

# United States Patent

Sullivan et al.

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[54] **ASSEMBLY FIXTURE FOR  
CONSTRUCTING SUPERHEATER  
AND/OR REHEATER MODULES**

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[21] Appl. No.: **32,573**

[52] U.S. Cl. ....**29/202 R, 228/49, 269/132**  
[51] Int. Cl. ....**B23p 15/26**  
[58] Field of Search .....**29/202 R, 200 P, 200 J, 33 G, 29/159.4; 165/172, 173; 228/6, 47, 49; 269/55, 60, 82, 131, 132, 287, 299, 95**

[56]

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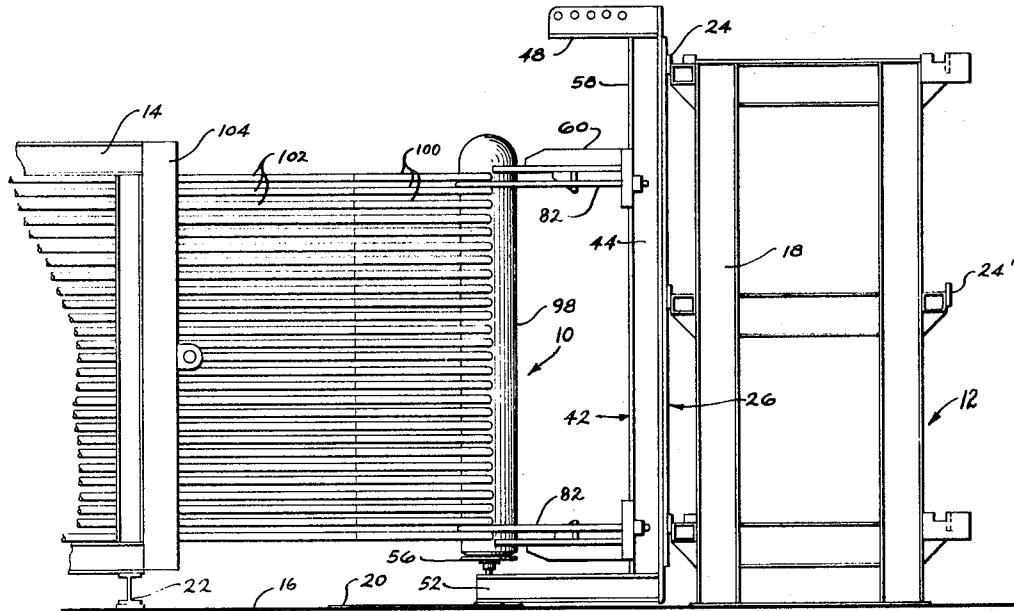
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[57]

## ABSTRACT

A fixture for shop assembly of superheater and/or reheat modules including a structural frame having accurately machined surfaces to enable exact positioning of a segment of a superheater or reheat header in a particular orientation with respect to a lifting and shipping frame mounted on a fixed reference base. The module may then be completed by placing individual superheater or reheat tube panels in the frame and joining them to the header.

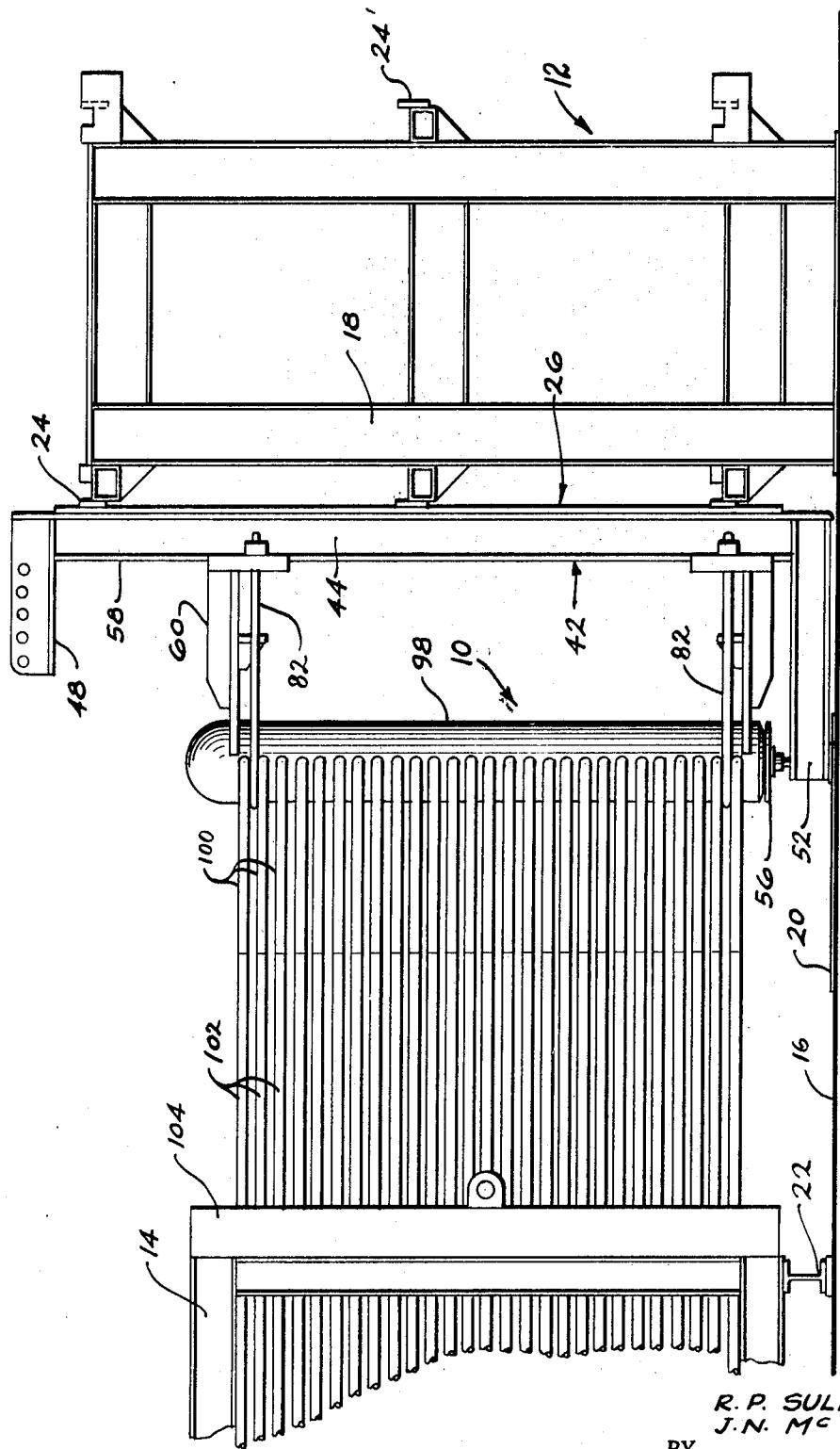
9 Claims, 9 Drawing Figures



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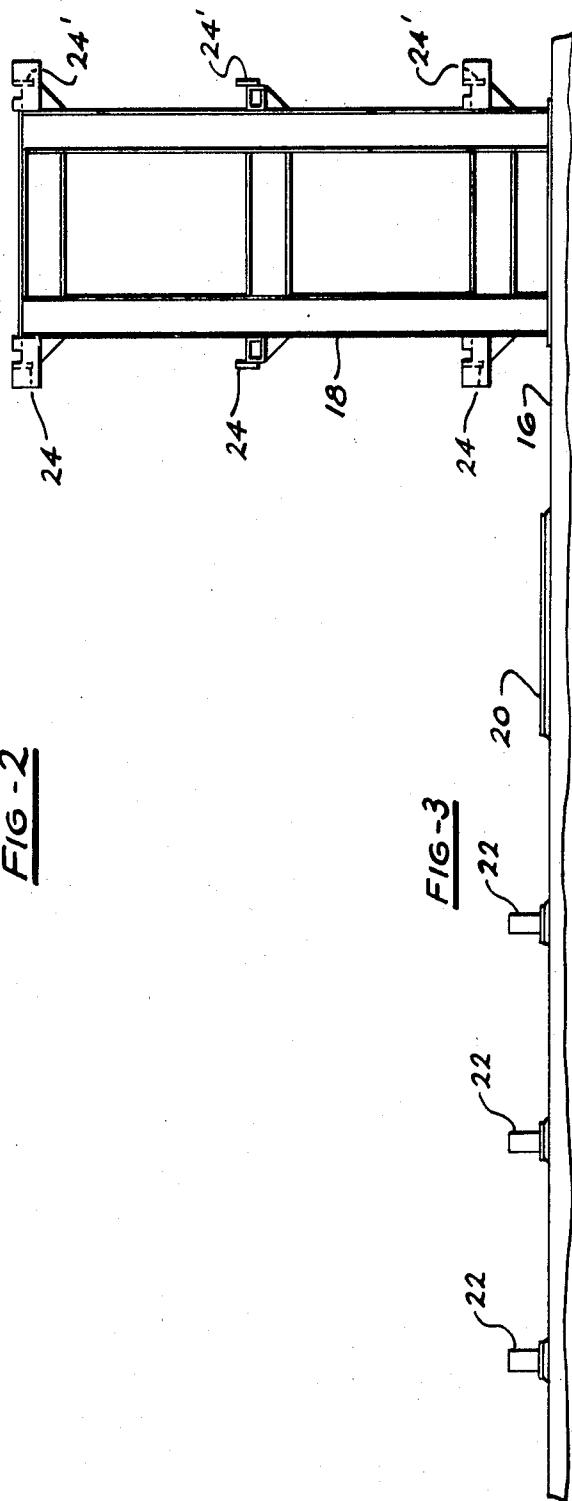
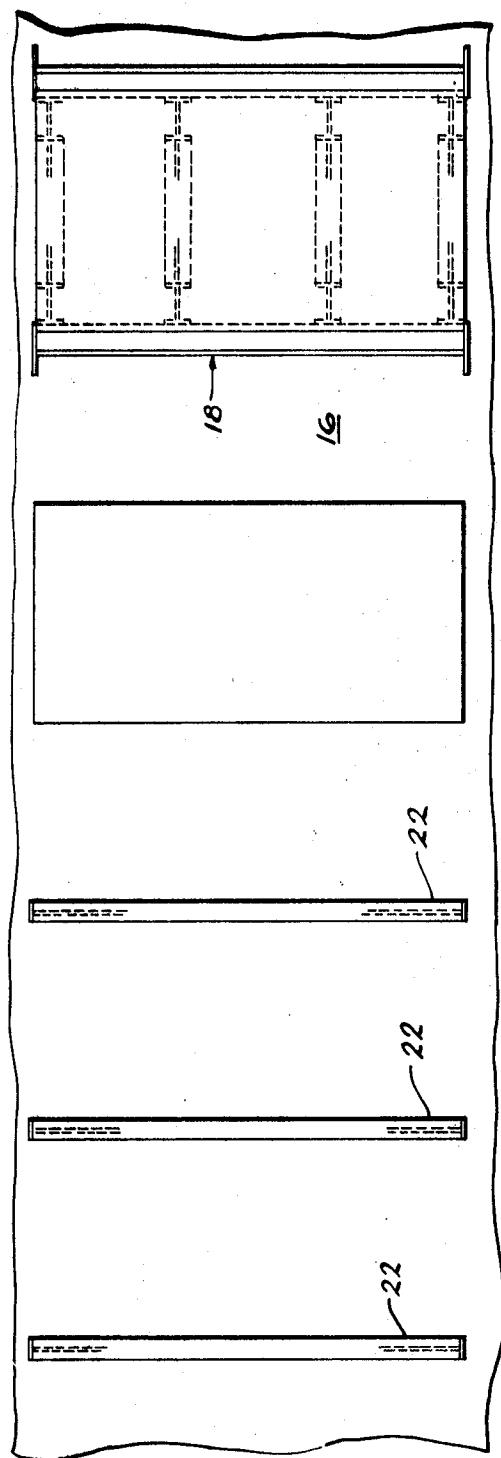


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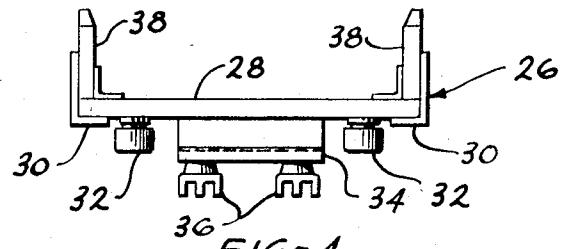


FIG-4

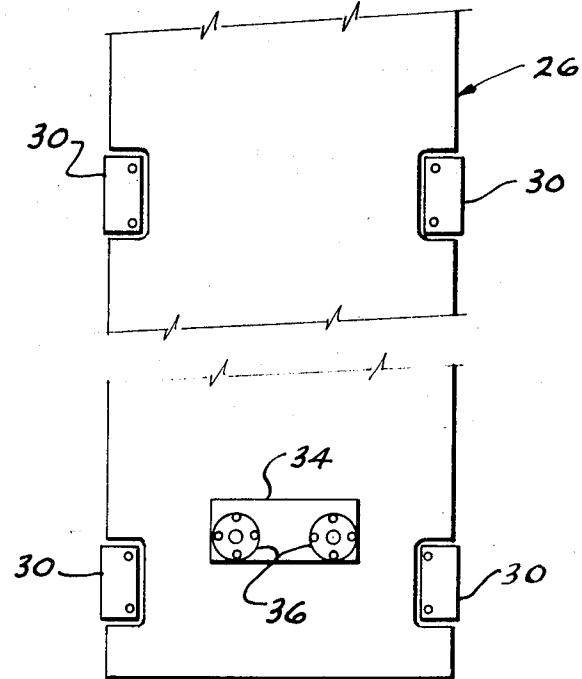
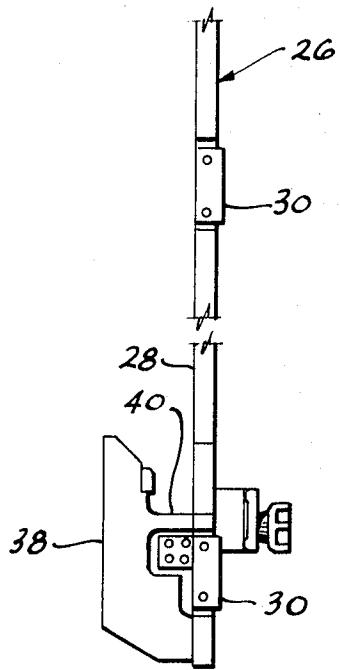
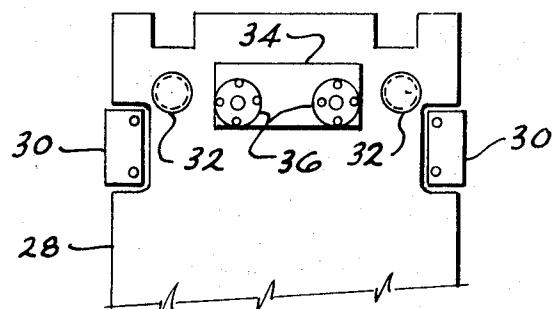
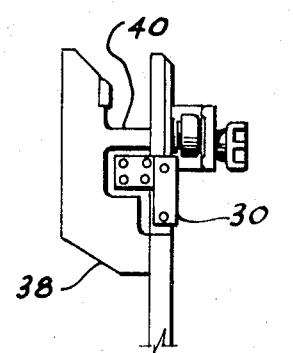


FIG-5

FIG-6

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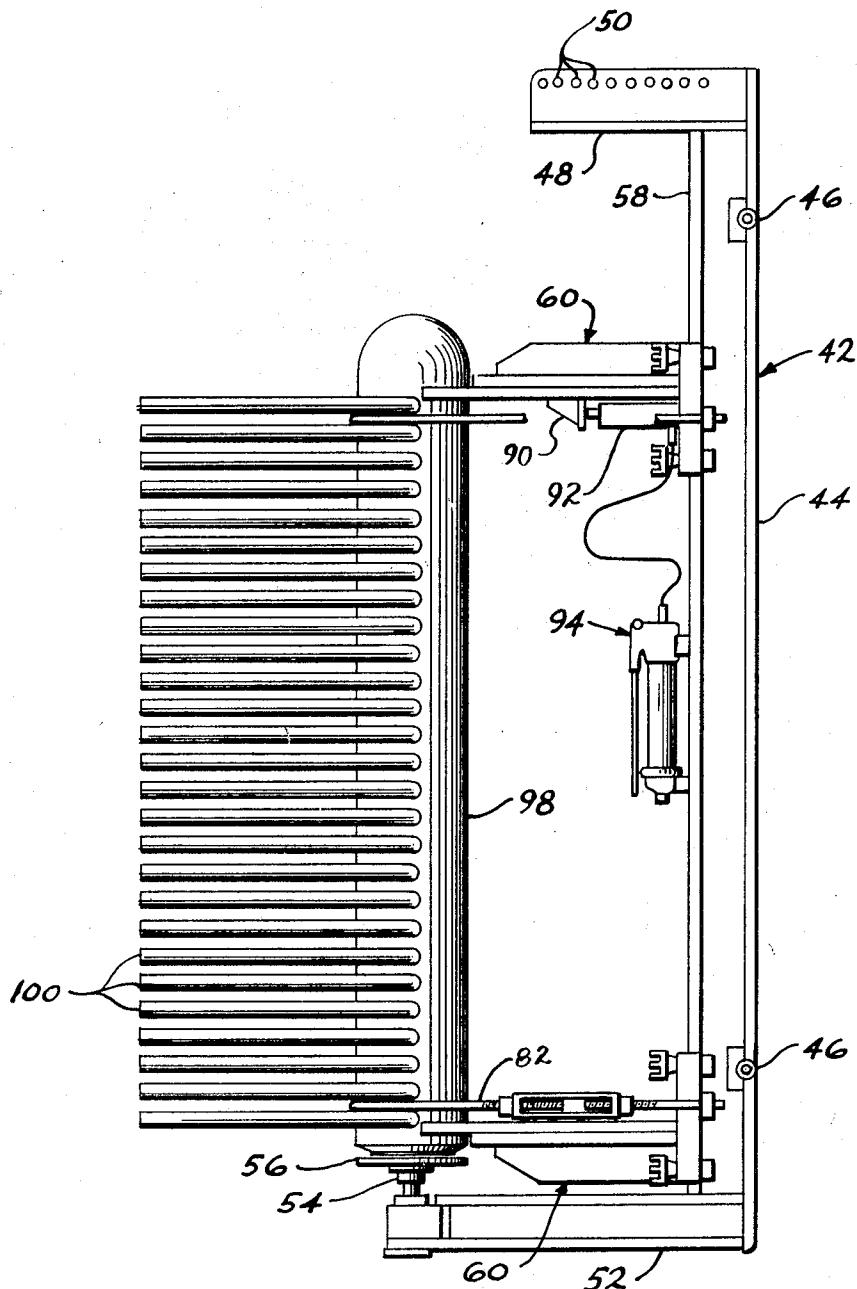


FIG-7

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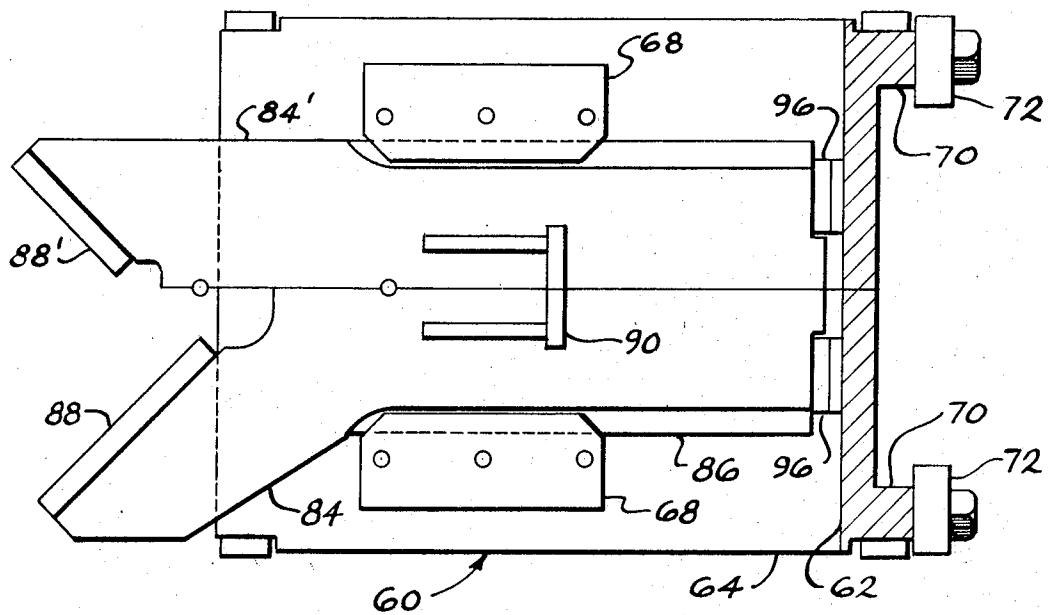


FIG-8

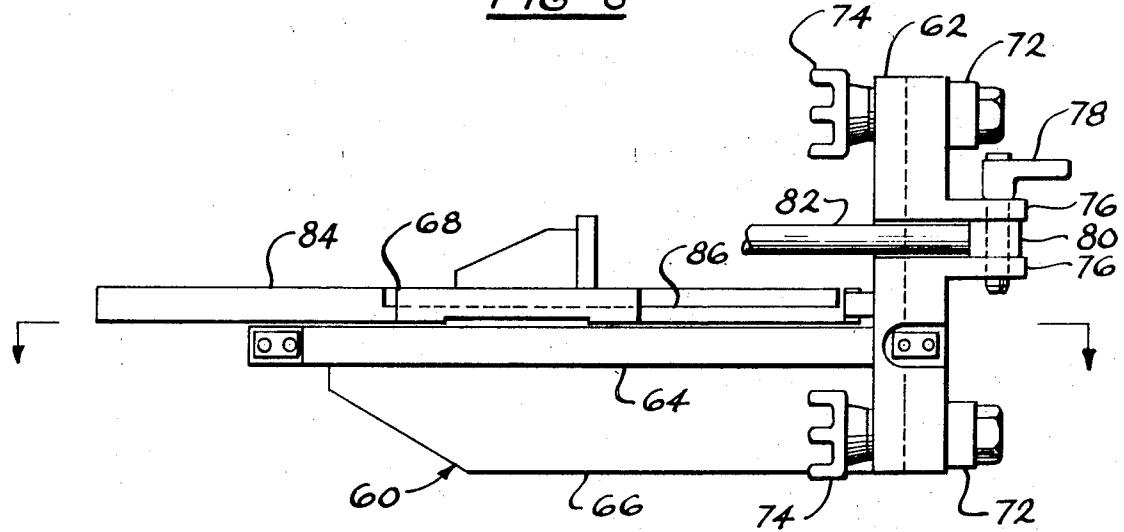


FIG-9

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## ASSEMBLY FIXTURE FOR CONSTRUCTING SUPERHEATER AND/OR REHEATER MODULES

### BACKGROUND OF THE INVENTION

The construction of boiler units for steam generation in utility power plants and large industrial facilities is accomplished directly at the location selected for the plant. This is due to the size and lack of standardized construction of these facilities. Field erection is expensive in that construction and erection equipment must be brought to the building site and erection efficiency is dependent upon a transient labor market of inconsistent quality.

The advantages of shop assembly, as opposed to field erection, have long been realized in the manufacture of industrial boilers of somewhat smaller size. Standard designs with standard designs with maximum use of standardized use of standardized fabrication procedures considerably reduces the cost of these units over comparably sized field erected units. Additionally, labor control is more readily accomplished so as to insure more reliable and efficient construction of the boiler equipment.

While overall economy of construction of utility plant and large industrial boilers is dependent upon many factors, in general there is an attempt to optimize this economy by utilizing shop assembly techniques where shipping considerations permit. Boiler components, and the procedures for the fabrication thereof, whenever possible are being standardized and moved into the shop so as to maintain more accurate control over their manufacture as well as reducing their cost.

When high final steam temperatures for the above-noted facilities are required, panel-type superheaters and reheaters are necessary to provide the required heat transfer surfaces. In the past, superheater and reheater construction for these boiler systems has necessarily been accomplished in the field. These superheater and reheater arrangements were constructed by hanging headers and then raising and welding individual tube panels thereto. This construction technique was not only expensive and time consuming but required a large number of accurate field welds by skilled welders which are not always available.

### SUMMARY OF THE INVENTION

It is the purpose of this invention to provide a novel apparatus which permits shop assembly of superheaters and/or reheaters for utility plants and large industrial boilers. A shop assembly fixture is provided which has specifically machined surfaces to enable accurate positioning of a segment of a superheater or reheater header in a vertical orientation with respect to a lifting and shipping frame. Individual tube panels are placed in the frame and joined to the header until a complete module is built up. The module may then be conveniently shipped to the erection site in its frame where it may be positioned and joined to similar modules to form the unitary superheater or reheater structure.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of the assembly fixture for constructing superheater and/or reheater modules according to this invention.

FIG. 2 is a plan view of the structural frame tower and module support of FIG. 1.

FIG. 3 is a side elevational view of the structure of FIG. 2.

FIG. 4 is a plan view of the mounting plate of FIG. 1.

FIG. 5 is a side elevational view of the mounting plate of FIG. 4.

FIG. 6 is a rear elevational view of the mounting plate of FIG. 4.

FIG. 7 is a side elevational view of the V-slide base of FIG. 1.

FIG. 8 is a plan view of the V-slide assembly of FIG. 1.

FIG. 9 is a side elevational view of the V-slide assembly of FIG. 8.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 1 shows an overall view of the assembly fixture for constructing superheater and/or reheater modules according to this invention. The superheater or reheater modules 10 are elements of a superheater or reheater structure for a large steam generator. The modules 10 are built up on an assembly fixture 12 in a lifting and shipping frame 14. On completion of each module 10 in the frame 14, a package is formed which facilitates handling and shipping of the modules to the erection site for final assembly into a unitary superheater or reheater structure.

The assembly fixture 12 comprises a structural frame tower 18 mounted on the fixed reference base 16 (FIG. 2). In relation to the tower 18 there is positioned a bed plate 20 and bed rails 22 on the fixed reference base 16 for support of the module 10 during assembly. The structural frame tower 18 has mounted thereon longitudinally oriented machined surfaces 24 accurately positioned with respect to the reference base 16. The tower 18 may have additional machined surfaces 24' mounted on the side opposite from V-slide assembly 60 relative to the V-slide base 42. The baseplate 62 additionally has bosses 76 through which a locking handle 78 extends. This locking handle 78 passes through an end connection 80 of a header retention cable 82 for the purpose to be explained hereinbelow.

A header locating plate 84 is positioned on the standard 64 and has tracks 86 which are engaged with guide bearings 68 of the V-slide assembly 60 so as to permit relative movement therebetween. The header locating plate 84 has a V-notch 88 in the outwardly extending end (FIG. 8 shows two half views of the header locating plate 84, the first header locating plate 84 with notch 88 for the purpose of supporting large headers and the second header locating plate 84' with notch 88' for smaller headers) and a ram reaction plate 90 mounted centrally thereon. As seen in FIG. 7, an hydraulic ram 92 actuated by an hydraulic actuator 94 is positioned between the ram reaction plate 90 and the baseplate 62 of the V-slide assembly 60 to control the position of the header locating plate 84. Blocks 96 (FIG. 8) are inserted between the header locating plate 84 and the baseplate 62 to maintain their relative positions.

The assembly fixture 12 is utilized in assembly of superheater or reheater elements or modules 10 in the following manner. A segment of the superheater or reheater header 98 having tube nipples 100 extending therefrom is positioned on the header locating plates 84 of the V-slide assemblies 60, the V-slide assemblies in turn being positioned on the V-slide base 42 so as to support the ends of the header 98 and clamped in the supporting position by clamps 74. The header 98 is retained against the header locating plates 84 by the header retention cables 82 which are locked by the locking handles 78. The end of the header 98 is supported by the header support means 56 and longitudinal positioning jack 54.

After the hydraulic jack 92 is actuated to move the header locating plate 84 to accurately position the header 98 with respect to the base 44 of the V-slide base 42, the V-slide base 42 is lifted by means (not shown) engaging the lifting holes 50 in the upper extension 48 lifting and positioning the guide rollers 46 into the machined surfaces 24 in order to accomplish simultaneous construction of several modules at one time.

A mounting plate assembly 26 is particularly supported by the structural frame tower 18 so as to maintain an accurate relationship with the reference base 16. As best seen in FIGS. 4-6, the mounting plate assembly 26 comprises a mounting plate 28 which has accurately machined surfaces 30 positioned thereon so as to mate with the machined surfaces 24 to provide the desired accurate support therebetween. At the top portion of the plate 28 are mounted rollers 32 which serve to support the mounting plate assembly 26 and permit transverse adjustment thereof along the machined surfaces 24. Additionally, the plate 28 has horizontal guides 34 which assist in

the support and guiding of the mounting plate assembly 26. The horizontal guides 34 have clamp means 36 so as to secure the position of the mounting plate assembly 26 with reference to the structural frame tower 18 and the shipping frame 14 when proper transverse positioning is accomplished. Extending from the plate 28 are V-slide base supports 38 which have particularly shaped notches 40 in the upper portions thereof for the purpose of accurately supporting the V-slide base 42.

The V-slide base 42 (best shown in FIG. 7) which serves to support the header segment of module 10 is comprised of a structural base 44 upon which are mounted guide rollers 46 which engage the notches 40 of the V-slide base supports 38 of the mounting plate assembly 26. The base 44 has an upper extension 48 which in turn has a series of holes 50 to permit lifting and positioning of the V-slide base 42. Additionally, the structural base 44 has a lower extension 52 which supports a longitudinal positioning jack 54 and a header support means 56.

The structural base 44 has an integral slide track 58 upon which V-slide assemblies 60 may be positioned. The V-slide assembly 60, as best seen in FIGS. 8 and 9, is comprised of a baseplate 62 having a standard 64 extending outwardly therefrom supported by web 66. The standard 64 has guide bearings 68 mounted thereon. The baseplate 62 of the V-slide assembly 60 has guides 70 formed by blocks 72 affixed to the baseplate 62. These guides 70 ride on the slide track 58 so as to be adjustably positionable thereon. Clamp means 74 serve to secure the position of the notches 40 of the mounting plate assembly 26 to accomplish the correct relative positioning therebetween. The mounting plate 26 is accurately positioned on the machined surfaces 24 of the structural frame tower 18 and clamped in position so that the header 98 is mounted in a vertical orientation and a fixed position relative to the structural frame tower 18. The longitudinal positioning jack 56 may then be utilized to position the header 98 with respect to its height above the fixed reference base 16. With the header so positioned, a lifting and shipping frame 14 is particularly positioned on the bed rails 22 so as to permit tube panels 102 for the superheater or reheat module 10 to be accurately positioned relative to the header 98 to build up the module 10.

After the lifting and shipping frame 14 is positioned on the bed rails 22, a first tube panel 102 is positioned in the frame 14 and welded to the corresponding nipple 100 on the header 98. The welding is accomplished by clamping the tube panel 102 to the respective tube nipples, tack welding the tubes and tube nipples, removing the clamps and completing the welding. After the welding of the first tube panel is completed, the next tube panel 102 is positioned in the frame 14 and the procedure is repeated until a complete module 10 is built up. There may be included with the tube panels 102 sealing means (not shown) serving to form the sealing wall of the boiler casting which are integrally welded together as the module is built up. When the module is complete, the shipping frame 14 may be completed and the entire unit positioned for shipping by the manipulation of the lifting and shipping frame 14.

In the assembly of certain superheater or reheat arrangements, header segments are positioned on each end of the tube panels. This type assembly is easily accomplished by providing a second mounting plate, V-slide base, and V-slide assembly supporting a second header segment. The second header segment is accurately positioned on the machined surfaces 24 by the mounting plate and relates structure to be particularly located relative to the reference base 16 and the first header segment. The tube panels can then be readily joined to each header segment to form the desired superheater or re-

heater module configuration.

In view of the above, it can be seen that there is provided a novel means for shop assembling superheater and/or reheat modules. By providing a structural frame tower with accurately machined surfaces, it is possible to position a segment of a superheater or reheat header in a particular vertical orientation with respect to a lifting and shipping frame. With the header so positioned, tube panels can accurately be joined to the header so that the module can readily be built up in a shop environment.

10 While this preferred embodiment of the invention has been shown and described, it will be understood that it is merely illustrative and that changes may be made without departing from the scope of the invention as claimed.

15 We claim:

1. An apparatus for shop assembly of superheater or reheat modules comprising:

a fixed reference base, a first support means mounted on said base, an upstanding structural frame tower mounted on said base, accurately machined surfaces particularly positioned on said structural frame tower, a second support means for supporting in a vertical orientation a segment of a header to which tubes supported by said first support means are to be joined to form said superheater or reheat module, and means for accurately positioning said second support means on said machined surfaces of said structural frame tower so as to maintain a particular relationship to said first support means.

2. The apparatus of claim 1 wherein said accurately machined surfaces include plural transverse elements fixed to said structural frame tower at spaced vertical intervals.

3. The apparatus of claim 2 wherein the means for positioning said second support means includes at least one mounting plate, said at least one mounting plate supported by and transversely movable with respect to said machined surfaces of said structural frame tower, said mounting plate further having complementary accurately machined surfaces mating with said machined surfaces of said structural frame tower.

35 4. The apparatus of claim 3 wherein the means for positioning said support means includes plural mounting plates, relatively movable with respect to each other for accurate relative positioning thereof.

40 5. The apparatus of claim 3 wherein said second support means further includes a header support base mounted on said at least one mounting plate.

45 6. The apparatus of claim 5 wherein said header support base includes a longitudinal trackway and a plurality of V-slide assemblies mounted on said trackway for selective relative movement with respect thereto.

50 7. The apparatus of claim 6 wherein said V-slide assemblies include a baseplate slidable along said longitudinal trackway, a standard extending outwardly from said baseplate, said standard having guide bearings thereon, a plate slidably mounted in said guide bearings having a V-shaped notch in one end opposite said baseplate for adjustable support engagement with said header, and a retention means for retaining said header against said V-shaped notch.

55 8. The apparatus of claim 7 wherein said retention means is an adjustable cable means entrained about said baseplate and fixed at its ends to said base.

60 9. The apparatus of claim 7 wherein said header support base further includes a first jack means for moving said plate of said V-slide assemblies in said guide bearings, and a second jack means for positioning said header longitudinally with respect to said header support base.

\* \* \* \* \*

UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,644,978

Dated February 29, 1972

Inventor(s) Robert P. Sullivan and John N. McClain

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

Column 1, line 16, of the patent, delete "Standard designs with".

Column 1, line 17, of the patent, delete "standardized use of".

Column 3, line 63, of the patent, change "relates" to --related--.

Column 4, line 59, of the patent, change "baseplate" to --header--.

Column 4, line 60, of the patent, change "base" to --baseplate--.

Signed and sealed this 18th day of December 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.  
Attesting Officer

RENE D. TEGTMAYER  
Acting Commissioner of Patents