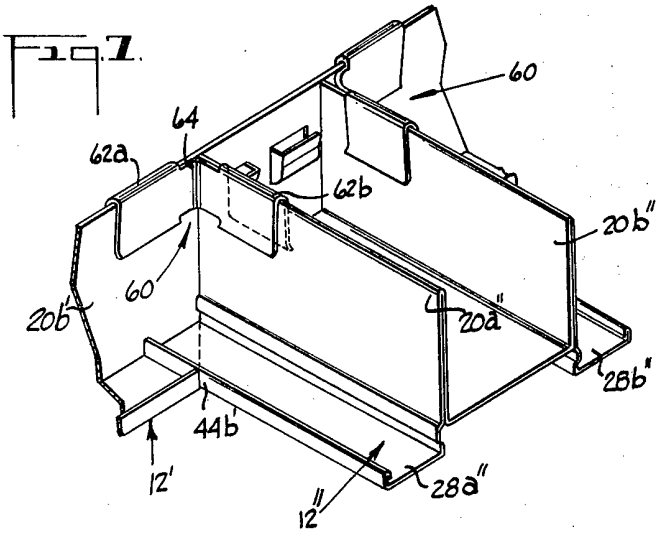
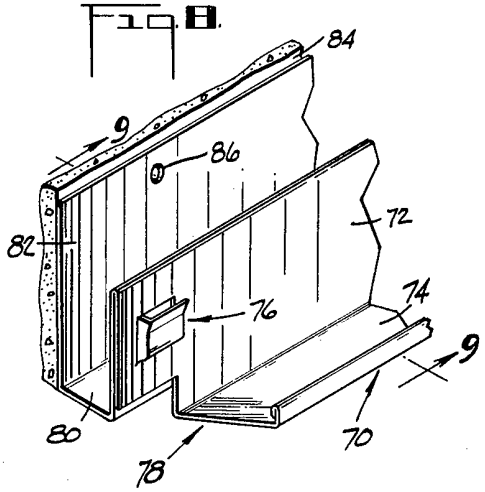


Fig.8.



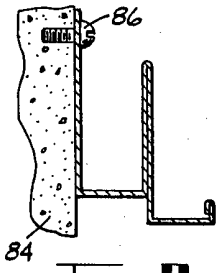


Fig.9