May 24, 1938. L. G. SYMONS 2,118,782

SCREEN

Original Filed July 18, 1934 3 Sheets-Sheet 1

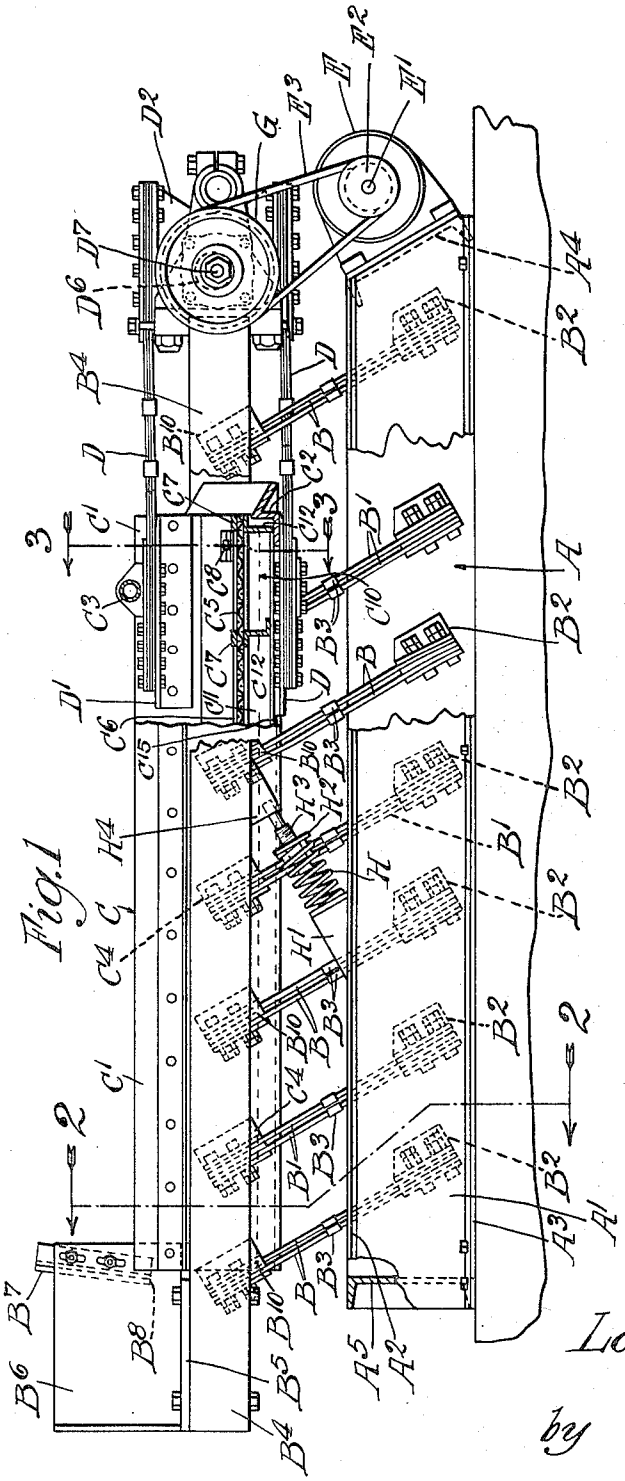


Fig. 1

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Fig. 2

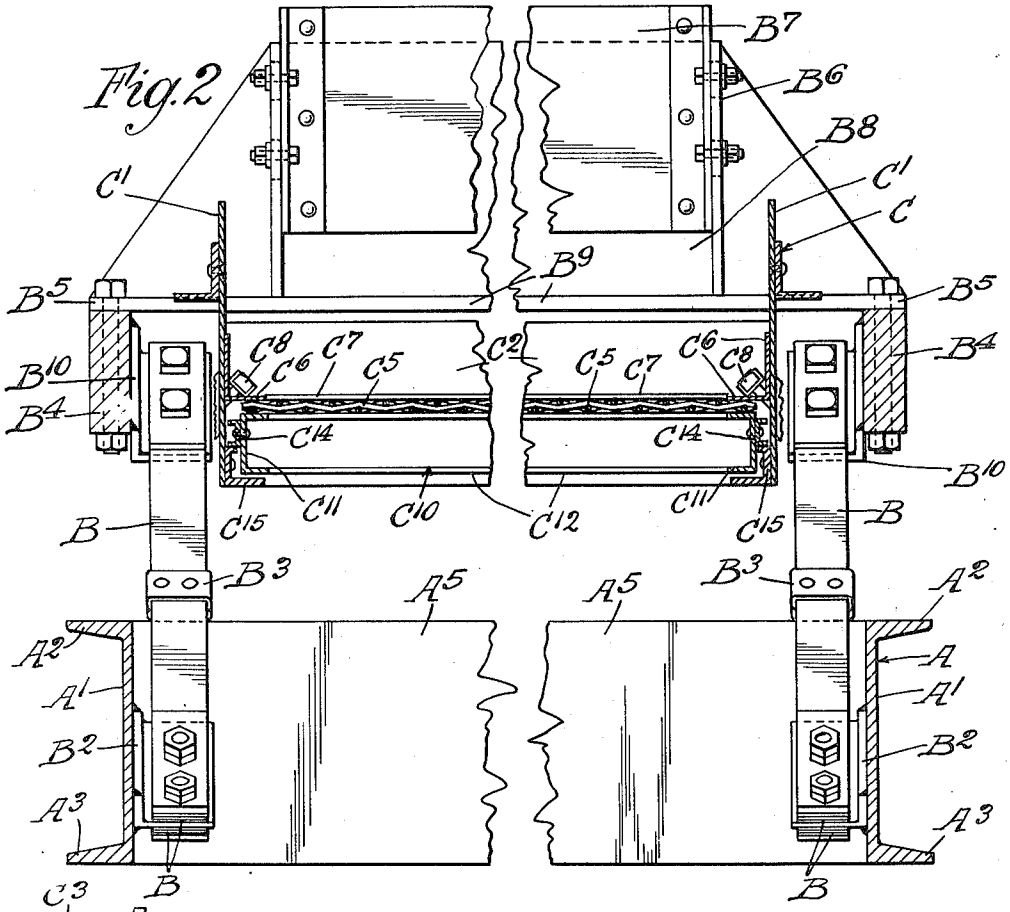
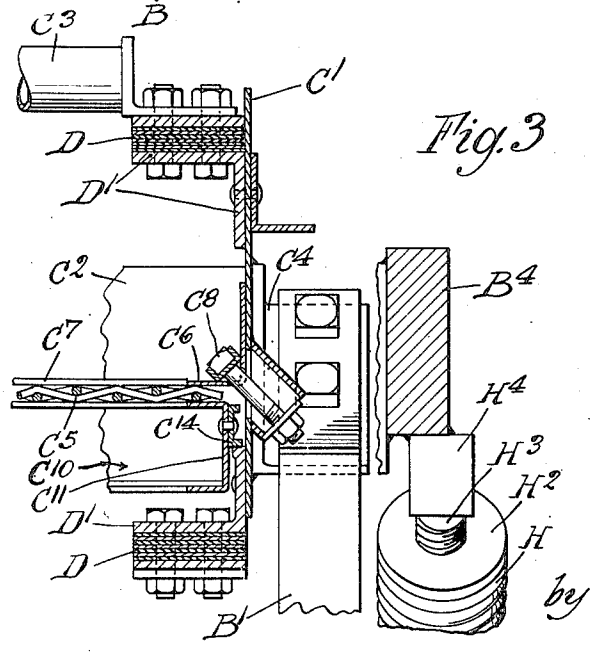


Fig. 3



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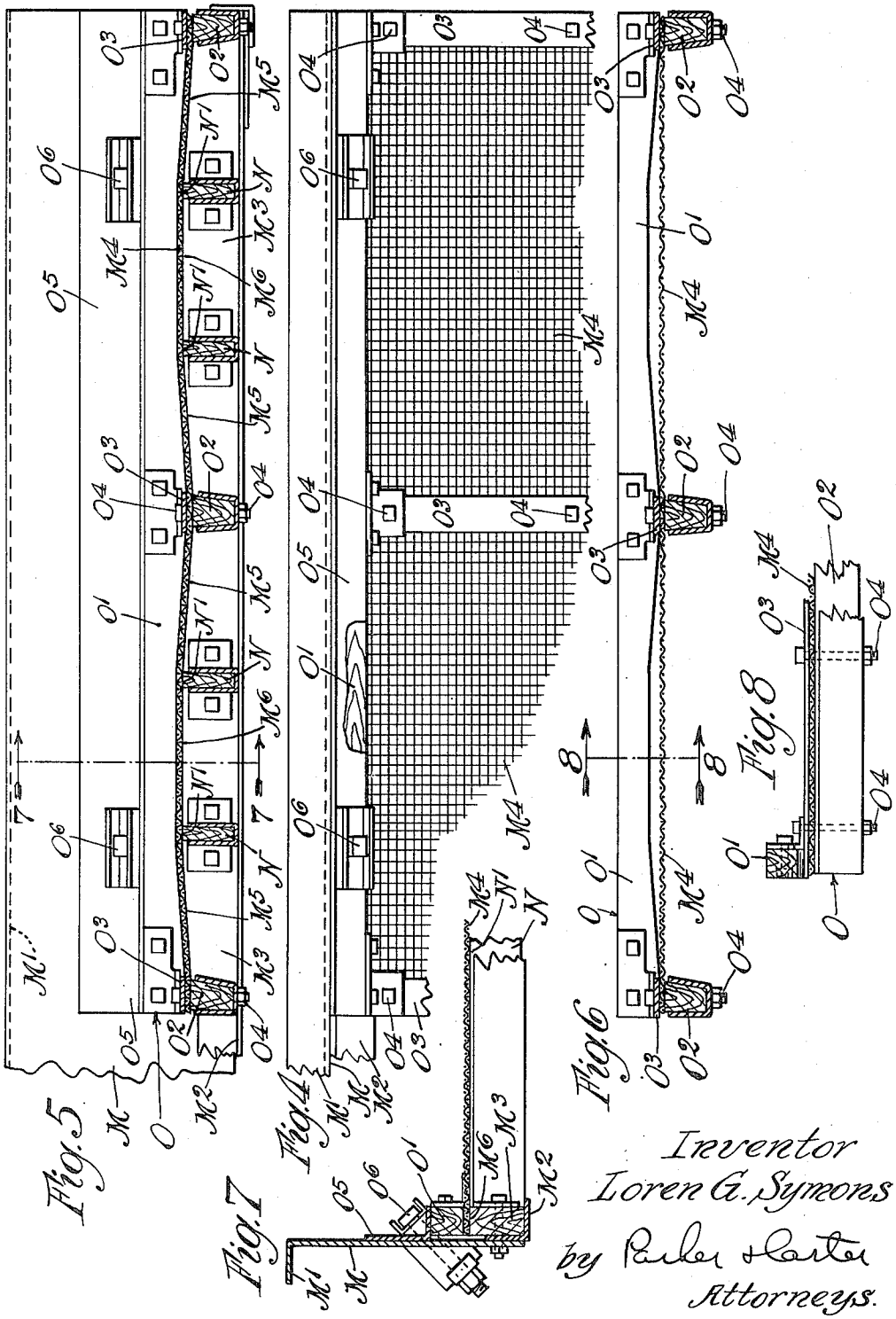


Fig. 5

Fig. 4

Fig. 7

Fig. 6

Fig. 8

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UNITED STATES PATENT OFFICE

2,118,782

SCREEN

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Original application July 18, 1934, Serial No. 735,724, now Patent No. 2,008,648. Divided and this application June 12, 1935, Serial No. 26,232

7 Claims. (Cl. 209—403)

My invention relates to an improvement in screens or material separating devices and has for purpose the provision of a screen which will be economical to manufacture, easy to operate, durable, and highly efficient in operation. One object is the provision of improved means for securing the screen cloth in position. Another object is the provision of improved means for rendering the application and removal of screen cloth quick and easy. Other objects will appear from time to time in the course of the specification and claims.

The present application is a division of my copending application Ser. No. 735,724, filed on July 18, 1934, now Patent Number 2,008,648.

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a side elevation with parts broken away and parts in section;

Figure 2 is a section on the line 2—2 of Figure 1;

Figure 3 is a section on the line 3—3 of Figure 1;

Figure 4 is a partial plan view;

Figure 5 is a longitudinal vertical section through the structure shown in Figure 4;

Figure 6 is a transverse vertical section;

Figure 7 is a section on the line 7—7 of Figure 5; and

Figure 8 is a section on the line 8—8 of Figure 6.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, A generally indicates any suitable base which may, for example, be formed by generally parallel channels A1 with bottom flanges A3 and top flanges A2. It will be noted that the channels terminate in inclined edges at the discharge edge of the screen and are connected by an inclined member A4. The opposite end may be connected by any suitable transverse member A5.

Inclining upwardly from the side base members A1 are two sets of springs which I have indicated respectively as B and B1. Both sets may be clamped to the main frame by means for example of angles B2 which may be welded to the main frame. Each spring is formed of several thin laminations, preferably not over $\frac{1}{16}$ of an inch in thickness, which may be bolted or otherwise secured together. I illustrate, for example, securing clamps B3. The springs B are associated with and are bolted to the angles B10 which may be welded to the longitudinal bars or weights B4, as illustrated in Figure 2. One of these bars or weights B4 extends along each side of the base. At the feed end of the screen the bars are connected by a transverse frame member B5 mounted upon or associated with which is a feed box B6 with a movable inclined gate B7 adapted, in response to its movement, to open up a feed aperture B8. B9 is any suitable feeding bottom or lip for the feed box.

C indicates the main frame of the screen proper. It includes side frame members C1 and end members C2 and any suitable transverse bracing member C3. It is mounted upon the upper ends of the springs B1 which may be bolted to it for example to angles C4 which may be welded to the main deck or to the side members C1. C5 indicates any suitable screen cloth on the deck which may be held down for example by side strips or clamps C6 and transverse strips C7. The screen cloth is preferably supported upon a detachable box-like structure C10 which, as shown in Figures 1 and 2, may be formed of longitudinal channel members C11 and transverse connecting members C12. By means of suitable channel members C14 secured to the members C11, the detachable structure C10 is supported upon angle members C15 fastened to the side frame members C1. Bolts C8 serve to secure the screen structure above described to the side frame members C1. It will be noted, however, that the screen deck underlies the feed box B6 so that material in the feed box is delivered to the feed end of the screen.

Extending from the ends of the side frame members C1 are connecting rod springs generally indicated as D. These are also laminated springs and are secured at one end to angles or brackets D1 bolted or welded to the screen frame. The four springs D are arranged in pairs, one pair at each side of the screen. One spring of each pair is secured to the top of the screen frame and one to the bottom. The opposite ends of the springs are bolted or clamped to housing end members D2. Mounted in the housing end members D2 is a driven shaft D7, to which are fastened one or more eccentric sleeves D6, diagrammatically illustrated in Figure 1, by means of which the screen is vibrated.

E indicates any suitable motor having a rotary shaft E1 and a pulley E2. It may be mounted for example to the inclined end member A4. It is advantageous to so mount the motor that its driving belt E3 extends along a plane generally parallel with the springs B, B1. In such case

vibration of the screen does not substantially slacken the belt.

The main driven shaft D7 is provided with a pulley G about which passes the belt or belts E3. In order to hold the screen deck and the weights B4 in neutral position I may employ coil springs H mounted on brackets H1 on the flange A2 of the side members A1 and compressed against abutments H2 adjustable along the screw threaded member H3 secured to a bracket H4 upon the weights or bars B4. The effect of the springs H is that as the screen operates, the springs B and B1 will vibrate in equal amounts in each direction from their neutral axis.

Referring to Figures 4 to 8 inclusive, I illustrate an improved means for holding screen cloth in position, which is particularly applicable to fine screen cloth and which permits its very ready and easy application to and removal from the screen. The side frame member of the screen proper is indicated as in Figure 5 as M, having an outwardly extending flange M1 at its upper edge, provided also with a lower flange M2 which may be in the form of an angle iron and which may be welded or otherwise secured to it and projects inwardly along its lower edge. M3 are wooden pieces that are bolted to the side of the frame M in order to furnish a support for the wire cloth and to prevent the material from escaping between the side of the frame and the edge of the wire cloth. M4 indicates any suitable wire cloth the edge of which is laid upon the upper faces of the wooden members M3. It will be observed, as in Figure 5, that the contours of the members M3 vary from the horizontal including upward inclines M5 connected by horizontal portions M6.

N indicates cross members extending between the members M3 and having upper surfaces N1 which receive the screen cloth M4. These upper surfaces N1 conform to the upper portions M6 of the upper faces of the wooden members M3.

O generally indicates a removable frame which includes wood side members O1 and transverse members O2. The wooden side members O1 conform to the faces M5, M6 of the wooden members M3 of the fixed screen frame. It will be observed that the screen cloth M4, prior to being positioned in place upon the members M3, is secured to the removable frame and is stretched on a straight line and bolted or otherwise secured in place, as shown in Figure 6. It may, for example, be bolted down as by the transverse strips O3 held by bolts O4 passing through the supports O2. Thereby the screen cloth M4 is tightly secured at its ends and, if desired, at the intermediate transverse supports O2. The removable frame O is then positioned as a unit with the side members O1 overlying the wooden side members M3 of the fixed screen. The side members O1 are then drawn down as by the angles O5 which are clamped in position by the inclined bolts O6 as shown, for example, in Figure 7. As the sub-frame or removable frame O is thereby drawn down into clamping position the wire cloth M4 is deflected upwardly and stretched. The amount of stretching depends on the difference in height between the members O2 and N. As the height of the members O2 fixes the height of the lowest portions of the screen M4, the height of the transverse members N fixes the height of the highest portions of the screen cloth. In addition, the side members M3 and O1 serve as clamping means for firmly clamping the edge of the screen cloth.

It will be understood that the difference in height between the members O2 and N may be varied according to the stiffness of the wire to be stretched. For instance, with very fine wire this distance would not have to be over 3 or 4 inches in a normal sized screen, but with wire as coarse as $\frac{3}{16}$ of an inch this difference might be as great as 6 inches.

It will be realized that whereas I have shown a practical and operative device, nevertheless many changes may be made in the size, shape, and number of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative and diagrammatic rather than as limiting me to my specific showing.

The use and operation of my invention are as follows:—I provide a screen in which the vibration is transmitted to the base practically not at all, and in which the efficiency of the cleaning or screening action is out of line with and vastly superior to that of prior art screens. I employ, for example, the fixed base A which in practice vibrates so little that it does not have to be bolted down to the floor. Mounted upon inclined leaf springs on this space A are two members, namely the screen deck or screen proper and an actuating member for it which includes two longitudinally extending balancing weights or beams B4, a feed box B6 secured to that and a vibrating mechanism herein shown as a shaft D7 having eccentrics D6. This vibrating plant is connected to the screen by two vertically spaced horizontal leaf springs D at each side of the screen frame. This provides a singularly flexible and efficient connection. As the shaft D7 is rotated by the pulley G the effective length of the connection between the power plant and the screen is varied and the result is a very rapid vibration. As both the power plant and weights B4 and the screen itself are mounted on inclined leaf springs, the latter being bolted on the fixed base, the fixed base itself is not vibrated. The springs D, in their vertically spaced pairs, are a singularly efficient and flexible actuating connection. The coil springs H are used to hold the screen and the weights in a neutral position, so that as the screen operates the leaf springs upon which the screen and weights are supported will vibrate an equal amount in each direction from their neutral position.

The weights or bars B4 furnish the inertia necessary for driving the screen deck. Fastening the members or connectors D above and below the center of the screen, as shown in Figure 1, causes them to bend in an S-shape. This S-bend throws the same stress or strain on each leaf of each individual spring, which would not be the case if only one set of springs were used, and if the connection were disposed on a central line of the bearings. If one connection is above and one below the bearings, as shown in Figure 1, unequal strain is avoided. Each spring is made up of a sufficient number of layers for strength, with the metal thin enough indefinitely to withstand the bending moment. The coil springs H relieve the inclined leaf springs from supporting the load which might cause them to bend or sag when the screen is quiet, the coil spring keeping the leaf springs vibrating each way from a neutral point.

An advantage of the removable sub-frame structure shown in Figures 4 to 8 inclusive is that an extra removable frame O can be furnished with very little expense, and the wire cloth M4 bolted to it and laid away ready for quick change when repairs are necessary. In the second place, it is not necessary to take great

pains in stretching the wire cloth M4 on the removable frame O, as the bars or transverse supports N will take up all slack when the frame O is bolted in place. The bolting in place of the removable frame O first stretches the wire and then clamps it in place on the sides, making it possible to get a perfectly even tension over every square foot of the surface of the wire cloth. It is kept securely clamped in that position.

Irrespective of the details of the securing of the screen mesh in position, I find it highly desirable to so secure the mesh as to create one or more, and preferably more than one, wave-like formations extending transversely across the path of the particles undergoing screening. Referring for example to Figure 5, the particles as they are conveyed along the screen by the movement or vibration of the screen are required first to climb up the slope leading to one of the transverse supports N1. The particles thereafter travel along the horizontal portion M6 and finally travel down an incline to the next member O2. At the end of the incline the transverse clamping member O3 serves as a species of low dam which dams back the material undergoing separation and permits local stratification and settling out of the fine particles. In the normal operation of the screen the particles will finally cross the dam or member O3 and ride up the ensuing incline over the next wave and so on until they pass through the mesh or over the end of the screen.

I claim:

1. In a vibratory screen, a screen frame, a removable sub-frame therefor, flexible screen material secured to said removable sub-frame, means for securing said removable sub-frame to the screen frame, and means for tensioning the screen material in response to the application of the sub-frame to the screen frame, including opposed clamping members associated with the screen frame and the sub-frame, adapted to engage the edges only of the screen material.

2. In a vibratory screen, a screen frame, a removable sub-frame therefor, flexible screen material secured to said removable sub-frame, tensioning supports extending transversely across said screen frame and generally perpendicular to the path of movement of the material along the screen, said transverse members including some members the tops of which extend above a plane defined by the tops of the lower of said members and project upwardly above the plane defined by the connections of the screen material and the sub-frame when the sub-frame is in operative position in relation to the screen frame, means for locking the sub-frame in position in relation to the screen frame and for thereby tensioning said flexible screen material over the upwardly extending transverse tensioning members, and means, opposed to the upper surface of the flexible screen material, adapted to clamp it downwardly against the lower of said transverse supports.

3. In a vibratory screen, a screen frame, a removable sub-frame therefor, flexible screen material secured to said removable sub-frame, tensioning supports extending transversely across said screen frame and generally perpendicular to the path of movement of the material along the screen, said transverse members including some members the tops of which extend above a plane defined by the tops of the lower of said members and project upwardly above the plane defined by the connections of the screen material and the sub-frame when the sub-frame is in operative position in relation to the screen frame, and means for locking the sub-frame in position in relation to the screen frame and for thereby tensioning said flexible screen material over the upwardly extending transverse tensioning members, and means, opposed to the upper surface of the flexible screen material, adapted to clamp it downwardly against the lower of said transverse supports, said means including transverse members associated with the sub-frame.

4. In a vibratory screen, a main screen frame including frame members extending along opposite sides of the screen, transverse members connecting said side frame members, a removable sub-frame including corresponding frame members adapted to overlie said first mentioned frame members of the main screen frame, and having transverse frame members out of vertical alinement with the transverse frame members of the main screen frame, flexible screen material secured to said removable sub-frame and to the transverse members thereof, and having edges adapted to overlie said first mentioned main screen frame members, means for securing said removable frame to said main screen frame and for tensioning the screen material in response to the application and securing of the sub-frame to the main screen frame, the edges of said flexible screen material being gripped between the opposed faces of the first mentioned main screen frame members and the sub-frame members opposed thereto.

5. In a vibratory screen, a main screen frame including frame members extending along opposite sides of the screen, a removable sub-frame including corresponding frame members adapted to overlie the said frame members of the screen frame, flexible screen material having edges adapted to overlie said first mentioned frame members, means for securing said removable frame to the main screen frame and for tensioning the screen material in response to the application and securing of the sub-frame to the main screen frame, the edges of said flexible screen material being gripped between the opposed faces of said corresponding frame members when the sub-frame is secured in position, the opposed faces of said frame members being formed to constrain the screen material to a wave-like form having a plurality of crests extending transversely across the screen, adjacent crests being separated by a depressed area of the screen material, and transverse sub-frame members to which the depressed areas of screen material are secured, and transverse main frame members adapted to underlie and engage the screen material along said crests.

6. In a vibratory screen, a main screen frame including side frame members, and transverse members connecting them at various points along the length of the screen, screen cloth supported upon the upper portions of said transverse members, the screen supporting portions of said transverse members being located at varying heights, whereby the screen cloth is constrained to form a plurality of transversely extending waves, and a sub-frame removably mounted on said main frame, and having transverse connecting members overlying the lower only of the transverse members of the main frame, whereby the screen cloth is tensioned over the higher of the transverse members of the main frame, and is constrained to said transversely extending waves.

7. In a vibratory screen, a main screen frame

including side frame members, and transverse members connecting them at various points along the length of the screen, screen cloth supported upon the upper portions of said transverse members, the screen supporting portions of said transverse members being located at varying heights, whereby the screen cloth is constrained to form a plurality of transversely extending waves, and a sub-frame removably mounted on said main frame, and having transverse connecting members overlying the lower only of the transverse members of the main frame, whereby the screen cloth is tensioned over the higher of the transverse members of the main frame, and is constrained to said transversely extending waves, said main and sub-frames having opposed clamping portions adapted to clamp the longitudinal edges of said screen cloth in conformity with said waves.

LOREN G. SYMONS.