

- [54] APPARATUS FOR INSTALLING CEILINGS
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Related U.S. Application Data

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[52] U.S. Cl. **29/200 P, 29/211 M, 29/407**
[51] Int. Cl. **B23p 19/00, B23q 17/00**
[58] Field of Search **29/200 P, 200 J, 407, 155,**
29/150, 211 M

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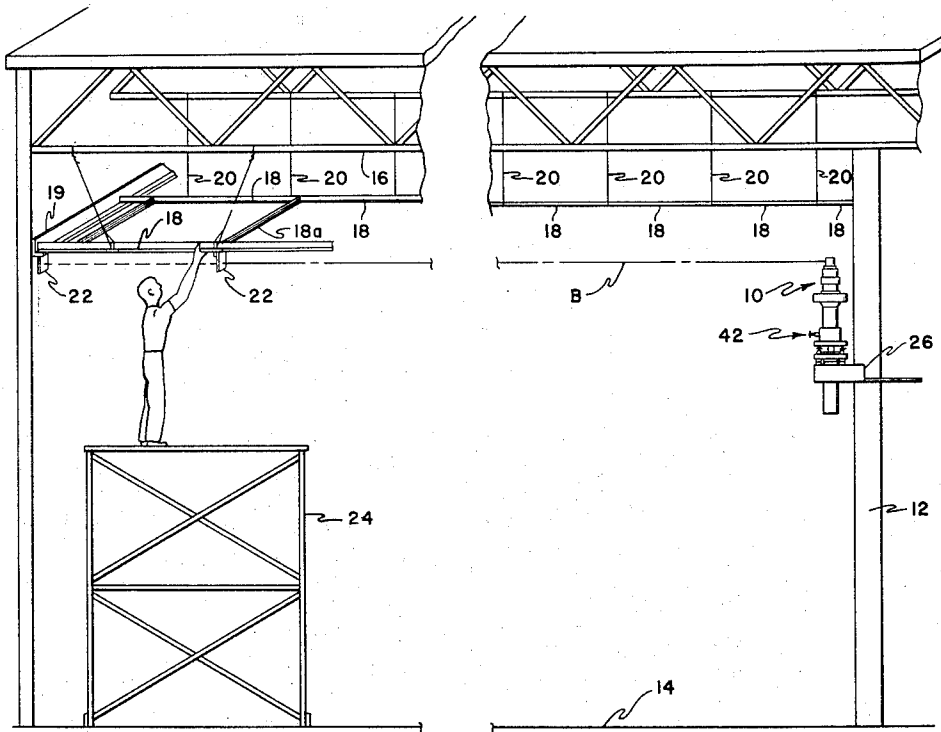
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& Cooper

[57] **ABSTRACT**

A device which emits a rotating beam of collimated light, preferably a laser source assembly, is mounted at a level which has a predetermined relationship to the level desired for a suspended ceiling. A target is placed on a ceiling panel supporting member and the member is elevated until the target is intercepted by the light beam at a predetermined line on the target. At this point, the ceiling supporting member is fixed in place. When it is desirable to bend the supporting wires before the ceiling supporting members are installed, the target may be moved along adjacent the wire and the wire bent at a given distance from the point where the light beam intercepts the target.

13 Claims, 12 Drawing Figures



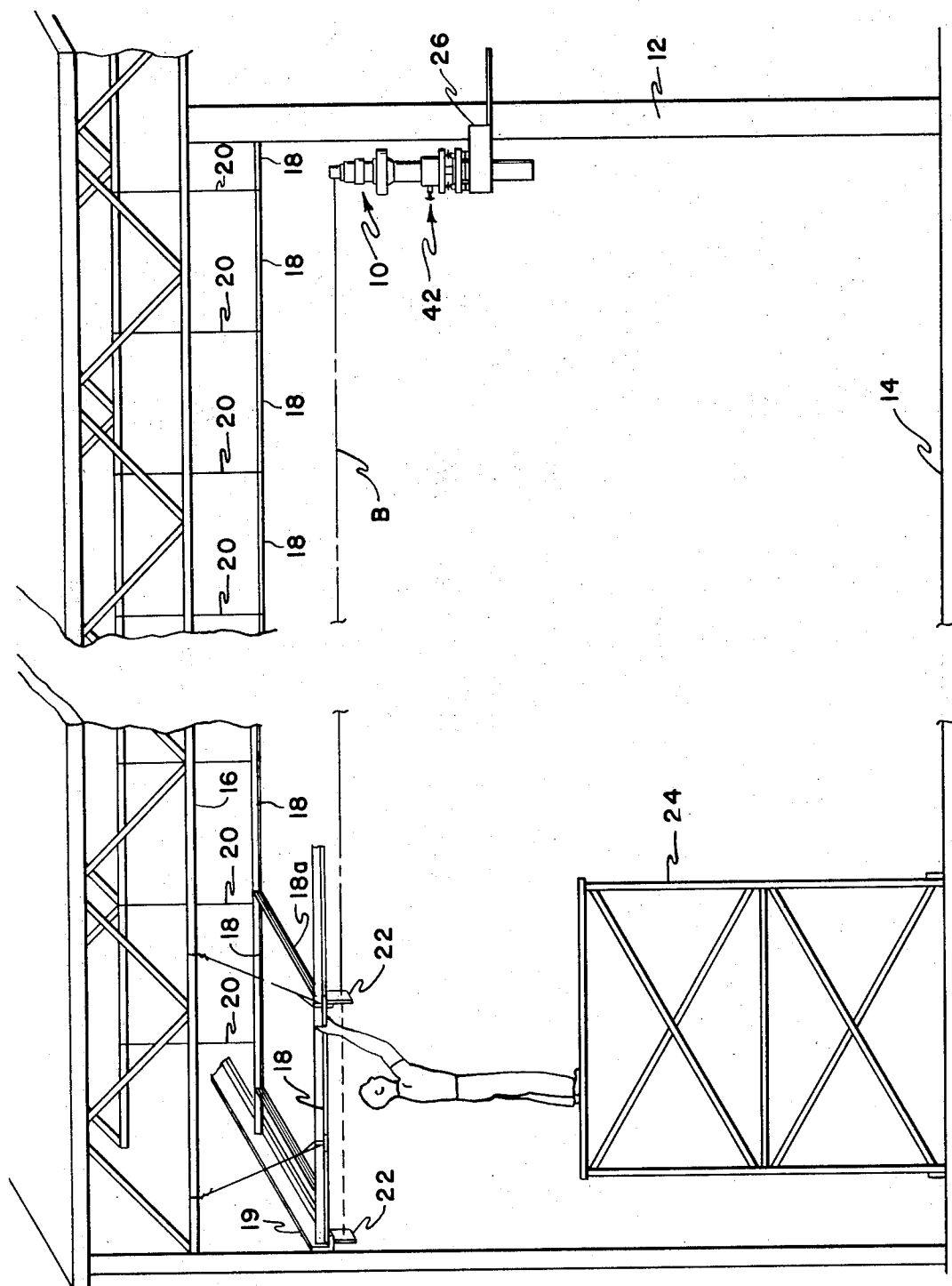
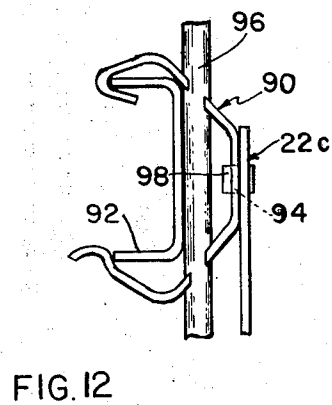
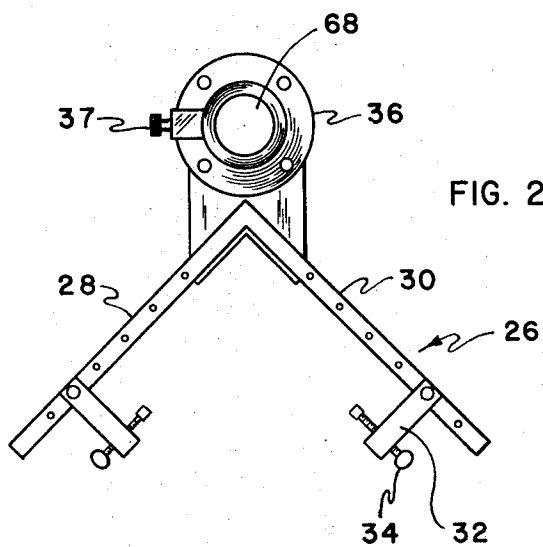
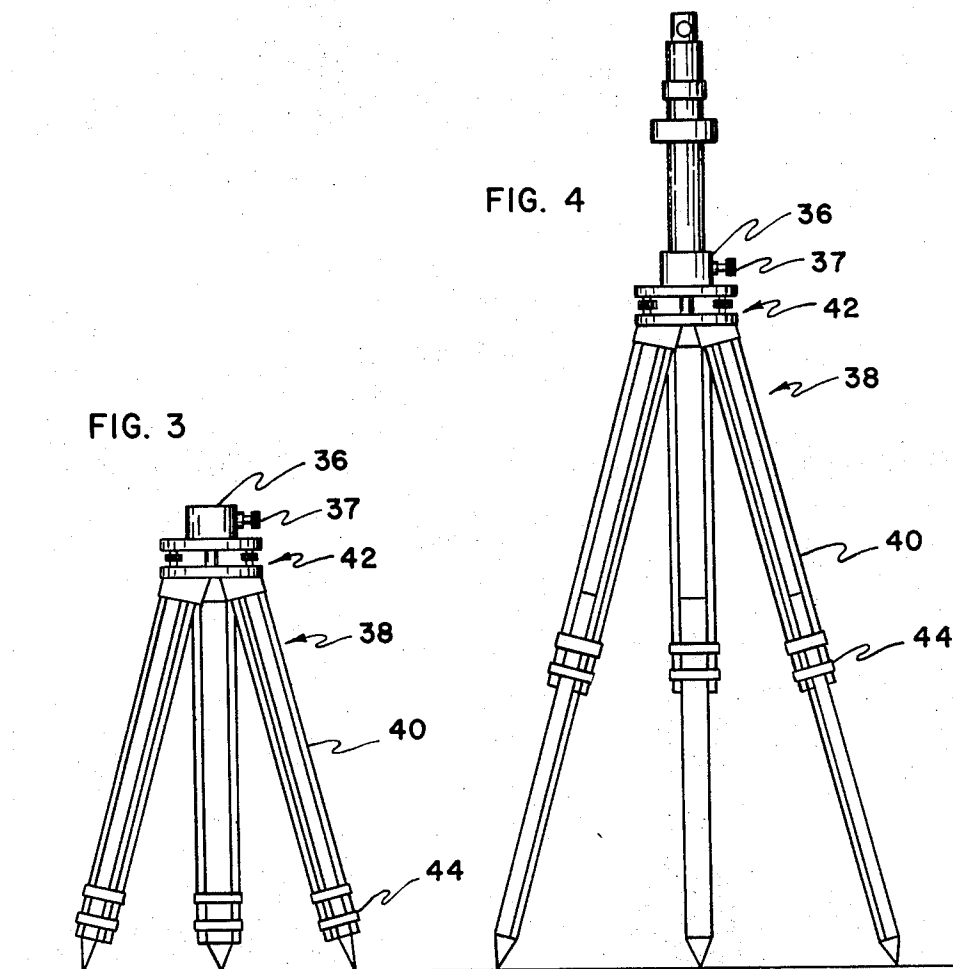


FIG. 1



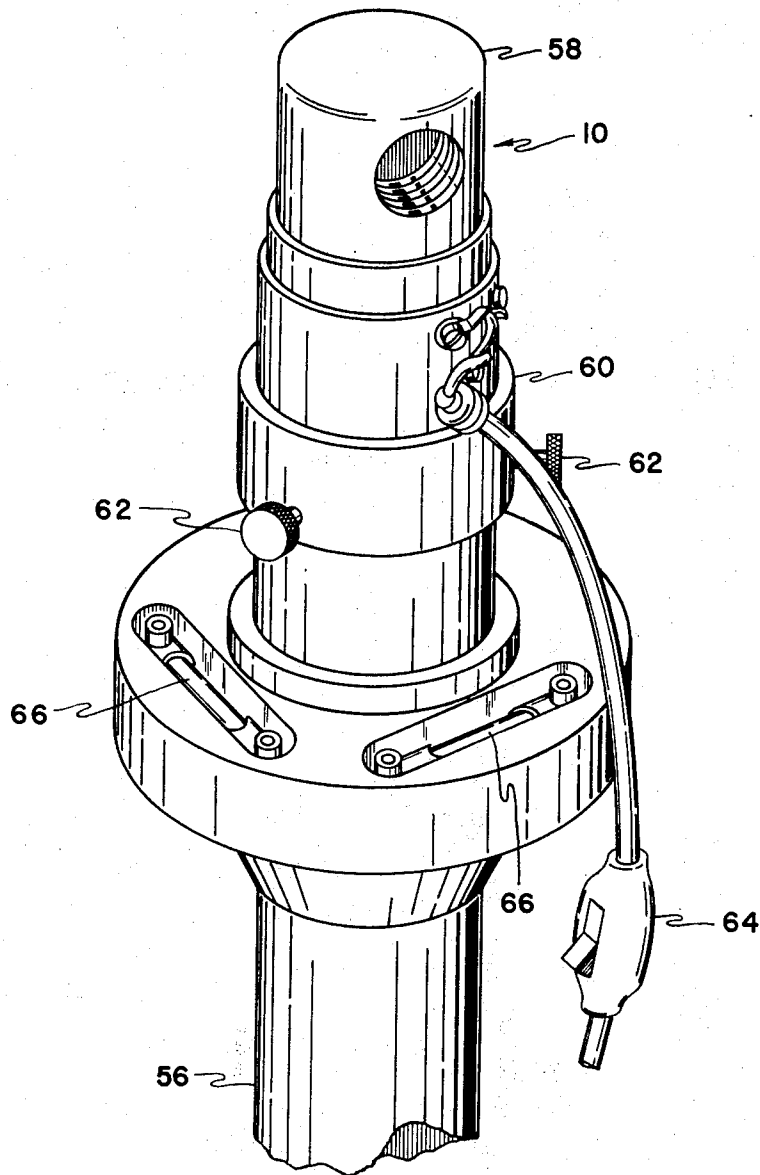
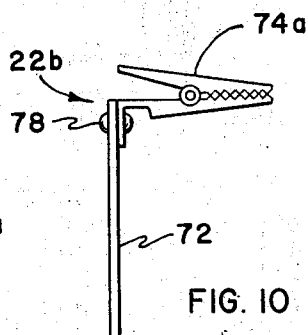
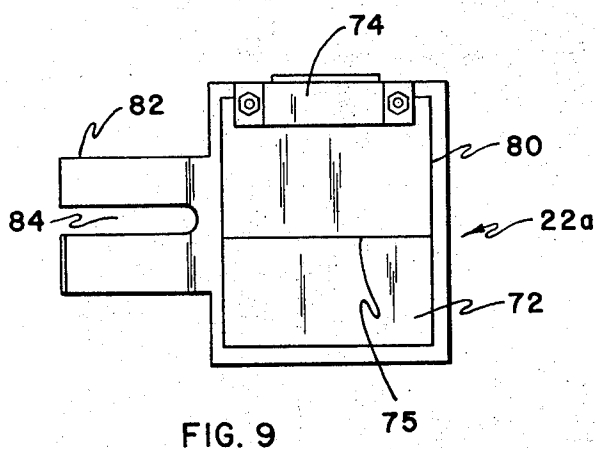
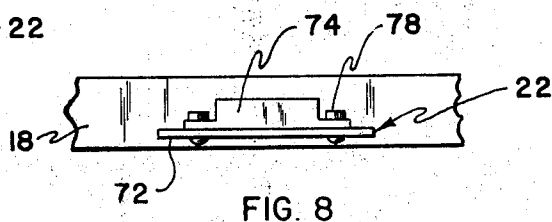
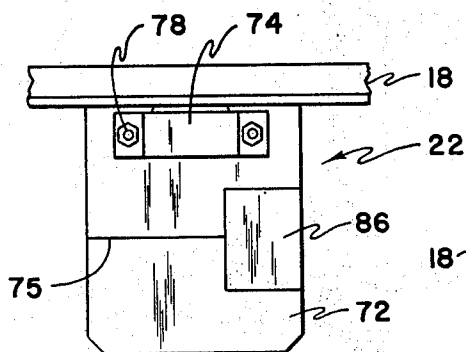
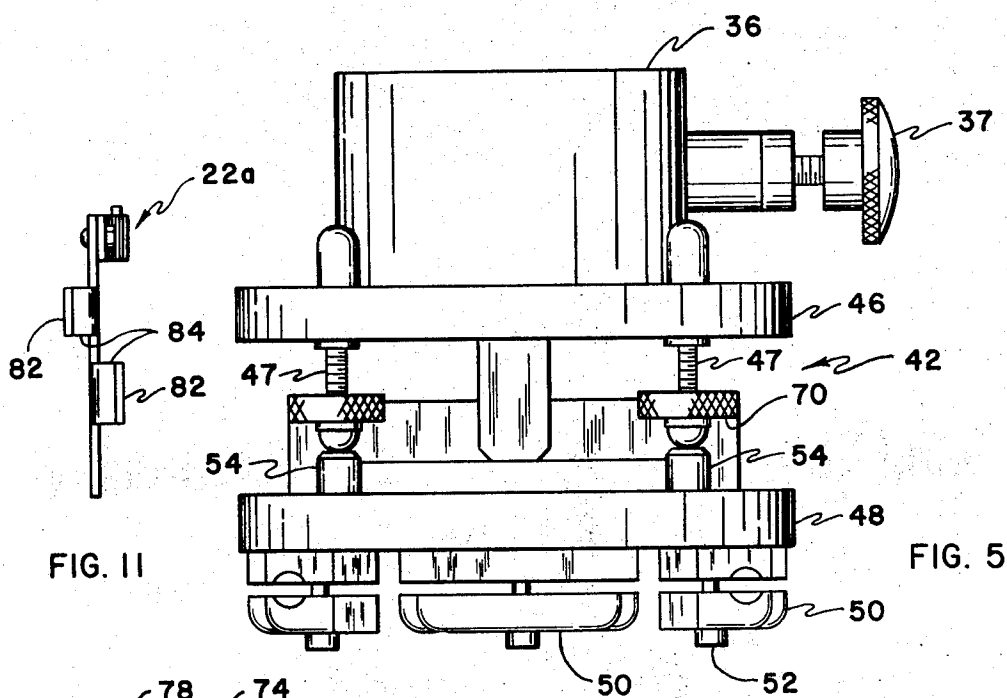


FIG. 6



APPARATUS FOR INSTALLING CEILINGS

This is a division of application Ser. No. 152,298, filed June 11, 1971.

BACKGROUND OF THE INVENTION

Ceilings, particularly those comprising a plurality of individual panels supported in a gridwork system suspended from the overhead joists have become extremely popular in recent years for installation in new buildings. As a practical matter, ceilings of this type are relatively easy to install and low in cost. The gridwork may be suspended from wires or from special clip members fastened to the overhead structure.

When systems of this type are installed, a desirable ceiling height is established which will clear the lowest air ducts, utility piping, plumbing, etc. and which will be higher than the highest window and door frame openings. L-shaped wall angles are then placed around the outer periphery of the room at this established level. Each wall bracket, of course, must be placed at the same level. In that neither the floor nor the existing overhead structures are found to be level even in new construction, the installer must utilize various leveling devices, chalk lines and like tools in an attempt to establish a horizontal and level reference plane. Generally, a transit is used to establish several bench marks or reference points, and then a water level is used to level the wall angles with respect to that point.

Wall angles are then fastened around the outer perimeter of the room along this level horizontal plane and then the location of the main grid runners must be established across the room. In an average installation each individual panel measures approximately 2 feet by 4 feet with the main grid runners being spaced 4 feet apart. In order to hang these runners, a string is stretched across the room at the 4 foot intervals and hangers or suspension wires are affixed to the joists or other upper support structure at no greater than 4 foot intervals along the main runners. As the hangers are affixed, they are bent at the level of the string.

When the hangers have been installed and bent, the string is removed and the main runners are hung in place on the bent hangers or suspension wires. A water level may be used in an attempt to compensate for string sag. After the grid runners have been installed and are leveled with the wall angles, cross "T"s are then inserted between the main runners and finally the individual panels are slipped into place.

In large commercial installations, however, it is often extremely difficult to stretch the taut string across an area without having a certain amount of sag present. Additionally, it is necessary to either have a large amount of scaffolding or to move scaffolding over the same area twice in order to first bend the wires and then hang the runners. The two steps cannot be performed simultaneously since the hung runners would interfere with the line of the string. Finally, another problem is created when the hanger cannot be hung directly above the string and directly above the ultimate position of the hanger hole in the runner. It is pure guesswork for the worker to bring the hanger wire down at an angle and bend it at the proper level.

Thus, the difficulties involved in the preliminary render the installation of this type of ceiling very costly.

SUMMARY OF THE INVENTION

The present invention comprises an apparatus which greatly simplifies the preliminary installation of wall angles and runners by providing an apparatus for establishing a "working" reference line for the installation of such a suspended gridwork. Basically, the invention comprises an apparatus for projecting a collimated horizontal light beam, preferably from a laser source, throughout the area in which a suspended ceiling is to be installed. The light source may be centrally positioned in an area and swept around the area. Targets attachable to the gridwork structure are utilized to position the structural members with reference to the light beam where they may be fixed in place by attaching the suspending wires and bending them to hold the structural members in predetermined positions.

The targets are provided with fastening means for quick attachment and removal from the structural members. In one embodiment the targets may be provided with an integral wire bending tool. In another embodiment the target member is provided with a reflector for use in areas where the ambient light is particularly high.

Finally, in another aspect of this invention, various structures are provided for mounting and positioning the light beam source so that it may be effectively utilized over a large area.

By various aspects of this invention, one or more of the following or other objects can be obtained.

It is a primary object of the present invention to provide an apparatus for installing suspended ceilings.

It is another object of this invention to provide an apparatus for utilization in the installation of suspended ceilings.

It is yet another object of this invention to provide an apparatus for establishing a level base reference line around the perimeter of a room for the installation of wall angle supports for a suspended ceiling.

Other aspects, objects and the many advantages of this invention will become apparent to one skilled in the art from a study of this disclosure, the drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a view illustrating the utilization of the method and the apparatus of the present invention;

FIG. 2 is a top plan view of a mounting means for the light beam projector of the invention;

FIG. 3 illustrates an alternate mounting means for the light beam projector;

FIG. 4 is a view like FIG. 3 showing the light beam projector in an extended position;

FIG. 5 is an elevational view of an adjustable holding ring for the rotating light beam projector;

FIG. 6 is a perspective view of the laser light beam projector showing the leveling ring mounted thereon;

FIG. 7 is an elevational view of the target member showing its attachment to the supporting gridwork of a suspended ceiling;

FIG. 8 is a plan view of the target member;

FIG. 9 illustrates a target member similar to FIG. 8 having an integral wire bending tool;

FIG. 10 is a side elevational view of a target member illustrating an alternate embodiment of a holding means;

FIG. 11 is a side elevational view of the target of FIG. 9; and

FIG. 12 is a side elevational view of a target member attached to a clip utilized in the construction of permanent ceilings.

PREFERRED EMBODIMENT OF THE INVENTION

Turning now to the drawings, FIG. 1 graphically represents the method and the apparatus of the present invention. The laser beam projector 10 is shown mounted within an area on any conveniently located supporting structure such as a support column 12 extending between the floor 14 and the overhead structure 16. A collimated horizontal beam of the laser light B is swept around the area and is arranged to sweep at a predetermined level relative to the height desired for location of the suspended main runner 18. Wires 20 are fixed to the overhead structure in any convenient manner such as by twisting one end around the supporting structure and around itself. At their opposite ends wires 20 are passed through mounting holes in the gridwork main runners 18. A target member 22 is attached to the main runner 18 and is moved by the installer with the gridwork until the desired level position is obtained with reference to the projected laser beam B. The wire 20 passing through the hole in the gridwork runner 18 may then be twisted around itself to prevent downward movement of the gridwork and hold it in its level position. Thus, the wires are bent and gridwork 18 is hung without moving a given scaffold section 24. In the preferred embodiment, the bending and hanging steps are simultaneous. However, in an alternative embodiment, the wires can be bent before being passed through mounting holes in gridwork 18. Even in this alternative, scaffold 24 does not have to be moved around between steps.

FIG. 2 illustrates a convenient mounting bracket assembly 26 for mounting the laser beam projector 10 on a supporting column 12 as illustrated in FIG. 1. The bracket assembly has a pair of legs 28 and 30 extending at a right angle to each other and essentially forming a V-shape. Each of the legs has a series of holes along its length for adjustable engagement with a clamp member 32 which has an adjusting screw 34 threaded therein. At the apex of the V formed by the legs 28 and 30 a mounting ring 36 is fixed to engage and hold the projector 10. The projector is securely held therein by means of a lock screw 37 adapted to tighten against the projector 10 while it is held in a central opening 68 in the ring. The mounting bracket, because of the adjustable feature of the clamp members 32, may be easily adjusted to fit varying sizes and shapes of support columns 12.

In large clear areas constructed without supporting posts 12 it may be necessary to utilize a laser beam projector support mechanism as illustrated in FIGS. 3 and 4. The support illustrated therein is basically a tripod 38 having a plurality of legs 40. Each of the legs is divided into an upper and lower section with the lower section being telescopically received and slidable into and out of the upper section. A mounting ring 36 having essentially the same configuration as that shown in FIG. 2 is fixed centrally of the tripod and rests on the

top thereof on a mounting ring adjustment assembly 42 which will be more fully described hereinafter. The laser beam generator 10 is vertically mounted (FIG. 4) in the support ring and held in position by the locking screw 37. The height of the laser beam generator is adjustable by extending the lower section of the legs 40 to the desired height, locking sections of the legs to secure them at the desired position.

Referring to FIG. 5, the mounting ring adjustment assembly 42 will be described in greater detail. The base portion 46 of the mounting ring 36 is provided with a plurality of adjustment screws 47 (two are shown, while four are preferable, spaced 90 degrees apart) which are threadably received in the case 46. A base support member 48 is mounted on the tripod 38 as shown in FIGS. 3 and 4 or on a mounting bracket 26 as illustrated in FIG. 2 below the mounting ring 36. In either event the base may be fixed to its supporting structure by means of a plurality of clamps 50 and screws 52 or in any other conventional, well-known manner. Adjustment screw support pads 54 are provided on the base 46 for the ends of the adjustment screws. The adjustment screws 47 may be turned to position the laser beam generator 10 in position such that the beam of light emitted therefrom is horizontal and level.

The laser beam generator is illustrated in FIG. 6 and may be of the type commercially available from Laser Alignment, Inc., of Grand Rapids, Mich., and which is most fully disclosed in commonly assigned, abandoned patent application Ser. No. 564 filed Jan. 5, 1970 and entitled, APPARATUS FOR GENERATING A PLANE OF LIGHT. The laser itself is housed in an elongated tube 56 and is designed to project a beam of light upwardly to a rotating prism arrangement 58 which bends the light at a 90° angle and projects it horizontally outwardly to sweep over the area in which the ceiling gridwork is to be installed. The rotating prism assembly 58 and a self-contained drive mechanism 58 therefor are fixed to the elongated tube 56 which houses the laser generator by means of a collar 60 held in place by fastening screws 62. A switch 64 is conveniently provided to turn the mechanism off when the generator is not in use.

A plurality of liquid filled levels 66 are mounted in a ring-like member which is affixed to the elongated tube 56 of the laser generator. The levels and ring are very precisely aligned with the light beam of the laser and are used in conjunction with the mounting ring adjustment assembly 42 illustrated in FIG. 5.

The preliminary setup of the laser beam generator is best illustrated with reference to FIGS. 2 through 6 wherein the laser generator is elevated to its desired height with respect to the floor 14 and the overhead structure 16. The laser beam generator 10 may be located on a support post 12, on a tripod 38, or in any other convenient fashion. The tube 56 is positioned in the opening 68 provided in the mounting ring 36 and once the prism assembly 58 is positioned at the desired height, the fastening screw 37 may be tightened to secure the laser generator 10 therein by the tube 56.

The adjustment screws 47 are then turned in and out, moving the laser generator with respect to the base support 48. When the levels 66 indicate that the laser generator 10 is perfectly level the knurled locking nuts 70 may be tightened against the base of the mounting ring 46.

Referring now to FIGS. 7 through 12, the various alternative target members 22, 22a, 22b and 22c will be described. The target is basically a translucent screen 72 preferably made from reinforced fiber glass approximately one-sixteenth of an inch thick. An opaque line 74 is horizontally drawn across the middle portion thereof. Fastening means 74 is attached to the upper portion of the screen 72 and is fixed by means of screws or rivets 78. The fastening means illustrated in FIG. 7 may be of the magnetic type commonly used for holding cabinet or cupboard doors closed. The magnetic fastener is rapidly and easily applied to the metallic gridwork 18 and does not damage the surface while remaining tightly held thereon.

The fastening means 74a illustrated in FIG. 10 on alternative target 22b is affixed by screws or rivets 78 and is of the "alligator" clip type with the opening between the jaws being formed at a right angle to the plane of the target. This type of fastener is particularly useful in installations wherein the supporting gridwork is made from a non-magnetic material such as aluminum. Also, it can be used by clipping it directly to the handle of a pair of pliers. In the embodiment shown in FIG. 9, the screen 72 of 22a is formed in a metal framework 80 and at one side thereof is provided with extended tabs 82 having a slot or opening 84 therebetween. The tabs provide a convenient tool for bending and tightening the wires 20 after the height of the gridwork is established. Referring to FIG. 11, it can be seen that the tabs 82 are bent out of the plane of screen 72, in opposite directions. This allows one to hold the target generally vertically while moving it along a wire 20 with the wire 20 in position in slot 84.

Referring to FIG. 12, there is illustrated a resilient C-shape clip member 90 often utilized in a well-known manner to adjustably support a channel iron 92 used in the construction of permanent type ceilings, such as plaster ceilings. The clip 90 is provided with an opening 94 in the back face of the "C" and is slidably mounted along a rigid rod member 96 fixed to the overhead structure. The target member 22c utilized in connection with clips of this type may be provided with a tapered magnetic plug 98 which is adapted for insertion in the opening 94 in the clip 90.

As a matter of convenience the opaque line 74 on the screen 72 is precisely located two inches below the upper gridwork engaging surface. A reflector 86 (FIG. 7) may be provided on one side of the screen for use when ambient lighting conditions are extremely high. The reflector has also been found to be extremely useful when installing the wall angles to the outer perimeter of the room.

METHOD OF OPERATION

Referring again to FIG. 1, the laser beam generator 10 is centrally positioned within the area in which the supporting gridwork for the ceiling is to be installed. The generator may be mounted by means of the bracket 26 (illustrated in FIG. 2) on the structural support column 12 or it may be mounted in the tripod 38 illustrated in FIGS. 3 and 4.

Once mounted, tube 56 is moved up or down with respect to mounting ring 36 until rotating prism assembly 58 is positioned to emit a laser beam at a desired level. The level selected has a predetermined distance relationship to the ultimately desired ceiling level. If target 22 of FIG. 7 is used, the prism assembly 58 is posi-

tioned to cast a beam in a reference plane which is the same distance below the ceiling level as line 74 is from the top of target 22. If target 22a is used, the reference plane for the rotating laser beam will be at the same height as is ultimately desired for the ceiling. This is because line 74 is directly in line with the wire bending slot 84.

When the leveling adjustments are made as described in connection with FIG. 5, the laser beam generator 10 is in condition to project a horizontal level beam B of light around the area as the rotatable prism 58 shown in FIG. 7 is set into operation.

The wall angles 19 are first set into position around the perimeter of the area by simply attaching a target member 22 to the lower edge of the angle and moving it into position such that the beam B strikes the target. The wall angle and target are moved up or down until the beam which presents a streak of light on the target is exactly positioned on the opaque line 74. The bracket is then fixed to the wall by suitable fastening means such as nails or adhesives. Many installers may be working around the perimeter of the area with complete assurance that each section of wall angle 19 will be level and at exactly the same height with respect to each other.

A section or runner of the supporting main runner 18 is then fixed at one end to the wall angle 19 and extends outwardly therefrom toward the opposite side of area. A supporting wire 20 is then hung from any nearby convenient location on the superstructure 16 and the free end of the wire is passed through a hole in gridwork runner 18. A target 22 is attached to the gridwork runner 18 and is moved into its proper level position by viewing the projected beam of light through the transparent screen and moving the grid and target until the streak of light is exactly in line with the opaque line 74 as previously described. The supporting wire 20 is then bent around the opening in gridwork runner 18 and is twisted to hold it in place. Subsequent gridwork runners are added in line with this previously hung runner. If desired, the target 22a illustrated in FIG. 9 may be used for this bending operation. Slot 84 is slipped over wire 20 and target 22a is moved along until the laser beam flashes across the face of screen 72 at the level of line 74. At this point, target 22a is twisted such that the tab 82 bends wire 20. Then, main runner 18 is slipped over the end of wire 20, i.e., by passing wire 20 through a hole in main runner 18. Finally, wire 20 is twisted around itself. While this procedure is not quite as ideal as that set forth above, the invention can be carried out in this fashion without the need for a great deal of scaffolding or without having to move a section of scaffolding over the same area twice. Operations may continue in this fashion until the entire area is provided with level, aligned main gridwork runners 18 at which time the cross "T"s and individual ceiling panels may be set in place. During either of these operations many installers working in the same area will be installing the respective sections to exactly the same reference line, that is, to the projected beam.

In order to make sure the main runners 18 are in proper alignment, two techniques can be used. Both involve establishing a single reference line or row relative to which all rows of runners 18 are suspended. The first is to direct a laser beam directly across the room along the desired line. The first row of main runners 18 are suspended on this beam line. Subsequent lines of main

runners 18 are then aligned by joining a cross "T" runner 18a of a given length to the first row of runners 18 and to the particular runner 18 being suspended parallel thereto. In this fashion, the rotating laser beam is used to establish proper elevation while proper line is insured by the fact that the cross "T"s 18a are of identical, fixed length and the first row of main runners 18 are known to be in a straight line.

In the alternative, a taut string can be used to establish line for the first row of main runners 18. It will be understood that this string is used only for establishing line for the first row, and is not used at all to establish elevation.

The wall itself could be used as a first reference line if it were erected using a laser beam. However, where this is not the case, the wall will be crooked and one of the above two techniques must be used to establish a proper line for the first row of gridwork runners 18 erected. The cross "T" runners 18a from this first row to the wall are then individually cut to appropriate lengths to reach the wall.

It should be noted that in some applications the ceiling superstructure will itself lie on a true line and the hanging wires 20 will hang vertically straight downward. Also, there will be situations where the wires 20 will be mounted in anchors which are somehow embedded in the ceiling. If the anchors are inserted on line, as by using a laser beam, wires 20 will hang vertically on the line desired for the main runners 18. When this is the case, target 22a can be used to bend the wires and the runners 18 can be slipped onto the wires 20 after they are bent.

In using target 22a, the vertically hanging wire is slipped into the slot 84. The target is slid along the wire until the laser beam hits line 75. Then, the wire 20 is bent using slotted tab 82.

Target 22b of FIG. 10 can be used by clipping it to a runner 18 or by clipping it to the handle of a pair of pliers. When clipped to a runner 18, target 22b is used like target 22. When clipped to a plier's handle, it is used like target 22a.

Finally, target 22c of FIG. 12 is used by inserting its tapered plug 98 into the opening 94 in clip member 90 and sliding the clip along the rod member 96 until the laser beam sweeps across the reference line 75.

As an actual practical demonstration of the utility of this invention, a suspended ceiling was installed in a large discount department store which was under construction. According to the estimates of the foreman there was a 30 percent time savings alone in overall installation time with a somewhat greater than 90 percent time savings in the leveling operation alone. Costs of installing such suspended ceilings can be considerably reduced when using the invention disclosed herein.

When ambient light conditions are high, the reflector 86 shown in FIG. 7 serves to enhance the visibility of the streak of light projected on the target. During normal conditions, however, the light streak is viewed through the target. Unlike the normal operations involved in installing suspended ceilings wherein the taut strings and levels were used for alignment and leveling requiring at least a certain amount of light for making measurements, the present invention can be operated in an area having minimal ambient light; in fact, the invention can be operated in near total darkness.

Having thus described the invention, it will become immediately obvious to those skilled in the art that the

invention not only provides a new, unique use for a laser, but additionally provides a new and unique method and apparatus for installing supporting structure for suspended ceilings. The method disclosed saves considerable time in installation and leveling procedures with a corresponding reduction in total labor costs.

Additional modifications and variations will naturally be suggested to those skilled in the art without departing from the scope of the invention which is defined by the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An apparatus for installing a gridwork for a suspended ceiling to supporting structure on a predetermined plane comprising:

a. a light generator for generating a narrow plane of collimated light;

b. means for supporting said light generator for projecting said plane of light along a plane parallel to the predetermined plane on which the suspended ceiling is to be installed; and

c. a target member removably fixable to said gridwork, said target member being movable with said gridwork and movable with respect to said level beam of light for moving the same into alignment therewith.

2. The apparatus of claim 1 in which the target member has a means for suspending itself downwardly from the gridwork to which it is secured.

3. The apparatus of claim 1 in which the target has a fastening means for securement to said gridwork and a depending light beam interceptor and indicator means depending therefrom.

4. The apparatus of claim 1 in which the light generator is a narrow beam light generator for projecting a straight beam of light and means is provided for causing said beam to be swept on an arc to generate a plane of light.

5. The apparatus as defined in claim 3 wherein the fastening means of said target member is a magnetic fastening means for securement to said gridwork.

6. The apparatus as defined in claim 3 wherein said target member has a slotted elongated tab-like extension along one side thereof forming a tool for permanently securing said gridwork to the overhead supporting structures.

7. The apparatus as defined in claim 3 wherein the fastening means of said target means is a clip member mounted for securement to said gridwork.

8. A target member for use in combination with a light beam projector for installing gridwork structure for suspended ceilings comprising:

a. a transparent screen for intercepting said light beam;

b. opaque indicator means on said screen; and

c. fastening means attached to said screen for securement to said gridwork.

9. A target member as defined in claim 8 wherein said fastening means is a magnetic fastening member for securement to said gridwork.

10. A target member as defined in claim 8 wherein said fastening means is a clip member mounted for removable securement to said gridwork.

11. A target member as described in claim 8 and further including a slotted tab-like extension along one

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edge thereof, said slotted extension forming a tool for forming the supporting structure for said gridwork.

12. A target member as defined in claim 8 and further including a reflector positioned on said screen adjacent said indicator means.

13. A target member as described in claim 11 in

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which said slotted tab includes a pair of spaced fingers defining said slot, said fingers being bent in opposite directions out of the plane of said screen whereby said target can be held generally vertically as it is slid along a hanging wire with said wire positioned in said slot.

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**UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION**

Patent No. 3,824,666 Dated July 23, 1974

Inventor(s) Roger J. Roodvoets, Edward G. Nielsen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, lines 33-35;

Delete "It is another object of this invention to provide an apparatus for utilization in the installation of suspended ceilings."

Col. 2, line 33;

Add --- Another object of the present invention provides a "working" level reference line to be utilized in conjunction with a target member for the installation of suspended ceiling structures. ---

Signed and sealed this 3rd day of December 1974.

(SEAL)

Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents