Nov. 9, 1926. 1,606,546

F. O. WALLENE

HYDRAULIC PLANT AND SCREEN THEREFOR

Filed August 2, 1920 4 Sheets-Sheet 1

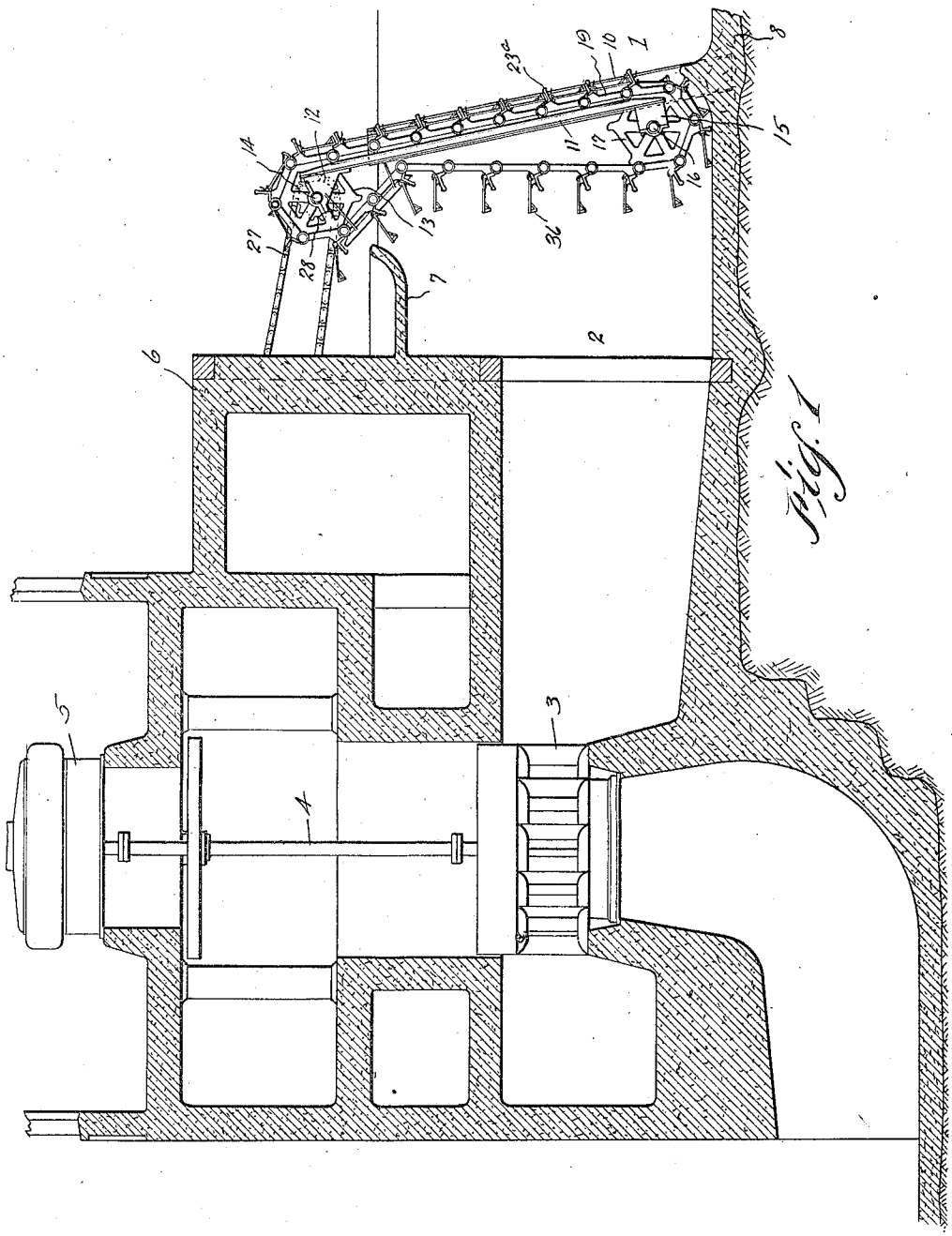


Fig. 1.

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HYDRAULIC PLANT AND SCREEN THEREFOR

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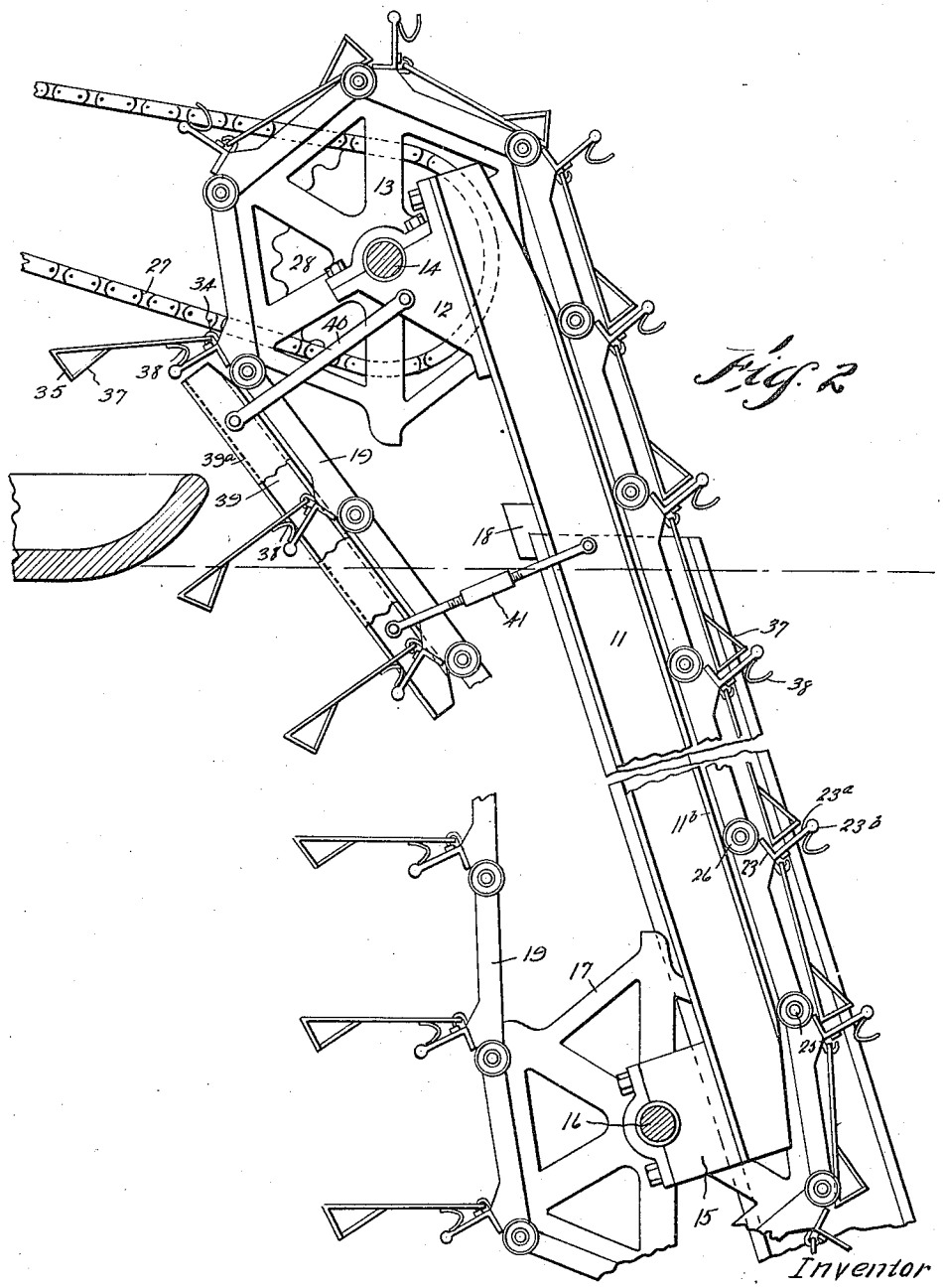


Fig. 2

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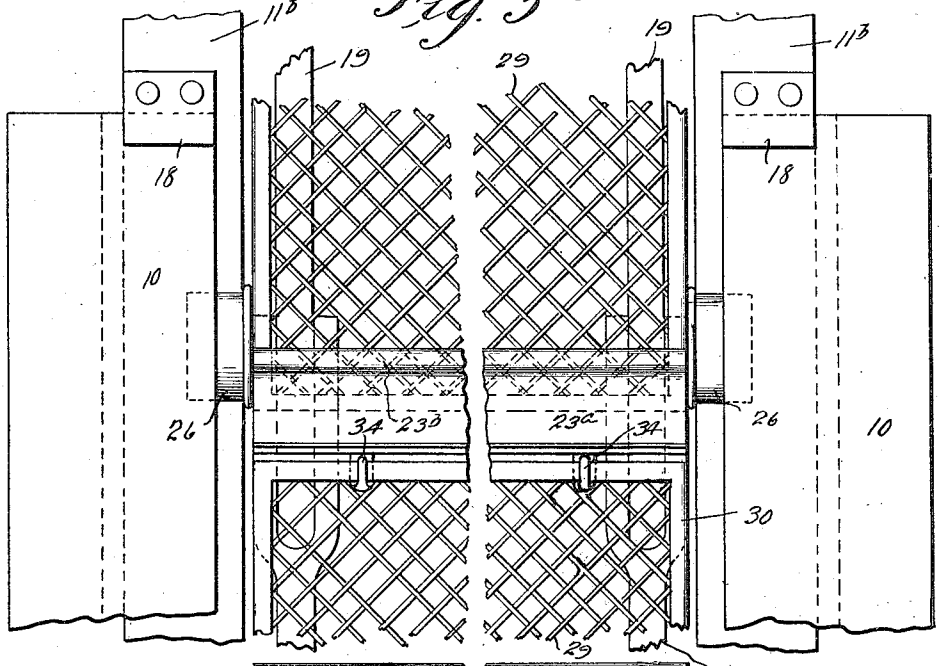
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HYDRAULIC PLANT AND SCREEN THEREFOR

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Fig. 3a



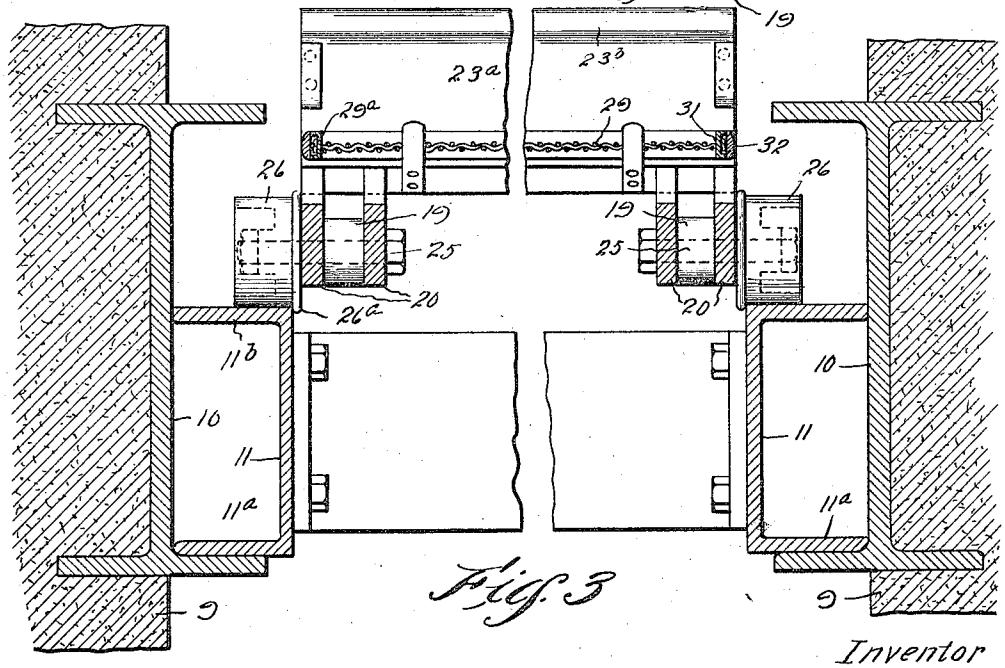


Fig. 3

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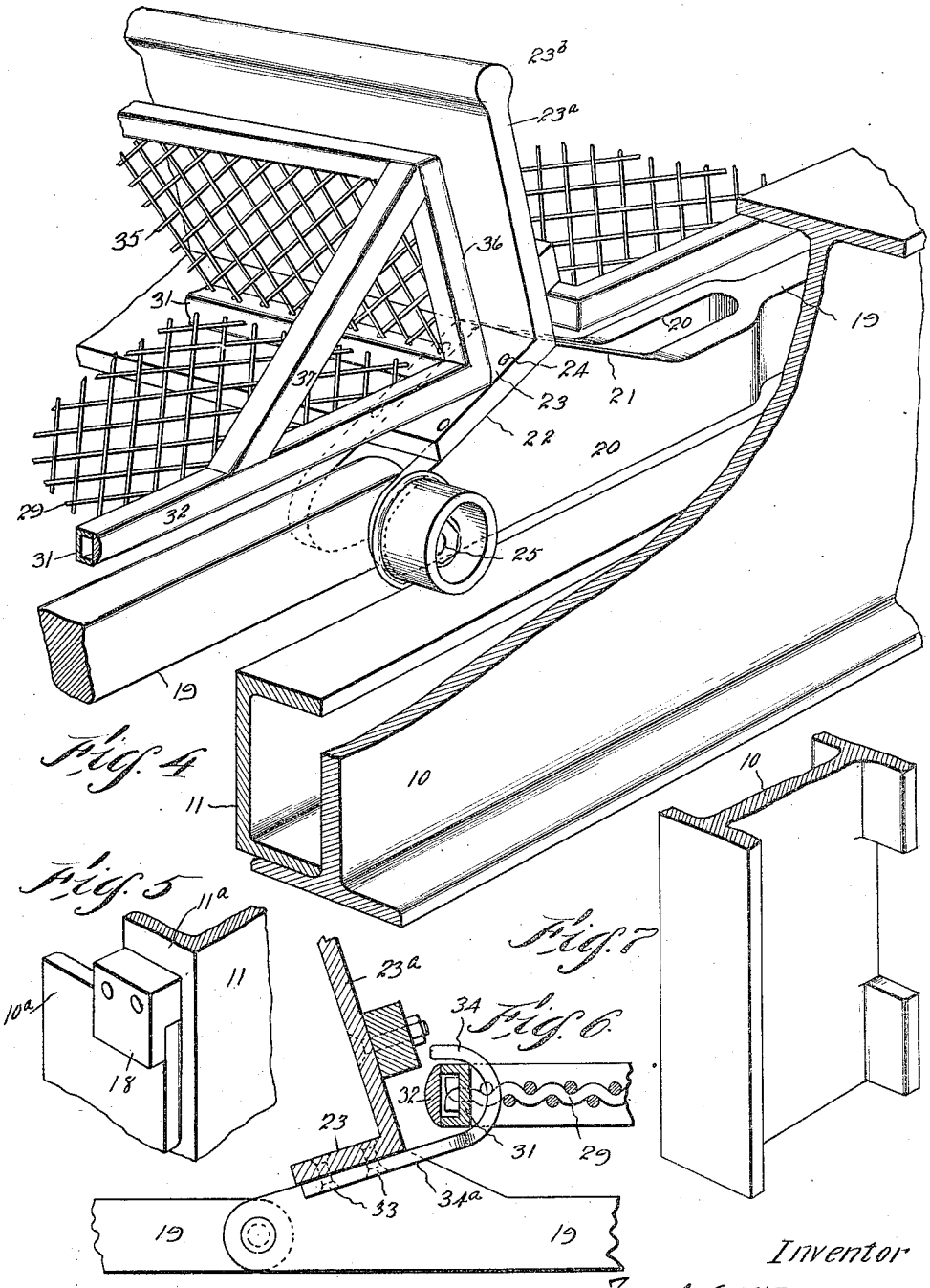
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UNITED STATES PATENT OFFICE.

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HYDRAULIC PLANT AND SCREEN THEREFOR.

Application filed August 2, 1920. Serial No. 400,839.

This invention relates to hydraulic plants, and more particularly to the screens which are interposed between the forebay and the penstock for the purpose of removing from the water such refuse as might interfere with the proper operation of the turbine, pump, reservoir, or other hydraulic device.

The objects of the invention are the provision of a self cleaning screen which shall be rugged, reliable, and not unduly expensive; the provision of a screen which shall remove litter completely and permanently from the water; the provision of a self cleaning screen which shall not become clogged by the accumulation of chips and other small litter; the provision of a screen of such construction as to permit its ready and complete removal as a unit for purposes of replacement or repair; while further objects and advantages of the invention will become apparent as the description proceeds. The essence of my invention resides in the employment of a screen of the endless belt type, whose sections shall be movable in such wise that only one run of the same shall be operative at one time.

In the drawings, Fig. 1 is a sectional view through a portion of a water-power plant showing the application of my screen thereto; Fig. 2 a side elevation, with parts broken away, of the said screen and its mounting; Fig. 3 a detail in section and Fig. 3ª a detail in plan of such screen and its mounting; Fig. 4 a detail in perspective of the screen and mounting; Fig. 5 a detail in perspective illustrating the manner of supporting one of the channel guides for the screen rollers upon the top of an I-beam support; Fig. 6 a sectional detail of a part of the screen; and Fig. 7 a detail in perspective of a portion of one of the I-beam supports.

Describing the parts by reference characters, 1 denotes the forebay. 2 the penstock and 3 the turbine of a water-power plant, the said turbine being provided with a shaft 4 for driving a generator, indicated generally at 5.

Projecting from the power house, and indicated generally at 6, is a trough 7 which is adapted to receive the material removed from the water delivered to the penstock from the screen. The parts thus far described are such as are ordinarily employed in hydro-electric and other water-power plants, although my improvements are equally applicable to pumping stations, reservoirs and other hydraulic plants.

Mounted in the concrete or other wall 8, 9 enclosing the forebay are a pair of opposed I-beams 10, the exposed web and flanges of such beams forming upwardly and rearwardly inclined mountings for the screen assembly, which will now be described. This assembly comprises a pair of opposed channel members 11, each mounted in an I-beam and preferably with their webs presented toward each other and each with its rear flange 11ª engaging the rear flange of an I-beam. Secured to the upper end of each channel member 11 is a bracket 12, which brackets jointly support a sprocket 13, the shaft 14 whereof is shown as mounted on split bearings provided on such brackets. Secured to the lower end of each channel 11 is a bracket 15 each having a split bearing supporting the shaft 16 of a sprocket 17. Each channel 11 is provided with a hook 18 which is adapted to engage the upper end of the rear flange 10ª of an I-beam, whereby the channels 11, with their brackets, sprockets, and screen (to be described hereinafter) may be removed from the supports formed by the I-beams.

The screen comprises a plurality of transversely extending screen members each of which is pivotally supported from opposed side links, each screen member being provided with a shelf adapted to convey to the upper sprockets and to dump into the trough 7 any material in the liquid which might interfere with the operation of the screen, the screen thus constituting an endless conveyor for such refuse material. In addition, each transverse member of the screen is provided with gravity-operating means for swinging it about its pivots in such manner that the screen members on the rear side of the screen will be separated and the rear side will be open to the flow of the water discharged through the front and operating part or side of the screen.

19 denotes generally one of the side links of the screen. Each of these side links is provided with a fork at one end thereof, its opposite end being adapted to be inserted between the forks of the next adjacent link. Each member 20 of each fork is supplied on its screen-supporting face with a pair of oppositely extending inclines 21 and 22. Secured to the inclines 22 of each opposed

pair of side links is a shelf, the shelf being preferably a bulb angle member or beam, one flange 23 of which is secured to the inclined portions 22 of opposed side links, as by rivets 24. The flange 23^a carrying the bulb 23^b projects from the front of the screen outwardly and forwardly into the forebay, the said flanges serving as shelves to elevate the refuse matter collected by the screen. The overlapping ends of the side links are connected by pins 25, each constituting a journal for a roller 26 adapted to engage the front flange 11^b of a channel 11 and each roller being provided with a flange 26^a engaging the web of a channel member. The channel members thus constitute upwardly and rearwardly extending rails or tracks along which the rollers of the screen move when the said screen is driven, as by means of a chain 27 extending over a sprocket 28 on the shaft 14, the said chain being driven from another sprocket by any convenient source of power (not shown).

Each screen member comprises a transversely extending screen proper 29 secured to a frame 30. This frame, as will appear from Fig. 3, may be formed as a channel 31 having its flanges presented outwardly, with a cover plate 32 bearing against such flanges, thus providing room within the channel flanges for bending or clinching the ends 29^a of the screen wires.

Secured to the flange 23 of each bulb angle shelf, as by rivets 33, are a pair of hooks 34, each hook having a base 34^a for the reception of such rivets. These hooks receive the portion of the channel frame 31 adjacent thereto and provide means for pivotally supporting the upper ends of the screen members on the front or refuse-receiving side of the screen and the lower ends of such members on the rear or delivery side of the screen. Each screen member is provided at the end opposite its pivotal connection with a screen projecting at substantially right angles thereto. One of these screens is shown in detail in Fig. 4 and comprises the wires 35, which are secured at one end within the channel 31 of the adjacent end of the main screen, and a frame 36 (preferably similar to the frame 31, 32), projecting at substantially right angles from the last mentioned frame and braced from the side members thereof, as by means of inclined struts 37.

Each shelf formed by a bulb angle has secured near each end thereof, and on what will be the upper face of the flange 23^a in the rear portion of the screen, a spring 38, the purpose of which will now be described in connection with the operation of the screen.

The parts being constructed and arranged as described and the shaft 14 being driven by the chain 27, the front portion of the screen will move upwardly, the rollers 26 supporting the screen upon the tracks formed by the flanges 11^b of the channel members 11. The screen will operate to remove the refuse from the water, the shelves formed by the bulb angles elevating such refuse as may pass through and beyond the projecting bucket portions of the members. After the screen passes over the sprockets 13 it is directed forwardly toward the front side of the screen. For this purpose, a pair of independent guides 39 are provided, one for each side of the screen members. Each guide 39 is conveniently formed as a channel, one of the flanges 39^a of which is adapted to receive the rollers on two or more of the side plates 19. Each guide 39 is pivotally suspended at or near its upper end from a bracket 12, as by means of a link 40. The lower end of each guide 39 is adjustably supported from a channel 11, as by means of a turn-buckle 41. This construction serves the double purpose of affording a convenient take-up for slack in the chain and of affording a sharp inclination to that portion of the chain which overhangs the trough 7, thus serving the more surely to remove adherent litter and enabling the trough to be set so close to the chain that none of that litter will fall back into the water when the rear side of the screen has assumed the proper angle. At this time each member of the screen swings about its hooks 34, assisted by the gravity exerted by its auxiliary screen 35, until the side frames of each screen member engage the springs 38. As each screen member, in this position, passes the trough 7, it will be tilted upwardly by engagement with the lip of such trough, the inclined struts 37 facilitating their riding over the trough, after which each screen again drops and is again caught by the springs 38. From and below the level of the water in the forebay, the screen members comprising the rear section or portion of the screen project substantially horizontally, thus providing a free flow through such rear section for the water screened by the active or front portion thereof together with any chips or other small litter which may work through the active portion.

When it is desired to remove the screen assembly, as for purposes of inspection or repair, the chain 27 will generally need to be removed from one of its sprockets, after which the entire screen assembly (comprising the members 11, the sprockets 13 and 17, and the floating supports 39) may be lifted from the I-beam supports. The same screen, repaired, or a like screen assembly, may be replaced within the I-beam supports or guides, the hooks 18 engaging the tops of the I-beams and supporting the assembly for convenient removal.

Having thus described my invention, what I claim is:

1. In a hydraulic plant, the combination of a forebay, an endless screen extending across said forebay, the said screen comprising a plurality of transversely extending members, each member being pivotally supported at one end thereof and provided at its opposite end with a gravity-operating device adapted to swing it about its pivotal support, and springs on said carrier and arranged between the members thereof in position to be engaged by a member thereabove when such member is swung about its pivotal support.

2. In a hydraulic plant, the combination of a forebay, an endless screen extending across said forebay, the said screen comprising a plurality of transversely extending screen members each pivoted at one end and each having an outwardly extending screen projection at its opposite end, supports carried by the screen assembly between the members thereof, and springs on each of said supports arranged each to engage the screen member thereabove as said member swings about its pivot.

3. In a hydraulic plant, the combination of a forebay, and an endless screen extending across said forebay, the said screen comprising a plurality of transversely extending screen members each pivoted at one end and having each an outwardly extending screen projection at its opposite end, shelves carried by the screen members, and a spring carried by each shelf and arranged to be engaged by the member thereabove when such member swings about its pivot.

4. In a hydraulic plant, the combination of a forebay having vertically extending guides on opposite sides thereof, a pair of channel members each removably mounted within a guide, sprockets supported at the tops and bottoms of said channel members, an endless screen mounted on said sprockets, rollers on said screen adapted to engage said members, and hooks carried by said members and adapted to engage their respective guides.

5. In a hydraulic plant, the combination of a forebay having vertically extending guides on opposite sides thereof, a pair of rails each removably mounted within a guide, sprockets supported at the tops and bottoms of said rails, an endless screen mounted on said sprockets, rollers on said screen adapted to engage said members, and means carried by said rails for removably supporting the same within their respective guides.

6. In a hydraulic plant, the combination of a forebay, a channeled guide member mounted in each side of said forebay and each having its flanges projecting into the forebay, a pair of channel members each mounted within the channel of a guide member and each having a hook adapted to engage the upper end of one of the flanges of such member, an endless screen, driving means for said screen supported by said channel members, and rollers carried by said screen and adapted to engage said channel members.

7. In a hydraulic plant, the combination of a forebay, an I-beam mounted in each side of said forebay and each having flanges projecting into the forebay, a pair of channel members each mounted within the inner channel of an I-beam and each having a hook adapted to engage the upper ends of one of the flanges of such beam, an endless screen, driving means for said screen mounted in said channel members, and rollers carried by said screen and adapted to engage said channel members.

8. In a hydraulic plant, the combination of a forebay, vertically extending guides located on opposite sides of the forebay, a supporting member mounted in each guide, an endless screen comprising a plurality of transversely extending members, driving means for said screen carried by said supporting members, each screen member having at each side thereof a side plate having forks at one end thereof adapted to receive the end of the side plate of an adjacent screen member, pins connecting the ends of adjacent side plates, and a roller mounted on each pin and adapted to engage the said supporting members.

9. The combination, with a pair of spaced supporting members, of an endless screen comprising a plurality of transversely extending members, each screen member having at each side thereof a side plate having forks at one end thereof adapted to receive the end of the side plate of an adjacent screen member, pins connecting the ends of adjacent side plates, and a roller mounted on each pin and adapted to engage its supporting member.

10. In a hydraulic plant, the combination of a forebay, supports extending vertically on opposite sides of said forebay, a rail mounted in each support, sprockets supported by said rail, an endless screen mounted on said sprockets, said screen comprising a plurality of transversely extending screen members each pivotally supported at one end, rollers on each member adapted to engage said rails, guides for the rear upper portion of said screen, means adjustably supporting said guides from said rails, means cooperating with each screen member for swinging the same about its pivotal support, and means for limiting such swinging movement.

11. In a hydraulic plant, the combination of a forebay, an upwardly extending rail on each side of said forebay, sprockets sup-

ported by said rail, an endless screen mounted on said sprockets, said screen comprising a plurality of transversely extending screen members each pivotally supported at one end, guides for the rear upper portion of said screen, and means adjustably supporting said guides from said rails.

12. In a hydraulic plant, the combination of a forebay, guides extending vertically on opposite sides of said forebay, rails mounted in said guideways, an endless screen comprising a plurality of transversely extending screen members, each of said members being pivotally supported, rollers carried by said screen and cooperating with said rails, shelves projecting outwardly from said screen adjacent the pivoted end of each screen member, gravity means cooperating with each screen member to move it about its vertical support when on the rear side of the screen, and one or more springs carried by each shelf and adapted to limit the movement of the transverse member adjacent thereabove.

13. In a hydraulic plant, the combination of a forebay, guides mounted in opposite sides of said forebay, an endless screen comprising a pair of rigid supporting members each mounted in a guide, a plurality of transversely extending screen members, rollers carried by said screen members and engaging the said supporting members, sprockets for said screen carried by said supporting members, and means connected with said supporting members for adjusting the tension of said screen, said supporting members and screen members being removable from said guides as a unit.

14. A screen for the purpose described comprising opposed series of side plates, each plate having a fork at one end thereof adapted to receive the end of an adjacent plate and each fork having an inclined surface, an angular shelf secured to the inclined surfaces of opposed side plates, hooks secured to the flange of the angular shelf which is secured to the side plates, and a screen member supported by the hooks of each angular shelf.

15. A screen for the purpose described comprising opposed series of connected side plates, angular shelves secured respectively to opposed side plates, and a screen member pivotally supported at one end from each shelf.

16. A screen for the purpose described comprising a plurality of transversely extending screen members, each of said members being pivotally supported, and shelves projecting outwardly from said screen between the members thereof.

17. An endless screen for the purpose described comprising a plurality of transversely extending screen members each having an angularly projecting screen extension constituting an elevating bucket, and shelves projecting outwardly from said screen between the members thereof.

18. An endless screen for the purpose described comprising a plurality of screen members each pivotally supported at one edge thereof and each having an angular projection at its swinging edge constituting an elevating bucket, shelves projecting outwardly from said screen between the members thereof, and means yieldingly supporting each member from the shelf therebeneath when such member is swung about its pivot.

19. In hydraulic apparatus, in combination, a water passage, a pair of opposed upright channels formed in the walls thereof, a pair of rails removably mounted in said channels, brackets carried by the upper and lower ends of said rails, sprocket wheels journaled to said brackets, chains carried by said wheels and having steadying devices which run along said rails, screening devices carried by said chains, and extending across the water passage, and means for driving said chains.

20. In hydraulic apparatus, in combination, a water passage, a pair of opposed upright channels formed in the walls thereof, a pair of rails removably mounted in said channels, brackets carried by the upper and lower ends of said rails, sprocket wheels journaled to said brackets, chains carried by said wheels and having steadying devices which run along said rails, means for driving said chains in a direction to raise that side which lies upstream, and movable screening devices carried by said chains adapted to lie closely together upon the upstream side so as to obstruct the passage of litter and to become separated on the downstream side so as not to obstruct the passage of litter.

21. In hydraulic apparatus, the combination of a forebay, a pair of rotatable members mounted upon horizontal axes, one at the bottom of the forebay and the other above the water level, an endless screening device surrounding said members and extending laterally from wall to wall of said forebay, means for rotating one of said members, a guide at each side of said forebay engaging the margin of said screening device upon its descending side, and a litter receiving trough located between and beneath said guides.

22. In hydraulic apparatus, the combination of a forebay, a pair of rotatable members mounted upon horizontal axes, one at the bottom of the forebay and the other above the water level, an endless screening device surrounding said members and extending laterally from wall to wall of said forebay, means for rotating said members in a direction to elevate the upstream run of said screening device and an adjustable

guide adapted to engage each margin of said device upon its descending run and draw it toward the ascending run, and a receiving trough located adjacent such descending run.

23. In hydraulic apparatus, the combination with a forebay, of a pair of rotatable members mounted upon horizontal axes, one at the bottom of the forebay and the other above the water level, a pair of chains comprising opposed series of connected side links, one chain located adjacent each wall of the forebay, means for rotating said members to elevate the upstream runs of said chains, adjustable guides engaging the downstream runs of the same and carrying the same toward the upstream runs, and screen panels pivoted to said links adapted to lie closely together on the upstream side and to lie widely apart on the downstream side.

24. In hydraulic apparatus, the combination with a forebay, of a pair of rotatable members mounted upon horizontal axes, one at the bottom of the forebay and the other above the water level, a pair of chains comprising opposed series of connected side links, one chain located adjacent each wall of the forebay, means for rotating said members to elevate the upstream runs of said chains, rectangular screen panels having their upper margins pivoted to the upper ends of ascending links on horizontal axes and having outwardly projecting flanges carried by their opposite margins, guides engaging the descending runs of said chains to carry the same toward the ascending runs so as to dump said screen-panels, and a trough into which said panels discharge.

In testimony whereof, I hereunto affix my signature.

FRANK O. WALLENE.