March 19, 1957 L. G. SYMONS 2,785,802

ROTARY-GYRATORY WET SCREEN

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Fig. 1

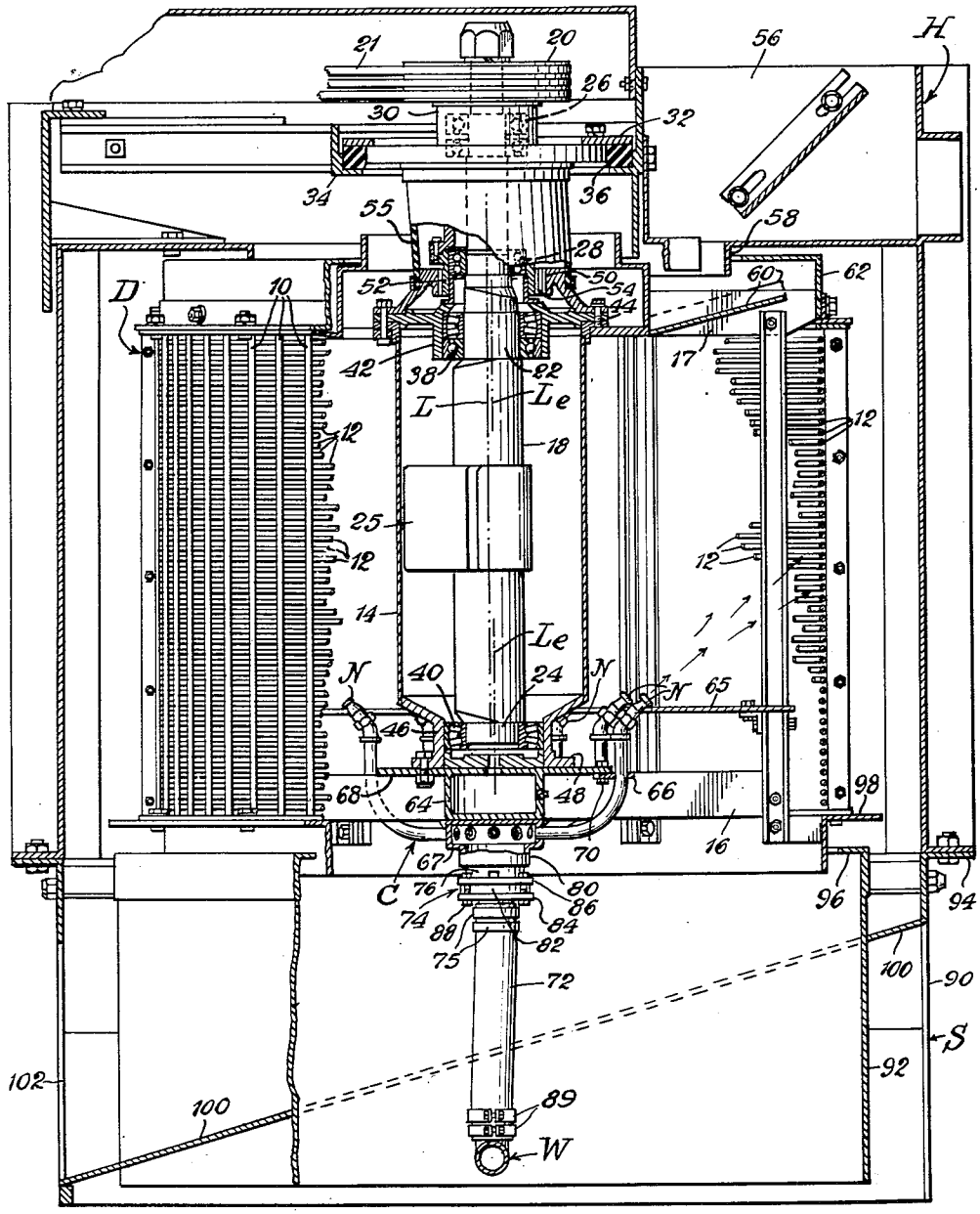

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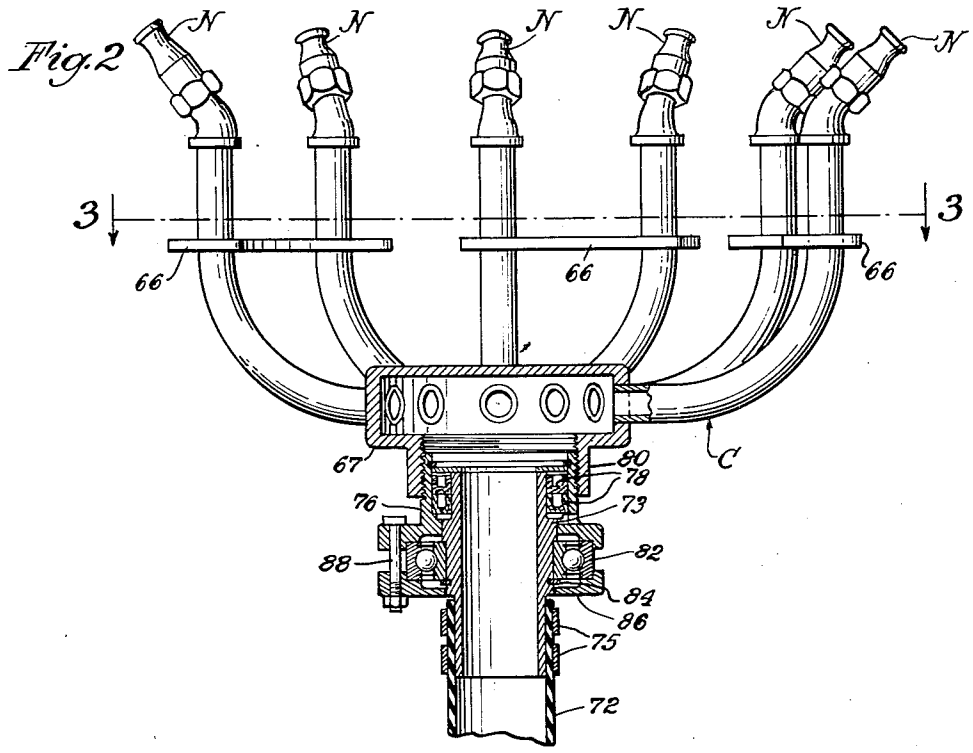
Fig. 2



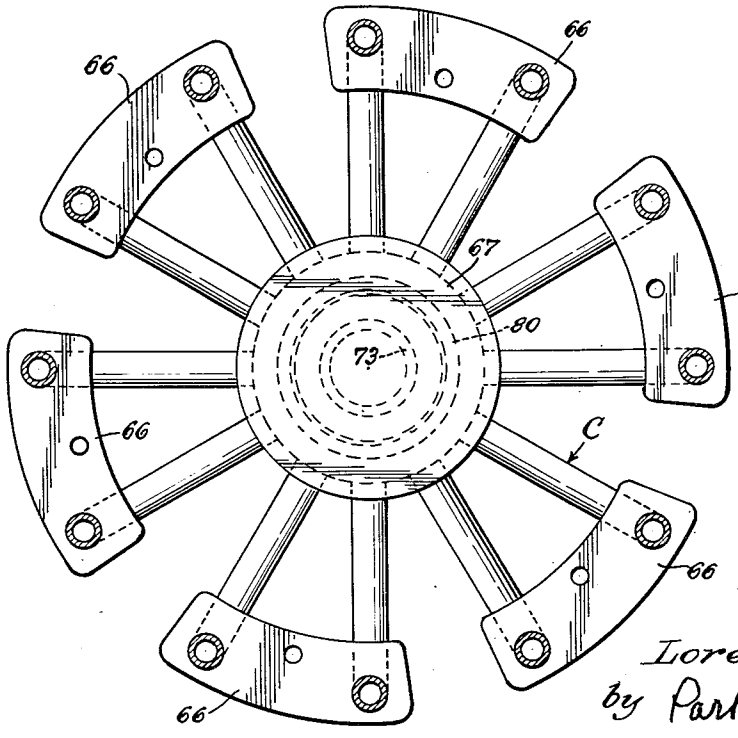


Fig. 3

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ROTARY-GYRATORY WET SCREEN

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Application July 9, 1952, Serial No. 297,916

9 Claims. (Cl. 209—270)

My invention resides in the field of rotating screens for screening materials and has for its main object an improvement on screens of the vertical rotary-gyratory variety, wherein particles to be screened are urged into contact with the inner surface of the screen as the same is rotated and gyrated through an amplitude and with a frequency in relation to the speed of its rotation sufficient to intermittently advance the particles downwardly over the inner screening surface. This particular type of rotary-gyratory screen is fully disclosed in my prior patent, No. 2,500,965 and present pending application No. 292,106, and for the details of the screen assembly and the particular driving mechanism employed to obtain the rotary-gyratory motion, attention is directed to that patent and application.

Under certain circumstances in screening operations it has been found desirable to operate screens in a wet condition which means that a liquid, usually water, is sprinkled or sprayed over the material and the screen during its screening operations. To acquire the most advantageous wet conditions a liquid diffusing system must be provided so that the liquid is evenly distributed over the entire inner surface of the cylindrical screen drum. It is also desirable that the liquid impinge against the inner surface of the screen drum with a direction of movement complementary to the rotary-gyratory motion of the drum and at approximately the same peripheral speed. This requires that the liquid diffusing system be installed so as to rotate and gyrate in harmony with the movements of the drum.

Therefore, the primary object of my invention is a liquid diffusing or spraying system mounted integrally in a rotary-gyratory screen so that liquid distributed by the system will impinge against the surface of the screen in a direction of movement complementary to the rotary-gyratory motion being imparted to the screen.

Another object is a liquid spraying system with a series of nozzles equally spaced circumferentially within the drum, appropriately directed so that the entire inner surface of the drum will be subjected to spray.

Another object is a liquid spraying system with a swivel joint between its diffusing head or chamber and the liquid connections leading to the chamber so that the chamber or head is allowed to rotate and gyrate with the screening drum while the liquid connections leading to the swivel joint remain free from rotation with only a minimum of gyrations being imparted thereto.

Other objects will appear from time to time in the specification and drawings to follow, in which:

Figure 1 is a side elevation of my improved rotary-gyratory screen partly in section and with parts omitted to disclose the liquid system mounted within the drum;

Figure 2 is a side elevational view of the liquid system shown in Figure 1, taken partly in section; and

Figure 3 is a sectional view along line 3—3 of Figure 2.

In Figure 1, H is a generally upright housing and base supporting a screen drum D mounted therein. The drum is mounted about an axis disposed in a vertical direction

and is provided with a driving means so that material to be screened will be impelled against the inside of the drum by centrifugal force thus acquiring a screening action. The driving means gyrate the drum at the same time that it is rotated and with a predetermined relationship existing between rotation and gyration. The gyration of the drum allows the particles to be moved downwardly across the inner surface of the screening medium during the screening action.

The drum itself is composed of a plurality of vertical bars 10, these bars extending in an axial direction. Mounted between the bars and extending circumferentially around the drum are a series of smaller bars 12 which are appropriately spaced with relation to each other so that together they constitute a screen. Although I disclose a collection of bars, it should be understood that any appropriate screen may be used, for example, those shown in my above-referred to patent and pending application.

The interior of the drum has a central housing 14 which is connected to the supporting bars 10 by a collection of radially extending lower and upper braces 16 and 17.

The driving means that imparts a simultaneous rotary and gyratory motion includes a vertically disposed shaft 18 which extends from a driven pulley 20 at one end to a bearing unit at its other end. The pulley 20 is driven by any conventional power means, not shown, through a plurality of belts 21. The shaft has a center line L and an eccentric center line L_e with an eccentric distance x therebetween. A pair of eccentric portions 22 and 24 respectively are spaced along the shaft, the eccentric portion 22 being positioned slightly above the midpoint of the shaft and the eccentric portion 24 being positioned at the lower end of the shaft. These eccentric portions are concentric with the eccentric center L_e and the slight eccentricity x exists between the main center line L and eccentric center line L_e. A counterweight 25 is positioned on the shaft to offset the unbalancing effect of the eccentric portions 22 and 24. The shaft is supported at its upper end by a pair of supporting bearing units, the upper bearing unit 26 being positioned concentric with the main center line L and relatively adjacent the upper end of the shaft while the lower bearing unit 28 is positioned along the level of the upper edge of the drum and is concentric with the main center line L. These bearings are of the conventional variety adapted to absorb both thrust and radial forces. The upper unit 26 is enclosed by a cylindrical housing 30 which has detachably connected thereto a supporting ring 32.

Around the upper end of the shaft is a cylindrical supporting plate 34 which is securely mounted on the housing H and has a pad of resilient material or the like 36, which engages and supports the shaft supporting ring 32. By the use of this resilient pad the entire shaft and its associated structure including the screening drum D are flexibly supported on the housing H so that any excessive vibration will be absorbed through the flexible material.

The eccentric portions 22 and 24 are provided with eccentric bearing units 38 and 40 which are concentric, respectively, with the eccentric center line L_e. The upper eccentric bearing 38 has a bearing housing 42 which surrounds the eccentric bearing unit 38. This housing 42 is provided with outstanding flanges 44. The upper edge of the drum D is mounted on these flanges 44 by a collection of appropriately spaced upper radial braces 17. The lower eccentric bearing unit 40 has a cylindrical housing member 46 with outstanding flanges 48 that are connected to the lower radial braces 16. The entire screening drum D is rotatably mounted on and supported by the shaft through the flanges 44 and 48 which are connected to the radial braces 16 and 17.

The upper bearing housing with its flanges 44 and the lower bearing housing with its flanges 48 constitute respectively the top and bottom for the central drum housing 14.

As thus far explained, the shaft is rotated by any conventional power means. As the eccentric portions 22 and 24 gyrate they induce gyration into the drum because the drum and its interior supporting structure are mounted on the eccentric bearing units 38 and 40 by the upper flanges 44 and the lower flanges 48.

To impart rotary motion to the drum at the same time that it is gyrating, an internally toothed ring gear 50 is mounted on the flanges 44. Extending below the lower supporting bearing unit 28 of the shaft supporting bearings is a cylindrical housing 52 which is provided on its outer surface with an internal pinion 54 that engages and meshes with the ring gear. As the housing 52 is stationarily mounted with respect to the supporting ring 32 and with respect to the housing H it is held stationary during the gyratory movement of the drum D and by engagement with the internally toothed ring gear 50 induces rotation into the drum in response to the gyratory motion. A flexible sleeve 55 slidably mounted at its upper end is provided between the gear 40 and the supporting plate 34 to exclude dust and dirt from the gear and bearing mechanism.

For details and features of the driving mechanism for imparting this rotary and gyratory motion to the drum, references should be made to the above-referred to prior patent and present co-pending application, and the details of this drive form no part of the present invention.

The supporting housing H is provided with a collection of vanes or guiding structure for properly directing the material to be screened to the inner surface of the screening drum as the same is in operation. Stationarily mounted on the housing at the top is a cover and guide unit 56 into which the material to be screened is deposited. By appropriately directed flanges 58 the material is allowed to descend into the upper structure of the rotating and gyrating drum. The upper supporting braces 16 on the drum are provided with a plurality of guiding vanes 60 directed outwardly and upwardly to propel the material against the inner surface of the rapidly moving drum. To prevent material from being thrown over the upper edge of the drum a baffle 62 with an inturned flange is provided on the top of the drum so as to shield and deflect the material downwardly along the inner surface of the drum. The baffle 62 and the flange 58 on the upper cover of the housing are formed so as to reside relatively adjacent one another and to present a tortuous path to material attempting to escape from the screening process.

To operate the drum under a wet condition it is necessary to provide a liquid spray system that will distribute water evenly over the entire inner surface of the drum. In Figure 1, this liquid system C is fitted or otherwise securely attached to the bottom of an oil sump 64 on the bottom of the lower eccentric bearing housing member 46.

The liquid system includes a manifold chamber 67 mounted concentrically with the sump 64. This chamber is attached so as to both rotate and gyrate with the drum D. A collection of equally spaced nozzles N are circumferentially located in and around the housing 14 and are directed upwardly and outwardly toward the inside of the drum so that the entire inner surface of the drum is coated uniformly with the liquid. The nozzles protrude above a circular plate 65 mounted within the drum D, the purpose of this plate being to concentrate the spray from the nozzles on approximately the upper three-quarters of the screening surface.

In Figure 3 the plates 66 are arranged so that each plate supports a pair of nozzles and each plate is connected to the central plate 68 extending outwardly from the oil sump 64 by any suitable means such as bolts 70.

Water is fed to the rotating and gyrating chamber 67 by a flexible rubber hose 72 through a swivel joint, designated generally at 74, which is provided between the flexible hose and the chamber so that the latter is allowed free rotative movement while the hose is permitted to remain relatively stationary.

The swivel joint is composed of an inner casing 73 which is connected to the rubber hose by one or more ring clamps 75. The upper portion of the inner casing is surrounded by an upper bearing and seal housing 76. Suitable oil seals 78 are located between the upper portion of the inner casing and the housing 76 so that relative rotational movement may exist between these two without leakage of the fluid. The outside of the housing 76 is threaded into a depending casing 80 on the chamber 67 so that the housing and the chamber will rotate and gyrate in unison. A ball bearing 82 is interposed between the housing 76 and inner casing 73 so that free frictionless relative rotation is permitted between these two parts. The inner race of the ball bearing 82 is retained in position on the inner casing by a suitable snap ring 84. The outer race of bearing 82 is securely connected to the housing 76 by a housing ring 86, through any conventional means, such as bolts 88.

In operation as the liquid chamber 67 rotates and gyrates with the drum, the upper housing 76 and housing ring 86 rotate with respect to the inner casing 73. The inner casing will remain stationary with respect to the chamber and housing but by its flexible hose connection it is allowed to follow their gyratory movements.

The lower end of the rubber hose 72 is connected to any suitable source of liquid W by one or more conventional hose clamps 89.

The bottom of the main housing H is composed of a structure S for receiving the fluid and material that has passed through the screen and the material retained on the inside of the screen. Generally this structure is composed of a cylindrical outer tank 90 and an inner chamber 92. The upper edge of the outer tank is flanged at 94 and conveniently connected to the lower edge of the housing H. The upper edge of the inner chamber is flanged at 96. The lower edge of the screening drum D is provided with a circular angle iron 98, one leg of which extends horizontally outward toward the housing H, and the other leg of which extends downwardly into the confines of the inner chamber 92. By the proper positioning of the angle iron 98 with respect to the flanged edge 96 of the inner chamber a relatively close fit can be acquired while still allowing for the rotary-gyratory motion of the screening drum D.

The material passing through the screen engages the housing H and by gravity descends to that area intermediate the inner chamber 92 and the outer tank 90. The material failing to pass through the screen will descend to the inside of the inner chamber 92. The area between the chamber and the tank which receives the screened material is provided with a diagonal shield 100 sloping downwardly from the upper right, as shown in Figure 1, to the lower left so that material deposited between the tank and the chamber will move downwardly to the left side where it can be removed through an opening 102. The material failing to pass through the screen and falling directly into the chamber will be deposited between the inner chamber 92 and the outer tank but below the shield 100 as the inner chamber is open at its bottom end.

The use and operation of my invention are as follows:

The material to be screened is deposited on the top cover member 56 and allowed to fall through the opening defined by flanges 58 to the area of the guiding vanes 60 on the top of the rotating and gyrating drum. These vanes and similar guiding structures propel the material against the circular baffle 62 attached to the top edge of the screening drum where it is allowed to move intermittently downward over the surface of the screening medi-

um. During this process portions of the material of a requisite size pass through the screening medium and fall between the drum and the housing H downwardly to the base structure S. Those portions of the material too large to pass through the screening medium are retained within the drum and are deposited within the confines of tank 92. The upper inner surface of the drum is completely covered by the spray from the circumferentially spaced nozzles so that both portions of the material will be thoroughly wetted, whether they pass through the screening medium or not. That portion of the material passing through the screen and residing between the inner chamber 92 and the outer tank 90 contacts the shield 100 and passes downwardly from right to left in Figure 1, to the opening 102 where it may be removed by any suitable means. That portion of the material failing to pass through the screen will fall into and through the chamber 92 to the base of the tank 90 and may be also removed separately from the other portion of the material by any suitable means.

The nozzles N are arranged in pairs as shown in Figure 3, and each pair is supported by one of the six segmental plates, each plate being attached to the central plate 68 of the oil sump 64 by a bolt 70. The pipes leading from chamber 67 to each of the nozzles are metal and the segmental plate 66 is sealed by welding to each of its respective pair of pipes so that the entire liquid system is supported through the connection of the segmental plates 66 with the central plate 68. After the bolts are removed from the entire liquid system, it may be disconneced from the lower end of the internal housing 14, whereupon the drum may be operated as a dry unit. As the liquid system can be attached or detached at will it is in the nature of an attachment but it should be understood that such a system can be permanently secured by welding so as to remain in place continuously. This is to be governed by the type of operation the drum is to perform, but I find a detachable liquid system is the most desirable.

The above disclosure is only one embodiment of my invention and should not be interpreted to limit or restrict my invention except by the appended claims.

I claim:

1. In a rotary-gyratory screen, a base, a vertically axised screening medium structure rotatably and gyratably suspended on said base, actuating means for simultaneously rotating and gyrating said medium with respect to the base, and a liquid diffusing system suspended and non-rotatably mounted in and with respect to the medium structure so as to rotate and gyrate therewith as the same is rotated and gyrated by the actuating means, and a flexible fluid conductive connection between the base and a lower part of said structure, said fluid connection including a pair of relatively rotatable parts, one being mounted against movement in relation to the structure, and a flexible tube extending upwardly to the other such rotatable part, of sufficient length and flexibility to permit gyration of said structure.

2. In a rotary-gyratory screen, a base, a screening medium rotatably mounted on said base, actuating means for simultaneously rotating and gyrating said medium with respect to the base, and a liquid diffusing system mounted in said medium so as to rotate and gyrate with the medium as it is operated by the actuating means, said liquid diffusing system including a liquid proof swivel joint with two portions, the first portion being non-rotatably mounted with respect to the medium so as to rotate and gyrate therewith, the second portion being non-rotatably mounted with respect to the base and adapted to gyrate with the medium, a liquid seal between the two portions, and a flexible liquid conveying means connected at one end to the second portion and adapted to be connected at its other end to a source of liquid supply.

3. In a rotary-gyratory screen, a base, a screening medium rotatably mounted on said base, actuating means for simultaneously rotating and gyrating said medium with respect to the base and a liquid diffusing system extending axially into the medium and having an upper and lower portion, the upper portion being non-rotatably mounted in the medium so as to rotate and gyrate therewith, the lower portion being non-rotatably mounted with respect to the base and adapted to gyrate with the medium, a liquid seal between the two portions, and a flexible liquid conveying means connected at one end to the second portion and adapted to be connected at its other end to a source of liquid supply.

4. In a rotary-gyratory screen, a base, a vertically axised screen drum with an internal housing, means intermediate the base and the housing for suspending the drum from the base and for simultaneously rotating and gyrating the drum, and a rotary liquid diffusing system extending axially into the drum to simultaneously distribute liquid against the circumferential inner surface of the drum, a portion of the system assuming the same rotary-gyratory motion as the drum, said portion including a plurality of spray nozzles circumferentially spaced about the axis of the drum and positioned to spray liquid against said circumferential inner surface and a flexible fluid conductive connection between the base and the rotary liquid diffusing system including a pair of relatively rotatable parts, one being mounted against movement in relation to the screen drum, and a flexible tube extending upwardly from the base to the other such rotatable part, of sufficient length and flexibility to permit gyration of the screen drum.

5. In a rotary-gyratory screen wherein particles to be screened are subjected to both intermittent centrifugal and continuous gravitational forces, a base, a screen drum for screening the particles mounted on said base so as to be supported by the same, a rotary-gyratory driving means for the drum to rotate and gyrate the same with respect to the base with a predetermined relationship between rotation and gyration, a liquid system extending axially into the drum at one end to distribute liquid against substantially the entire inner circumferential surface of the drum and being composed of an upper and lower portion, the upper portion including a chamber mounted so as to rotate and gyrate with the drum and a plurality of spray nozzle units connected to the chamber, the nozzles being spaced circumferentially about the axis of the drum so that liquid imparted therefrom under pressure will impinge against the inner surface of the drum with a direction of motion complementary to the rotary and gyratory motion being imparted to the drum, the lower portion of the system including a flexible member adapted to be connected to a source of liquid and to gyrate with the upper portion of the system, and a liquid seal interposed between the two portions.

6. For use in a rotary-gyratory screen wherein a base is adapted to support a screen drum which is rotated and gyrated about a vertically disposed axis, the improvement including a liquid spray system composed of an upper and lower portion, the upper portion comprising a chamber in axial alignment with the axis of the drum, a series of nozzles in communication with the interior of the chamber and extending in substantially a single plane outwardly from and equally spaced circumferentially about said chamber and about said drum axis and spaced outwardly from said drum axis a distance less than the radius of said drum, the lower portion including a flexible liquid conveying means, one end of said conveying means being fixedly connected to a source of liquid, and a swivel joint interposed between the other end of the liquid conveying means and the chamber, the chamber and nozzles being connected to the drum for rotation and gyration therewith.

7. In a rotary-gyratory screen, a base, a vertically axised screening medium structure rotatably mounted on the base, actuating means for simultaneously rotating and gyrating the structure with respect to the base, and a liquid diffusing system suspended and mounted within the medium so as to rotate and gyrate therewith as the medium is rotated and gyrated by the actuating means to distribute

liquid under pressure against the entire circumferential inner surface of the screening medium at the same rotary-gyratory and circumferential peripheral speed as the medium, and a flexible fluid conductive connection between the base and the liquid diffusing system, said fluid connection including a pair of relatively rotatable parts, one being mounted against movement in relation to said structure, and a flexible tube extending upwardly to the other such rotatable part, of sufficient length and flexibility to permit gyration of said structure.

8. In a rotary-gyratory screen, a base, a screening medium rotatably and gyratably mounted on the base, actuating means for simultaneously rotating and gyrating the medium with respect to the base, and a liquid diffusing system within the medium including a liquid proof swivel joint with two portions, the first portion being non-rotatably mounted with respect to the medium so as to rotate and gyrate therewith, the second portion of the system being non-rotatably mounted with respect to the base and adapted to gyrate with the medium, a liquid seal between the two portions, and a flexible liquid conveying means connected at one to the second portion and adapted to be connected at its other end to a source of liquid supply.

9. In a rotary-gyratory screen, a base, a screening medium rotatably mounted on the base, actuating means for simultaneously rotating and gyrating the medium with respect to the base, and a liquid diffusing system within the medium, including a liquid proof swivel joint having two portions, the first portion including a series of spray nozzles spaced at approximately equal intervals

circumferentially around the inside of the medium and about the axis of the medium, the nozzles being mounted and arranged to distribute liquid equally against substantially the entire inner circumferential surfaces of the screening medium as it is rotated and gyrated by the actuating means, a chamber for the nozzles non-rotatably mounted with respect to the medium so as to rotate and gyrate therewith, the chamber being in liquid communication with the nozzles, the second portion of the system being non-rotatably mounted with respect to the base and adapted to gyrate with the medium, a liquid seal between the two portions, and a flexible liquid conveying means connected at one of its ends to the second portion and adapted to be connected at its other end to a source of liquid supply.

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