United States Patent

McKee et al.

[15] 3,680,156

[45] Aug. 1, 1972

[54] **SUSPENSION SYSTEM**

[72] Inventors: **Herbert A. McKee,** Collingswood, N.J.; **Charles E. Kensil,** Philadelphia; **Walter B. Udell,** Melrose Park, both of Pa.

[73] Assignee: **said McKee, Kensil and Udell,** part interest to each

[22] Filed: **March 9, 1970**

[21] Appl. No.: **17,383**

Related U.S. Application Data

[62] Division of Ser. No. 645,454, June 12, 1967, Pat. No. 3,503,389.

[52] **U.S. Cl.**.....**5/238,** 5/309

[51] **Int. Cl.**.....**A47c 21/00,** A47c 23/00, A47c 31/00

[58] **Field of Search** 5/210, 238, 309; 297/452; 128/33; 248/20–22

[56] **References Cited**

UNITED STATES PATENTS

2,543,043	2/1951	Militello	5/210 X
3,110,464	11/1963	Baratoff et al.	248/20
3,116,495	1/1964	Cross	5/238 X
3,275,131	9/1966	Erickson	248/22 X
3,426,370	2/1969	Underdown, Sr.	5/309 X

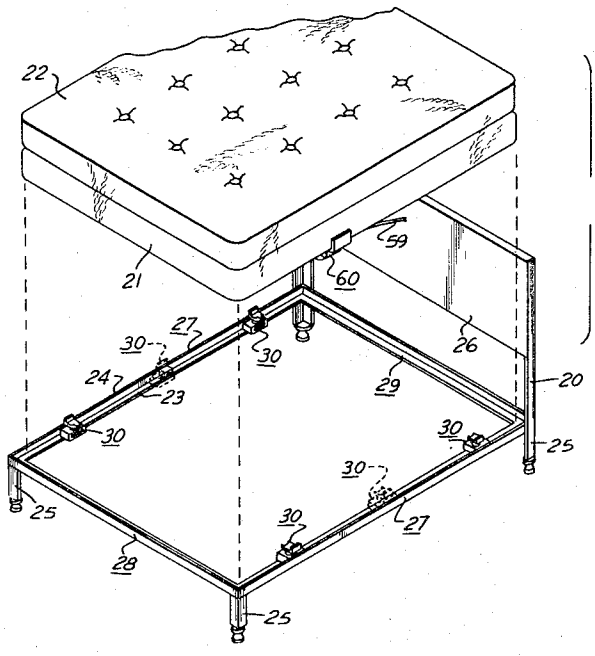
Primary Examiner—Casmir A. Nunberg

Attorney—Edelson and Udell

[57] **ABSTRACT**

A plurality of resilient supports or floats are interposed between a body structure such as the box spring of a bed and the bed frame to float the box spring and mattress, and may if desired be used in conjunction with an electrically energizable vibrator clamped to the box spring base to impart vibrations to the entire box spring and mattress when energized. The positioning of the floats and the vibratory characteristics thereof affect the vibrational amplitude and direction which may be generated at different points on the support structure. A resilient rubber column of 30 to 50 durometer is used in each float and provides for movement with three degrees of freedom. Optimum general usage of the suspension system is provided by two floats on each side of the box spring endspaced inward from head and foot , and when used, the vibrator is preferably clamped to one side of the box spring base.

6 Claims, 11 Drawing Figures



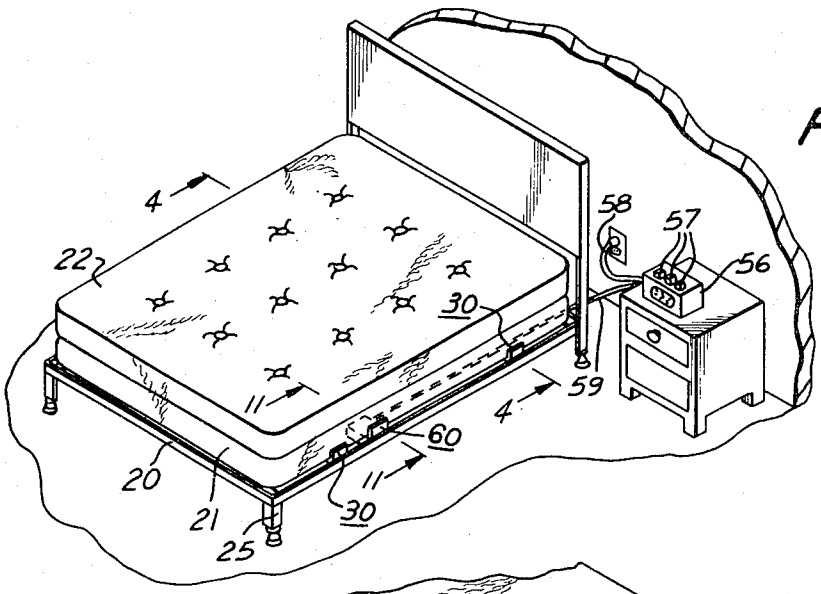


FIG. 1

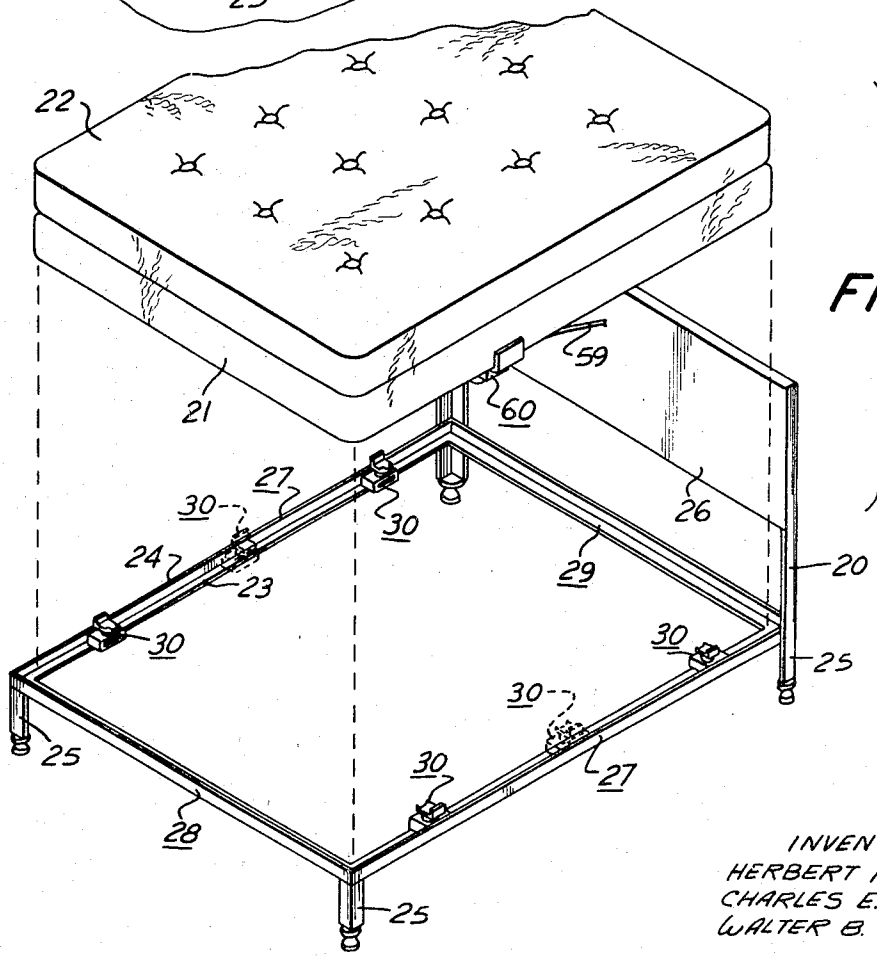
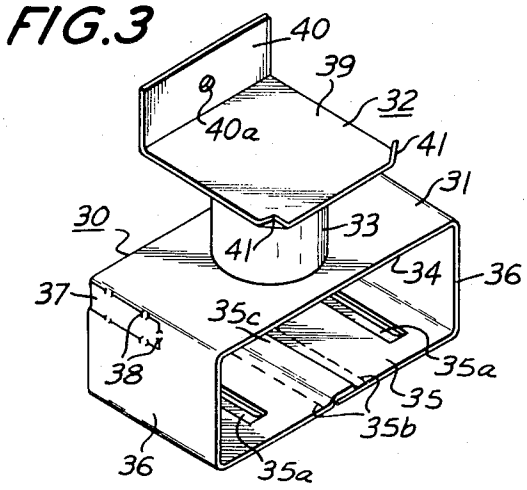


FIG. 2

INVENTORS.
HERBERT A. McKEE
CHARLES E. KENSIL
WALTER B. UDELL

Walter B. Udell
ATTORNEY

FIG.3



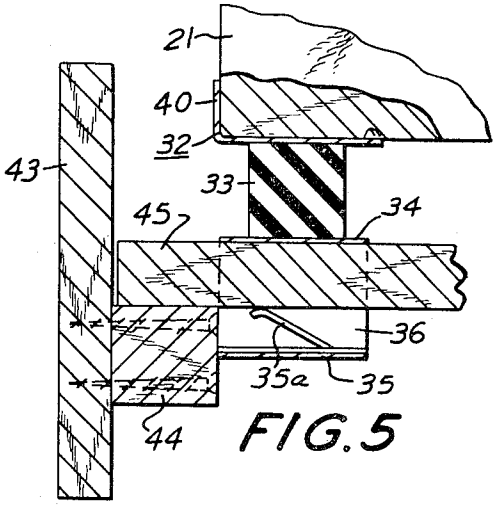
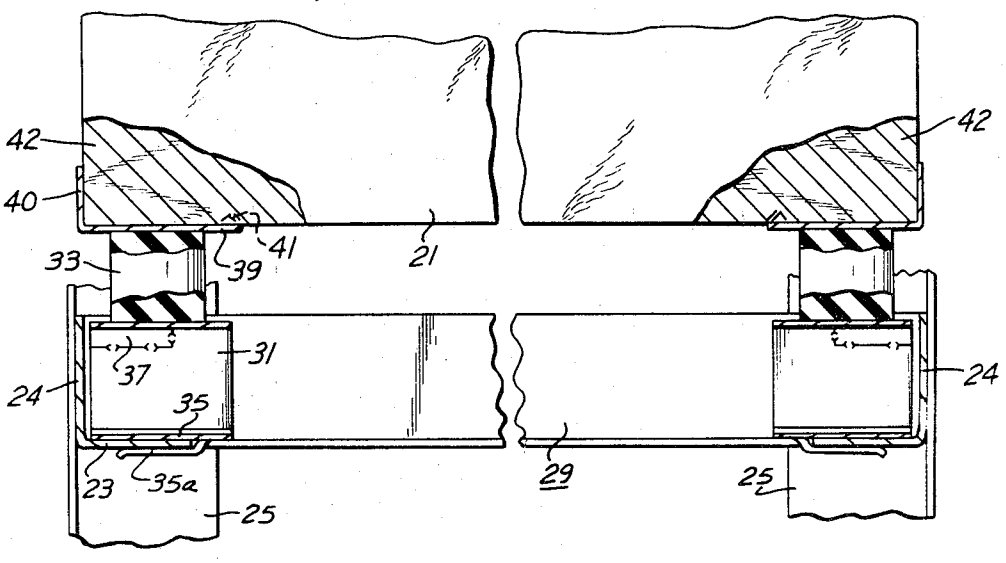


FIG.5

FIG.4



INVENTORS.
HERBERT A. McKEE
CHARLES E. KENSIL
WALTER B. UDELL
Walter B. Udell
ATTORNEY

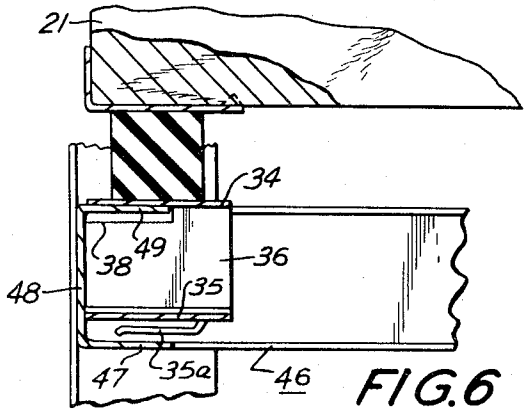


FIG.6

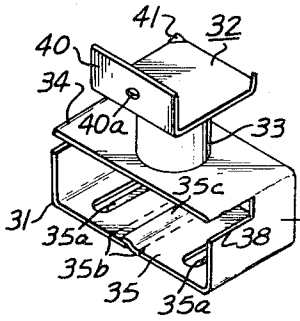


FIG.7

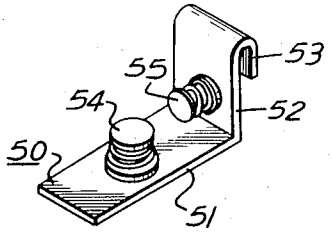


FIG.8

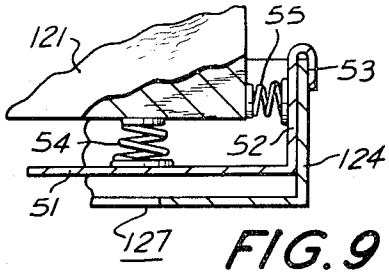


FIG.9

FIG.10

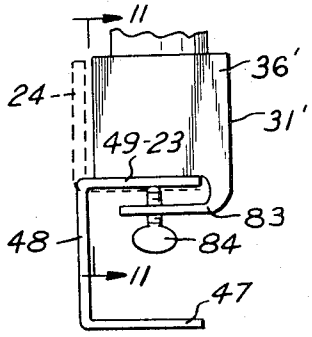
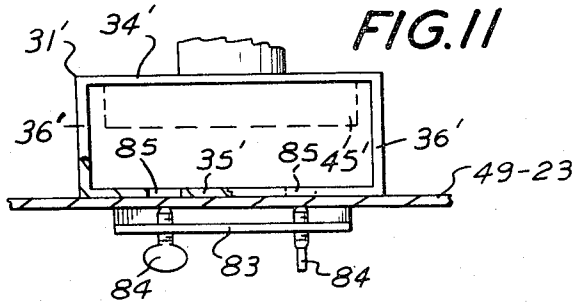


FIG.11



INVENTORS.
HERBERT A. McKEE
CHARLES E. KENSIL
WALTER B. UDELL

Walter B. Udell
ATTORNEY

SUSPENSION SYSTEM

This application is a division of our co-pending application Ser. No. 645,454 filed June 12, 1967, now U.S. Pat. No. 3,503,389, and relates to a novel suspension system for resiliently supporting a box spring and mattress from its associated bed frame.

In the past, vibration devices have been developed in various forms such as pads or cushions including a vibrator internally housed, devices for clamping onto various parts of the bed frame and mechanically engaging the mattress of the bed, vibrating structures built inside of mattresses or connected to the springs of a box spring, and even more complicated structures including large numbers of vibrator motor systems. All of these known devices have disadvantages of one type or another. The devices which are built into spring and mattress constructions are comparatively expensive and produce localized effects or hot-spots due to their connection to only a few coil springs in the spring or mattress. Other types are clamped or otherwise attached to the bed frames and are generally unsightly and frequently mar the bedsteads. None of these devices vibrationally isolate the box spring and mattress from the bed frame.

All of these devices which are in the nature of attachments or auxiliary devices, and even some of those expensive types which are specially designed treatment structures, cause vibration transmission through the legs of the bed frame to the floor of the room, such vibrations being transmitted through the structural parts of the building and being clearly audible at considerable distances from the source of vibration generation. Some types which utilize high speed brush motors generate an audible low-pitched vibration which is transmitted into the walls of the room. Both of these forms of vibration are very annoying and pose a particular problem when these devices are installed in the rooms of hotels and motels since the annoying vibrations may be heard by guests as far as four or five rooms away from that in which the apparatus is being used.

The apparatus according to the present invention is characterized by none of these undesirable qualities. Accordingly, a primary object of our invention is to provide a floating suspension by means of which a box spring and mattress may be quickly and easily resiliently supported from the bed frame to provide a floating suspension which is operative as such when used with or without a vibration inducing apparatus. Another object of our invention is to provide a novel suspension system which when utilized in conjunction with vibration generating apparatus of the auxiliary or attachment type produces substantially uniform vibration of the box spring and mattress of a bed while at the same time preventing transmission of any vibrations whatever to the bed frame or floor and walls of the room, and is silent in operation.

Another object of our invention is to provide a novel apparatus of the type described in which the floating suspension for the box spring and mattress has three degrees of freedom of movement, and which when used with a vibration generating apparatus operatively coupled to the suspension system is effective to produce several modes of vibration simultaneously throughout the box spring and mattress.

Still another object of our invention is to provide an apparatus as aforesaid which may be quickly and easily attached to and detached from a bed with no special tools and without tearing or marring any part of the bed structure, the system when installed being in most cases completely invisible.

The foregoing and other objects of our invention will become clear from reading the following specification in conjunction with an examination of the appended drawings, wherein:

FIG. 1 is a perspective view of a bed with the apparatus according to the invention attached thereto;

FIG. 2 is a partially exploded view of FIG. 1 on a somewhat enlarged scale showing a vibrator as being clamped to the box spring and with the isolation floats supported by the bed frame;

FIG. 3 is a perspective view of one of the vibration isolating float devices;

FIG. 4 is a vertical sectional view through the bed structure of FIG. 1, fragmented and on an enlarged scale, as would be seen when viewed along the line 4—4 of FIG. 1;

FIG. 5 is a fragmentary view of the float structure of FIG. 3 operatively installed on a slat type bed instead of the angle frame bed of FIG. 4;

FIG. 6 is a showing similar to FIG. 5 and FIG. 4 but with the vibration isolating float installed on a bed frame of the channel type;

FIG. 7 is a perspective view of the vibration isolating float of FIG. 3 taken from the rear end and with the side knock-outs removed for use as shown in FIG. 6;

FIG. 8 is an alternate form of vibration isolating float, and FIG. 9 illustrates this form of float installed on an angle frame bed of the type shown in FIG. 4;

FIG. 10 is a side view of the lower box of a modified form of vibration isolating float; and

FIG. 11 is a front view of the modified form of float shown in FIG. 10 as would be seen when viewed along the line 11—11 of FIG. 10.

In the several figures, like elements are denoted by like reference characters.

As best seen in FIGS. 1 and 2, the suspension system according to the invention is used in conjunction with a bed having a frame 20, box spring 21, and a mattress 22. The frame 20 as best seen from FIGS. 2 and 4, has a horizontal rectangular perimeter frame formed of a steel angle with horizontally inwardly extending legs 23 and vertically extending legs 24. The lower perimetral edge of the box spring 21 in normal bed usage is disposed flatwise downward upon the horizontal legs 23 of the bed frame angles and within the confines of the vertical legs 24. The mattress 22 of course rests on the box spring in the usual manner. The remainder of the bed frame 20 includes the legs 25 and a headboard 26.

Seated on the horizontal legs 23 of the bed frame side-rails 27 and end-spaced inward from the foot-rail 28 and head-rail 29 are four vibration isolating floats designated generally as 30, two floats being supported by each side-rail 27 to form a four-point suspension for the box spring and mattress. Each of the floats, as best seen in FIG. 3, includes a lower box 31 in the form of an open-ended rectangular tube, an L-shaped upper anchor plate 32, and an intervening cylindrical resilient support 33 having its lower end bonded to the upper surface of the box 31 and its upper surface bonded to the under-side of the anchor plate 32.

The lower box **31** has an upper wall **34**, a lower wall **35** and a pair of opposite side walls **36** joining the upper and lower walls. Each of the side walls **36** is formed with a rectangular knock-out **37** defined by the holding lines **38**. The area of the knock-out **37** extends inward from one end of the side wall **36** immediately adjacent to the upper wall **34** and inward for more than half of the length of the lower box as measured in the direction of the tubular axis. The knock-outs **37** are offset only sufficiently to enable them to be broken out when required, as will be subsequently described, but to normally function as part of the load bearing side wall **36**.

The lower wall has punched out of and downwardly offset therefrom a pair of laterally spaced clipfingers **35***a* which extend substantially parallel to the side walls **36** with the clip fingers free ends toward the end of the box **31** formed with the knock-outs **37** and with the hinges of the fingers **35***a* toward the opposite end. When used with an angle frame in the manner shown in FIG. **4** the center section of the lower wall **35** is superfluous and may be eliminated between the dotted lines **35***b* including the weldment **35***c*.

The L-shaped anchor plate **32** includes a platform leg **39** disposed substantially horizontally, and a vertically upwardly turned retainer leg **40** having a hole **40***a* therethrough, the plane of the retainer leg **40** being substantially orthogonal to the tubular axis of the lower box **31**. The corners of the horizontal platform leg **39** of the anchor plate **32** at the opposite end from the retainer leg **40** are turned upward to form a pair of prongs **41**.

As best seen from the showing of FIG. **4**, each of the floats **30** is supported on the bed frame side-rail with the lower wall **35** and clip fingers **35***a* of the float lower box **31** respectively seated flatwise downward upon and engaged under the horizontal leg **23** of the side-rail so that the retainer leg **40** of the float anchor plate **32** is disposed parallel to and spaced upwardly above the vertical leg **24** of the bed frame side-rail **27**. The box spring **21** includes a perimetrally extending lower wooden frame **42** which forms the box spring base, the width of the wood forming this frame being usually on the order of between two inches and four and a half inches in width. Box springs are of standard sizes and the bed frames **20** are constructed to just accommodate the wooden base of the box spring with substantially no lateral play. Many bed frames of this general type formed from steel angle are widthwise adjustable by virtue of utilizing split and overlapped foot rails and head rails.

Because of the relationship of the box spring base to the bed frame side-rails, when the floats **30** are positioned on the bed frame side-rails **27** as illustrated, the wooden base **42** of the box spring **21** is seatable downward on the horizontal platform legs **39** of the floats **30** with the retainer legs **40** of the float anchor plate disposed flatwise against the side of the box spring base. An easily removable small nail or screw may be inserted horizontally into the box spring base through the hole **40***a* in the retainer leg **40** to insure against vertical separation of the box spring and float. The weight of the box spring causes the platform leg prongs **41** to penetrate upward into the wood of the box spring base **42** to thereby prevent any relative lateral movement between the box spring base and the anchor plate of the float. The vertical legs **24** of the bed frame side-rails **27** prevent any outward shifting of the lower box **31** of the floats **30** so that the entire body support system consisting of the box spring **21** and mattress **22** is resiliently supported on the floats **30** and held captive in the bed frame **20**.

The lower box **31** and the anchor plate **32** of the floats **30** may be made of any suitably strong material such as steel, while the cylindrical resilient supports **33** may suitably be made of rubber.

The float **30** as illustrated in FIGS. **3** and **7** is intended to be a universal type device suitable for use with substantially all bed frames in common use. FIG. **5** illustrates the manner of using the float **30** with the widely encountered wooden bed frame having side boards **43** to the inside of which are fixedly secured side-rails **44** which support a plurality of transversely extending slats **45**. For this type of installation, the box spring and mattress are first removed and each end of the head and foot slats is lifted so that the float **30**, after turning the clip fingers upward into the box **31**, may be placed on the slat by projecting the end of the slat through the open tubular cross section of the lower box **31** with the anchor plate retainer leg **40** disposed outwardly toward the inner face of the bed frame side board **43**. With the slats **45** again disposed downward upon their supporting side-rails **44**, the upper wall **34** of the float lower box **31** is seated flatwise downward upon the upper surface of the slat **45**, and the clip fingers **35***a* are pressed upward into engagement with the underside of the slat **45**. The box spring **21** is now placed in position in the previously described manner.

While bed frames of the types shown in FIGS. **4** and **5** constitute the majority of those in general use, there are also an appreciable number of bed frames similar to that of FIG. **2** but employing U-shaped channel members instead of the L-shaped angle members shown in FIG. **4**. The channel type bed frame is illustrated in FIG. **6** from which it will be seen that the channel members are utilized to provide a lower horizontal wall **47**, a vertical outer wall **48** and an inwardly extending upper horizontal wall **49** overlying the lower wall **47**. Disposing the lower wall **35** of the float lower box **31** in downward seating engagement upon the upper wall **49** of the bed frame channel members **46** would result in a very unstable condition since there is nothing to prevent lateral shift of the entire box spring and mattress on the float assemblies completely horizontally off of the bed frame side-rail upper wall **49**.

From FIG. **4** it is of course seen that no problem of this nature can occur with the angle type frame because of the presence of the bed frame vertical legs **24** in enclosing relationship to the lower box **31** of the floats. A stable support structure is provided for the channel frames as shown in FIG. **6** by simply breaking out the knock-outs **37** in the side walls **36** of the float lower box **31** and sliding the floats onto the bed frame channel upper wall **49** in the manner illustrated so that the upper wall **49** projects into the slots in the float lower box side walls **36** formed by removal of the knock-outs **37**, the lower box upper wall **34** being seated downward upon the upper wall **49** of the bed frame U-shaped channel member **46**.

Vibration transmission into the box spring and mattress is affected by the resilience of the float suspension

system, which of course is determined by the characteristics of the resilient supports **33** of the floats **30**. These resilient supports **33** are placed in vertical compression by the weight of the box spring and mattress and the occupants of the bed, and a proper selection is required to insure that over-compression does not occur because such will destroy the resilience of the suspension. Similarly, if too stiff a characteristic is incorporated into the supports **33** then the spring and mattress vibrating system will be insufficiently decoupled from the bed frame.

It has been found that excellent overall results are achievable when the resilient supports **33** are made in the form of a cylinder of 40 durometer rubber approximately 1¼ inches high and 1¼ inches in diameter, and with four floats **30** being utilized to provide a four point stable suspension, each float being located along the sides about 12 inches from the end of the box spring. Occassionally, a box spring having a very weak base is encountered, and in such case it may be found desirable to utilize an additional float **30** on each side of the box spring at substantially the longitudinal center. The resilient rubber supports **33** of the floats **30** while preferably of 40 durometer rubber as described, may be made from rubbers as low as 30 durometer and as high as 50 durometer provided that the cross-section and height are properly altered to maintain the proper condition of resilience and support when subjected to compressional loads up to 400 pounds.

Placement of the floats substantially closer to the corners of the box spring tends to stiffen the suspension and reduce vertical components of vibration which may be generated when a vibration generator is used. Placement of the floats substantially closer toward the center of the side of the box spring leads to mechanical instability of the box spring and mattress should someone sit on the end of the bed.

FIGS. **8** and **9** show an alternate form of float designated generally as **50** which is somewhat less expensive to make, but which is restricted in applicability to use with the L-shaped angle type frame designated generally in FIG. **9** as **127** and having a vertical outer side wall **124**. The hook type float **50** is generally L-shaped having a horizontal leg **51** and a vertical leg **52** extending upward from the horizontal leg and terminating in an outwardly and downwardly turned hook **53**. A vertically acting compression spring **54** is fixedly secured to the horizontal leg **51**, and a horizontally acting compression spring **55** is fixedly secured to the vertical leg **52**.

The hook float **50** is installed simply by lifting the box spring **121** and slipping the hook float over the side-rail so that the vertical leg **52** of the hook float is disposed flatwise on the inside face of the vertically extending leg **124** of the side-rail **127** with the hook **53** of the hook float **50** locked over the upper edge of the side-rail. The length of the vertical leg **52** of the hook float **50** is preferably shorter than the vertical extent of the leg **24** of the bed frame side-rail **127** so that the horizontal leg **51** of the hook float does not quite seat downward upon the horizontal leg of the side rail. This insures that the hook **53** physically engages with and locks to the bed frame side-rail when the box spring **121** is seated downward on the spring **54**. The horizontal compression springs **55** prevent side locking of the box spring by maintaining the latter spaced away from the bed frame side-rail.

In any application where the suspension system is likely to be subjected to a high impact force applied laterally through the box spring and mattress it may be desirable to provide a support system positively locked to the bed frame. Such a support is shown in FIGS. **10** and **11** which illustrate a modified form of lower box **31** designated generally as **31'** having an upper wall **34'**, a lower wall **35'** and a pair of opposite side walls **36'**.

Extending downward and forward beneath the lower wall **35'** is a clamping flange **83** through which are upwardly threadedly projected a pair of wing bolts **84** operative to engage the under-surface of the horizontal bed frame side-rail support designated as **49–23** to illustrate that this may be either the upper wall **49** of the channel type side-rail or the horizontal leg **23** of the angle type side-rail, all as previously described. The lower wall **35'** of the float lower box **31'** is provided with a pair of apertures **85** aligned with the wing bolts **84** and larger in diameter than the latter. For use with a slat bed a longer wing bolt may be used to clamp the underside of the slat **45'** shown in dotted outline.

The aforedescribed float structures vibrationally isolate the box spring and mattress from the bed frame so that the vibratory movement of the box spring and mattress which occurs when a vibration generator is used is not transmitted to the bed frame, and consequently is not transmitted into and through the floor and walls of the room in which the bed is located. A suitable vibration generating apparatus for setting the spring and mattress into vibratory movement, if such use is desired, is shown in FIG. **1** as including a control console **56** having control buttons **57** by means of which electrical energy drawn from a source of power via power cord **58** is selectively controlled in magnitude and delivered through electrical conductor **59** to the vibrator assembly designated generally as **60** and which is illustrated as clamped to the lower left side of box spring **21**.

When the vibration generator **60** is of the type having an electric motor rotatably driving an eccentric weight which is rotated in a horizontal plane, the horizontal rotary movement of the eccentric weight is transmitted to the box spring and causes the latter to oscillate with a rotary motion in the horizontal plane. As the box spring **21** starts to move horizontally, the upper ends of the resilient supports **33** of the floats **30** move with it while the lower ends of the resilient supports remain motionless. The resilient supports **33** are thus shortened vertically so that the box spring and mattress in effect move downward for a distance while also moving laterally thereby inducing a vertical component of motion into the box spring and mattress.

Due to the resilient nature of the supports **33** a counter-directed restoring force is set-up in the supports tending to move the box spring and mattress back toward its original position. This restoring force is also aided by the fact that the rotating eccentric weight moves on to another position opposite to that which caused the initial deflection. The circular symmetry of the resilient supports **33** favors the aforegoing described action regardless of the position of the box spring or mattress at any given instant. Consequently, the horizontal oscillating motion of the box spring and

mattress is elliptical or circular in nature while a vertical oscillating component is also introduced.

Various different types of vibratory action may be induced into the box spring and mattress by rotating the eccentric weight at different rotative speeds, quite a marked variation in effect occurring within the range between approximately 350 RPM and 1,000 RPM. At the low-speed end of the range, the induced vibrations are predominately those of the horizontal component of motion while at the high-speed end of the range the vibrations contain a much stronger vertical component. In the intermediate speed ranges a more balanced combination of vibrations appears to exist.

Having now described our invention in connection with a particularly illustrated embodiment thereof it will be appreciated that modifications and variations of our invention may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of our invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed to be new and useful is:

1. A mechanical suspension system for use with a bed having a bed frame, a substantially rigid mattress support having a head end and a foot end and normally carried by the bed frame in direct mechanical engagement, and a mattress carried by the mattress support, said suspension apparatus comprising a plurality of resilient support means each of which is characterized by more than one degree of motional freedom and being each interposable between and mechanically engageable with the mattress support and bed frame and operative when so interposed to resiliently support the mattress support from the bed frame, each of said plurality of resilient support means comprising,

a. a base portion including detenting means for mechanically engaging the bed frame,

b. an upper anchor element including anchoring means for mechanically engaging the mattress support, and

c. a resilient column extending between and secured to each of said base and upper anchor element, said anchoring means of said resilient support means upper anchor element including anti-slip gripping means operative to grip the mattress support and prevent relative lateral movement of said anchor element with respect thereto.

2. A suspension system as defined in claim 1 wherein said resilient support means base portion comprises a substantially rigid box having spaced apart top and bottom walls and opposite side walls, said detenting means comprising at least one detenting finger turned out of the said box bottom wall, and said resilient column being secured at its lower end to said box top wall and extending upward to said upper anchor element.

3. A suspension system as defined in claim 1 wherein said resilient support means base portion comprises a substantially rigid box having spaced apart top and bottom walls and opposite side walls joining said top and bottom walls, said detenting means comprising a removable strip knock-out portion of said sidewalls immediately adjacent to and extending along the edges of said top wall which when removed leave slot openings in said sidewalls.

4. A suspension system as defined in claim 1 wherein said plurality of resilient support means comprises four such means spaced apart from one another in a generally rectangular array to provide a four point suspension system with the points of suspension lying substantially at the perimeter of and end-spaced inward from the head and foot ends of the mattress support along opposite sides thereof, at least a portion of each said resilient support means having limited two dimensional motional freedom in a substantially horizontal plane and limited motional freedom in a substantially vertical direction, and wherein said resilient column of each said resilient support means is a column of rubber in the range of 30 durometer to 50 durometer of sufficient cross-section and height to maintain resilience and support when subjected to compressional loads up to four hundred pounds.

5. A suspension system as defined in claim 4 wherein said resilient support means base portion comprises a substantially rigid box having spaced apart top and bottom walls and opposite side walls, said detenting means comprising at least one detenting finger turned out of the said box bottom wall, and said resilient column being secured at its lower end to said box top wall and extending upward to said upper anchor element.

6. A suspension system as defined in claim 5 wherein said resilient support means are endspaced inward for a distance between ten and fifteen inches from the head and foot ends of the mattress support.

* * * * *