E. S. McKINLAY.

SCREEN FOR ORES AND COAL AND OTHER MATERIAL.

APPLICATION FILED JAN. 31, 1908. RENEWED FEB. 15, 1915.

1,153,804.

Patented Sept. 14, 1915.

4 SHEETS—SHEET 1.

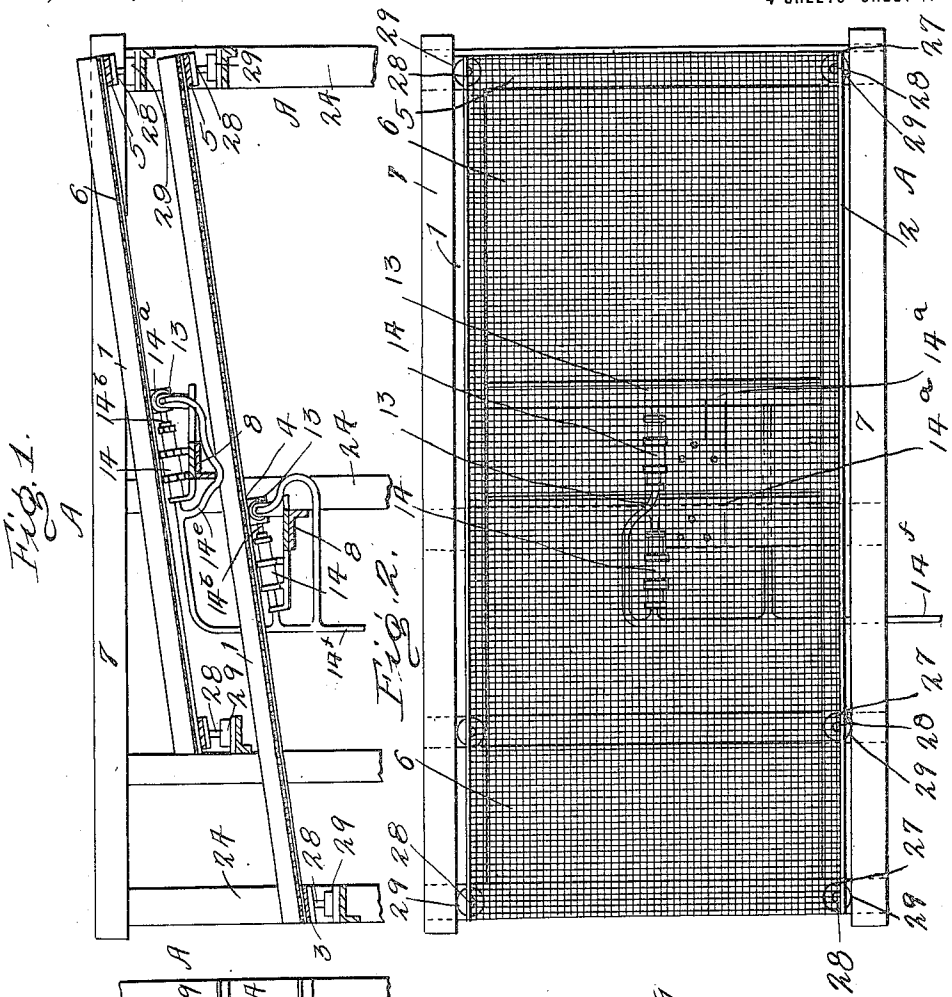


Fig. 1.

Fig. 2.

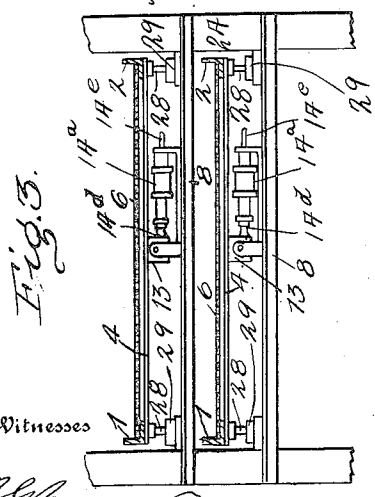


Fig. 3.

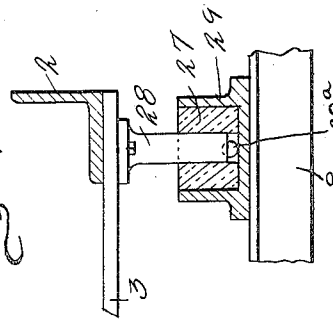


Fig. 4.

Witnesses

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4 SHEETS—SHEET 2.

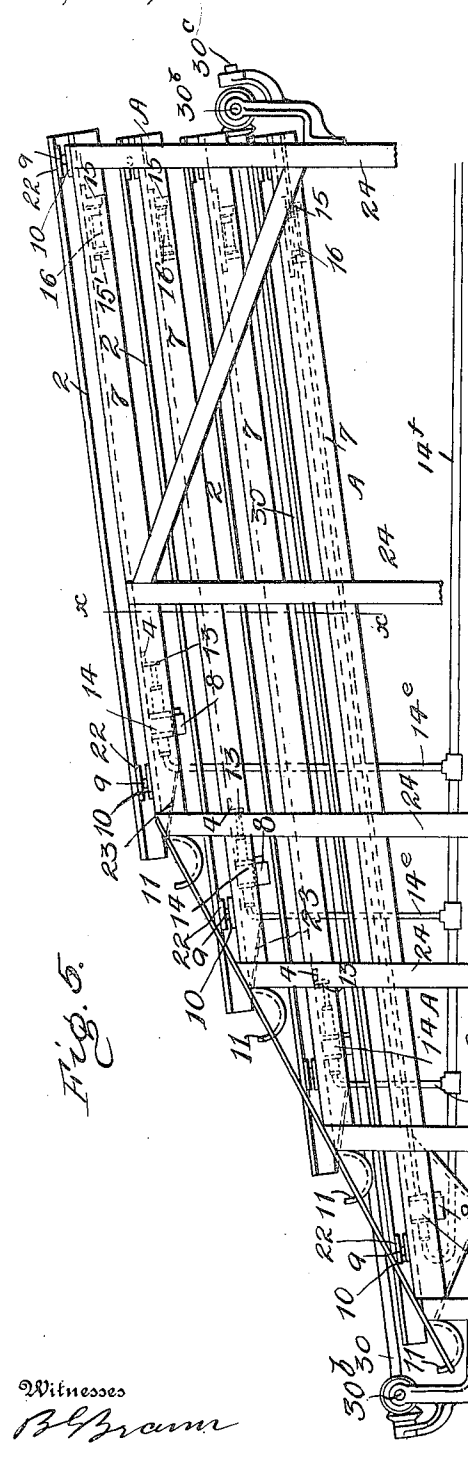


Fig. 5.

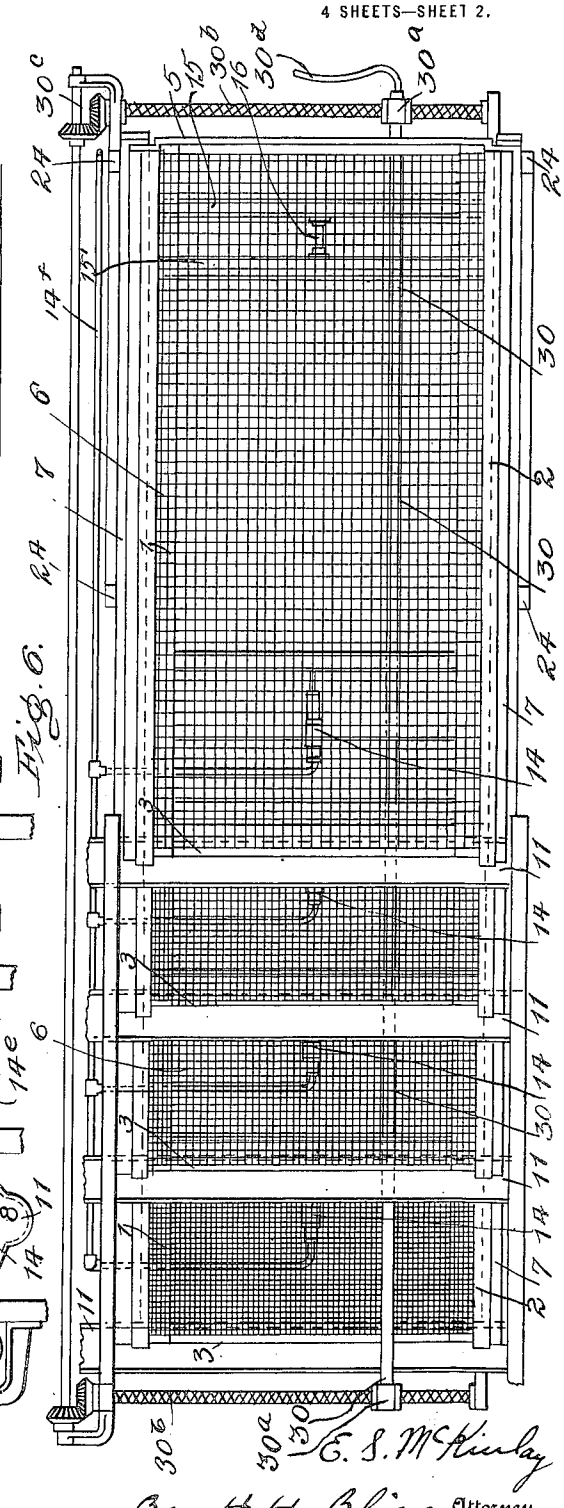


Fig. 6.

Witnesses

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4 SHEETS—SHEET 3.

Fig. 10.

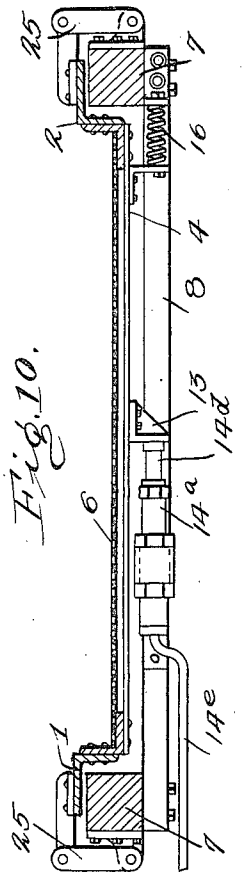


Fig. 11.

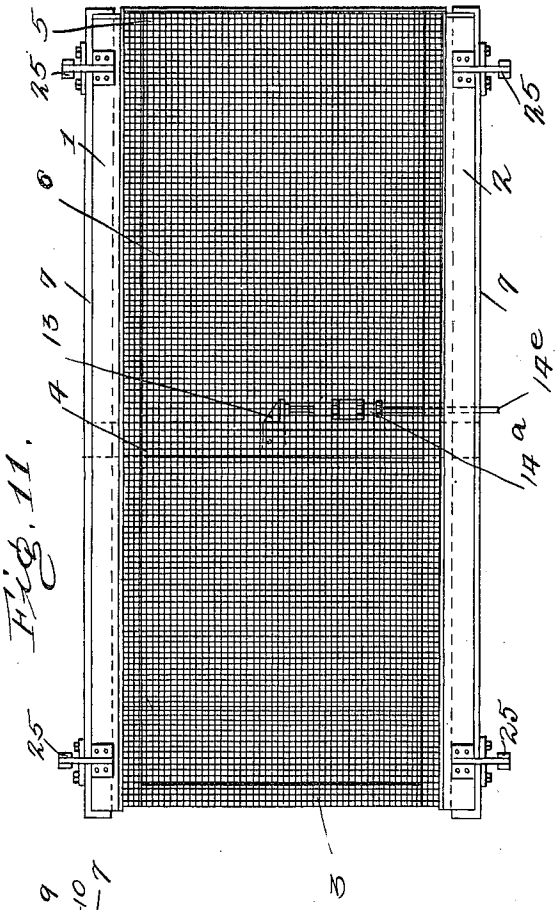
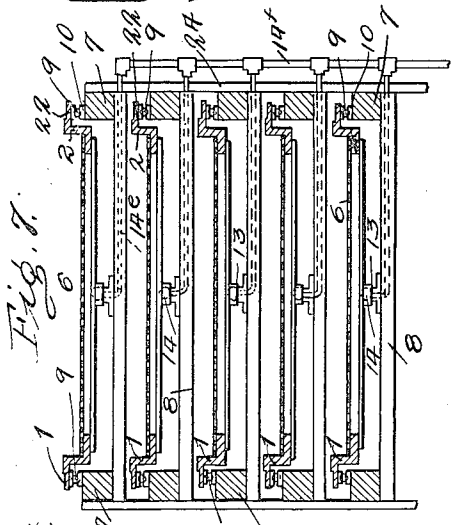


Fig. 7.



Witnessess

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4 SHEETS—SHEET 4.

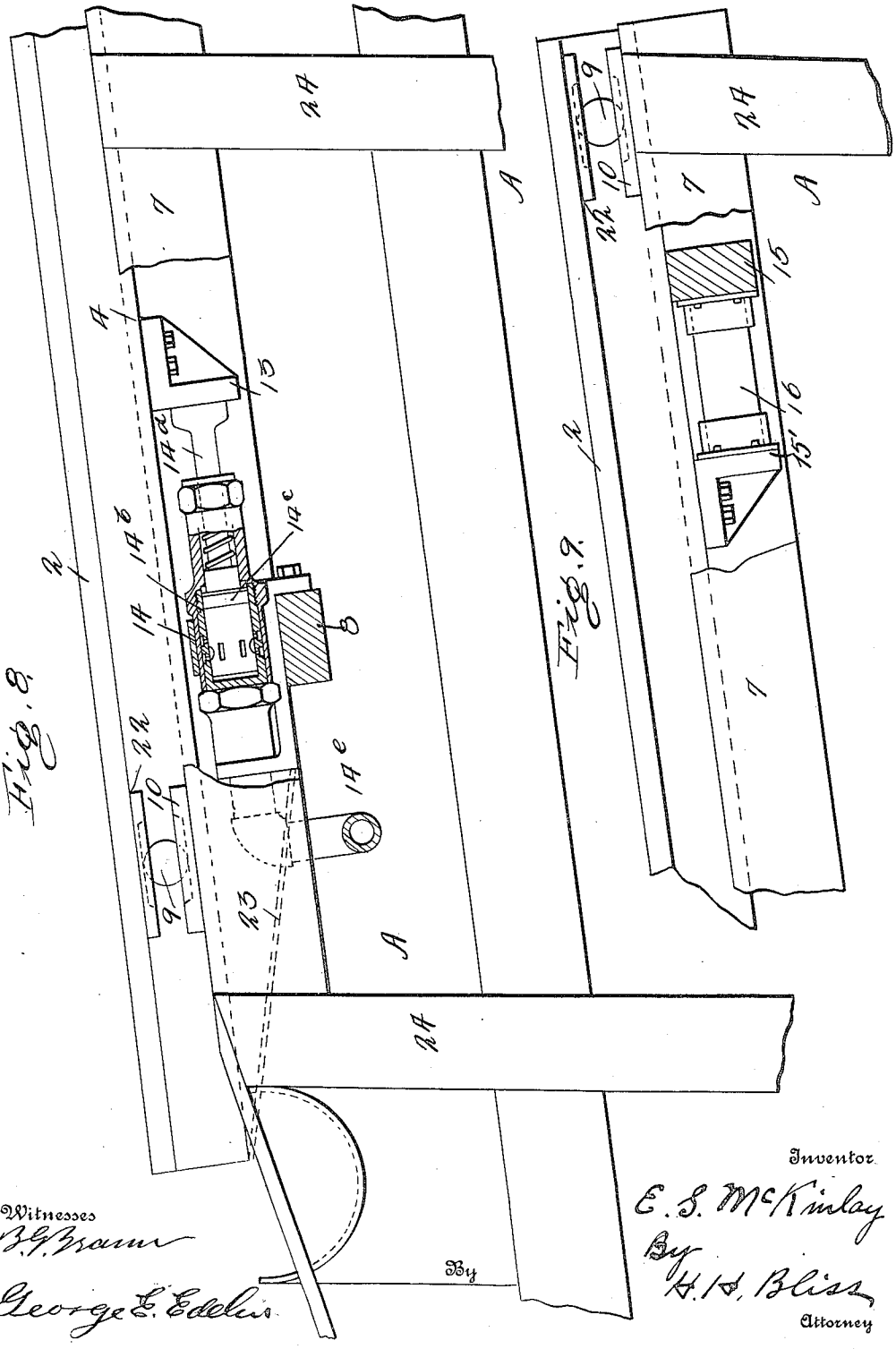


Fig. 8.

Fig. 9.

Witnesses
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UNITED STATES PATENT OFFICE.

EDWARD S. McKINLAY, OF STEAMBOAT SPRINGS, COLORADO.

SCREEN FOR ORES AND COAL AND OTHER MATERIAL.

1,153,804. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed January 31, 1908, Serial No. 413,702. Renewed February 15, 1915. Serial No. 8,289.

To all whom it may concern:

Be it known that I, EDWARD S. McKINLAY, a citizen of the United States, residing at Steamboat Springs, in the county of Routt and State of Colorado, have invented certain new and useful Improvements in Screens for Ores and Coal and other Material, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention has relation to improvements in screens for ores, coal and similar products, and has special relation to screens of that type or class wherein the purpose is effected by the rapid vibration or reciprocation of the screen or screens; and the purpose or object is to provide an improved screening machine, associated with novel means for imparting the requisite vibration to the screens.

Another purpose is to construct and equip the screen so as to have a compound vibration; that is, a simultaneous longitudinal and lateral movement.

In the drawings—Figure 1 is a longitudinal sectional view of a screening mechanism embodying my improvements. Fig. 2 is a plan view of the parts in Fig. 1. Fig. 3 is a vertical transverse section of Fig. 1. Fig. 4 is a sectional detail of the screen support in Figs. 1, 2 and 3. Fig. 5 is a side view of a screening mechanism showing features of modification as to the screen supports and the arrangement of the vibrating mechanism. Fig. 6 is a plan view of the parts in Fig. 5. Fig. 7 is a cross section on the line x—x, Fig. 5. Fig. 8 is a view on an enlarged scale, partly in side elevation and partly in section, of parts of the apparatus in Fig. 5 at the lower end of a screen. Fig. 9 is a view on an enlarged scale, partly in elevation and partly in section, of the parts at the upper end of one of the screens. Fig. 10 is a section of a screen with a modified form of support. Fig. 11 is a plan view of the parts in Fig. 10.

Referring to the drawings, A designates the frame which supports the screen, or a plurality of screens placed in vertical series. In the latter instance the oppositely arranged side rails 7, 7 are in vertical alinement, at such distance apart as may be desired, and made of such length, as the proposed capacity of the machine may require. The side rails or supports are tied together at the ends by suitable bars or rods and by vertical plates or timbers 24. The screens 6 are preferably secured to the inner flanges of angle irons 1, 2 which are also employed as a means of support. In some cases they rest on legs 28 seated in holders 29 secured to the frame; in others they rest directly on bearing balls 9 loosely seated in cup bearings 10 secured on the frame, the angle bars of the screen in the latter case having suitable seats as at 22 for the balls. The first form of support is illustrated in Figs. 1, 2, 3 and 4 and the second in Figs. 5, 6, 7, 8, and 9. Another manner of supporting the screens is illustrated in Figs. 10 and 11, where the angle irons are shown to be connected by arms with links 25. These angle irons may be each in a single piece of Z form in section, as in Figs. 5, 6, 7, 8, and 9, or two L angles may be secured together as in Figs. 10 and 11. A single L shaped angle iron is sufficient with a form such as shown in Figs. 1, 2 and 3.

If the screens are arranged in vertical series, the discharge ends can be successively extended, the upper screen being the shorter and the lower being longer, and extending beyond the other, so that material falling through the higher screen adjacent to the end thereof, would drop on the lower extended portion and be additionally screened in its passage over the extension. Reversely inclined screen plates 23 may be employed, placed at the discharge end of each screen, and extended back a desired distance to drop the material on the next lower screen, whereby the last portion of the material may be given additional screening in the passage over the lower screen. A trough 11 is placed at the end of each screen, these being shown in Figs. 5, 6, and 8, but it will be understood they are applicable to constructions such as shown in Figs. 1 and 2.

It is the object to apply as the actuating power (to accomplish the requisite sieving or screening function) to the screen or screens, a pneumatic or other elastic fluid striker, the rapid reciprocations of which will produce the requisite vibrations to effect a thorough and complete cleansing or separation of the ore from the debris. On suitable supports 8 across the main or stationary frame 7, 24 is mounted and secured the pneumatic striker 14, the piston of which impinges and impacts on the buffer-block 13. As indicated in the drawings this buffer block or abutment is shown as being formed

on or attached to a cross bar 4 which has its ends secured to the side bars of the screen frame; but it will be understood that the blows or impacts of the striking device can be applied to the screen in other ways. These pneumatic strikers may be of any of the approved styles, having the reciprocating plungers, and disposed and adapted to contact with the buffer-block.

One or more springs are arranged to act in opposition to the striker or hammer, these tending to return the screen to its initial position more rapidly than would the action of gravity alone. The action of gravity may be found sufficient under some conditions of construction and operation, but in many cases the supplemental action of springs or the like is desirable. Springs or resilient bodies for this purpose may be employed of either of several sorts and arranged in any suitable way. In the machine shown in Figs. 1, 2, 3 and 4, the legs 28 are arranged to bear against rings or blocks of rubber 27. In the devices shown in Figs. 5, 6, 7, 8 and 9 a rubber spring 16 is employed near the upper end of each screen, the pneumatic striker or hammer being at the lower end. This spring 16 is carried by the bars 15 and 15′ on the main and screen frames respectively. Instead of a rubber spring of this character a coiled metallic spring can be used as shown in Fig. 10. The screen can be not only vibrated longitudinally in this peculiar manner by the co-acting and oppositely acting pneumatic striker or hammer on the one hand and the recoil spring on the other, but can be also vibrated laterally in a similar manner. As illustrated in Figs. 1 and 2 of the drawings, hammers or strikers 14^a are arranged transversely of the screen and are adapted to impart blows or thrusts to it on lines at right angles to those imparted by the hammers or strikers 14, both being here shown as impacting upon the same block or abutment at 13. In order to permit the compound movement resulting from the employment of these strikers or hammers the screens must be so supported that they can yield both laterally and longitudinally, and this is allowed by the rubber cushions or blocks 27 in the sockets 29 against which the standards 28 bear.

Where vibrations on longitudinal lines only are desired the strikers or hammers can be arranged as in Figs. 5, 6, 7 and 8; and where a lateral motion only is required they can be applied as in Figs. 10 and 11, the recoil springs 16 being suitably arranged to correspond to the position of the strikers or hammers.

I am aware that screens have been vibrated in numerous ways, that attempts have been made to secure very rapid movements thereof, as by using eccentrics and connecting rods, rotary toothed cams, etc., and that pneumatic hammer devices have been suggested for use in connection with small light screens or riddles, but I believe myself to be the first to devise a screening mechanism suited for the handling of coal, ore and the like, wherein an excessively high speed, characteristic of the pneumatic tool, is attained without requiring the rapid rotation of shafts, gearing or other parts with the consequent friction and wear incident to those so constructed and moved especially in the case of comparatively large and heavy mechanisms.

It is well known that the pneumatic tools employing reciprocating plungers and automatically acting valves are capable, in actual practice, of a speed as high as four thousand and more reciprocations per minute. It is also well known that the efficiency of screening devices depends upon the number of vibrations per minute that can be imparted to them, their capacity increasing in ratio approximately directly with the increase of such speed. But it is practically impossible to pass a relatively low limit of speed when using a screen actuating mechanism which comprises one or more rotary parts. I employ a reciprocating driver of such nature that no translating or motion transforming parts are required, the initial driven body (the plunger and stem of the pneumatic hammer tool here used) exerting its movement and force directly upon the screen.

As shown in Fig. 4 bearing balls 28^a may be used below the standards 28 of the screen frame, they assisting in taking the weight and in permitting the rapid vibrations. As stated the striker may be of any preferred form, and need not be described in detail. In Fig. 8 the parts are more or less conventionally shown which characterize devices of this class, 14^b indicating the cylinder which is stationarily held by the main frame, being clamped to the cross bar 8. 14^c is the piston or plunger which rapidly reciprocates in the cylinder under pressure of air or steam. 14^d is the stem part which imparts the blow or impact to the screen frame which it receives from the plunger 14^c. The usual valves are employed and also inlet and exhaust ports, the air or steam being conducted to the inlet port through the pipe 14^e, these pipes 14^e communicating with a main pipe 14^f.

As has been pointed out above, a much higher speed of vibration can be obtained with a tool or striker actuated by elastic fluid than would be possible with purely mechanical devices. The penumatic hammers, however, have additional advantages in screening mechanism of the character to which my invention relates in which there are a series of screens mounted in a common supporting frame. This advantage arises from the fact that the hammers move in-

dependently of each other, their cyclical movements having no fixed time relation to each other. By reason of this fact there is no tendency to set up rhythmical vibratory movements in the frame structure such as are present in screens actuated by mechanical devices which move uniformly and in unison with each other. In a large multiple screen structure, such vibrations may become quite serious. In a word, my improved screening mechanism attains at the same time a largely increased capacity and the obviation of destructive vibrations such as referred to.

To keep the screen meshes clear use may be made of an air pipe 30 arranged above each of such screens as it is desired to clean. The pipe is moved at the proper speed back and forth across the screen, as for instance by means of nuts 30^a on shafts 30^b respectively, these shafts being each provided with a right hand thread and a left hand thread, capable of moving the nuts alternately in opposite directions, a power shaft 30^c being geared to the screw shaft for actuating them. In Figs. 5 and 6 a single cleaning pipe of this sort is shown, but it will be understood that they can be employed with each of the screens if desired. The air is delivered to the pipe by flexible hose couplings as at 30^d.

For the sake of brevity and convenience in describing my invention, I have frequently referred to the striking devices as pneumatically actuated, but it will be understood that any suitable elastic fluid, such as steam, can be used and that my invention is not restricted to the use of any one working medium.

I claim—

1. In a screening mechanism, the combination of a main frame, a series of superposed independent screens each having a frame mounted in said main frame and each longitudinally movable independently of the others, a series of independent elastic fluid-actuated blow-striking hammers each supported on the main frame and adapted to impart with great rapidity impacts to one of said screens, and resilient devices engaging with the screens in opposition to said hammers, the cyclical movements of the hammers being independent of each other, substantially as set forth.

2. A screen mechanism comprising in combination a supporting frame, a screen in the frame arranged to move longitudinally and laterally, an elastic fluid-actuated tool to contact with the screen and impart longitudinal motion thereto, and an elastic fluid-actuated tool to contact with the screen and impart lateral motion thereto, the cyclical movements of the said tools being independent of each other, substantially as described.

3. In a screen mechanism, a supporting frame, a screen in the frame slidable longitudinally and laterally, a block carried by the screen, an elastic fluid tool to engage the block and move the screen longitudinally, a second elastic fluid tool operating independently of the first named tool to move the screen laterally, and resilient devices to return the screen longitudinally and laterally to normal position, substantially as described.

4. In screening mechanism, the combination of a supporting frame, a screen supported on the frame to move edgewise in all directions, a rubber annulus mounted on one of the said parts, a stud carried by the other part and projecting into said annulus, and impact mechanism for moving the screen in two or more directions against the resistance of the rubber annulus.

5. In a screening mechanism, the combination of a main frame, a series of inclined superposed independent screens each having a frame mounted in the main frame and each longitudinally movable independently of the others, and a series of independent elastic fluid-actuated blow-striking hammers each supported on the main frame and adapted to impart with great rapidity impacts to one of said screens, the cyclical movements of the hammers being independent of each other, substantially as set forth.

In testimony whereof I affix my signature, in presence of two witnesses.

EDWARD S. McKINLAY.

Witnesses:

WILLIAM A. McKINLAY,

HENRY S. PRITCHETT.