

May 18, 1954

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2,678,720

SUPPORT FOR VIBRATORY CONVEYERS AND THE LIKE

Filed Nov. 29, 1946

2 Sheets-Sheet 1

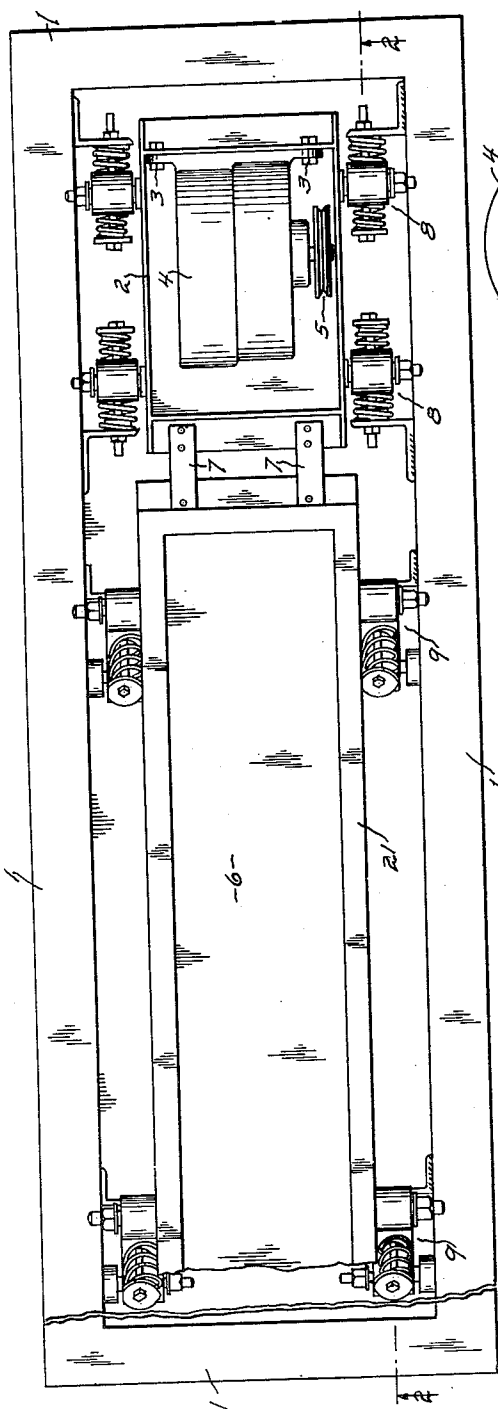


Fig. 1

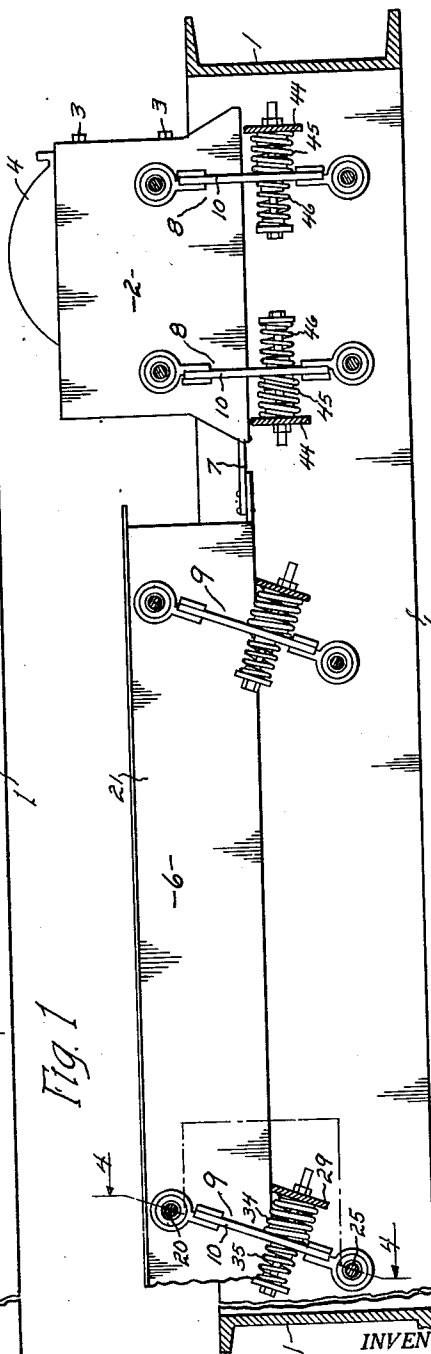


Fig. 2

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2 Sheets-Sheet 2

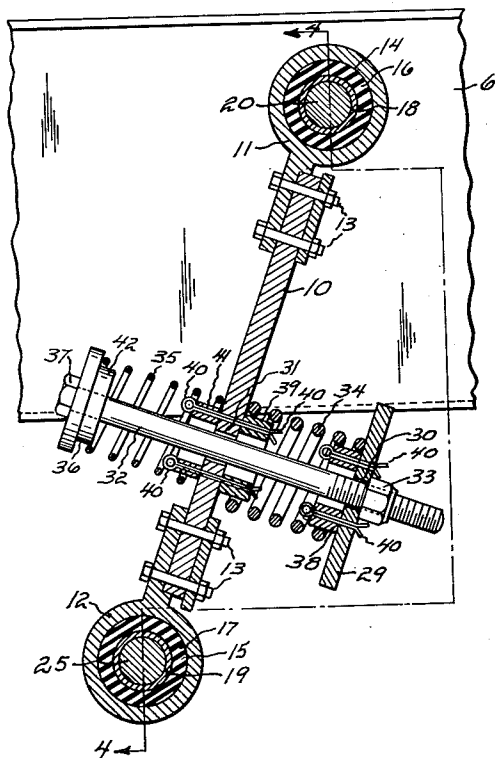


Fig. 3

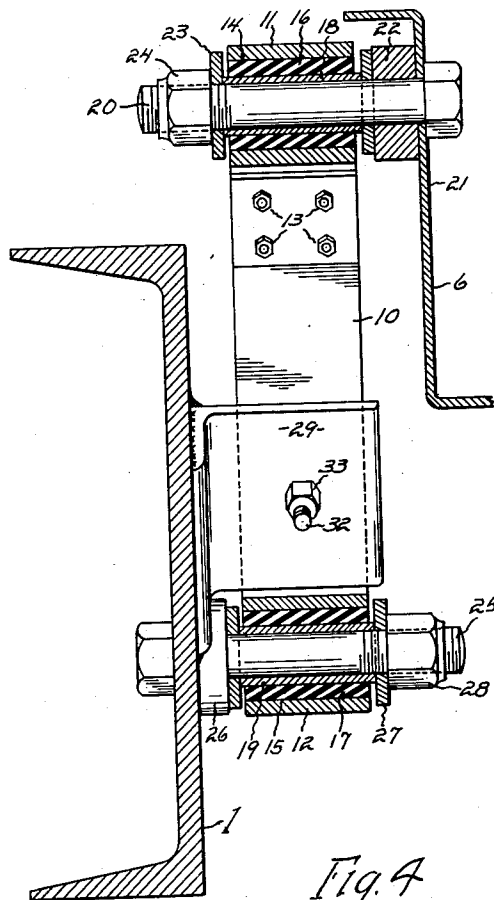


Fig. 4

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2,678,720

SUPPORT FOR VIBRATORY CONVEYERS
AND THE LIKE

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Application November 29, 1948, Serial No. 62,469

7 Claims. (Cl. 198—220)

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This invention relates to vibratory loads and supports therefor.

The invention is applicable to various kinds of vibratory loads; but inasmuch as one of its most important practical applications is to vibratory conveyors, it will be described herein as applied to that use; and those skilled in the art will then understand how to apply it to other types of vibratory loads, for example to screens for screening discrete materials, etc.

As is well known, a vibratory conveyor comprises an elongated bed in the form of a pipe, trough, box or the like, disposed generally horizontally; and a power driven vibratory mechanism connected to it at one end communicates longitudinal vibrations to it; whereby material deposited on the bed at one end is caused to travel continuously over the bed toward the other end, and to be discharged therefrom at the other end, or at points along the length of the bed.

The vibrating bed is supported so as to have an upward component of movement as it moves forwardly, and a downward component as it returns rearwardly, in order to propel the material forwardly; and it is desirable to support it in this manner by frictionless supports.

These requirements have led to the employment of rectilinear, elongated, leaf type springs as the supports; one end of the spring being anchored to a part of the stationary main frame of the conveyor, and with the spring extending therefrom at an inclination to the vertical, and the other end being connected to the conveyor bed.

Spring supports of this type are fairly satisfactory when first installed; but the spring bends back and forth at high frequency as the conveyor bed is vibrated, and this crystallizes the metal of the spring and after a relatively short life compared to that of the other parts of the conveyor, it breaks; and the conveyor must be shut down for repairs.

Also, the load being vibrated is greater in the forward direction of movement than in the rearward direction due to the fact that when the load comprising the conveyor and the material on it is moved forwardly, it is also elevated; whereas in moving rearwardly, the conveyor falls away from under the load; but the resilient force of such a leaf support spring is the same in both directions of bending, and although tension is stored up in the support and given out to the load in each direction, it aids little in propelling the greater load forwardly and aids greatly in returning the lighter load rearwardly, which ob-

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viously is the reverse of the ideal, and is an inefficient arrangement.

It is the main object of the present invention to provide a conveyor having a support of the class referred to in which the above mentioned defects are obviated.

Another object is to provide a conveyor having a support of the class referred to comprising spring means of the helical type and a mounting therefor whereby a greater length of spring material may be incorporated in the support and the distortion thereof accordingly lessened, and crystallizing and breaking of the spring prevented.

Another object is to provide such a support by which the spring action may be adjusted to adapt it to the vibrated load.

Another object is to provide such a support having improved means for connecting it to the stationary frame and to the vibrating load as mentioned hereinbefore.

Another object is to provide a support of the class referred to which may be used to support either the bed of the conveyor or that part of the vibration producing apparatus which itself has vibrating movement.

Another object is to provide a spring support for a loaded conveyor which exerts a relatively great resilient force forwardly when the conveyor is being moved forwardly, and a relatively weaker force when it is being moved rearwardly, to equalize the action of the support on the unequal forward and rearward loads moved by the vibrator.

With these objects in view, and others which will be apparent hereinafter to those skilled in the art, the invention, in the illustrative embodiment thereof described herein, and generally speaking, comprises a rigid arm connected at its opposite ends to the main frame and conveyor bed respectively, the connection preferably being a torsion rubber bushing type of connection; and a helical spring structure reacting upon the rigid arm intermediate its end connections, and upon a stationary part of the frame; the tension of the helical spring structure being preferably readily adjustable.

The invention itself is set forth in the appended claims.

The invention is fully disclosed in the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a top plan view of a conveyor mechanism embodying the invention, with parts broken away;

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Fig. 2 is a side sectional view of the embodiment of Fig. 1 from the plane 2—2 of Fig. 1;

Fig. 3 is a view to enlarged scale showing separately and in longitudinal section a part shown in elevation in Fig. 2;

Fig. 4 is a view from the plane 4—4 of Fig. 3; or the view may be considered as taken from the plane 4—4 of Fig. 2.

Referring to the drawing, Figs. 1 and 2, there is shown at 1 an elongated rectangular main base or frame which conveniently may be fabricated from channel-section steel. At 2 is a vibrator frame fabricated from steel; and upon which is rigidly secured as by bolts 3—3, a housing 4, within which is a vibrator preferably of the rotary unbalanced weight type, rotatably driven by a belt pulley 5, connected by a belt to a motor under the housing 4, the belt and motor not being shown for simplification, in view of the fact that such vibrators and drives therefor are well known.

At 6 is an elongated trough-like conveyor fabricated from steel, extending generally horizontally, and connected at one end to the vibrator frame 2 by steel straps 7—7.

At 8—8 are generally vertical supports, connected at upper and lower ends respectively to the vibrator frame 2 and main frame 1. At 9—9 are supports connected at upper and lower ends respectively to the conveyor 6 and main frame 1; and these supports 9—9 extend upwardly from the main frame 1 at an upwardly forward angular inclination to the vertical as shown. A part of the invention resides in the construction of the supports 8—8 and 9—9 and they will presently be described in detail.

In general operation, however, the vibrator frame 2 is vibrated back and forth longitudinally of the main frame by the vibrator in the housing 4, and the supports 8—8 support the frame 2 while allowing it to vibrate freely; and are yieldable resiliently, forwardly and rearwardly; and the resilience may be adjusted to have a periodicity relative to that of the vibratory movement. The conveyor 6 is vibrated by the vibrator frame 2 and the supports 9—9 may be like or similar to the supports 8—8 and, being likewise adjustable, support the conveyor in a manner similar to the support of the frame 2 by the supports 8—8; but the supports 9—9 being at an angular inclination for the purposes referred to, their resilience may be adjusted to a different value.

The supports 9—9 are best shown in Figs. 3 and 4.

A link or link element 10 preferably of rigid material such as steel, has bearing elements 11—12 which may be of cast metal, secured to its opposite ends by bolts 13—13. The bearing elements have respectively cylindrical bores 14—15 therein in which are sleeves or tubes 16—17 of rubber or like torsionably yieldable material; and telescoped through the tubes and projecting beyond their ends are sleeves 18—19 of metal. The rubber or the like is in each case vulcanized or otherwise secured, against slipping, to the wall of the bore and to the sleeve.

A bolt 20 is projected through the side wall 21 of the conveyor trough 6, through suitable spacers 22 and through the metal sleeve 18 and through a washer 23; and a nut 24 on the bolt clamps the sleeve 18 rigidly to the trough.

Similarly, a bolt 25, a spacer 26, a washer 27, and nut 28 clamp the sleeve 19 rigidly upon the main frame 1.

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As the trough 6 is vibrated longitudinally relative to the main frame 1, the bearing elements 11—12 will have an oscillating rotary movement relative to the bolts 20—25 permitted by torsional yielding of the rubber tubes 16—17; whereby bearings without frictional wear and requiring no lubrication are provided.

There will be any desired number of supports 9—9 along the length of the conveyor and on each side thereof as shown in Figs. 1 and 2 and adjacent to each of them is a transverse abutment 29, which may be conveniently provided by welding a short length of angle section steel to the main frame as indicated in the drawing. The abutment 29 is opposite the intermediate portion of the link 10 and has a perforation 30 therein; aligned with a perforation 31 in the link element.

A tie element in the form of a bolt 32 is projected through the perforations 30—31 and a nut 33 is screwed on the tie bolt on the outer side of the abutment 29.

A coil compression spring 34 surrounds the bolt 32 and abuts upon one side of the link 10 and upon the abutment 29. Another coil compression spring 35 surrounds the bolt 32 and abuts upon the other side of the link 10 and upon a washer 36 under the head 37 of the bolt 32.

The spring 34 is made stronger than the spring 35 by being wound from larger diameter material; or by being shorter; or both.

The coil springs 34—35 are preferably held in coaxial alignment with the bolt 32 and with each other. To this end, rings 38—39 are provided in the ends of the spring 34, and lying upon the abutment 29 and link 10 respectively and secured in coaxial positions against shifting by cotter pins 40, passing through holes in the rings and in the link or abutment as the case may be; and a similar ring 41 in one end of the spring 35 is similarly mounted on the link 10 by cotter pins 40; and the washer 36 has a reduced diameter shank 42 projecting into the other end of the spring 35.

The springs 34—35 are adjustably pre-loaded to suitable tension by turning the nut 33 on the bolt 32 as will be understood; and this adjustment may be fixed by a lock nut jammed upon the nut 33; or the nut 33 may be any desired type of self-locking nut.

In operation, as the conveyor trough 6 moves forwardly and rearwardly horizontally, the link 10 correspondingly rocks around its lower supporting bolt 25; and in the forward direction of rocking the spring 34 expands, and the spring 35 is compressed against the washer 36; and in the rearward direction the spring 35 expands and the spring 34 is compressed against the abutment 29.

The reason for and the effects of having the spring 34 stronger than the spring 35 can best be understood by first considering them equal. When the conveyor moves forwardly, it also moves upwardly due to the angular inclination of the links 10, and the load of the material on it must be moved forwardly and also elevated, the load to be moved thus being relatively heavy. When the conveyor moves rearwardly and downwardly, it in effect falls from under the material and slides rearwardly under it, the load to be moved then being a relatively light load. If the springs were of equal size and tension, the vibrator would have to do more work on its forward than on its rearward movement of the conveyor, and the vibratory movement would tend

to be non-harmonic or symmetrical; but with the springs unequal and the spring 34 stronger than the spring 35, the difference of load in the two directions is balanced out, and the vibratory movement is made substantially harmonic and symmetrical, resulting in a freer vibratory movement of the conveyor and a more continuous rapid flow of material over it.

In spite of the difference of load in the two directions of movement, the springs 34—35 when suitably chosen and adjusted, for a predetermined material and conveyor load, will cause the conveyor to tend to vibrate under load with a substantially true harmonic vibration, even without the vibrator, so that all the work the vibrator has to do is to overcome friction and incidental losses, and keep this harmonic movement going on.

This balanced harmonic movement of the load is impossible with a simple resilient leaf spring type of support heretofore employed for conveyors of this type, as it is believed will be apparent.

Improvement in the conveying of loads and in the power consumption at the vibrator are thus effected, in addition to the lengthened life of the supports due to the utilization of coil springs as referred to hereinbefore.

The supports 8—9 under the vibrator frame 2, may be like the above described supports 9—9; but here the frame 2 moves horizontally only, and the supports 8—9 are therefore vertically disposed; and the abutments, here 44—44, are placed oppositely with respect to the two links 10—10; and in this case, the springs 45—46 at the opposite sides of the link 10 may be equal in tension.

While the link 10 is illustrated as comprising a link proper in the form of a bar, with separate bearing elements 11—12 attached thereon, the bearing elements and link may be made in one piece, for example as a forging; it being deemed unnecessary to illustrate such modification since it will be understood by those skilled in the art.

The link 10 need not be made of metal, but may be made of other materials such as wood; and while it will perform its functions as described above when rigid, resilience in it, if provided, will not interfere with its operation as described.

In the foregoing, I have illustrated and described a conveyor as supported from below by the supports 9—9. Conveyors of this type are well known which are suspended from above by supports. It is believed to be apparent without further illustrations that the supports 9—9 hereof may be applied to a suspended conveyor.

In the foregoing, in which the preferred embodiment of the invention is described, the torsionally yieldable sleeves 16—17 are referred to as providing merely frictionless bearing connections for the rigid link element 10 on the frame 1 and conveyor trough 6; resilience in the supports being provided by the springs 34—35.

However, it will be understood that these torsionally yieldable sleeves, being of rubber or the like, are themselves resilient and act like torsion springs; accumulating torque tension in one direction when the conveyor trough moves in one direction from a neutral position; discharging the tension when it returns in the other direction to neutral position; and accumulating torque in the other direction when it moves from neutral position in the other direction, and so on.

In some cases, these sleeves may be relied upon to provide all of the resilience needed, for a fully

operative conveyor, in which case, the structure would comprise the link 10 and the bearing elements 11—12 with the rubber sleeve construction therein; and without the springs 34—35, abutment 29, and associated parts.

In the operation of such a structure the sleeves 16—17 would aid the vibratory movement of the conveyor trough, in much the same way as do the springs 34—35; and therefore in the environment illustrated, constitute a part of the present invention by themselves and apart from the springs 34—35.

It will be understood by those skilled in the art, that changes and modifications may be made in the embodiment of the invention illustrated herein; and the invention is comprehensive of all such changes and modifications which come within the scope of the appended claims.

I claim:

1. In a vibratory apparatus of the type comprising a stationary main frame and a vibratory body and mechanism to vibrantly reciprocate the body; a support on the frame for the body, comprising: an elongated link element; bearing connections between the ends of the link element and the frame and body respectively; said connections comprising each a rubber or like tubular torsionable sleeve secured in the end of the link element, a metal sleeve secured coaxially in the torsionable sleeve, and a bolt in the metal sleeve, one bolt clamping one sleeve upon the main frame, the other bolt clamping the other sleeve upon the vibratory body; a stationary abutment on the main frame; a tie element stationarily engaged with the abutment and extending transversely of the link element; a pair of coil compression springs on opposite sides of an intermediate portion of the link element; one spring reacting between the abutment and the link; the other spring reacting between the tie element and the link.

2. In a vibratory apparatus of the type comprising a stationary main frame and a vibratory body and mechanism to vibrantly reciprocate the body; a support on the frame for the body, comprising: an elongated link element; bearing connections between the ends of the link element and the frame and body respectively; said connections comprising each a rubber or like tubular torsionable sleeve secured in the end of the link element, a metal sleeve secured coaxially in the torsionable sleeve, and a bolt in the metal sleeve, one bolt clamping one sleeve upon the main frame, the other bolt clamping the other sleeve upon the vibratory body; a stationary abutment on the main frame; a rod-like tie element extending transversely of the link element at an intermediate portion thereof and through an aperture in the link element and stationarily engaged at one end with the abutment; a coil compression spring surrounding the tie element and reacting upon one side of the link element and upon the abutment; and a coil compression spring surrounding the tie element and reacting upon the other side of the link element and upon the opposite end of the tie element.

3. In a vibratory apparatus of the type comprising a stationary main frame and a vibratory body and mechanism to vibrantly reciprocate the body; a support on the frame for the body, comprising: an elongated link element; bearing connections between the ends of the link element and the frame and body respectively; said connections comprising each a rubber or like tubular torsionable sleeve secured in the end of the

link element, a metal sleeve secured coaxially in the torsionable sleeve, and a bolt in the metal sleeve, one bolt clamping one sleeve upon the main frame, the other bolt clamping the other sleeve upon the vibratory body; a stationary flange like abutment on the main frame; a rod-like tie element stationary with respect to the abutment and having a head on one end and extending therefrom transversely of an intermediate portion of the link element through apertures in the link element and abutment; a nut threaded on the other end of the tie element beyond the abutment; a coil compression spring on one side of the link element surrounding the tie element and reacting on the link element and tie element head and holding the nut against the abutment; and a coil compression spring on the other side of the link element surrounding the tie element and reacting on the link element and abutment.

4. In a vibratory material conveyor or the like, a stationary main frame; an elongated conveyor bed; a vibrator for vibrating the bed forwardly and rearwardly longitudinally; a support for the bed comprising a link element having bearing connections at its opposite ends with the main frame and bed respectively; the link element inclined angularly to cause the bed to have an upward component of movement when moved forwardly; a pair of coil compression springs at the forward and rearward sides of the link respectively, disposed to react at one end in opposite directions on a portion of the link element between its bearing connections; means associated with the main frame to support the other ends of the springs and upon which the said other ends of the springs are stationarily engaged and upon which said other ends react; the arrangement causing the springs to be alternately compressed by forward and rearward movement of the bed, and the spring which is compressed upon rearward movement being stronger than the other.

5. In a vibratory apparatus of the type comprising a stationary main frame and a vibratory body and mechanism to vibrantly reciprocate the body; a support on the frame for the body, comprising: an elongated link element; bearing connections between the ends of the link element and the frame and body respectively; said connections comprising each a rubber or like tubular torsionable sleeve secured in the end of the link element, a metal sleeve secured coaxially in the torsionable sleeve, and a bolt in the metal sleeve, one bolt clamping one sleeve upon the main frame, the other bolt clamping the other sleeve upon the vibratory body.

6. In a vibratory apparatus of the type comprising a frame element and a vibratory body element and mechanism to vibrantly reciprocate the body element; a support on the frame element for the body element, comprising: an elongated link having connections at opposite end portions with the frame and body elements respectively upon which it has hinging oscillatory movement during vibratory movement of the body element; the connections comprising each a body of rubber or like resilient yieldable material rigidly connected at spaced portions thereof to the link and corresponding element.

7. In a vibratory material conveyor or the like, a stationary main frame; an elongated conveyor bed; a vibrator for vibrating the bed forwardly and rearwardly longitudinally; a support for the bed comprising a link element having bearing connections at its opposite ends with the main frame and bed respectively; the link element inclined angularly to cause the bed to have an upward component of movement when moved forwardly; a pair of coil compression springs at the forward and rearward sides of the link respectively, disposed to react at one end in opposite directions on a portion of the link element between its bearing connections; means associated with the main frame to support the other ends of the springs and upon which the said other ends of the springs are stationarily engaged and upon which said other ends react; the arrangement causing the springs to be alternately compressed by forward and rearward movement of the bed, and the spring which is compressed upon rearward movement being stronger than the other; the said bearing connections at opposite ends of the link comprising respective bodies of rubber or like resilient yieldable material, one body rigidly connected at spaced portions thereof to the link and to the main frame, and the other rigidly connected at spaced points thereof to the link and to the bed.

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