March 30, 1943. R. D. HELLER 2,314,879

SCREEN

Original Filed Oct. 8, 1938

Fig. 1

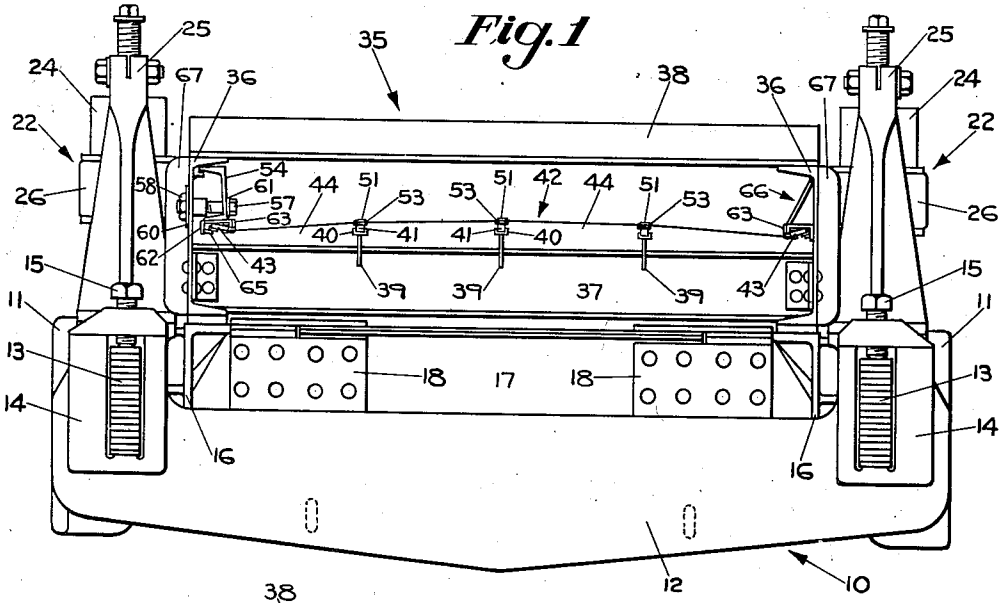


Fig. 2

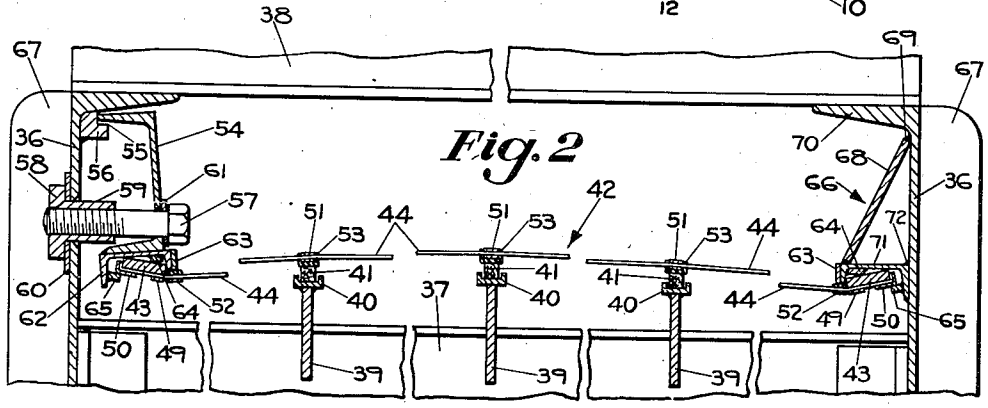
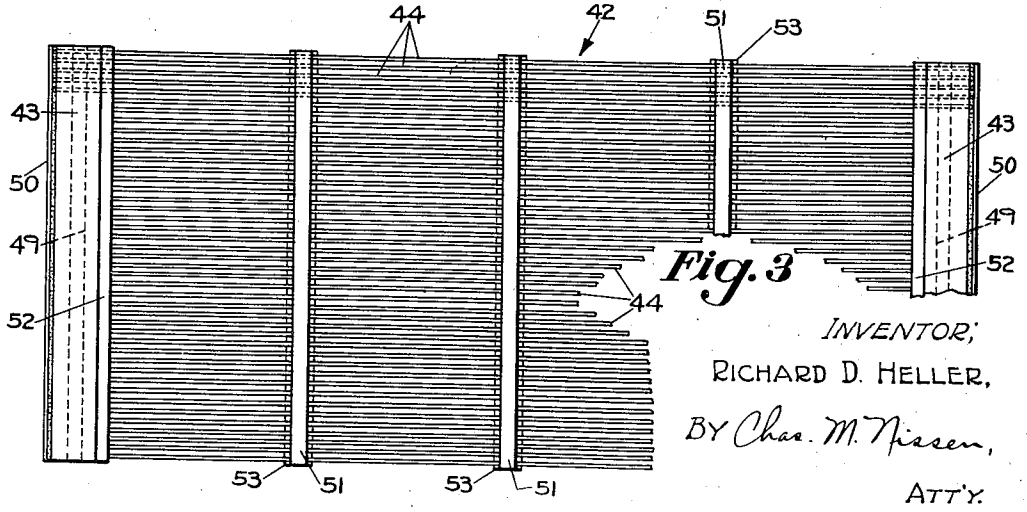


Fig. 3



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Patented Mar. 30, 1943

2,314,879

UNITED STATES PATENT OFFICE

2,314,879

SCREEN

Richard D. Heller, Columbus, Ohio

Original application October 8, 1938, Serial No. 234,014. Divided and this application May 23, 1941, Serial No. 394,847

10 Claims. (Cl. 209—403)

This invention relates to vibratory screening apparatus and one of the objects is the provision of improved and efficient means for attaching a screen to a deck.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawing,

Fig. 1 is an end elevational view of vibratory screening apparatus embodying my improvements;

Fig. 2 is a transverse sectional view of the screen attaching mechanism; and

Fig. 3 is a plan view of the unwoven type of screen to which my improvements are particularly adaptable.

This application is a division of my co-pending application S. N. 234,014, filed October 8, 1938, Patent No. 2,283,877, granted May 19, 1942 for an improvement in Screens.

In a vibratory type of screen, particularly of the type energized from mixed or alternating current of 60 cycle frequency or from rectifiers, in which the frequency of vibration is relatively high, such as 3600 vibrations per minute, or in excess thereof, as derived from a source of commercial current of 60 cycle frequency, there is a considerable whipping action imparted to the screen cloth which tends to reduce the life of said screen cloth not only by virtue of the whipping action which tends to break the cloth at its point of anchorage, but also because of the wearing at positions where the wires of the screen cloth contact the deck of the vibrating screen.

In the invention herein disclosed an essentially new type of screen cloth is provided for a high frequency vibratory screen in which the life of the screen is materially increased due to the fact that very high carbon steel wires, such as music or piano wires, make up the screen cloth and further, at the points of bearing between the screen cloth and the deck, resilient rubber or similar bearing means are provided.

Referring particularly to the drawing, there is seen a main frame 10 comprising a steel casting which includes longitudinally extending side members 11, 11 connected together at their opposite ends by transverse cross members 12. Extending longitudinally along the side members 11, 11 are spring bars 13, 13 the ends of which are attached in boxes 14, 14 formed as integral parts of the side members 11, 11, the bars 13 being clamped in said boxes 14 by clamp screws 15, 15.

To the centers of said spring bars 13, 13 there are clamped castings 16, 16 which are rigidly attached together by a transversely extending I-beam 17 by means of riveted plates 18, 18. The clamping of each casting 16 to the centers of the cooperating spring bars 13 is effected by a clamp screw similar to that designated 15. Rigidly attached to each casting 16 is a bracket which carries an armature of a vibratory electro-magnetic motor 22, said armature being formed of laminated sheet steel. Coöerating with the armature to form the complete motor 22 is a U-shaped core of laminated sheet steel which is carried by a bracket 24, which bracket 24 is in turn adjustably mounted upon a U-shaped bracket 25 the ends of which are attached to a side member 11.

Each leg of the U-shaped core carries an energizing field coil 26 adapted to be energized with pulsating, mixed or alternating current.

It may be stated that the structure of the screen and its general mode of operation, insofar as above described, is disclosed and claimed in the patent to James A. Flint, No. 1,846,326, dated February 23, 1932, for an Electric reciprocating motor.

Mounted upon and rigidly attached to the castings 16 to vibrate therewith is a deck 35. The deck 35 is formed by a pair of longitudinally extending channel members 36, 36, the bottom flanges of which are rigidly attached together by cross channels 37 of which there is one at each end and preferably two intermediate the ends. The top flanges of the channel members 36 are also attached together by three spaced angle members 38.

Extending longitudinally of the deck and supported in notches in the channels 37 to which they are welded, is a plurality of upstanding ribs 39 having elongated channel tops 40 adapted to receive elongated longitudinally extending wood strips 41 which bear against the screen cloth 42, as hereinafter described in complete detail.

Referring particularly to Fig. 3 of the drawing, it will be seen that the screen cloth 42 comprises a pair of end bars 43, 43, preferably rectangular in shape, though other shapes may be employed, said end bars 43 being made of steel or iron.

Extending between the said end bars 43 is a plurality of parallel wires 44 which are preferably made of high carbon steel, such as bright piano or music wire. It is to be noted that these parallel wires 44 are straight or substantially straight, therefore differing from the common screen cloth in which the strands are interwoven transversely and longitudinally whereby substantially each strand forms a zigzag path or is crimped at each contact area with another strand.

The wires 44 are soldered or otherwise adhesively attached to the end bars 43, preferably in the manner described in complete detail in my Patent No. 2,220,106, granted Nov. 5, 1940, for an improvement in screen cloth and method of making same.

To insure the secure attaching of said wires 44 with said end bars 43, a pair of tin strips 49 and 50 are placed over the ends of the wires 44 and are attached to the solder above mentioned, the extreme ends of said wires 44 being bent over the outer corner of the end bar 43 with the outer end of the tin strip 50 to contact the outer edge of the associated end bar 43, as clearly illustrated in Fig. 2 of the drawing.

Intermediate the end bars 43, 43 the wires 44 are preferably attached together through the longitudinal length of the screen by top and bottom tin strips 51 (sheet iron coated with tin) which are attached together and to said wires 44 by solder. The tin strips 51 are preferably so positioned that they will be directly above the aforementioned wood strips 41.

Adjacent each bearing area between the screen cloth 42 and the deck 35 I provide rubber or other depressible material cushion means which performs three functions, hereinafter set forth.

Adjacent the positions of attachment of the wires 44 to the end bars 43 are strips of rubber 52 or any other similar material which extend longitudinally the entire length of the screen cloth and are compressed against the wires 44 so as to extend on both sides of them, being attached to said wires as by rubber cement. Rubber strips 53 are also laid under one of each of the tin strips 51 which is to bear against a wood strip 41 thereby forming a cushion between the wood strip 41 and the tin strip 51. The rubber strip 53 extends laterally beyond the extremity of the associated tin strip 51 and is compressed between the wires 44 adjacent each edge of said tin strips 51.

The three-fold function of the rubber strips 52 and 53 is as follows. In the first place, these rubber strips provide a resilient cushion between screen cloth 42 and the associated bearing portion of the deck 35 thereby preventing undue wear of both the deck and the screen cloth. In the second place, these rubber strips are, of course, positioned at areas on the screen cloth at which there is no substantial independent vibration of the wires 44, said wires 44 being free to vibrate individually between any two bearing areas of said screen cloth 42 and the deck 35. Consequently since the rubber extends beyond the point of rigid connection between an end bar 43 and a wire 44, or a tin strip 51 and the wire 44, this rubber will progressively dampen the vibration of each individual wire 44 as it progresses towards its point of rigid attachment thereby reducing appreciably the tendency of the wire to break off at its point of rigid attachment to a bar 43 or tin strip 51 under the influence of the relatively high frequency vibration of the vibratory screen. In the third place, since there is a very small amount of vibration of each wire 44 adjacent its point of attachment to an end bar 43 or a tin strip 51 the wires 44 are not able to clear themselves of any material which tends to become lodged between adjacent wires due to this lack of vibration and this rubber along this area prevents material being caught between adjacent wires or strands 44 and thereby becoming lodged in the screen cloth 42.

To provide for the attachment of the screen cloth 42 to the deck 35 and for its adjustable tensioning I provide a novel attaching means which is designed particularly to aid in maintaining the wires 44 in attachment with the end bars 43. As clearly seen by reference to Fig. 2 of the drawing, adjacent the left hand side of the deck 35 there is a longitudinally extending channel member 54 the top flange of which is pivoted in a longitudinally extending groove 55 formed by the top flange of the channel member 36 and a notched longitudinally extended member 56 welded to the upper corner of said channel member 36.

Adjacent the bottom of the channel 54 and distributed along the length thereof is a plurality of holes adapted to receive tensioning bolts 57 which extend through apertures in the channel 36 and receive adjusting nuts 58 provided with bearing sleeves 59 which extend through the receiving apertures in the channels 36. A washer 60 is also preferably positioned between the outer face of the channel 36 and the head of each nut 58. Another washer 61 is also preferably placed between the head of each bolt 57 and the inner face of the channel member 54.

The bottom flange of the channel 54 carries a downwardly extending or inverted channel 62, the inner flange of which carries a bearing plate 63 to increase the bearing area in contact with the rubber strip 52 which bears against said plate 63 and the inner flange of said channel 62.

Extending longitudinally substantially the full length of the channel 62 and in the corner adjacent the inner flange is a ledge 64 formed by a longitudinally extending rectangular bar which is welded at the position indicated. Carried on the opposite or outer flange of the channel 62 is an abutment 65 formed by a longitudinally extending bar which is spaced from the outer corner of said channel 62 and is welded to said outer flange thereof.

As is clearly illustrated in Fig. 2 of the drawing, the outer end of an end bar 43 projects over the abutment 65 and engages the bottom of the channel 62 which is, of course, in an inverted position. The top inner edge of the bar 43 abuts the inner flange of the channel 62, and said bar 43 at a position adjacent said top inner edge engages the ledge 64. It will be seen that the structure defined locks the end bar 43 to the attaching and tensioning mechanism after the end bar 43 is inserted in place.

Furthermore, it is to be noted that the abutment 65 cooperates with the end bar 43 to effect a clamping action on the wires 44 and the tin strip 50 to prevent any of the wires 44 being pulled loose from the end bar 43.

As a further action to prevent any wire 44 being pulled from an end bar 43 it is to be noted that each wire 44 bends as it leaves the end bar 43 and bends in a direction to force said wires 44 into engagement with the bar 43. In other words, this results in the wires 44 being at least partially wrapped around the bars 43 which are carried even farther at the outer ends of said wires 44, thereby resulting in a very secure connection between the two, particularly when supplemented by the aforementioned attaching solder and tin strips 49 and 50.

At the right hand end of the deck 35 the screen cloth 42 is attached in a manner quite similar to that above described by an attaching bracket indicated generally by the reference character 66, except for the fact that the bracket 66 is not adjustable but is fixed to the channel 36, and the structure of which is obvious from the above de-

scription of the adjustable attaching means and by reference to said Fig. 2 of the drawing.

The attaching bracket 66 comprises an elongated rectangular flat plate 68 the upper edge of which is welded at 69 adjacent the flange 70, to the inner wall of the vertical plate of the channel 36 shown at the right in Fig. 2. The lower edge of the elongated plate 68 is welded to the inner edge of the inverted channel 71, the outer edge of which is welded at 72 to the inner wall of the vertical plate of the channel 36. It will thus be seen that the attaching bracket 66 comprising the plate 68 and the inverted channel 71 co-operates with the ledge 64 and the abutment 65 to provide a fixed anchorage for the right-hand end bar 43 as viewed in Fig. 2.

The fixed anchorage for the right-hand end bar 43 as viewed in Fig. 2 and the movable anchorage for the left-hand end bar 43 are at lower elevations than the intermediate supports for the wires 44 and the latter are therefore supported in transversely crowned formation. Consequently sufficient vertical forces are exerted by operation of the series of nuts 58 to press the wires 44 against the rubber strips 52, 52 and the latter against the lower edges of the bearing plates 63, 63 and against the lower edges of the inner flanges of the channels 62, 71. Such crowning of the wires 44 also co-acts with the tilting of the end bars 43, 43 to hold the wires 44 pressed against the end bars 43 and thereby prevent the wires 44 from being even partially ripped or torn loose from such end bars. Furthermore, the structure for mounting the wire screen on the deck is such as to hold all parts together as a rigid unit thereby eliminating objectionable noises and damaging vibrations, there being no relative vibration between parts except that of the wire sections relatively to the deck, as above explained.

It may additionally be mentioned that to reinforce the deck 35 there is provided a plurality of spaced outward extending webs or fins 67 which provide vertical rigidity to the channel members 36.

In the operation of the screen comprising my invention alternating, mixed or rectified, pulsating current is supplied to the vibratory motors 22 which will cause vibration of the deck 35 relative to the main frame 10 in a manner well understood in this art and more completely described in the above mentioned patent to James A. Flint. This vibration will be at a relatively high frequency, such as 3600 vibrations per minute though, of course, other frequencies of vibration are contemplated.

Under the influence of this relatively high frequency of vibration the individual wires 44 of the screen cloth 42 vibrate as individual units between the points of bearing between them and the deck, for example, between the rubber strips 53 and between one rubber strip 53 and a rubber strip 52. As a consequence, blinding of the screen cloth 42 is substantially prevented because this individual vibratory motion of each portion of a wire 44 in addition to the entire vibratory motion of the deck 35 will clear the screen cloth 42 of any material which tends to adhere thereto. As a consequence, the screen cloth of my invention is extremely desirable in combination with a relatively high frequency vibratory type of screen, though its use is not entirely so restricted.

As previously mentioned, to prevent undue wear of the screen cloth 42 or of the deck, cushion means in the form of rubber strips 52 and 53 or any other appropriate cushioning material is provided and interposed between the screen cloth 42 and each point of bearing or contact with the deck 35. These rubber strips 52 and 53 additionally prevent breakage of the individual wires 44 due to their vibration by virtue of the dampening of the vibration thereof adjacent their points of rigid attachment either to end bars 43 or to tin strips 51.

Still further, these rubber strips 52, 53 prevent blinding of the screen at the areas where there is no appreciable individual vibration of the wires 44 as distinguished from the vibration of said wires due to their attachment to the vibratory deck 35. The wood strips 41 are preferably provided because there is inherently some wearing at these bearing areas and as said wood strips 41 become worn they can be replaced.

Another important advantage of this type of screen cloth lies in the fact that it may be made of very high carbon steel such as music or piano wire. This steel wire has a very long life even when used to screen abrasive materials and due to the fact that the strands of wire 44 are substantially straight, as distinguished from crimped or zigzag wire found in woven screen cloth, it is possible to employ this relatively stiff, high carbon steel wire.

It will, of course, be understood that material will be fed to the screen at its upper end, and will travel downwardly over said screen under the influence of gravity aided by the vibratory motion of the deck 35, as well as the superposed individual vibration of the free portions of the wires 44. The material which is of sufficiently small size to pass through the screen cloth 42 will do so and will be discharged through the bottom of the screen while the oversize material will discharge over the lower end of said screen cloth 42.

No rubber strips of any kind are disclosed in the aforesaid patent to Flint, No. 1,845,326. The rubber strips 52 and 53 are disclosed in my Patent No. 2,220,106, granted Nov. 5, 1940, on an application filed Oct. 8, 1938, but such rubber strips are not included in the claims of Patent No. 2,220,106, the claims in the latter being directed to the method of attaching the end bars in the formation of a screen cloth. The claims hereto appended are directed to the structure for attaching the lateral ends of the screen to the deck of vibratory apparatus. The rubber strips 52 and 53 are described and claimed in my co-pending application, Serial No. 394,848, filed May 23, 1941, filed on even date herewith for an improvement in Screens, and as a continuation in part of my co-pending application, Serial No. 234,014, filed October 8, 1938, Patent No. 2,283,877, granted May 19, 1942, for an improvement in Screens.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and I therefore wish not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. A screen deck comprising an upright support comprising a vertical plate and an inwardly extending flange, an inverted channel having one of its flanges secured to said vertical plate, a reinforcing plate having its lower edge secured to the inner edge of said inverted channel and having its upper edge rigidly secured to said ver-

tical plate adjacent to said inwardly extending flange, and screen cloth attaching means on the under side of said inverted channel.

2. A screen deck comprising the combination with a frame having spaced-apart upright metal side plates at least one of which has an inwardly extending top flange, of an inverted channel having its outer flange secured to the upright side plate having the inwardly extending top flange, a reinforcing plate rigidly secured at its lower edge to the inner edge of said inverted channel and having its upper edge rigidly secured to the last-named upright side plate adjacent said inwardly extending top flange, and screen cloth attaching means mounted in the underside of said inverted channel.

3. A screen deck comprising the combination with a frame having an upright metal side plate provided with an inwardly extending top flange, of an inverted channel having its outer flange rigidly secured to said side plate, a reinforcing plate having its lower edge rigidly secured to the inner edge of said channel and its upper edge rigidly secured to said side plate adjacent to said flange, and screen cloth attaching means mounted in the underside of said inverted channel.

4. A screen deck comprising the combination with an upright plate having an inwardly extending flange at its upper edge, of an angle strip secured to said plate at the base of said flange and having a vertical abutment and a horizontal ledge to form an elongated groove, a channel having spaced upper and lower flanges, the outer edge of the upper flange extending into said groove, a screen anchorage secured to the lower flange of said channel, and tensioning mechanism between said upright plate and said channel to tilt the latter on said groove as a fulcrum.

5. A screen deck comprising a support having an upper horizontal flange extending inwardly from a vertical plate, of an angle strip welded to said support to occupy a position extending along the angular junction between said horizontal flange and said vertical plate, said strip having a vertical wall and a horizontal ledge to cooperate with the under side of said flange to form an elongated groove, a channel having its upper flange extending into said groove, a screen anchorage carried by the lower flange of said channel, and tensioning mechanism between said vertical plate and said channel.

6. A screen deck comprising the combination with a support having an inwardly extending flange at the upper edge of a vertical plate, of an angle strip secured to said support at the base of said flange, said strip having a horizontal ledge spaced from the underside of said flange to form an elongated groove, a channel having spaced upper and lower flanges, the outer edge of the upper flange extending into said groove, a screen anchorage secured to the lower flange of said channel, and tensioning mechanism between said upright plate and said channel to tilt the latter on said groove as a fulcrum.

7. A screen deck comprising the combination with an upright supporting plate having an inwardly extending flange at the upper edge thereof, of an angle strip fitting the corner where the inside upper edge of said plate merges into the base of said flange, said angle strip having a vertical wall and a horizontal ledge, the latter being spaced from the underside of said flange and the vertical wall extending from such horizontal ledge to the underside of said flange, a channel having its upper flange in position to engage said vertical wall as a fulcrum and the upper outer edge of said flange to abut against the underside of said first-named flange, a screen anchorage secured to the lower flange of said channel, and tensioning mechanism comprising a series of bolts extending through said supporting plate and through said channel to tilt the latter on said vertical wall as a fulcrum and thereby move said anchorage toward said supporting plate, the said horizontal ledge and the under surface of said first-named flange spaced above the ledge serving to confine said channel against vertical movement relatively to said support.

8. A screen deck comprising the combination with spaced-apart upright supporting plates, of a screen anchorage secured rigidly to one of said plates, an elongated support associated with the other plate, an inverted channel secured to the bottom of said elongated support for suspension thereby, a screen anchorage in the underside of said inverted channel, and means acting on said elongated support to move the inverted channel and the anchorage toward the adjacent upright plate to effect tensioning of the screen connected to said anchorages.

9. A screen deck comprising the combination with a supporting frame having an upper inwardly extending horizontal flange, of a channel member having an upper flange, an elongated strip welded to said frame and having a horizontal ledge spaced a short distance from said inwardly extending horizontal flange to form a narrow groove extending longitudinally along said supporting frame in position to receive the outer edge of the upper flange of said channel member, said narrow groove having as its upper wall the bottom of said inwardly extending horizontal flange and as its lower wall said ledge and being adapted to confine said channel member against vertical movements relatively to said frame, a screen anchorage carried by the lower flange of said channel member, and mechanism between said channel member and said supporting frame for tilting said channel member on said groove as a fulcrum.

10. A screen deck comprising the combination with a support having a vertical plate and an upper horizontal inwardly extending flange, of an elongated channel member having upper and lower outwardly extending flanges, an elongated strip welded to said vertical plate to form a ledge spaced from the bottom of said upper horizontal inwardly extending flange a short distance to afford an elongated groove for receiving a relatively long portion of the outer edge of the upper flange of said channel member, a screen anchorage carried by the lower side of the lower flange of said channel member, and a series of spaced-apart bolts extending through said support and through said channel member for tilting said channel member on said groove as a fulcrum to effect movement of said anchorage toward said support, said groove serving to confine said channel member against vertical movements relatively to said support while the bottom of said upper horizontal inwardly extending flange serves as an abutment for the upper outer edge of the upper flange of said channel member.

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