June 7, 1955 A. T. JORN 2,710,336

LIGHT TROFFER WITH HEAT TRANSFER MEANS

Filed Sept. 6, 1952 2 Sheets-Sheet 1

Fig. 1

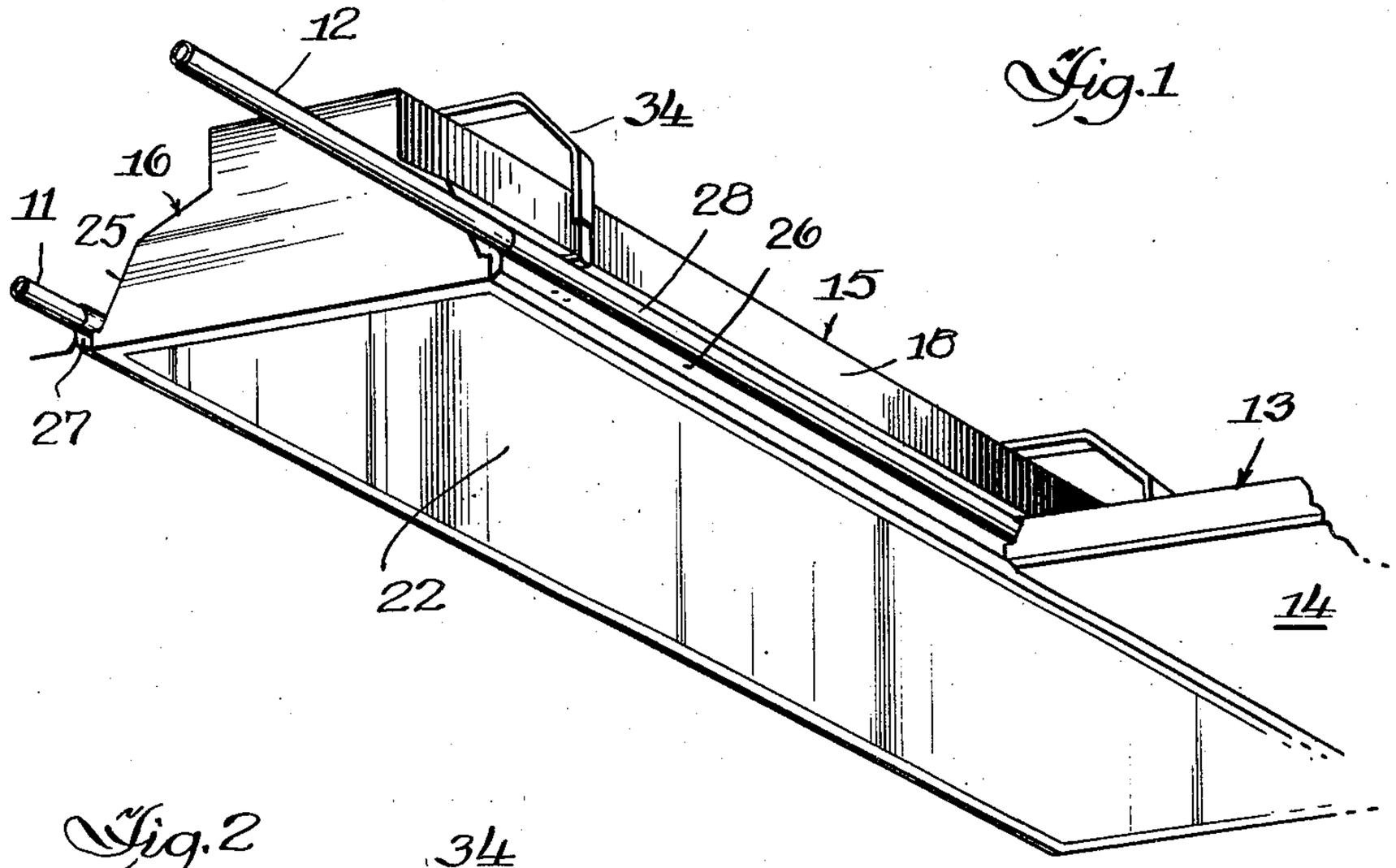
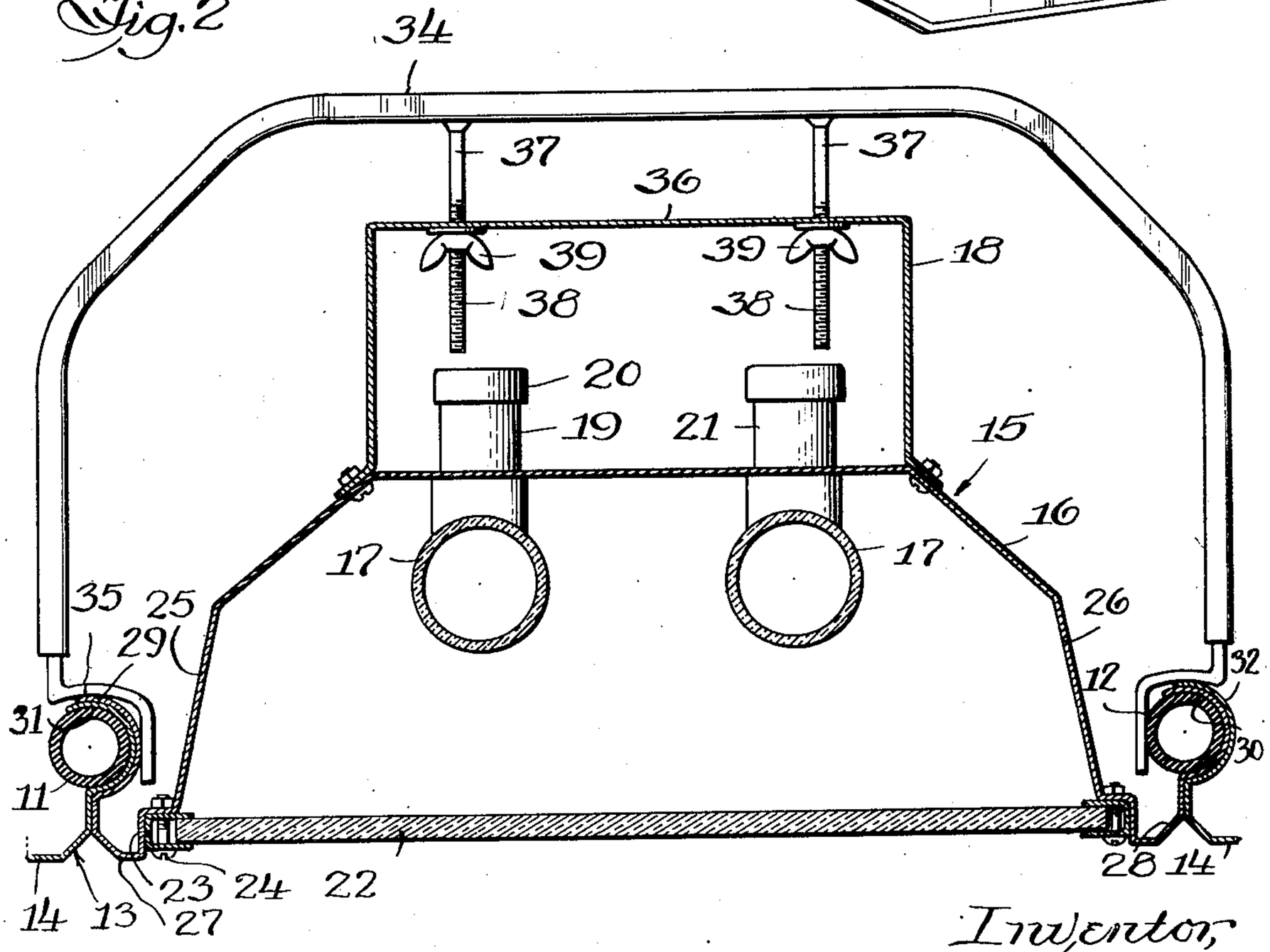


Fig. 2



Inventor,
Albert T. Jorn

By: Jones, Tesch and Barbo Attys.

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Filed Sept. 6, 1952 2 Sheets-Sheet 2

Fig. 3

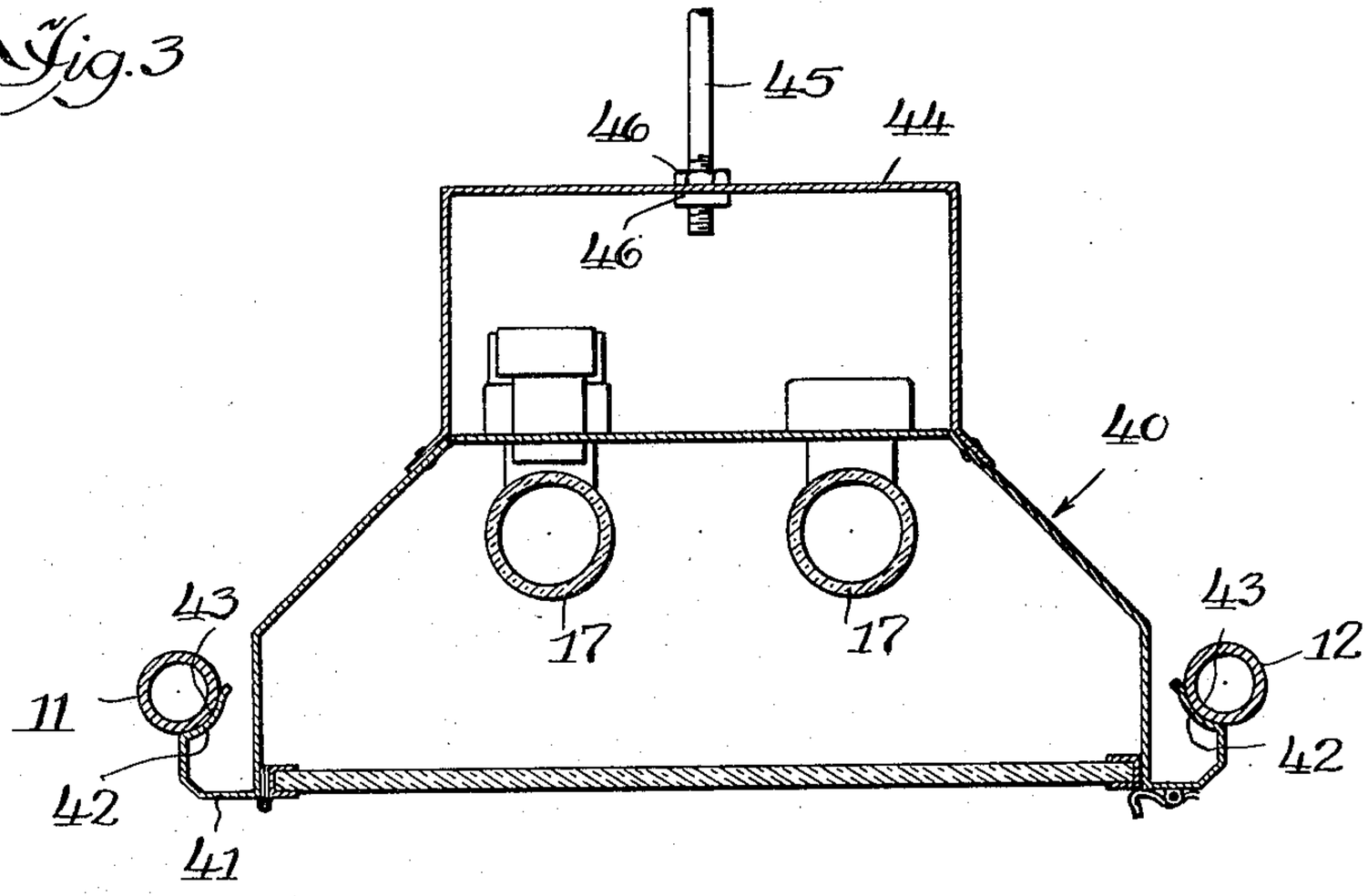
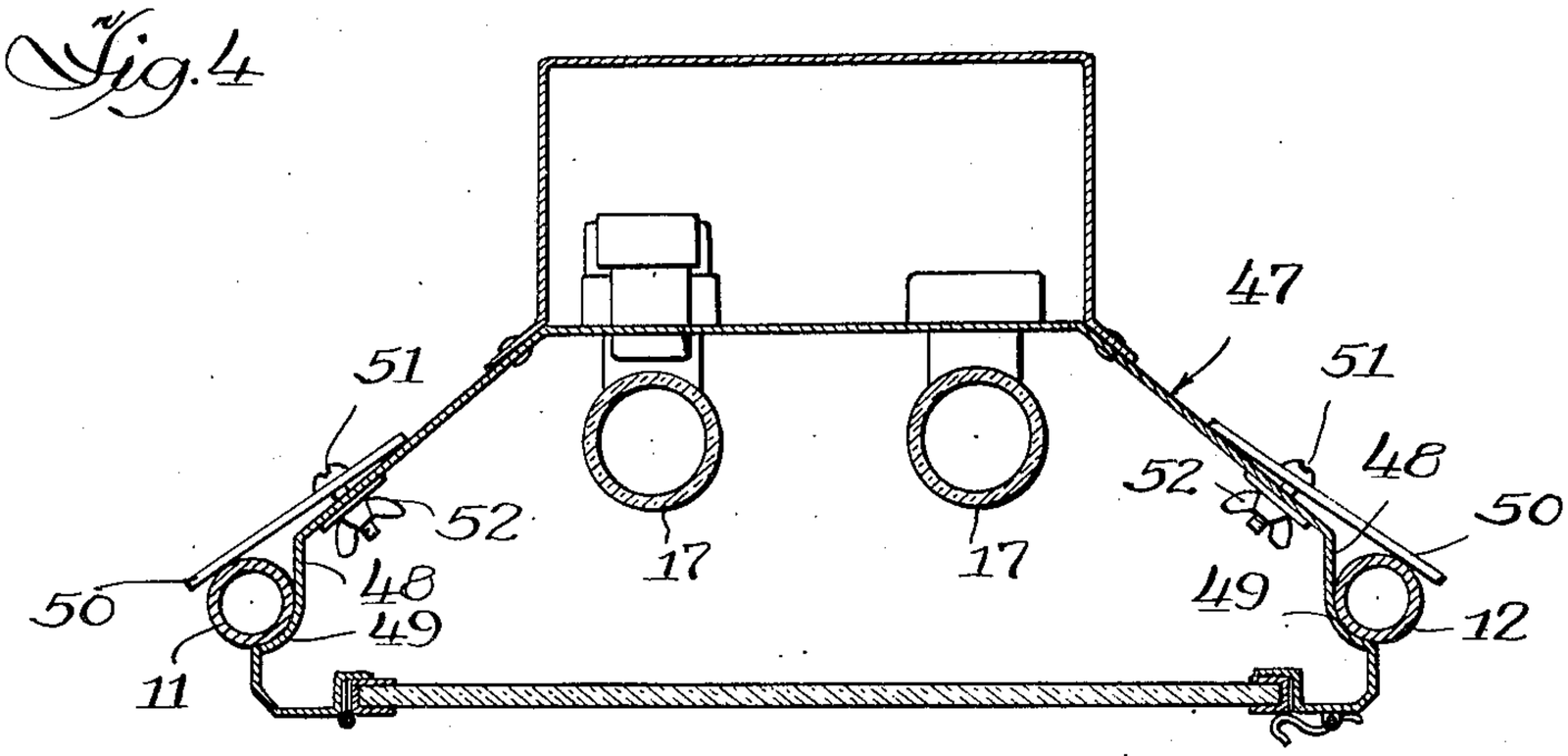


Fig. 4



Inventor,
Albert T. Jorn,
By: Jones, Tesch and Darbo Attys

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LIGHT TROFFER WITH HEAT TRANSFER MEANS

Albert T. Jorn, Grayslake, Ill., assignor to Burgess-Manning Company, Libertyville, Ill., a corporation of Illinois

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7 Claims. (Cl. 240—9)

This invention relates to light troffers with heat transfer means for cooling the unit to thereby minimize the radiation of heat therefrom during warm weather. Luminaires or troffers such as fluorescent lighting devices including inverted trough-like structures which serve as housings and reflectors are commonly interspersed with modular ceiling panels of acoustical or radiant panel heat transfer ceilings. Where the ceilings are used for heating or cooling, the panels may be carried by ceiling pipes through which a heat transfer medium such as hot water in the winter and cold water in the summer are circulated. In order to maintain uniformity of appearance for the ceiling structure, the troffers may be arranged between a pair of such parallel pipes in place of one or more ceiling panels which would otherwise appear in such location, the ceiling panel as is well known being of metal and having curved or hook-like flanges which engage the pipes both to support the panels from the pipes and to serve as a heat bridge between the panel and the pipe.

I have discovered that the light troffers referred to, which are also commonly of metal, may advantageously be engaged with the pipes by means which will serve as direct heat bridges between the troffers and the pipes, either with or without an arrangement for causing the same heat bridge means to act as supports for the troffers on the pipes.

The invention will be understood by reference to the following description, taken together with the accompanying drawings of illustrative embodiments of the invention and in which drawings—

Figure 1 is a general somewhat schematic perspective view of a light troffer and panel ceiling construction with the present invention associated therewith;

Figure 2 is an enlarged cross-sectional view through the light troffer of Fig. 1;

Figure 3 is a cross-sectional view of a modified construction, and

Figure 4 is a cross-sectional view of a further modification.

Referring in detail to the illustrative construction shown in Figs. 1 and 2, the ceiling construction, only the pertinent parts of which are shown, may include a pair of pipes such as **11** and **12**, suitably supported from a building structure as need not be here described and in turn supporting a secondary suspended ceiling including metal pans or panels **13** having surfaces **14** forming in general the visible ceiling of the room and providing radiation surfaces for giving off heat rays in winter when the pipes **11** and **12** are used for circulating heating hot water and for absorbing heat rays from objects in the room in summer when the pipes are used for circulating cool water.

As already alluded to, the light troffer **15** takes the place of one or more of the panels **13** in a selected location, as in this instance between the pipes **11** and **12** for a portion of their length, and the luminaire, as best seen in Fig. 2, includes the metal trough-like reflector or housing **16** in which are suspended the fluorescent tubes **17**.

Running along the top of the reflector **16** is a loft **18** which may house electrical starting, ballasting and balancing devices such as indicated generally by the numerals **19**, **20** and **21** with which the light tubes **17** are suitably electrically connected as need not be here further described.

The troffer also may carry a glass lens or cover **22** in a suitable frame **23** shown mounted in the trough by suitable means such as bolts **24**, for good light distribution and to act, to some extent, to confine heat within the unit.

Turning now to the subject matter of the present invention, the reflector **16** is shown having its longitudinal side members **25** and **26** extended laterally outwardly preferably throughout the entire length of the troffer and bent upon themselves to provide formed flanges **27** and **28**, respectively, adapted to connect with the pipes **11** and **12** and provide a heat transfer bridge between the troffer **15** and the pipes.

As best seen in Fig. 2, the heat bridge flange **27** is continued upwardly and formed into a hook terminal portion **29**, while the heat bridge flange **28** is continued upwardly and formed into a hook portion **30**. It will be understood that these hook portions may continue throughout the longitudinal extent of the troffer **15** to enhance the bridge area and thus the heat transfer effect. In the case of the flange **27**, its hook portion **29** is of slightly greater radius than the hook portion **30** of the flange **28**. Thus, for the pipe **11**, the hook **29** overlies the hook **31** of the adjacent ceiling panel **14**, whereas, for the pipe **12**, the hook portion **30** underlies the hook portion **32** of the adjacent panel **14**. In other words, it will be understood that each panel **14** and each troffer **15** has left-hand and right-hand pipe engaging flanges, the left-hand flange, in this instance going on top of the contiguous flange of the adjacent panel or troffer, as the case may be, and the right-hand flange going underneath the contiguous flange of the adjacent panel or troffer. In each case the underneath flange directly engages a pipe while the overlying flange is in thermal connection with a pipe through the thickness of an underlying flange.

In the structure shown in Figs. 1 and 2, the lighting assembly is supported from pipes **11** and **12** independently of flanges **27** and **28**. No support other than that provided by the pipes is required. The troffer hanger **34** of somewhat arch shape spans both the troffer and the two adjacent pipes and rests on the pipes, or, more accurately, upon the hook portions of the flanges, as at **35**. If desired, the hooks may be cut away to permit direct seating of the supporting hangers upon the pipes. The loft **18** of the troffer has openings through its upper wall **36** through which extend the rods **37** depending from the arched hanger **34** and threaded at their lower ends **38** to have screwed thereon wing nuts **39**, thereby suspending the troffer from the hanger with provision for vertical adjustment of the position of the troffer in the suspended ceiling.

Figure 3 shows a modified construction in which the troffer **40**, otherwise similar to the troffer **15**, has in this instance pipe engaging flanges **41** and **42** extending throughout the longitudinal sides of the troffer and extended upwardly to form arcuate seats **43** for the pipes **11** and **12** respectively. The arcuate portions **43** are here shown of less arc than the hook portions **29** and **30** of the troffer **15**. While the lighting fixture **40** may be supported by bracket hangers similar to hangers **34**, it alternatively may be directly supported from the main ceiling by tie bolts **45** passing into the loft **44** of the troffer and threadedly clamped thereto by nuts **46**. Because curved pipe contact portions **43** of flanges **41** and **42** engage only an under part of the pipes, these

fixtures may very readily be removed by dropping them down away from the pipes.

In the further modification shown in Fig. 4, instead of the reflector portions of the troffer 47 being flanged, they are indented as at 48 along and throughout the length of the reflector to again form arcuate seats 49 for the pipes 11 and 12 respectively. This has the advantage of reducing the length of the thermal path to the pipes and thereby improving the efficiency of the device. This unit may be supported by means of brackets or direct hangers, as described in connection with Figs. 2 and 3, or clamping arms 50 may be provided to hold arcuate seats 49 in firm contact with the pipes. Bolts 51 with wing nuts 52 are used to tighten the arms upon the pipes.

By making use of the cool water already flowing through the pipes in a suspended panel cooling ceiling, in each of the illustrated forms, heat generated by the lighting elements is removed from the troffer structure which is at a relatively high thermal potential and carried away by the water. In this way the heat is eliminated at its source rather than allowing it to first "shine" on the occupants and furnishings of the room. Also, the coolant used to remove the heat is not, like air, first pushed through the occupied room. The heat is removed without the creation of unpleasant drafts. This is very important with the high illumination loads created by recently evolved light-level practices where the removal of heat by ordinary air-conditioning equipment involves the total heat load developed in the conditioned room and thus requires the handling of excessive quantities of air or excessively cold air, or both, creating drafts unbearable to the occupants and involving high costs.

As illustrated, the troffers should provide the most direct and efficient thermal path for the flow of heat from the sources in the fixture, including the ballast and lighting elements. Preferably, the ballasts are mounted directly in the structural member which is integral with the housing and flanges. A highly conductive metal, such as aluminum, of thickness adequate for strength and heat transfer requirements should be used. If desired, the troffers may be suitably louvered to provide cooling by connection to the space above the suspended ceiling.

Quick and easy installation and removal of the luminaire is provided by the present invention and accommodation is permitted for slight lateral movement of the troffer in the plane of the panels during the finishing step of the installation to allow for alignment of the panel units. With modular design of troffers and ceiling panels, these elements are interchangeable in the suspended ceiling. Location of the lighting units may easily be changed with minor mechanical and electrical alterations without in any way interfering with or changing the piping system.

Such changes may be made as fall within the scope of the appended claims without departing from the invention.

Invention is claimed as follows:

1. In a ceiling structure for an enclosure, a light troffer arranged in said ceiling structure and cooling means therefor comprising a pair of spaced coolant-carrying parallel pipes extending generally horizontally in said structure, said light troffer including a metal inverted trough-like housing installed between said pipes in contact engagement therewith throughout substantially the entire length of said housing whereby to permit the flow of heat from said troffer to said pipes.

2. In a ceiling structure for an enclosure, a light troffer arranged in said ceiling structure and cooling means therefor comprising a pair of spaced coolant-carrying parallel pipes extending generally horizontally in said structure, said light troffer including a metal inverted trough-like housing installed between said pipes in contact engagement therewith throughout substantially the entire length of said housing whereby to permit the flow of heat from said troffer to said pipes, and means cooperating with said pipes for supporting said troffer therefrom.

3. In a ceiling structure for an enclosure, a light troffer arranged in said ceiling structure and cooling means therefor comprising a pair of spaced coolant-carrying parallel pipes extending generally horizontally in said structure, said light troffer including a metal inverted trough-like housing installed between said pipes in contact engagement therewith throughout substantially the entire length of said housing whereby to permit the flow of heat from said troffer to said pipes, and means cooperating with said pipes for supporting said troffer therefrom.

4. In a ceiling structure for an enclosure, a light troffer arranged in said ceiling structure and cooling means therefor comprising a pair of spaced coolant-carrying parallel pipes extending generally horizontally in said structure, said light troffer including a metal inverted trough-like housing having arcuate seats extending along the sides and throughout substantially the entire length thereof, said pipes being disposed in said arcuate seats in contact engagement with said housing whereby to permit the flow of heat from said troffer to said pipes.

5. The structure of claim 4 and including clamping arms mounted upon the housing and clamping the housing at said arcuate seats to the pipes.

6. In a ceiling structure for an enclosure, a light troffer arranged in said ceiling structure and cooling means therefor comprising a pair of spaced coolant-carrying parallel pipes extending generally horizontally in said structure, said light troffer including a metal inverted trough-like housing having the sides thereof extended to provide side flanges extending along each side of the troffer, each flange being formed to provide an arcuate seat extending substantially the length of the flange, said pipes being disposed in said arcuate seats in contact engagement therewith whereby to permit the flow of heat from said troffer to said pipes.

7. The structure of claim 6 wherein the arcuate seats are in the form of elongated hooks which extend over the pipes to support the troffer thereon.

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