MODULAR CONTINUOUS STRIP SCRUBBER MACHINE

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3 Claims. (Cl. 15—77)

This invention relates to continuous strip scrubbers and more particularly to a plural modular unit continuous strip scrubber machine.

In the present state of the art, machines of this type have many operating problems due to alignment of the rollers, wear of such rollers, inaccessibility of repair, and difficulties in maintaining a proper continuous flow of strip material through the machine, the requirement of skilled service technicians to keep the machine properly operating, stoppages of the machine due to the use of corrosive cleaning fluids which freeze the bearings of the rollers in the machine and sundry other problems.

The instant new strip scrubber machine overcomes the above problems by the use of a modular concept (or frame within a frame) to maintain the required measure of precision required in assembly and maintenance as needed for the proper passage of sheet material through the machine as desired for a required scrubbing action on both sides of the strip material. Further improvements in the machine take the form of stainless steel arbor means with adjustments on both the brushes and back-up rollers or brushes in association with disc slingers at each end of the brushes and back-up rollers to protect the bearings from stoppage (freezing) caused by corrosion from caustic detergents, fluids and the like.

The instant inventive scrubber is so designed that each set of brush units, including a scrubber roller brush and back-up roller, may be assembled as a modular unit and as the brushes and bearings become worn or mis-aligned, the used and defective modular unit may be easily removed from the machine and a new or properly adjusted modular unit may be installed and installed into the machine to prevent prolonged shut down of the machine during use.

Another novel improvement of the machine resides in the use of the principle of cantilevering the brush roll arbor from its drive end and sliding off the worn brush section from the operator's side of the machine.

Another object of the invention is to provide a continuous strip scrubber machine which utilizes a module having a brush roll-up arrangement and a module having a brush roll-down arrangement to scrub both sides of a strip of material.

Still further object of the invention is to provide a continuous strip scrubber machine containing a means adaptable to receive therein modular units, each modular unit containing an aligned and adjustable scrubber brush roller unit to coat with a properly aligned and adjustable back-up roller unit therein.

Another object of the invention is to provide a continuous strip scrubber brush unit having at each end of the arbor of each brush unit a disc (slinger) means to protect the bearing means of each brush unit from contact with corrosive scrubbing and cleaning detergents used in the continuous strip scrubber machine.

Another object of the invention is to provide a continuous strip scrubber machine containing a housing means having sturdy and machine face plates spaced by shims and sealably welded thereto to align and sealably receive therein a plurality of modular brush units.

Other objects and many of the attendant advantages of the instant invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, in which like reference numerals designate like parts throughout the figures thereof and wherein:

FIGURE 1 is a simplified front view in elevation of the invention showing the strip scrubber with two module assemblies without hose and fluid header connections;

FIGURE 2 is a more detailed front view in elevation of the invention showing the strip scrubber with two module assemblies with screw jack adjustment means for the roller brush scrub brush means of each module and fluid connections to each position of step operation in the housing of the invention;

FIGURE 3 is a plan view of FIGURE 2 showing the hydraulic actuated cover means of the invention for access to the brush roller means of each module assembly;

FIGURE 4 is a part sectional view of FIGURE 3 taken on lines 4—4 of FIGURE 3 showing the hydraulically operated mechanism to actuate the cover means of the new scrubber machine and also showing the motor assembly for actuating the brush roll-up pressure adjusting mechanism.

FIGURE 5 is a partial view in elevation of the invention having optional back-up roll worm gear screw jack adjustments;

FIGURE 6 is a perspective view of the module unit including arrangement of the brush and back-up roll units with end bearing means in association with energizing motor means known as the brush roll-up arrangement of module;

FIGURE 7 is a perspective view showing a frame means for supporting the brush and back-up roll units within a module unit;

FIGURE 8 is a perspective view showing a partial view of the scrubber brush in association with bearing means for the distal end of the brush connected to its driving motor means;

FIGURE 8A shows the bearing means for the rear end of the brush unit of FIGURE 8;

FIGURE 9 is a perspective view of the back-up roller means in the associated bearing means of FIGURE 6;

FIGURE 10 shows a detailed view in elevation of the assembled brush units in which the back up roller is above the scrubber brush in the module arrangement known as brush roll down module;
FIGURE 11 is a right end elevation view of FIGURE 10.

FIGURE 12 is a left end elevation view of FIGURE 10.

FIGURE 13 is a partial sectional view of FIGURE 12 taken on lines 13–13 of FIGURE 12 showing the sliding fit and structural arrangement between the end of the module frame and the tie plate of the brush roll assembly of the invention.

Refer now to the drawings, wherein like reference numerals designate like parts, FIGURES 1 through 13 illustrate preferred embodiments of the invention.

FIGURE 1 consists of a housing enclosure 20 having a module unit 22 with a brush roll-up arrangement and a module unit 24 having a brush roll-down arrangement.

Module unit 22 has a lower back-up roller 25 and an upper brush roll 26 energized by a back motor. Upper brush roll 26 has a screw jack adjustment 27 for its front roller bearing means 28. Back-up roller means 25 has an end bearing means 29. Machined match plate means 65a is welded to housing means 20. Front slide plate means 31 of module means 22 has a sliding and sealable fit in keeper bars 32 and securely locked into place by wedge clamp members 33, as shown.

Module unit 24 has an upper back-up roller 34 and a lower brush roll 35 energized by a back motor. Lower brush roll 35 has a screw jack adjustment 36 for its front bearing means 37. Frame means 66a is welded to housing means 20. Front slide plate means 39 of module 24 carries bearing means 34a of roller means 34 and has a sliding and sealable fit in keeper bars 40a by being securely locked into place by bolt means 40b. Keeper bar means 41a are securely locked by clamp members 41, as shown.

In operation a strip of material 42 passes through aligned end openings 43 and 44 in the direction of the arrows. As material 42 leaves opening 44 it passes through front roll 45 which splashes the rinse water and liquid from strip material means 42 into drain trough means 46. Housing means 20 has a base means 47 and a hinged lid means 48.

FIGURES 2 and 3 comprise additional detailed parts of those shown in FIGURE 1. In module 22, known as a brush-up module construction, a screw jack means 27 has a hand wheel means 49 which actuates by connecting shaft means 51 which passes through housing means 20 in FIGURE 3, shown in broken lines, and actuates jack means 27a on the back of housing 20 to adjust the distal end bearing of roll brush means 26. Screw jack means 27a is secured by pin means 52a to the bracket 29a of upper half 31a of front slide plate means 31 of roller brush means 26. Plate means 51 has a sliding and sealable fit in keeper bars 21 which are locked in place by bolt means 23 to plate means 65 of module means 22. Plate means 51, carrying end bearing means 29, is adjusted by screw means 54 and 55. Water supply header 56 is secured to housing means 20 by bracket means 57.

Scrubber brush 26 is connected by fluid rotary coupling 58a and hose means 55 to throttling valve means 59 and shut-off valve means 60 to coupling means 61 of header means 56. Coupling means 62 of entry spray means is connected to header means 56 and valve means 63 and 64 of entry spray headers 63a and 64a, shown in broken lines respectively above and below strip material means 42.

Registration and machined plate means 65a is sealably carried by bracket 32 which are securely held by clamping wedge member means 33.

Module unit 24 is similar to module 22, except that scrubber brush 35 is below strip material and back-up roll 34 is located above strip material 42 known as a brush roll-down module construction. Match plate means 66a is likewise welded to housing 20. Plate means 39a adjusts by means 34a and bearing means 34a for adjustment of roller means 34. For purposes of clarity, the operation of the roller means 34 and 35 and parts are the same as those of FIGURE 2 except the addition of screw jack means 92 which is operated by hand wheel means 93, similar to screw jack means 34 of FIGURE 2.

FIGURE 6 is a perspective view of module 22 showing the arrangement of scrub roller brush means 26 and back-up roller brush means 25. Brush means 26 and fluid slinger disk means 26a is carried on arbor means 26b. Back-up roller means 25 and fluid slinger disk means 25a is carried on front bearing means 34a of back-up roller means 34. Screw jack means 36 is actuated by hand wheel 71. Screw jack means 36 is connected by hand wheel 71 and 72 to a similar screw jack means 37 for the distal bearing of roller means 35. Front bearing means 37 is secured by bracket means 73 and pin means 73a to screw jack means 36.

Scrubber brush bearing means 37 is connected by rotary fluid coupling means 74 and hose means 75 to throttling valve means 76 and shut-off valve means 77 to coupling means 78 and header means 76 as shown in FIGURE 2. Wedge clamp members 41 are manually actuated as in FIGURE 1. Final spray rinse means 111 is connected by coupling means 113 to water header means 114 and is connected by pipe means 112 to a valve header means 113 indicated in broken lines to rinse the top portion of strip material 42 and to a valve header means 114 inside housing means 20 to rinse the bottom surface of strip means 42 before passing through external squeeze roller means 45 actuated and held under pressure by pressure means 46.

FIGURE 3 consists generally of lid means 48 being hinged by continuous hinge member 79 to housing means 20. Motor means 81 operates module means 22 and is mounted on the underside of mounting means 81a and motor means 82 operates module 24 and is mounted on the upper side of mounting means 82a. Lid means 48 is operated hydraulically by hinged lever means 83 welded to lid means 48 at points 88. Shaft means 84b, shown in broken lines, links screw jack means 56 of module 24 to a similar screw jack means for the distal bearing means of lower brush roller 35.

FIGURE 4 shows hydraulic cylinder means 84 secured to housing means 20 by hinge and bracket means 85. The piston rod 86 of hydraulic cylinder means 84 is connected by pivot means 87 to lever means 83 welded to lid means 48 and pivoted to housing means 20 by hinge means 79. Hydraulic cylinder means 84 is connected by fluid connection means 90 and 91 for operation, as shown.

Shown also in FIGURE 4 is a gear-motor assembly for actuating the brush roll-up pressure adjusting mechanism. This drive assembly serves as an alternate method of actuating the brush pressure mechanism, replacing the manual hand-wheel operator, and consists of a manually operated means 30 mounted on a support shelf 72 extending from reduction gear housing 67 which in turn is supported from mounting bracket 80 attached to housing means 20. Motor 30 is connected to reducer means 67 by flexible coupling 59, and output of reducer means 67 is operatively connected to input shaft of jack means 27a through flexible coupling 68.

FIGURE 5 is another view of module 24 of FIGURE 2 in which screw jack means 92, similar to screw jack means 36, has been added to back-up roller means 34 and bearing means 34a for adjustment of roller means 34. For purposes of clarity, the operation of the roller means 34 and 35 and parts are the same as those of FIGURE 2 except the addition of screw jack means 92 which is operated by hand wheel means 93, similar to screw jack means 34 of FIGURE 2.

FIGURE 6 is a perspective view of module 22 showing the arrangement of scrub roller brush means 26 and back-up roller brush means 25. Brush means 26 and fluid slinger disk means 26a is carried on arbor means 26b. Back-up roller means 25 and fluid slinger disk means 25a is carried on front bearing means 34a of back-up roller means 34. Screw jack means 36 is actuated by hand wheel 71. Screw jack means 36 is connected by hand wheel 71 and 72 to a similar screw jack means 37 for the distal bearing of roller means 35. Front bearing means 37 is secured by bracket means 73 and pin means 73a to screw jack means 36.

Scrubber brush bearing means 37 is connected by rotary fluid coupling means 74 and hose means 75 to throttling valve means 76 and shut-off valve means 77 to coupling means 78 and header means 76 as shown in FIGURE 2. Wedge clamp members 41 are manually actuated as in FIGURE 1. Final spray rinse means 111 is connected by coupling means 113 to water header means 114 and is connected by pipe means 112 to a valve header means 113 indicated in broken lines to rinse the top portion of strip material 42 and to a valve header means 114 inside housing means 20 to rinse the bottom surface of strip means 42 before passing through external squeeze roller means 45 actuated and held under pressure by pressure means 46.

FIGURE 3 consists generally of lid means 48 being hinged by continuous hinge member 79 to housing means 20. Motor means 81 operates module means 22 and is mounted on the underside of mounting means 81a and motor means 82 operates module 24 and is mounted on the upper side of mounting means 82a. Lid means 48 is operated hydraulically by hinged lever means 83 welded to lid means 48 at points 88. Shaft means 84b, shown in broken lines, links screw jack means 56 of module 24 to a similar screw jack means for the distal bearing means of lower brush roller 35.

FIGURE 4 shows hydraulic cylinder means 84 secured to housing means 20 by hinge and bracket means 85. The piston rod 86 of hydraulic cylinder means 84 is connected by pivot means 87 to lever means 83 welded to lid means 48 and pivoted to housing means 20 by hinge means 79. Hydraulic cylinder means 84 is connected by fluid connection means 90 and 91 for operation, as shown.

Shown also in FIGURE 4 is a gear-motor assembly for actuating the brush roll-up pressure adjusting mechanism. This drive assembly serves as an alternate method of actuating the brush pressure mechanism, replacing the manual hand-wheel operator, and consists of a manually operated means 30 mounted on a support shelf 72 extending from reduction gear housing 67 which in turn is supported from mounting bracket 80 attached to housing means 20. Motor 30 is connected to reducer means 67 by flexible coupling 59, and output of reducer means 67 is operatively connected to input shaft of jack means 27a through flexible coupling 68.

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means 51a and 52, as shown. Motor means 81 is alterna-
tively mounted on the underside of mounting means 81a by bolt or other means to plate means 81. Plate means 65b is sealed by gasket means 94 against a machined plate means 121 to machined plate means 66. Slide plate means 106 is sealably and adjustably retained by tab means 122 held in position by wedge latch means 40. Tie plate means 117 is also partially retained by a machined groove means 119. Slide plate means 106 in sliding bar means 118 secured by screw means 119 to machined plate means 66. When the module 24a is installed in housing enclosure means 20, module front plate means 66 and module back plate means 66b are sealably secured to a welded and machined surface by suitable bolts and by gasket means similar to those numbered 94 at bar means 81 shown in FIGURE 5. Baffle means 107a is secured to bar means 107 of the tie structure means of brush roll assembly means 99, as shown in FIGURE 10.

The conventional electrical wiring to the motors of the scrubber brush roller means of the drawings have not been shown for purposes of clarity, as it is well within the skill of one versed in the art to supply such wiring. FIGURE 13 illustrates a seal structure having a sliding fit in which key member 108a is welded at 108 to tie plate means 117 which is then secured by screw bolt means 101a to a machined stepped surface of bar structure 107 of the frame member of module 24a. Likewise, bar means 109 is welded at 109a to plate means 66 and seal means 110 is slidably secured between tie plate 117 and bar means 109. Toggle means 105 is secured by pin means 105a to bar member 117, as shown.

The module construction of the present invention is symmetrically constructed so that by inverting module 22, of FIGURE 2, it may be used as the roll-down module unit 24 or vice versa.

In the operation of the instant inventive machine, modular construction is incorporated, so as to permit replacement, as a unit, of entire brushing assemblies, each consisting of brush roll, brush roll drive motor, motor base, coupling, back-up roll, sliders, brush and back-up roll bearings, mounting plates for the bearings, and other items, as well as the main framework which carries, guides and retains all of these items. In other words, these module units consist of a supporting frame, a brush roll sub-assembly with motor drive, and a back-up roll sub-assembly. These three sub-assemblies are shown in FIGURES 7, 8, 8A, and 9, and a more comprehensive view is shown in FIGURES 10, 11, 12, and 13. An assembled brush roll-up module assembly is shown in perspective in FIGURE 6.

Therefore, in this new machine, complete interchange-
ability of modular units and sub-assemblies is featured therein, enabling the user to stock these items as spares, thus cutting down costly loss of production time by permitting routine maintenance to be done in the repair shop instead of on the production line.

Brush removal is quickly accomplished by the principle of cantilevering the brush roll arm from its drive end and sliding off the worn brush sections from the operator's side. If necessary, it is possible also to remove the entire arm simply by separating the coupling and removing the four cap screws which hold the bearing mounting plate to the slide plate on the drive side.

Quick release clamps as in FIGURES 8 and 8A comprising members 28a, 28b, and 28c are furnished, and wedge clamps 33 are substituted for bolts for holding keeper bars in place, as shown in FIG. 6, thus facilitating the brush changing operation.

Stainless steel brush arbor are employed so as to permit water or cleaning solution to be fed internally into the brush, from which it is discharged onto the strip of material to be cleaned by centrifugal force. Ordinary steel were used for the arbor, corrosion would rapidly freeze the brush sections in place, making their removal very difficult. If a loose fit were deliberately employed to offset this freezing or sticking of the brush roll sections to the arbor, then the unbalance existing in the brush roll plus any additional unbalance introduced by loose parts, or by the liquid being forced into the hollow...
would tend to cause excessive vibration, and optimum brushing would be impossible.

Maximum protection is thus afforded all bearings by mounting them outside the scrubber shell, and by using dish-shaped splingers on the ends of the brush and back-up roll shafts to deflect water or corrosive cleaning fluid away from the bearing mounting plates.

In scrubbing machines employing four or more modules mounted in a single shell or enclosure each set of two modules is compartmentized or isolated by means of baffles located internally in the scrubber shell, thus permitting the top and bottom brushes to be changed in one section while operation continues in other sections.

Machined match-plate means 65a or 66a of FIGURE 2 are welded by shims to prevent heat deformation of the walls of the scrubber shell 20 on the front or operator's side of the new machine, which makes it possible to remove a worn or damaged module from a scrubber and to replace it with a new one, without upsetting the alignment of the brushes, which is critically important if correct brushing and tracking of the cleaned strip material is to be obtained.

By supporting the back-up roll with an adjusting mechanism, as well as the brush roll as in FIGURE 5, it is possible to change over in a few minutes from a straight-through pass line to one in which the strip material is directed into the scrub, bending slightly over each back-up roll. It also permits maintaining a given pass line configuration every time there is a roll change, regardless of the diameter of the brush or change in diameter of the back-up roll due to wear or dressing.

Therefore, the success of the module (frame within a frame construction) concept depends on maintaining a measure of precision of tolerances in welding and machining of the instant new machine to insure good operation of the machine without leakage, proper alignment of the rollers, proper travel of the cleaned strip material and interchangeability of modular assemblies as shown. Of course, the invention is not restricted to only two module units to a machine, as any number of module units may be used as desired, or two or more such machines may be used in assembly line operation, if desired, within the scope and intent of the invention.

From the foregoing it will now be seen that there is herein provided an improved modular continuous strip scrubber machine which accomplishes all the objects of this invention, and others, including many advantages of great practical utility and commercial importance.

It should be understood, of course, that the foregoing disclosure relates to only preferred embodiments of the invention and that it is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention set forth in the appended claims.

We claim:
1. A modular continuous strip scrubber machine comprising housing means including aligned entrance and discharge end openings therein for passing a strip of material to be cleaned therethrough, a plurality of modular units operably interconnected together, each modular unit including a plurality of cooperating brush units having hollow perforated axle means rotatably communicating with a fluid supply and adapted to be interchangeably inserted from the front side of said machine and scaled in said housing means in alignment with said end openings, each of said brush units including a scrubber brush means and a back-up roller means to scrub and clean one side of a strip of material and a second modular unit including an interchangeable frame modular unit having a scrub roll-down adjustment arrangement to scrub and clean the opposite side of the strip of material interposed between said one of and said second modular units, an energized motor means operably connected to rotate said brush units, detergent supply means and water supply means including a final spray rinse header means having a desired temperature of fluid therein, said detergent means being operably connected to said hollow axle means of each of said brush rollers, said spray header means in said housing being juxtaposed to the exit opening in said housing for a cleaned strip of material, a pair of adjustable squeegee roller means juxtaposed externally to the exit opening in said housing means and adapted to compress surplus rinse water from a strip of material when cleaned and passed through said machine, and a housing means having sturdy and machined face plates spaced by metal openings, one of said modular units containing an interchangeable strip scrubber and the back-up roller means in each of said modular units.

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