

Dec. 18, 1934.

F. E. MIICK ET AL

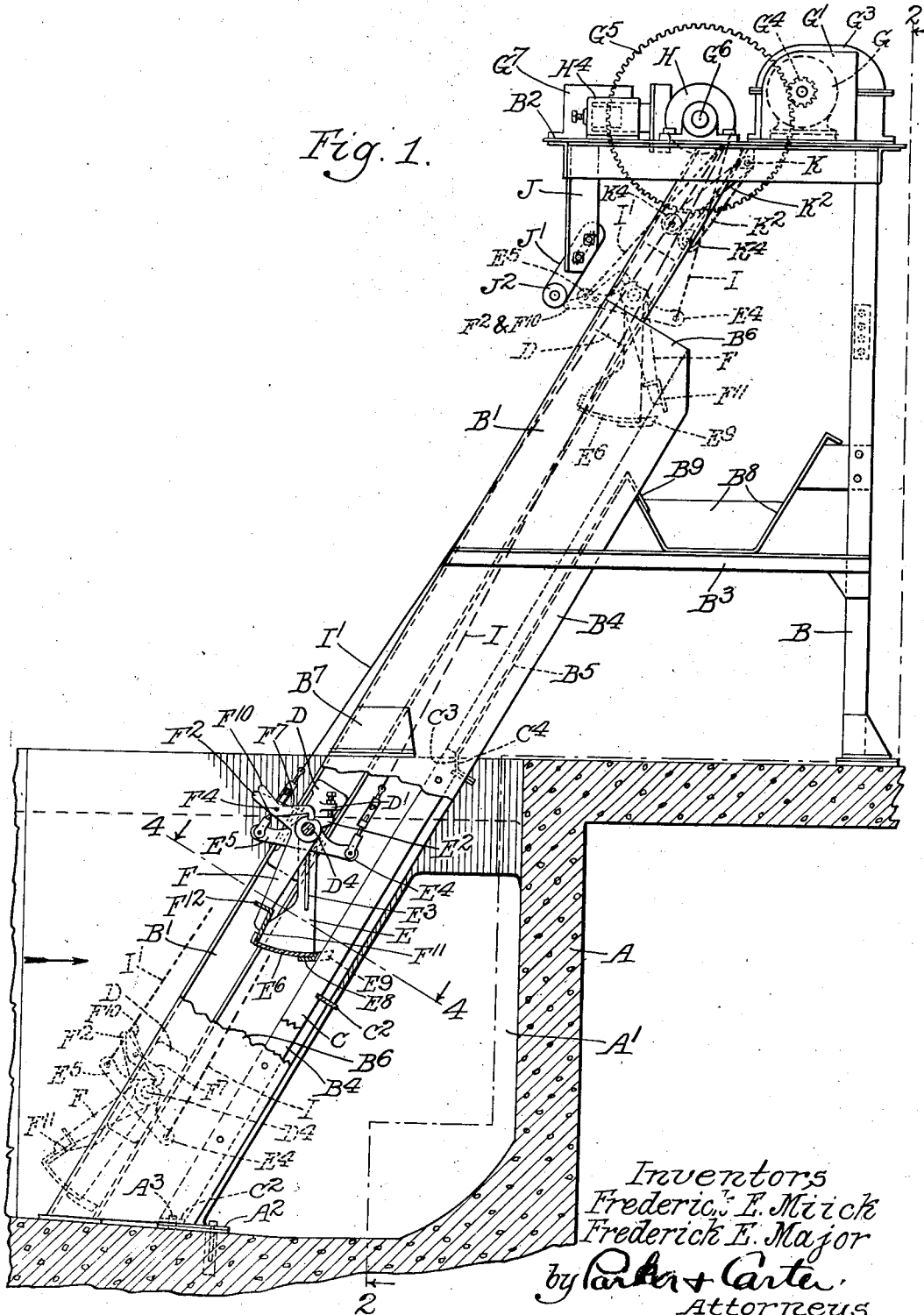
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SCREEN

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6 Sheets-Sheet 1

Fig. 1.



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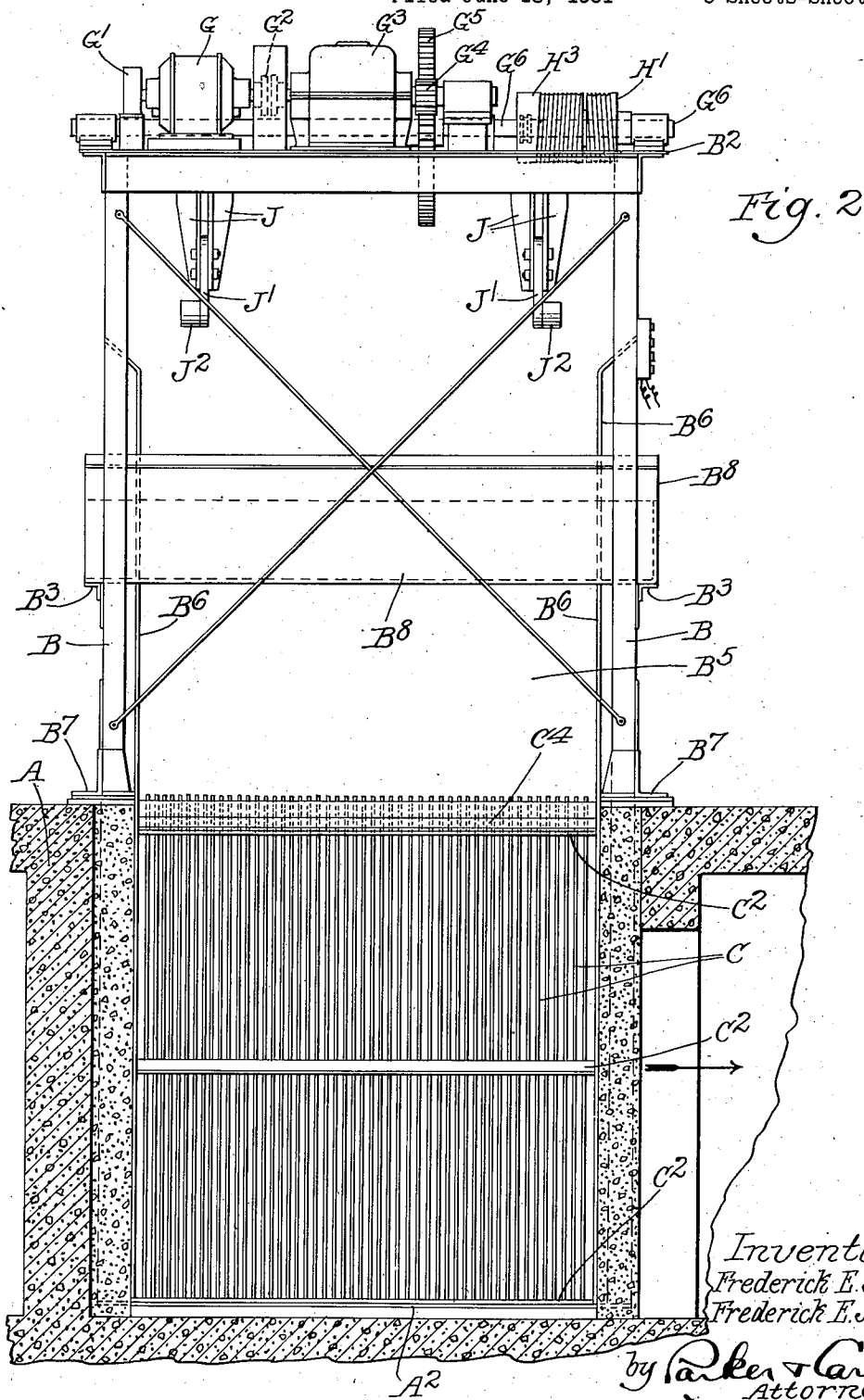
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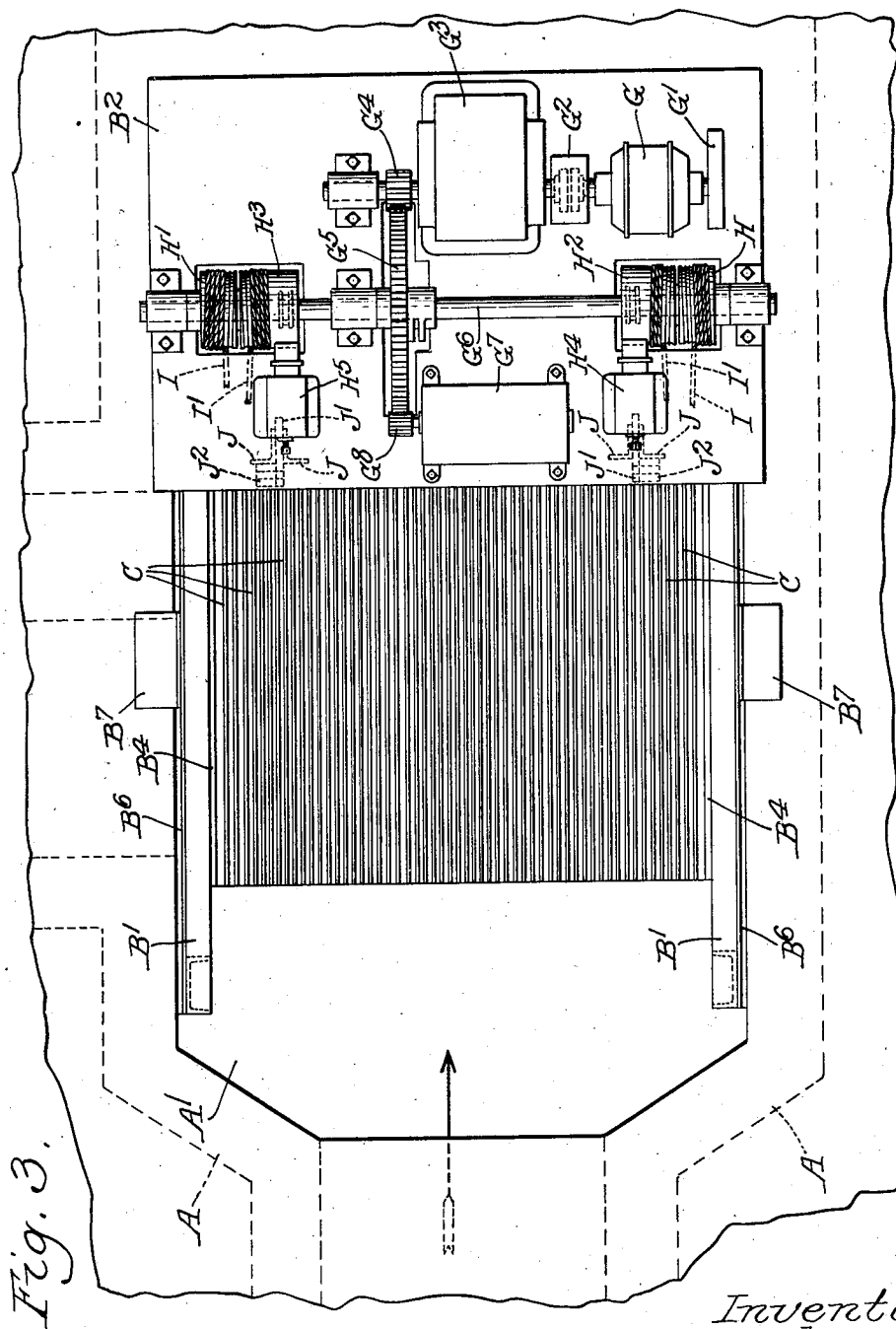


Fig. 3.

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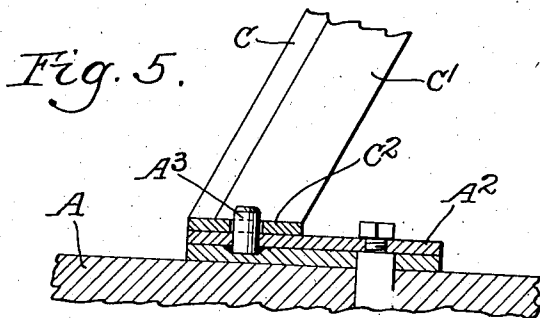
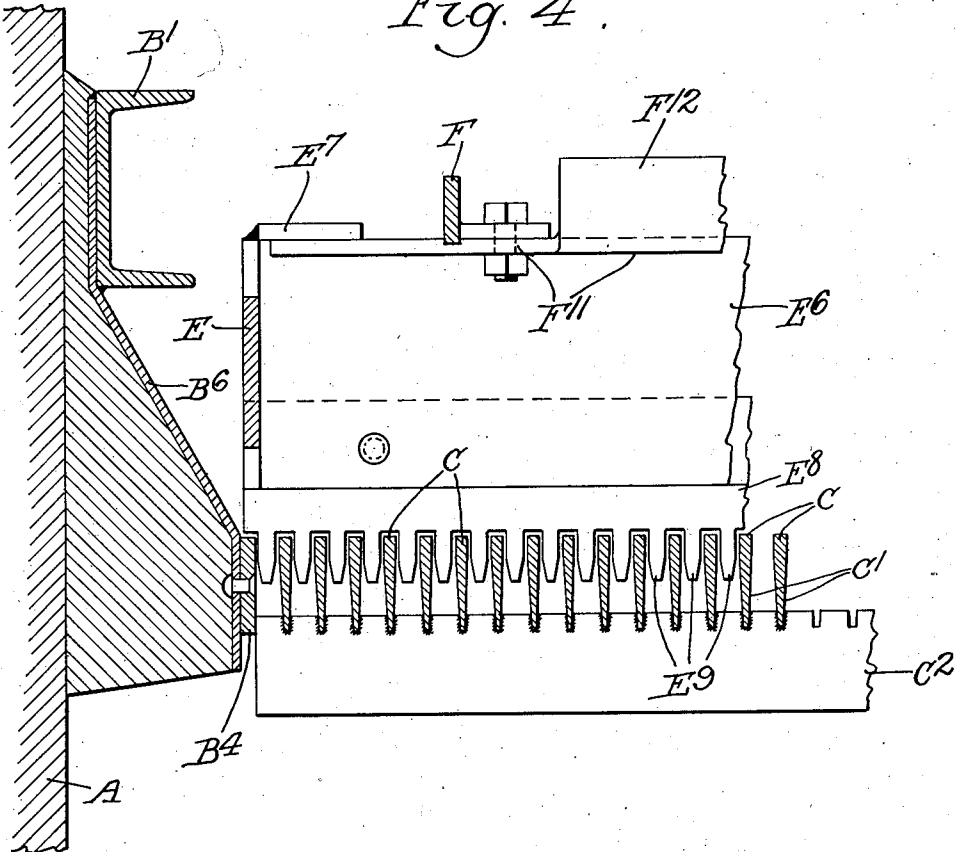
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Fig. 4.



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Fig. 6.

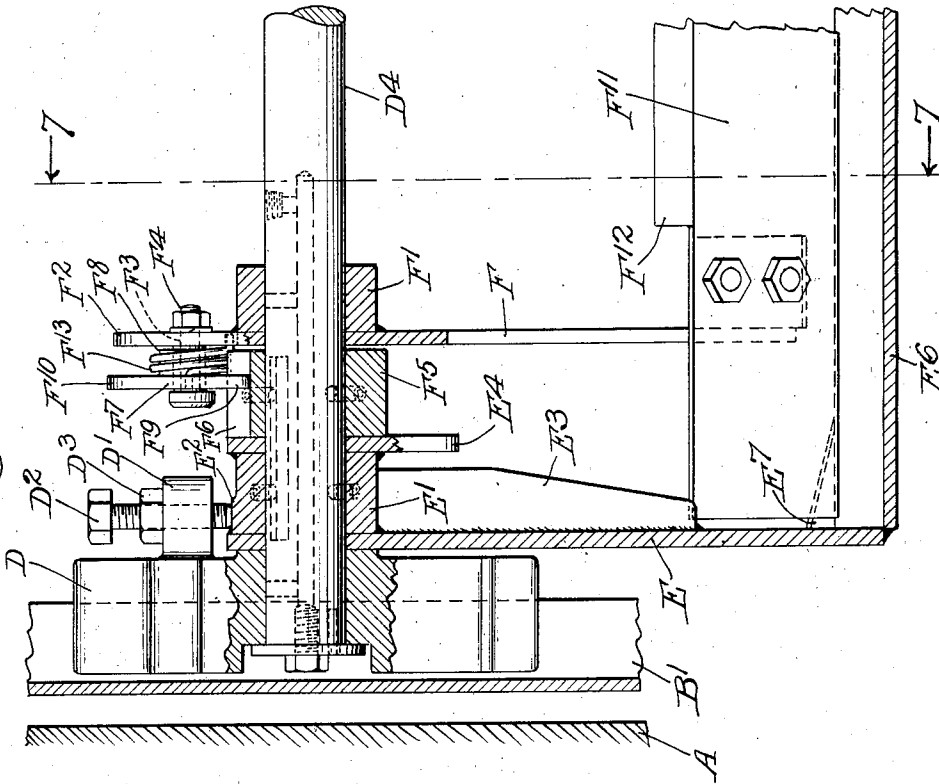
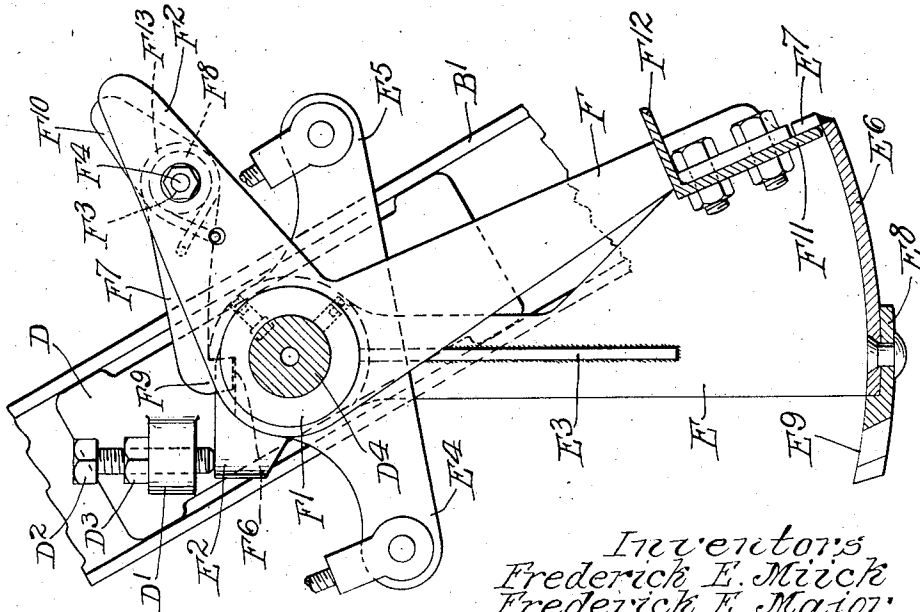


Fig. 7.



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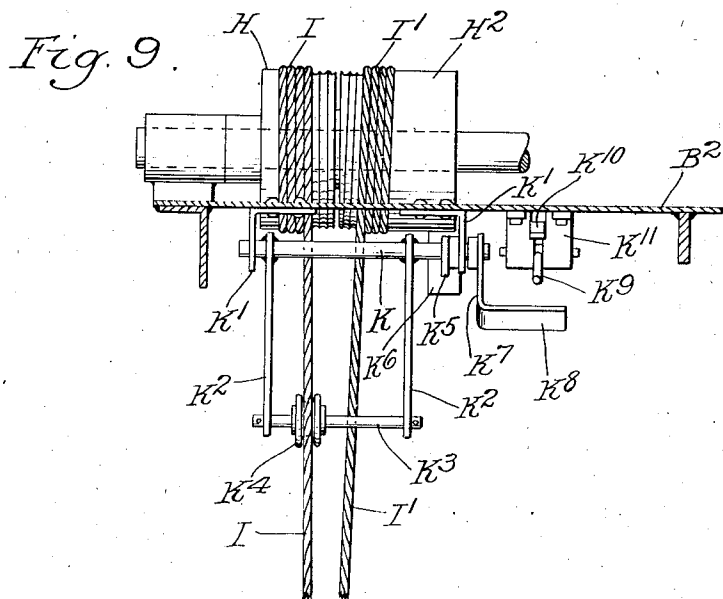
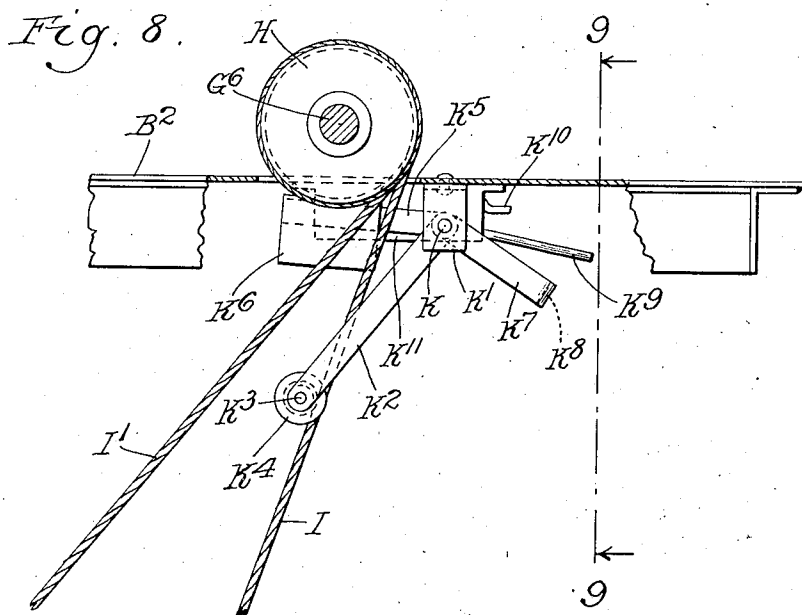
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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

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SCREEN

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Application June 18, 1931, Serial No. 545,272

11 Claims. (Cl. 210—176)

This invention relates to a screen, preferably a bar screen, and to a means and an apparatus for cleaning the screen.

It has for one object to provide a sectional screen construction. It has for another object to provide an apparatus for cleaning a screen in which the screen is subjected to a minimum of wear. Another object is to provide a rake for cleaning the screen cleaning means. Another object is to provide, in connection with the hoisting or moving apparatus for hoisting the screen, an automatic means for controlling the position of the rake.

Other objects will appear from time to time in the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawings, wherein:—

Figure 1 is a vertical cross section, showing the screen in position, the screen being shown largely in side elevation, with parts broken away and parts in section;

Figure 2 is a vertical cross section on line 2—2 of Figure 1, showing the screen in rear elevation;

Figure 3 is a plan view showing the screen in position, with rake and carriage omitted;

Figure 4 is a transverse cross section, taken on an enlarged scale at line 4—4 of Figure 1;

Figure 5 is a detailed vertical sectional view, showing the mounting of the foot of the screen;

Figure 6 is a transverse vertical sectional detail on an enlarged scale, showing one end of the carriage and rake assembly;

Figure 7 is a vertical section taken at line 7—7 of Figure 6, looking in the direction of the arrow;

Figure 8 is a side elevation of the slack cable switch, with parts broken away;

Figure 9 is a section along the line 9—9 of Figure 8.

Like parts are designated by like characters throughout the specification and drawings.

A indicates generally a wall construction defining a liquid chamber A^1 which has suitable outlets and inlets and into and through which liquid to be screened is moved. A plate A^2 may be secured to the bottom wall or floor member A, as indicated particularly in Figures 1 and 5. The plate may be fastened to the floor member in any suitable manner and is provided with one or more upwardly projecting pins A^3 which are adapted to receive and position the lower end of the screen.

A suitable framework is provided to support

the screen and its associated mechanism. The framework may comprise vertical members B and inclined track members B^1 which are joined at their upper ends to a platform B^2 which they support and upon which the driving mechanism of the screen assembly is mounted. Suitable cross frame members B^3 may be used. Additional inclined frame members B^4 lie generally parallel with the inclined track members B^1 and with them extend into the space A^1 . A plate B^5 extends between the upper ends of the members B^4 and may be fastened to them. This plate is largely situated outside of the space A^1 and does not come in contact with the material flowing therethrough. The frame members B^1 and B^4 may be joined by apron-like side members B^6 . Attaching brackets B^7 B^7 are positioned on the outside of the track members B^1 B^1 and are adapted to rest upon and to be fastened to suitable supports to assist in positioning the screening assembly. Upon the cross frame members B^3 may be positioned a refuse chute B^8 over which the refuse from the screening assembly is discharged. Any means may be used for removing the refuse from the chute. A plate or skirt B^9 may depend from the upper edge of the plate B^5 and overlap one side of the chute B^8 as indicated in Figure 1.

The screen proper may be made sectionally, the screen being formed of bars C which are preferably tapered at their rear edges as at C^1 and fastened by welding or otherwise to a plurality of cross members C^2 . At their upper ends they may be additionally tapered as at C^3 to match the downwardly inclined flange or end C^4 of the plate B^5 .

A carriage which supports a rake, is mounted to move up and down the screen. It moves along the tracks B^1 and carries a rake and a rake cleaning mechanism. The rake assembly includes two or more carriage members D each of which has projecting inwardly from it a lug D^1 in which is seated a set screw D^2 which may have co-operating with it a locking nut D^3 . A shaft D^4 is journaled in the carriage members D and from the shaft the rake mechanism is suspended.

The rake proper includes a pair of side members E, each of which is provided with a hub E^1 from which projects a lug E^2 . A stiffening member E^3 extends from the hub E^1 and along a portion of the side arm or member E. Fastened to the hub E^1 is a pair of lever arms E^4 , E^5 . Extending laterally across between the two side arms E and fastened to them preferably at their lower edges, is an arcuate plate E^6 which may

have at one side an upwardly extending flange or edge E⁷. Removably positioned at the opposite edge of the plate E⁶ is a finger bar E⁸ which has fixed or formed upon it fingers E⁹ which are so shaped and positioned as to extend between the bars C when they are moved into a position to do so, as shown for example in Figure 4.

Supported on the shaft D⁴ is a wiper assembly. This includes a plurality of side or end members F each of which is provided with a hub F¹ and a lever arm F² which is perforated for a bearing support as at F³. A bearing pin F⁴ is received in the perforation F³. The hubs F¹ are mounted for rotation about the shaft D⁴. A latching cam F⁵ is positioned and fixed upon the shaft D⁴. This cam is notched as at F⁶. A latching lever F⁷ which is provided with a hub portion F⁸ about which a spring F¹³ is positioned, is supported upon the pin F⁴. The member F⁷ at its outer end carries a latching nose F⁹ and at its opposite end has a relatively inclined and preferably somewhat shorter lever arm portion F¹⁰. Extending laterally across between the side members F of the wiper assembly is a wiping plate F¹¹ which may have at its upper edge a flange F¹². F¹³ is a spring serving normally to hold the latch in engagement.

The driving and controlling mechanism is preferably mounted on the platform B². It includes a motor G upon which a solenoid brake G¹ may be positioned. The motor, through a flexible coupling G² and a speed reducer G³, drives a pinion G⁴ which is in mesh with a gear G⁵ on the shaft G⁶, which is supported in suitable bearings. A traveling cam limit switch G⁷ is mounted adjacent the gear G⁵ and is provided with a shaft which carries a pinion G⁸ which meshes with the gear G⁵ and is driven by it. Thus motion of the gear is effective upon the limit switch to control the motor.

Keyed or otherwise fastened to the shaft G⁶ is a pair of drums H, H¹. Adjacent these and loosely mounted on the shaft G⁶ is a pair of drums H², H³. Brakes H⁴ and H⁵ are positioned to engage, respectively, the drums H² and H³. Each of the pairs of drums H, H² and H¹, H³ are provided on the adjoining faces of their hubs, with overlapping portions which permit some relative movement of the drums and serve to engage them and cause them to move as one, after a certain amount of rotation of the shaft in either direction. Thus, for example, the drums H, H² will have relative movement at first, when the shaft is moved in either direction, and will thereafter move in unison.

From each of the drums H, H¹ a hoisting cable or rope I extends downwardly and is fastened to one of the levers E⁴ of the rake assembly. From each of the drums H², H³ a lowering cable or rope I¹ extends downwardly and is fastened to one of the arms E⁵ of the rake assembly.

Extending downwardly from the platform B² are one or more supports J, upon each of which may be movably mounted a roller support J¹ carrying a roller J². This roller is positioned in the path of the rake assembly so that as the latter moves along the track, the roller may contact the wiper arm F² and the latch arm F¹⁰. Pivotaly mounted beneath the frame B² is a slack cable switch assembly of which one or more may be used. Each assembly includes a shaft K, supported in bearing brackets K¹ K¹ and having fixed to it a pair of arms K² K² which are joined at their lower ends by a shaft K³ upon which a flanged sheave K⁴ is mounted. The

sheave may rotate upon the shaft and may also move along it. It engages the rope or cable I. Fixed on the shaft K is a lever arm K⁵ which may have a counter-weight K⁶. Fixed also on the shaft K is a lever arm K⁷ which has a laterally bent portion K⁸ adapted to strike a switch operating rod K⁹ when moved to a suitable position and thus to contact the switch lever K¹⁰ of a switch K¹¹.

It will be realized that whereas we have herewith shown and described a practical operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts, without departing from the spirit of our invention and we wish, therefore, that our showing be taken as in a sense diagrammatic.

We have used the word "cable" or "rope" as applied to the hoisting members I and I¹. These, of course, could be changed to any suitable flexible means, and where the word "rope" or "cable" occurs in the specification and claims, it is to be understood as meaning any flexible member which could be used in place of a rope or cable to raise or lower the rake.

The use and operation of our invention are as follows:

The screen and its associated parts are positioned in the path of flowing liquid so that the liquid must pass through the screen. The bars intercept material and that which is larger than the spaces between the bars is caught by them and held from passing through. As will be seen particularly from the detail in Figure 4, the bars are thicker at their up-stream edges than at their down-stream edges, being tapered toward the down-stream side. The bars are preferably straight sided for a distance before the taper is commenced. Such bars offer less friction to passing liquid and minimize the loss in head. By reason of this shape of the bars, solids of approximately the width of the spaces between the bars which are caught on or between them will be removed by the rake. The teeth of the rake, when the latter is in raking position, normally extend between the bars of the screen sufficiently to force solids which have lodged between the bars beyond the straight sided portions and to the tapered portions where the clearance is sufficient to permit further movement of the solids through and away from the screen. By this tapered construction of the screen bars, clogging up of the spaces between the bars, in parts of the screen not actually reached by the cleaning fingers of the rake, is prevented. The bars are assembled into sections of convenient size so that a screen can ordinarily be installed by the use of one or more sections of bars and so that subsequent repair and renewal may be accomplished simply and without the necessity of always removing an entire section. In the particular form shown, each of the screen sections is provided at its lower edge with a plate having holes adapted to engage pins which are set into the floor of the channel through which liquid is to flow and the cross piece at the top, as indicated particularly in Figure 1, fits into or joins a structural member so as to support the upper end of the screen bars preferably above the flow line.

With the screen in place and liquid flowing through the system so that it passes through the space between the screen bars, the driving mechanism is operated so that the rake assembly moves up and down. The time and speed of its movement and the occurrence and duration of stops in its movement, both at the upper and

lower limits of its excursion, are controlled by a driven cam limit switch. The details of this switch are not shown as they form no particular part of the present invention and for the purposes of the present invention it is sufficient that means be provided for reversing the direction of movement of the rake assembly and for preferably stopping the rake for a period at the lower limit of its excursion and for stopping it again at the upper limit of its excursion. It is preferably stopped longer at the upper limit of its excursion than at the lower limit and at the upper limit a cleaning operation is effected, preferably automatic, to wipe or scrape the rake proper clean of material which has been removed from the bars and brought up by it and which has adhered to it. The details of this operation will be described more fully below.

The rake assembly includes a plurality of carriages D which are mounted to slide along tracks B'. A shaft D' is mounted in the carriages D. These latter may be of any suitable design and are here shown as a pair of blocks which are of such size that they fit and slide freely within the tracks B'. The carriages each are provided with set screws D² positioned for adjustment within lugs D' which form a part of or are attached to the carriages. Journaled upon the shaft D' are a pair of side arms E which preferably carry hubs E' from which project lugs E² positioned opposite the lugs D' of the carriages D. The relative position of the side arms and the carriages may be adjusted by varying the position of the set screws D² in the lugs D', as these set screws bear against the lugs E². Fastened at the lower end of the side arms E is a plate preferably arcuate in shape, which carries removably attached to it a finger bar having fingers of such size and shape that they can penetrate into the space between the screen bars. Double arm levers are fastened to the hubs E' and by means of these arms, to which cables are attached, the entire rake assembly may be raised and the rake proper may be rotated so as to swing the rake into and out of contact with the screen bars and plate.

Hoisting cables I are preferably fastened to the levers E' and lowering cables I' are fastened to the lever ends E⁵. When the rake assembly is hoisted, its weight and the material on it is carried by the hoisting cables I and the rake is rotated into the position shown in full lines in Figure 1. This rotating movement is made possible by a limited amount of slack which is allowed to develop in the lowering cable I'. When the rake assembly is lowered, slack is allowed to develop in the hoisting cable I and for an interval the assembly is thus held by the lowering cables I' and thus the rake rotates into the position indicated in dotted lines adjacent the bottom of the screen in Figure 1. This relative rotating of the rake parts occurs because the hoisting cables are wound on drums H, H' which are fixed on the driven shaft and because the lowering cables are wound on drums H², H³, which, while mounted upon the same shaft and adapted to be driven by it, are so arranged, by means of drum hubs, that whenever the shaft reverses its direction of movement there is an interval in which the shaft rotates without rotating the drums H², H³ as they are held, respectively, against rotation by brakes H⁴, H⁵ and it is only after a certain amount of rotation of the driving shaft that the drums H² and H³ commence to revolve with the other drums. Thus, with the

parts in the position indicated in dotted lines adjacent the lower end of Figure 1, when the hoisting cables are drawn up, since the hoisting cables I are about the drums H, H' which are keyed to the shaft G⁶, these cables at once move and since the cables I' are about the drums H², H³ which are for the moment free for movement with relation to the shaft, these cables I' are not drawn in and thus at the start the only effect is upon the levers E' and the parts are thus tilted into the position shown in full lines in Figure 1 before any hoisting of the rake occurs. The drum hubs and brakes are so arranged that only the proper amount of rotating movement can occur. Thereafter the drums H², H³ become locked to the other drums, and are rotated and the cables I' are thereby drawn in at the same speed as the cables I.

In the reverse movement, when the screen assembly is to be lowered, the shaft G⁶ is rotated and the cables I, being wound about the drums H, H', which are fixed to the shaft, are at once paid out or unwound while the cables I', which are wound about the drums H², H³, which for the moment are free for movement with relation to the shaft G⁶ and are held by the brakes, are not initially paid out or unwound and thus the lever ends E⁴ are lowered for a brief period before the levers E⁵ commence to move. Thereafter rotating movement occurs which rotates the rake assembly back into the position which is shown in the dotted line position shown at the lower end of Figure 1. Thus in hoisting, the rake is automatically brought into operative position in which the teeth of the finger bar penetrate between the bars of the screen and in lowering the rake is automatically brought into position in which the finger bar and the rake as a whole are rotated outwardly away from the screen and it is in this position that the rake assembly is lowered.

Additional members are provided in the rake assembly for cleaning or wiping the finger bar and rake. These members move with the rake assembly and form a part of it, but are also mounted and arranged for relative movement with respect to the arcuate plate so that at the proper time in the cycle of operation of the assembly, the wiper or scraper is automatically actuated to clean the rake plate and the finger bar. This wiper assembly includes a pair of arms F which are mounted for movement on the shaft D⁴. A latch cam is also mounted on the shaft and is keyed with respect to it. The arms F carry angularly disposed levers F² upon which a latch F⁷ is pivoted. The latch part F⁹ of the latch F⁷ normally engages a notch F⁶ in the latch cam and so holds the wiper against movement relative to the shaft D⁴. As the rake assembly is moved toward the upper limit of its excursion, the outer end of the latch lever F¹⁰ contacts a cam J² and is depressed so that the latch is free to rotate out of engagement with the latch cam into the position shown in dotted lines at the upper end of Figure 1. Thereafter the outer end of the lever portion F² of the wiper arms contacts the same cam J² and as the rake assembly moves upwardly, the wiper is rotated about the shaft D⁴ into the position shown in dotted lines at the upper end of Figure 1, thus wiping or scraping along the surface of the plate E⁶ and the finger bar E⁸, wiping or scraping material from these members and depositing it in the chute B³. When the rake assembly moves downwardly the motion of the parts is

reversed, the outer end of the portion F^2 again strikes the cam J^2 and swings it into its initial position in which the cross member F^{11} of the wiper is in contact with the flange E^7 of the rake. This position is indicated in full lines in the center of Figure 1.

As shown in Figures 8 and 9, a slack cable switch may be used to stop operation of the parts when for any reason excessive slack develops in the cable system. The slack cable switch assembly includes a roller mounted on a lever frame and engaging the hoisting cable. The roller being in engagement with the hoisting cable, will be affected if the carriage assembly should meet an obstacle before it reaches its lowest predetermined position. If that should occur, excess slack would develop in the hoisting rope or cable and the lever frame formed of the members K^2 K^3 and the shafts K and K^3 , the latter carrying the sheave K^4 , would rotate in a counterclockwise direction, as shown in Figure 8, and the member K^7 would contact the switch operating arm K^9 and if moved sufficiently would contact the switch lever K^{10} to operate it and stop further lowering.

It will be understood that the brakes H^4 and H^5 are drag brakes and that they preferably engage the drums constantly and are in contact with them at all times. Thus these brakes hold the loose drums from turning when they are not actually being driven from the hubs of the fixed drums. The brakes are normally just tight enough to prevent the loose drums from turning, except when they are actually being driven positively from the drums which are fixed on the shaft. The friction for this purpose can be very slight, so slight indeed that as a result of this friction practically no additional power is required to overcome the resistance.

We claim:

1. In combination with a screen, a rake assembly, movably positioned with relation thereto, means for moving the rake assembly therealong, the rake assembly including a rake adapted to be tilted into and out of engagement with the screen and including also a cleaner mounted to move with said assembly and adapted to be moved back and forth across the rake to clean the same, and automatic means for tilting the rake out of engagement with the screen and for tilting it into engagement with the screen.

2. In combination with a screen, a rake assembly, movably positioned with relation thereto, means for moving the rake assembly therealong, the rake assembly including a rake adapted to be tilted into and out of engagement with the screen, and including also a cleaner mounted to move with said assembly and adapted to be moved back and forth across the rake to clean the same, and automatic means for tilting the rake out of engagement with the screen and for tilting it into engagement with the screen, and for operating the cleaner to clean the rake adjacent the upper limit of its excursion.

3. In combination with a screen, a rake assembly, movably positioned with relation thereto, means for moving the rake assembly therealong, the rake assembly including a rake adapted to be tilted into and out of engagement with the screen and including also a cleaner mounted to move with said assembly and adapted to be moved back and forth across the rake to clean the same, and automatic

means for tilting the rake out of engagement with the screen upon lowering, for tilting it into engagement with the screen upon raising and for operating the cleaner to clean the rake adjacent the upper limit of its excursion.

4. In combination with a screen, means for cleaning the screen, including a rake assembly mounted to move along the screen, the assembly including a rake, the assembly also including a wiper mounted to move with the assembly and adapted to be moved to clean the rake, an automatic means for actuating the wiper, automatic hoisting means for raising and lowering the rake along the screen, and automatic means for tilting the rake into and out of engagement with the screen, said means including a driven shaft, said shaft carrying a drum fixed upon it and a drum loosely mounted upon it, the rake assembly carrying levers, a cable joining one lever to the fixed drum and a cable joining another lever to the loose drum, whereby when the shaft is rotated in either direction the cable joined to the fixed drum is at once moved, and whereby the cable joined to the loose drum is at first not moved.

5. In combination with a screen, means for cleaning the screen, including a rake assembly mounted to move along the screen, the assembly including a rake, the assembly also including a wiper mounted to move with the assembly and adapted to be moved to clean the rake, an automatic means for actuating the wiper, automatic hoisting means for raising and lowering the rake along the screen, and automatic means for tilting the rake into and out of engagement with the screen, said means including a driven shaft, said shaft carrying a drum fixed upon it and a drum loosely mounted upon it for limited relative movement with respect to the fixed drum in either direction about the shaft, the rake assembly carrying two levers, a cable joining one lever to the fixed drum and a cable joining the other lever to the loose drum, whereby when the shaft is rotated in either direction the cable joined to the fixed drum is at once moved, and whereby the cable joined to the loose drum is at first not moved.

6. In combination with a bar screen, means for cleaning the screen including a rake assembly mounted to move along the screen, the assembly including a rake and adapted in one position to engage the bars, the assembly also including a wiper mounted to move with the assembly and adapted to be moved to clean the rake, an automatic means for actuating the wiper, automatic hoisting means for raising and lowering the rake along the screen, and automatic means for tilting the rake into and out of engagement with the screen, said means including a driven shaft, said shaft carrying a drum fixed upon it and a drum loosely mounted upon it for limited relative movement with respect to the fixed drum in either direction about the shaft, the rake assembly carrying two levers, a cable joining one lever to the fixed drum and a cable joining the other lever to the movable drum, whereby when the shaft is rotated in either direction the cable joined to the fixed drum is at once moved, and whereby the cable joined to the loose drum is at first not moved, and is, after a predetermined movement of the fixed drum, moved.

7. In combination with a screen, a cleaner therefor, including a rake assembly, automatic means for raising and lowering the rake assembly along the screen, the rake assembly includ-

ing a pair of carriages, a shaft in them, rake arms fixed upon the shaft and carrying at their outer ends a plate, a rake, the plate having a finger bar, and wiper arms journaled on the shaft, carrying at their outer ends a wiper adapted to wipe the rake.

8. In combination with a screen, a cleaner therefor, including a rake assembly, automatic means for raising and lowering the rake assembly, along the screen, the rake assembly including a pair of carriages, a shaft in them, rake arms fixed upon the shaft and carrying at their outer ends an arcuate plate, a rake, the plate having a finger bar, and wiper arms journaled on the shaft, carrying at their outer ends a wiper adapted to wipe the rake, a latch mechanism adapted normally to hold the wiper arm against rotation about the shaft, and automatic means for freeing the wiper for movement.

9. In combination with a screen, a cleaner therefor, including a rake assembly, automatic means for raising and lowering the rake assembly along the screen, the rake assembly including a pair of carriages, a shaft in them, rake arms fixed upon the shaft and carrying at their outer ends an arcuate plate, a rake, the plate having a finger bar, and wiper arms journaled on the shaft, carrying at their outer ends a wiper adapted to wipe the rake, a latch mechanism adapted normally to hold the wiper arm against rotation about the shaft, and automatic means for freeing the wiper for movement and for moving it to wipe the rake adjacent the upper limit of its excursion.

10. In combination with a bar screen; a cleaner therefor, including a rake assembly, automatic means for raising and lowering the rake assembly along the screen, the rake assembly including a pair of carriages, a shaft in them, rake arms fixed upon the shaft and carrying at their outer ends an arcuate plate, a rake, the plate having a finger bar, and wiper arms journaled on the shaft, carrying at their outer ends a wiper adapted to wipe the rake, a latch mechanism adapted normally to hold the wiper arm against rotation about the shaft and automatic means for tilting the rake into engagement with the screen bars, and automatic means for freeing the wiper for movement.

11. In combination with a bar screen, a cleaner therefor, including a rake assembly, automatic means for raising and lowering the rake assembly along the screen, the rake assembly including a pair of carriages, a shaft in them, rake arms fixed upon the shaft and carrying at their outer ends an arcuate plate, a rake, the plate having a finger bar, and wiper arms journaled on the shaft carrying at their outer ends a wiper adapted to wipe the rake, a latch mechanism adapted normally to hold the wiper arm against rotation about the shaft and automatic means for tilting the rake into engagement with the screen bars as the rake moves upwardly, and for tilting it out of engagement with the screen bars as it moves downwardly, and automatic means for freeing the wiper for movement.

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