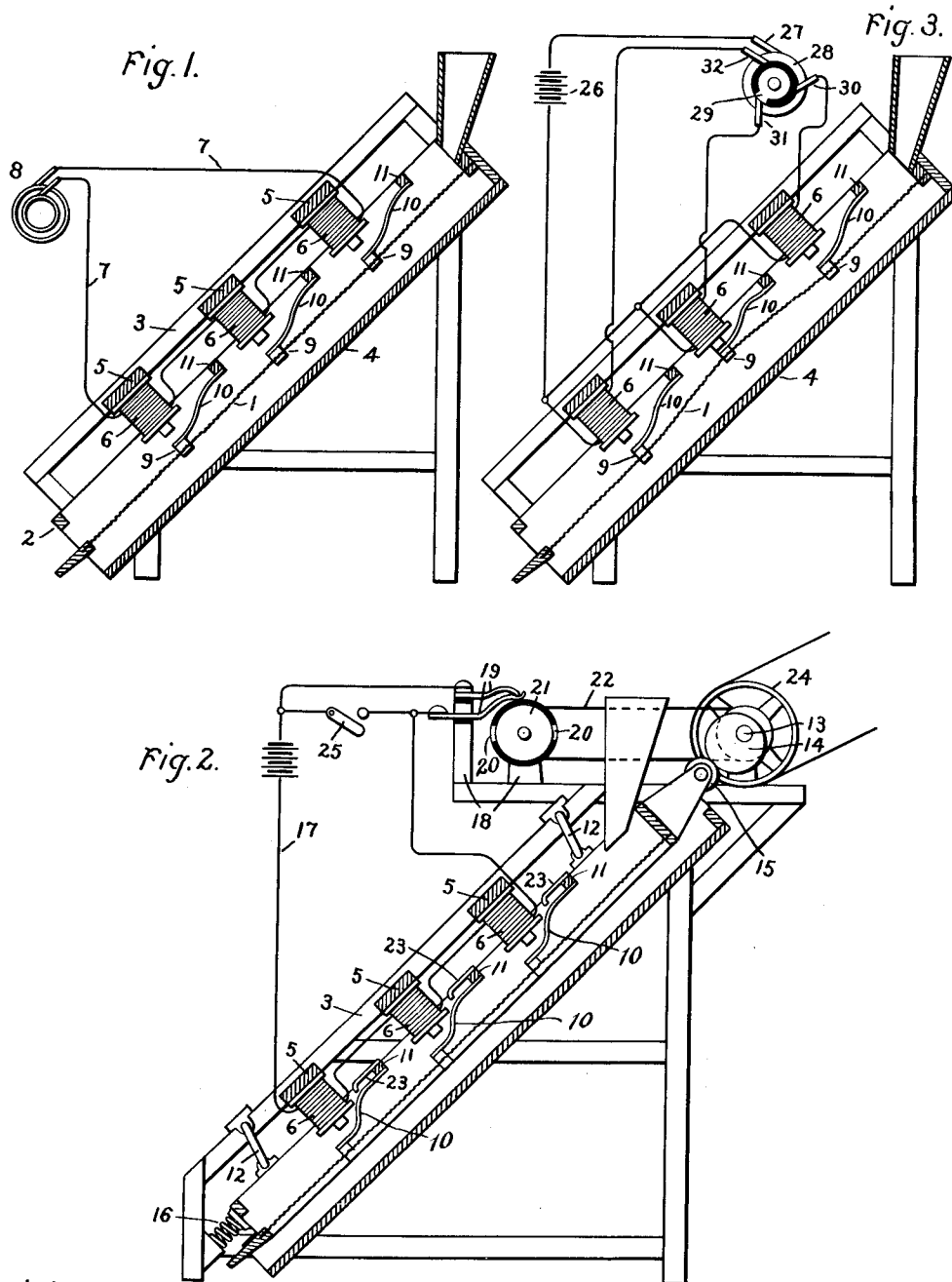


E. B. HAYES.
SCREEN.
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Patented Apr. 18, 1916.



Witnesses
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UNITED STATES PATENT OFFICE.

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SCREEN.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, EDGAR B. HAYES, a resident of the United States, residing at Park City, county of Summit, State of Utah, have invented new and useful Improvements in Screens, of which the following is a specification.

My invention relates to the art of screening, or passing powdered material through a screen or sieve, and more particularly to screens used in separating and handling crushed ore and similar materials which must be screened and classified according to size.

Where crushed ore or other powdered material is screened, and particularly where fine screens are used, the particles of ore or powder tend to clog up the screens, which must be kept clean and unobstructed in order to work efficiently. It has been proposed to use brushes which move over the surface of the screen and brush the fine particles out of the meshes, but such an arrangement has not proved satisfactory; it has also been proposed that the frame which carries the screen should be jarred by means of cogwheels, tappets, and similar devices, and by swinging the frame at each end of its stroke into contact with fixed pins or abutments. Jarring the screen frame is objectionable because the screen deteriorates very rapidly under the severe strains and jars to which it is subjected when the screen frame is violently jarred, and therefore the screen cannot be kept tight on the frame and in good repair.

The object of my invention is to vibrate the screen and keep it from clogging without causing undue and destructive strains on either the screen or the frame; and without loosening and deteriorating the screen by violent and destructive jarring.

A further object is to keep the screen in uniform and even vibration at any desired rate and in any desired manner with a minimum of wear and damage to the screen.

A still further object is to enable the operator to completely control the vibrations of the screen without altering the position or movement of the frame.

In carrying out my invention the screen, firmly secured to any suitable frame, is moved at right angles to its surface and independently of the movement of the frame by means of any suitable electromagnetic

actuating device arranged to exert directly on the screen a force which tends to move the screen at right angles to its surface and thereby shake or vibrate the screen so that the particles pass through it and out of the meshes. The preferred form of device for accomplishing this result comprises an electromagnet which has an armature directly connected to or carried on the screen and moved in response to variations in the strength of the field of the magnet.

Since the screens commonly used are made of nonmagnetic material, such as brass wire woven into a sort of cloth, the armature of the electromagnet is preferably a block of iron of any suitable size and shape arranged in any desired way so that its movement causes a movement of the screen. In the preferred construction the armature is attached directly to the screen and moves with it, although where an iron screen is used the metal of the screen may be utilized as an armature for the electromagnet without departing from the scope of my invention. If desired, the screen may be provided with some resilient means, such as a spring, or spring blade, for assisting the vibration of the screen. Since the armature is attracted and the screen moved whenever the magnetic field is strong enough both the armature and the screen may be vibrated as desired by intermittently energizing the electromagnet or otherwise varying the effect of the magnet on the armature. Where direct current is available the magnet may be intermittently energized by means of an interrupter which periodically opens and closes the circuit of the magnet, or the magnet may be periodically energized by connecting it to a generator of alternating or pulsating current of any desired frequency, in which case the armature and screen will vibrate in synchronism with the changes in current. The frame for holding the screen may be stationary, or may be moved in any desired manner, and in either case may be set at any angle, since the vibration of the screen does not depend in any way on the movement of the frame. Where a movable frame is used the interrupter may conveniently be driven from the power shaft which actuates the frame. By using a plurality of magnets properly arranged and by energizing them in definite order any desired movement, such as waves or ripples,

may be produced in the screen and may be controlled both in direction and in amplitude to secure the best results.

My invention will best be understood in connection with the accompanying drawings, which illustrate one of the many forms in which the invention may be embodied, and in which—

Figure 1 is a longitudinal section showing a screen attached to a stationary frame and vibrated by magnets energized by alternating current, Fig. 2 is a longitudinal section showing a movable screen frame with the magnets for vibrating the screen energized by current controlled by an interrupter and Fig. 3 is a longitudinal section similar to Fig. 1, but with means for energizing the magnets in succession to produce a wave or ripple motion in the screen.

In the form of device shown in Fig. 1 the screen 1 is firmly secured to a stationary frame 2 carried in any suitable framework 3 above a chute 4 for receiving the material which passes through the screen. The ground, powdered, or crushed ore or other material to be screened is delivered to the screen in any suitable way. The screen is actuated or vibrated by means of an electromagnetic-actuating device mounted on the frame 3, for example on crossbars 5 and comprising electromagnets 6 having laminated cores surrounded by suitable windings which are connected by leads 7 to an alternator 8 which supplies alternating current and intermittently energizes the electromagnets. The periodic variations in the strength of the field produced by the magnets causes the screen 1 to vibrate at right angles to its surface because the armatures 9 are mounted to move in response to the periodic variations in the magnetic field and to move or vibrate the screen in any suitable way.

In the preferred construction, as shown in Fig. 1, the armatures are secured directly to the screen and move with it, and in addition are carried on the free end of a spring blade 10 which is mounted on a support 11, so that one end is fixed and the free end vibrates the screen. The free end of the spring blade 10 is lifted each time the magnet is energized and is released when the magnet is unable longer to hold the armature. The spring blade 10 is of such a size and length that the armature and screen vibrate in synchronism with the alternations of current through the windings of the magnets, thereby keeping the screen in vibration at a predetermined rate as long as the alternator supplies current.

Since the vibration of the screen depends only on the magnets, the frame for the screen may be set at any desired angle, may be stationary or movable, and may be moved in any desired way. In the form of device shown in Fig. 2, the framework 3 is the

same as shown in Fig. 1, but the frame 2 is carried or hung on any suitable support which will permit it to move. Merely for the purpose of illustration the frame is shown supported by links or hangers 12 and is moved back and forth by any suitable shaking or actuating means, such as a driving shaft 13 which carries a cam 14 kept in engagement with a roller 15 on the frame by means of a spring 16 mounted on the framework to hold the roller 15 against the cam. The electromagnets in Fig. 2 are energized from a direct current circuit 17 periodically opened and closed by any suitable interrupter such as the interrupter 18, which comprises two brushes 19 connected to the leads of the circuit 17 and mounted to engage insulated bridging bars 20 on a rotary cylinder 21, which is driven from the driving shaft 13 by a suitable connection 22. The parts are so arranged that the circuit through the magnets is closed when one of the bridging bars 20 engages the two brushes 19, and the frequency with which the magnets are energized depends on the number of bars and the speed at which the interrupter is driven. The armatures 10 are connected to the screen and the supports 11 are carried on the frame 2 so as to move with the armatures, which are prevented from coming into contact with the magnets by stops 23 on the supports 11. The shaft 13 is driven in any suitable manner, preferably through the pulley 24 mounted on the shaft and belted to the source of power. As the frame swings back and forth the armatures are moved up and down by the variations in the field of the magnets, and the screen is vibrated at a rate determined by the speed and structure of the interrupter. In some cases where a movable frame is used a sufficient vibration of the screen may be secured by keeping the magnets continuously energized by keeping the circuit 17 closed, as by closing the switch 24, in which case the armatures and the screen will be lifted each time the movement of the frame brings the armatures close enough to the magnet, and will be dropped as the movement of the frame carries them away from the magnets.

It is evident that a wave or ripple motion may be given to the screen by energizing the electromagnets 6 one after another in definite sequence. One of the many ways in which this result may be obtained is illustrated in Fig. 3, in which I have shown, merely for purposes of illustration, a screen constructed in general like that shown in Fig. 1, but provided with a distributor, shown diagrammatically, for energizing the electromagnets 6 in definite sequence from some suitable source of current, which is conventionally indicated at 26. The distributor may be made in many different

forms, and is driven in any suitable way at the proper speed to secure the desired results. The particular form illustrated comprises a brush 27 connected to one pole of the source of current 26 and engaging a conducting ring 28 which is in permanent electrical connection with a distributing contact 29. The circuit is completed through the electromagnets 6 one after the other as a result of the distributing contact 29 engaging in succession the brushes 30, 31, and 32, each of which is connected through a different electromagnet 6 to the other pole of the source 26. With the parts in the position shown in Fig. 3 the middle electromagnet connected to the brush 31 is energized. An instant later this electromagnet will be deenergized and the one connected to the brush 32 will be energized, and so on. The result is that a wave or ripple is continually running along the screen from top to bottom. By increasing the number of magnets and also by varying the order in which they are energized variations in the form or amplitude of the waves or ripples may be produced.

My invention may be embodied in many other forms than that shown and described, and I do not wish to be restricted to the form shown, but intend to cover by the appended claims all changes and modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The combination of a screen frame, a flexible elastic screen having its edges secured to said frame, an armature connected to said screen and mounted to move independently of said frame in a path perpendicular to the surface of the screen, a magnet mounted to cooperate with said armature, and means for varying the effect of said magnet on said armature.

2. The combination of a screen frame, a flexible elastic screen secured at its edges to said frame, an armature connected to the middle portion of said screen and mounted to move in a path perpendicular to the surface of said screen, a magnet mounted above the screen to cooperate with said armature to lift it, and means for varying the field strength of said magnet to vibrate said armature and said screen independently of said frame.

3. The combination of a screen frame, a flexible vibratile screen mounted on said frame to be free to vibrate in a path perpendicular to its surface, a magnet, an armature for the magnet mounted on said screen to vibrate therewith, and means for intermittently varying the field strength of said magnet to cause said armature and said screen to vibrate.

4. The combination of a screen frame, a flexible screen mounted on said frame to be

free to vibrate perpendicular to its surface and independently of the frame, an armature carried by and movable with the screen, a magnet mounted to move the armature in a direction perpendicular to the surface of the screen, and means for varying the effect of said magnet on said armature.

5. The combination of a screen frame, a vibratile screen mounted thereon to vibrate in a path perpendicular to its surface and independently of said frame, an armature connected to said screen, resilient means mounted on said frame to hold said armature and screen in normal position, an electromagnet for actuating said armature, and means for intermittently energizing said electromagnet to vibrate said armature and screen.

6. The combination of a screen frame, a flexible vibratile screen secured to said frame to vibrate perpendicular to its surface and independently of said frame, a spring blade having one end fixed and the other end free to vibrate with said screen, an electromagnet cooperating with the free end of said spring blade, and means for energizing said electromagnet in synchronism with the periodic swings of said spring blade.

7. The combination of a screen frame, a flexible elastic screen secured at its edges to said frame and having its middle portion free to vibrate perpendicularly to its surface, a spring blade having one end fixed to said frame and the other end to the middle portion of said screen, an armature connected to said spring blade, an electromagnet for attracting said armature against the resistance of said spring blade, and means for causing said electromagnet to attract and to release said armature.

8. The combination of a flexible elastic screen, a resilient support for said screen, an armature connected to said screen adjacent said support, an electromagnet for attracting said armature and thereby straining said support, and means for energizing said electromagnet to intermittently strain said support and set said armature and screen into vibration.

9. The combination of a screen frame, a vibratile screen mounted thereon, an armature mounted on said screen and movable therewith, a magnet for actuating said armature, said frame and magnet being mounted for relative movement to bring said armature into and out of the field of said magnet, and means for causing such relative movement of said frame and said magnet.

10. The combination of a screen frame mounted to move in a definite path, actuating means for moving said frame, a vibratile screen mounted on said screen frame to be free to vibrate, an armature connected

to said screen and movable therewith, and a magnet mounted to actuate said armature as said armature is carried into and out of its field by said frame.

5 11. The combination of a movable screen frame, a vibratile screen mounted thereon to be free to vibrate, an armature mounted on said screen and movable therewith, a magnet mounted adjacent the path of said
10 armature, and means for moving said frame in the plane of the screen to carry the armature into and out of the field of the magnet.

12. The combination of a screen mounted
15 to vibrate perpendicular to its surface, a

plurality of armatures spaced along said screen and mounted to vibrate in a path perpendicular to the surface of the screen, a plurality of magnets coöperating with said armatures, and means for successively 20 energizing said magnets to vibrate said armature and said screen at different points in succession.

In witness whereof, I have hereunto set my hand this first day of September, 1908. 25

EDGAR B. HAYES.

Witnesses:

ARTHUR J. MILLER,
E. NESBIT.