This invention relates to the art of supports and, more particularly, to a spring device for supporting piping and similar loads that are subjected to generally vertical movement in use. The invention pertains, in one of its more specific aspects, to a variable spring support device having improved and simplified means for readily and conveniently converting the device into a rigid support unit for hydrostatic test and other purposes and for reconverting the device into a yielding support, as desired.

The present invention may be employed in various locations. It is especially useful in power plants and other places for supporting piping while permitting movement of the piping as a result of expansion or contraction thereof due to temperature changes in the material of the piping.

Variable spring supports have been used for many years to support piping loads. Such devices usually comprise a housing having lower and upper walls and side walls extending between and secured to the lower and upper walls. Positioned within the housing is a movable spring backing plate that is connected to a load rod which extends through the lower wall. A compression spring is positioned between and engages the lower housing wall and the backing plate.

It is frequently desirable to precompress the spring and temporarily secure the backing plate against movement in either direction away from its designed "cold" load position at the time the device is assembled and prior to installation. This facilitates installation and reduces the possibility of subjecting the device to excessive overloading at the time of installation.

It is known to the art to secure the backing plate, with the spring in precompressed condition, with the aid of various arrangements. One such arrangement contemplates affixing a pair of nuts to and above the backing plate and engaging the nuts by means of corresponding bolts which extend through openings in the housing side wall. This arrangement is unsatisfactory and objectionable for several reasons: firstly, it is usually tedious and time-consuming to align the bolts with the tapped nuts; secondly, the nuts, by virtue of their projecting above the movable plate, necessitate increasing the height of the device, thereby calling for taller devices and consuming valuable headroom which is frequently very limited; thirdly, the arrangement does not in any way indicate whether the loading on the device, after installation and prior to removal of the bolts, is in balance, overloaded or underloaded; fourthly, tools are required in applying the bolts to the device at the time of assembly and in removing the bolts from the device at the time of installation; and fifthly, the bolts constitute hazards which may result in damage to equipment or injury to workmen at the time they are removed from the device, depending on whether the device is underloaded or overloaded.

The spring support device of this invention successfully overcomes the above-mentioned objections in that it includes improved and simplified means for readily and conveniently converting the device into a rigid support at any time prior to installation and into a yielding support at the time of installation. In accordance with the present invention, the spring backing plate is preferably formed with a pair of circumferentially spaced blind openings which extend inwardly from its periphery. Each blind opening is adapted to receive a corresponding pin connector which extends through a corresponding opening in the side wall of the housing. The openings in the backing plate and in the side wall of the housing are larger than the cross sectional areas of corresponding pins, thereby facilitating insertion and removal of the pins, as desired, without the aid of any tool, without increasing the height of the device to accommodate additional internal parts. Also, the parts of the device are so configured and arranged that the exposed portions of the pins, i.e., the portions thereof exterior the housing, serve as visual indicators, at the time of installation and prior to removal, of whether the device is overloaded, underloaded or substantially in balance with the load.

It is the primary object of this invention to provide a spring support device with improved and simplified means for readily and conveniently converting the device into a rigid support and for reconverting the device into a yielding support, as desired.

Another object of this invention is to provide a spring support device, having a movable backing plate, with removable connector means for maintaining the backing plate in a selected, substantially fixed position relative to other parts, the connector means being so constructed and arranged as to indicate visually whether the device is overloaded, underloaded or substantially in balance with a load carried by the device.

A further object of this invention is to provide a means of the character indicated which is simple and compact in design, which is reasonable in manufacturing cost, which may be readily placed into and out of active service, without the use of tools; and which is adapted to perform its intended functions in a dependable manner.

The enumerated objects and other objects, together with the advantages of this invention, will be readily understood and appreciated by persons skilled in the art from the following detailed description and the annexed drawings which respectively describe and illustrate a recommended form of spring support device of this invention.

In the drawing, wherein like reference numerals denote corresponding parts throughout the several views:

FIG. 1 is a view in elevation of a spring support device constructed in accordance with this invention, partly broken away and partly in cross section for better illustration;

FIG. 2 is a view taken along line 2—2 of FIG. 1.

FIG. 3 is a view taken along line 3—3 of FIG. 2 and illustrates the relative position of certain parts when a load is evenly supported by the spring support device, i.e., the load and the force exerted by the device are in balance;

FIG. 4 corresponds to FIG. 3 and illustrates the relative position of the parts when a load is oversupported by the spring support device; and

FIG. 5 also corresponds to FIG. 3 and illustrates the relative position of the parts when a load is undersupported by the spring support device.

Referring initially to FIGS. 1 and 2 of the drawing, a housing, which is generally denoted by numeral 10, includes a lower wall 11 and 12, respectively. The lower wall has a circular, central, through opening 13. The upper wall is formed with an integral depending boss 14 and is provided with a central through tap 15. The housing also includes a pair of vertical side walls 16 and 17 which are spaced apart, as indicated at 18 and 19. Side wall 16 includes a through opening 20 (FIG. 3) which is adjacent space 18 and side wall 17 has a like opening 21 which is adjacent space 19. Openings 20 and 21 are preferably diametrically opposite each other and are equidistant from the housing lower wall. These openings are preferably circular in the inter-
est of manufacturing economy but may, if desired, be oval, square or any other suitable configuration. Side wall 16 is welded to the lower and upper walls, as indicated at 16a and 16b, respectively, while side wall 17 is similarly welded to the lower and upper walls, as indicated at 17a and 17b, respectively, to obtain a sturdy and durable housing construction. As is best shown in FIG. 2, the side walls are arcuate in transverse cross section.

An indicator plate 22 is mounted along a vertical edge of side wall 17 by means of screws 23. This plate is provided with a scale having a series of graduations 24 for indicating the weight of the load carried by the device and/or the distance traveled by the load.

Housing 10 is equipped with an eye bolt 25 which engages the threads of tap 15 and which is provided with a lock nut 26. If desired, the eye bolt may be permanently secured to the housing upper wall by a weldment 27. Eye bolt 25 serves as a means for suspending the housing and the parts carried thereby from an overhead structural member, such as a building beam (not shown).

Positioned within the housing is a spring backing plate 30. This plate is in the form of a dish, having a central through opening 31 and formed with a continuous flange 32. Integral with flange 32 is a lateral extension 33 which projects into space 18 and which is formed with a beveled edge portion 34 that constitutes an indicator which cooperates with graduations 24 to indicate load weight and/or load travel.

Diametrically opposed portions 35 and 36 of flange 32 are thickened, as shown in several views, and are provided with blind openings 37 and 38, respectively. These openings extend inwardly from the periphery of the flange. As in the case of openings 20 and 21, openings 37 and 38 are preferably circular in transverse configuration, but may be of any other desired configuration. It will be observed from an examination of FIG. 3 that openings 37 and 38 are adapted to be aligned with openings 20 and 21, respectively.

A helical compression spring 40 is interfaced between and against housing lower wall 11 and backing plate 30.

A load-carrying unit 41 (FIG. 1) includes a threaded upper rod 42, which extends through backing plate opening 31 and which has a head 43 that bears against the upper surface of the backing plate. The load-carrying unit also includes a threaded lower rod 44 and a turnbuckle 45 which engages the lower end portion of rod 42 and the upper end portion of rod 44. Rod 44 is adapted to be connected to a piping or other load (not shown). The turnbuckle serves as a means for varying the effect length of the load-carrying unit.

The device is equipped with a pair of connectors 46 for releasably coupling backing plate 30 to the housing whereby to maintain the backing plate in a predetermined position with respect to the housing against the action of spring 40. Each connector 46 is in the form of a pin consisting of a rectilinear Shank 47 and a head 48. Each Shank 47 is smaller in cross section than the transverse area of corresponding openings 20, 21, 37 and 38.

It will be noted from an examination of FIGS. 2 through 5 that one of connectors 46 extends through opening 20 in housing side wall 16 and projects into opening 37 of plate 32, and the other connector extends through opening 21 in housing side wall 17 and projects into opening 38 of the plate member. Inasmuch as the shanks of the connectors are smaller than the corresponding openings in the housing and in the plate member, the connectors may be readily inserted in or removed from their openings when the parts of the device are substantially properly aligned, as illustrated in FIG. 3, by hand and without the use of tools.

In practice, the device is assembled and, at any time prior to installation, the parts are disposed in "cold" load position, as shown in FIG. 1. This is accomplished by exerting a pulling action on load-carrying unit 41, thereby moving backing plate 30 downwardly against the action of spring 40 until openings 20 and 21 are respectively in alignment with openings 37 and 38 (FIG. 3) at which time connectors 46 are inserted into the corresponding openings.

The device is installed by connecting eye bolt 25 to an overhead support, such as a beam (not shown), and by connecting rod 44 of the load-carrying unit to a piping load (also not shown). Connector pins 46 indicate visually whether the loading on the device is in balance or whether the device is overloaded or underloaded. When the loading is in balance, the pins assume a substantially horizontal position, as shown in FIG. 3. When the load is oversupported, the pins assume the relative position shown in FIG. 4 and are tilted in corresponding downward and outward directions. Such tilting serves as a visual indication that the load is oversupported and that the device is underloaded.

When the load is undersupported, the pins assume the relative position shown in FIG. 5 and are tilted in corresponding upward and outward directions, thereby indicating visually that the device is overloaded.

When the parts are in the relative position shown in either of FIGS. 4 and 5, they may be relatively adjusted by turning turnbuckle 45 to thereby decrease or increase the effective length of the load-carrying unit and move backing plate 30 until the parts are in the relative position shown in FIG. 3. With the parts in this position, connector pins 46 may be readily withdrawn by hand. This completes the installation and the device affords a yielding support to the load.

From the foregoing, it is believed that the objects, advantages, construction and operation of my present invention will be readily comprehended by persons skilled in the art without further description. Though the invention has been herein shown and described in a simple and practicable form, it is recognized that certain parts thereof are representative of other parts which may be used in substantially the same manner to accomplish substantially the same results. Therefore, it is to be understood that the invention is not to be limited to the exact details described herein, but is to be accorded the full scope and protection of the appended claims.

1 claim:

1. In a spring support device, a housing comprising a lower wall and upper wall spaced from the lower wall and side wall means connected to the lower and upper walls, said side wall means having at least one through opening formed therein, a backing plate within the housing and movable in the space between the lower and upper walls, said backing plate having at least one opening formed therein, compression spring means within the housing and bearing against the lower wall and the backing plate, a load-carrying unit connected to the backing plate and extending through the spring means and through an aperture in the lower wall, and a removable connector including a substantially rectilinear Shank which extends through the opening in the side wall means and projects into the opening in the backing plate, the cross sectional area of the Shank being sufficiently smaller than the transverse area of either of said openings to permit tilting of the connector depending on the loading on the compression spring.

2. A spring support device according to claim 1 wherein the opening in the backing plate extends inwardly from the periphery thereof.

3. In a spring support device, a housing comprising a lower wall, an upper wall spaced from the lower wall and side wall means connected to the lower and upper walls, said side wall means having at least one through opening formed therein, a backing plate within the housing and movable in the space between the lower and upper walls, said backing plate having at least one blind opening extending inwardly from its periphery, compression spring means within the housing and bearing against
the lower wall and the backing plate, a load-carrying unit connected to the backing plate and extending through the spring means and through an aperture in the lower wall, and a removable connector including a substantially rectilinear shank which extends through the opening in the side wall means and projects into the opening in the backing plate, the cross sectional area of the shank being sufficiently smaller than the transverse area of either of said openings to permit tilting of the connector depending on the loading on the compression spring, and a load-carrying unit connected to the backing plate and extending through the spring means and through an aperture in the lower wall.

4. A spring support device according to claim 3 wherein the shank is substantially longer than the distance from the outer end of the through opening to the inner end of the blind opening whereby a substantial portion of the shank is positioned exterior of the housing.

5. A spring support device according to claim 3 wherein the connector also includes a head at one end of the shank and positioned exterior of the housing side wall means, and wherein the shank is substantially longer than the distances from the outer end of the through opening to the inner end of the blind opening, whereby the head of the connector is spaced from the outer surface of the housing.

6. In a spring support device, a housing comprising a lower wall, an upper wall spaced from the lower wall and side wall means connected to the lower and upper walls, said side wall means having a pair of through openings formed therein, said openings being angularly spaced about a vertical axis through the center of the lower wall, a backing plate within the housing and movable in the space between the lower and upper walls, compression spring means within the housing and bearing against the lower wall and the backing plate, said backing plate being generally parallel to the lower wall and having a pair of spaced blind openings extending inwardly from its periphery, each blind opening being in general alignment with a corresponding through opening, a pair of removable connectors, each connector including a substantially rectilinear shank which extends through a through opening and projects into a corresponding blind opening, the cross sectional area of the shank of each connector being sufficiently smaller than the transverse area of the corresponding through opening and of the corresponding blind opening to permit tilting of the connectors depending on the loading on the compression spring, and a load-carrying unit connected to the backing plate and extending through the spring means and through an aperture in the lower wall.

7. A spring support device according to claim 6 wherein said through openings are substantially coaxial and equi-distant from the lower wall.

8. A spring support device according to claim 6 wherein each shank is substantially longer than the distance from the outer end of the corresponding through opening and the inner end of the corresponding blind opening whereby a substantial portion of each shank is positioned exterior of the housing.

9. A spring support device according to claim 6 wherein each connector also includes a head at one end of the shank and positioned exterior of the housing side wall means, and wherein each shank is substantially longer than the distance from the outer end of the corresponding through opening and the inner end of the corresponding blind opening whereby each head is spaced from the outer surface of the housing.

10. A spring support device according to claim 6 wherein said through openings are substantially coaxial and equi-distant from the lower wall, wherein each connector also includes a head at one end of the shank and positioned exterior of the housing side wall means, and wherein each shank is substantially longer than the distance from the outer end of the corresponding through opening and the inner end of the corresponding blind opening whereby each head is spaced from the outer surface of the housing.

References Cited in the file of this patent

UNITED STATES PATENTS

2,397,094 Donkersley et al. Mar. 26, 1946
2,713,982 Sherbrooke July 26, 1955
3,000,600 Suozzo Sept. 19, 1961