Oct. 23, 1962 C. A. JOHNSON 3,059,863

SEGMENTAL FILLING FOR REFINER PLUGS

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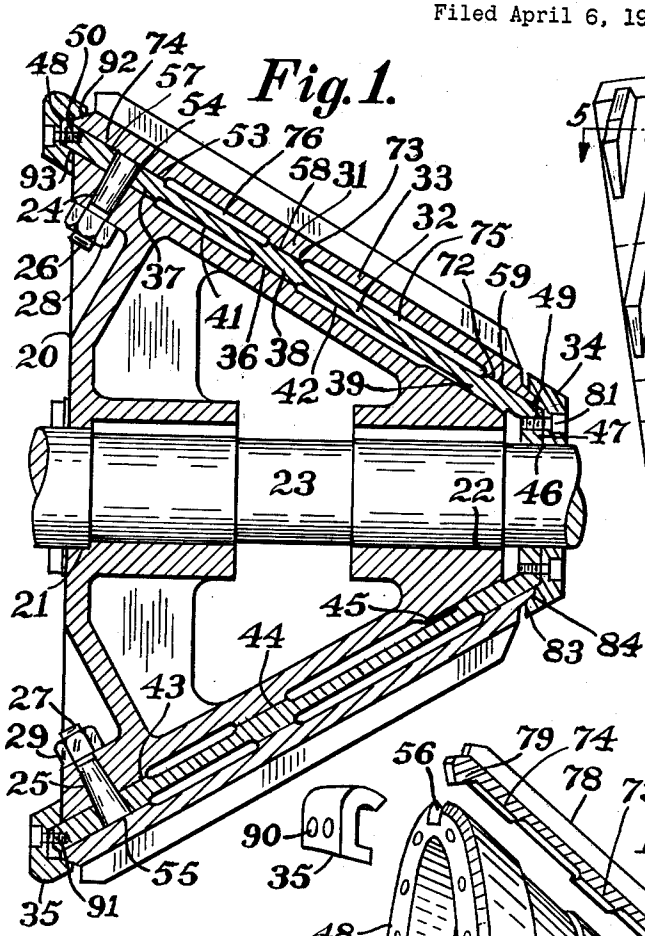


Fig. 1.

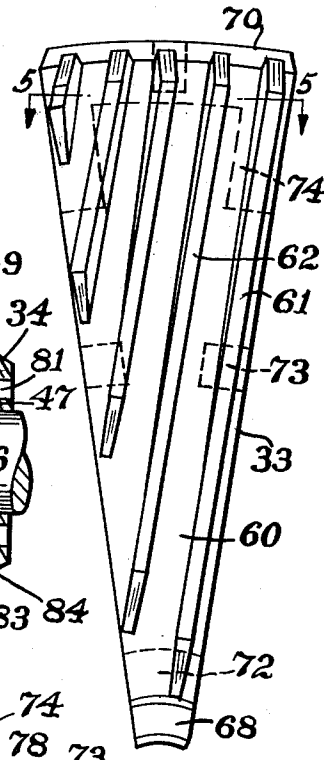


Fig. 3.

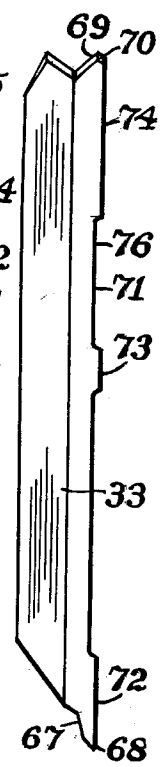


Fig. 4.

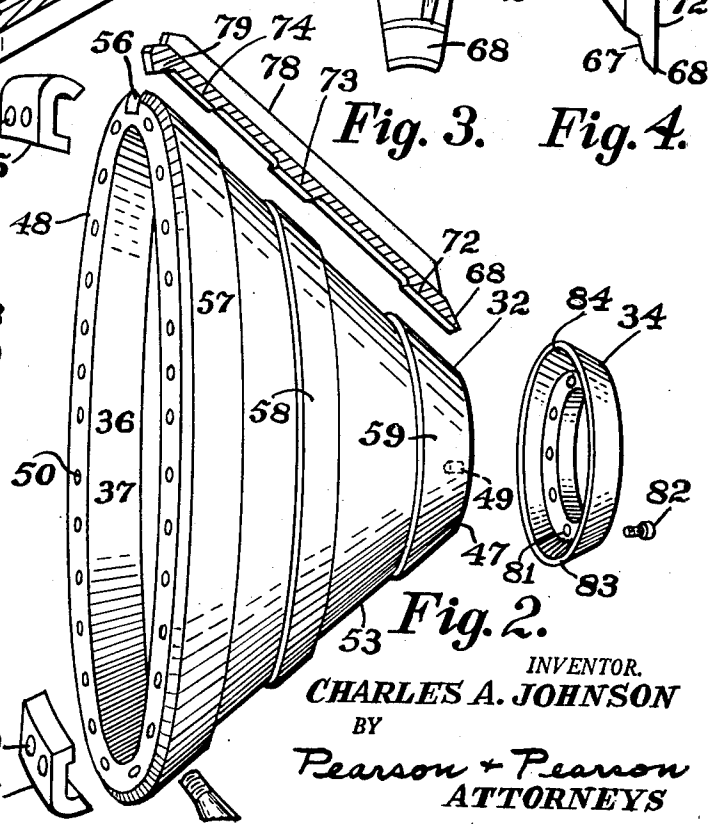


Fig. 2.

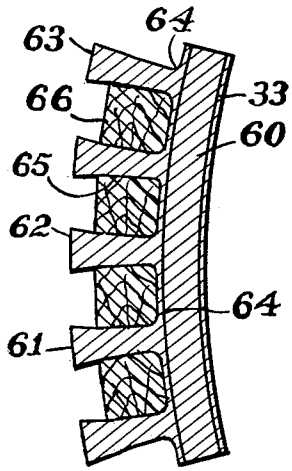


Fig. 5.

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SEGMENTAL FILLING FOR REFINER PLUGS

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This invention relates to segmental linings for the plugs of pulp refining engines, especially those of the "Claflin" type.

It has heretofore been proposed, as in U.S. Patent 1,166,310 to Bahr of December 28, 1915 and in U.S. Patent 1,184,058 to Watson of May 23, 1916, to provide a unitary, cast segment of generally triangular outline and with integral upstanding knives for use in lining the frustro-conical plug of such engines. The segments disclosed in these patents include bolt holes therethrough and they are intended to be secured against the centrifugal forces and endwise forces to which the plug is subjected, by being bolted to the frustro-conical face of the plug.

As far as I am aware, refining engine plugs with bolted segmental linings are not in use at present and the usual lining for a "Claflin" engine is a cast, one piece, truncated conical member having upstanding integral knives. Such one piece truncated, conical linings are usually secured to the plug by a pair of opposite tapered threaded pins and if a single knife needs replacement the entire lining must be replaced. A disadvantage of such cast, truncated, conical linings is that they cannot be drawn out of the mold without destroying the mold unless the knives are of uniform thickness. Thus the space between the knives cannot be of the desirable inverted keystone cross section, which permits wood fillers to be inserted endwise and firmly retained against centrifugal force, without incurring undue cost of mold replacement.

It is the object of my invention to provide an improved segmental filling for the truncated, conical plug of a pulp refining engine wherein the segments are detachably secured by individual clamps at the large end of a truncated conical liner sleeved on the plug, the liner being detachably secured to the plug by the usual tapered, threaded pins.

Another object of the invention is to provide such a filling in which the generally triangular segments include a beveled flange at each opposite end and each segment is individually clamped to the truncated conical liner with a wedging action. A single segment may thus be installed or removed with ease, without disturbing the other segments and without withdrawing the plug entirely from the shell of the engine.

A further object of the invention is to provide a filling for truncated, conical plugs made up of individual segments each having a plurality of integral knives of greater width at the tip than at the base for securing fillers of inverted keystone cross section, the segments being cast and homogeneous.

A still further object of the invention is to provide improved means for securing a plurality of filling segments to a plug or liner whereby individual clamps with a pair of beveled seats wedge the small end of each segment into an end ring, wedge the large end of the segment against the plug or liner and wedge the clamp itself against the plug or liner.

Other objects and advantages of the invention will be apparent from the claims, the description of the drawing, and from the drawing in which

FIG. 1 is a side view, in section, of a plug filling constructed in accordance with the invention.

FIG. 2 is a perspective, exploded view of the truncated, conical liner, detachable end ring and detachable, arcuate clamps of the device.

FIG. 3 is a plan view and FIG. 4 a side view of a cast, unitary, filling segment of the invention, and

FIG. 5 is an enlarged end view, in section on line 5—5 of FIG. 3 from the large end of the segment shown in FIG. 3 and FIG. 4.

As shown in FIG. 1, a well known type of truncated, conical plug 20 of the "Claflin" type has been selected for illustration and includes suitable bores 21 and 22 for the plug shaft 23, the plug 20 being cast of metal and having a pair of oppositely disposed tapered pin holes 24 and 25. The customary "Claflin" plug filling, now in use, is a one piece, truncated conical, casting having integral straight knives therearound and secured to the plug 20 by tapered, threaded pins such as 26 and 27 and threaded nuts such as 28 and 29.

In this invention, instead of a single, unitary, truncated conical plug filling, a composite filling 31 is provided preferably including a truncated conical liner 32, a plurality of cast, generally triangular segments such as 33, each outlining a portion of a truncated cone and having upstanding, integral knives thereon, a detachable end ring 34 and a plurality of detachable clamps such as 35.

The liner 32 is of truncated conical, or frustro-conical shape and cast in one piece with an interior face 36 having longitudinally spaced, annular ribs 37, 38 and 39, separated by annular recesses 41 and 42, whereby the liner ribs are in supporting engagement only with corresponding annular ribs 43, 44 and 45 of plug 20 when the liner is sleeved thereon. The small end of liner 32 may include an axial bore 46 of the same diameter as shaft 23 and project beyond the small end of plug 20, if desired. The opposite end faces 47 and 48 of liner 32 are provided with spaced, threaded holes such as 49 and 50 for receiving attachment or tightening bolts to be described hereinafter. The exterior face 53 of liner 32 is provided with the pair of tapered holes 54 and 55 for pins 26 and 27, at least one boss-receiving recess 56 and three annular ribs 57, 58 and 59 similar to the ribs 43, 44 and 45 of plug 20. The liner 32 is sleeved onto plug 20, the tapered pins 26 and 27 are inserted in their respective pin holes 54 and 24 and 55 and 25 and the nuts 28 and 29 are then tightened to detachably secure the liner to the plug.

Each filling segment 33 is cast in one piece in metal so that the plate portion 60 and the straight, parallel knives such as 61 and 62 are integral and homogeneous. As best shown in FIG. 5, each knife 61 is convergent from its tip 63 to its base 64 proximate plate portion 60, the tip 63 being of a predetermined width and the base 64 being of a lesser width. The spaces between the knives 61 and 62, as at 65 are thus of inverted keystone shape cross section to receive endwise a filler, 66 usually of wood, of inverted keystone shape cross section. The fillers 66 are thus secured against outward movement due to centrifugal force when initially installed in the pulp refining engine. Subsequent swelling of the fillers 66 locks them even more firmly in place. It should be noted that the ordinary truncated conical filling has straight knives of uniform thickness and does not have filler spaces of inverted keystone shape cross section because a filling with convergent knives destroys its mold upon withdrawal and is, therefore, unduly expensive to manufacture. A filling segment on the other hand, having knives which converge from tip to base, may be cast in one piece and even though it also destroys its mold cores, upon withdrawal, the expense is slight.

Each filling segment 33 also includes an elongated, gradually beveled, flange 67 at the small end 68 thereof and a shorter, sharply beveled, flange 69 at the large end 70 thereof. The lower face 71 of each segment 33 is provided with three, longitudinally spaced integral pads 72, 73 and 74, separated by the recessed areas 75 and 76, the pads 72, 73 and 74 being in supporting engagement with the corresponding exterior ribs 57, 58 and

59 on the liner 32. Thus the segments 33 when mounted around liner 32, to jointly form a truncated conical filling, are supported intermediate thereof and at each opposite end thereof for better seating and less likelihood of rust-locking.

All of the filling segments 33 are identical except for a single segment such as 78, shown in FIG. 2, which segment includes a boss 79 arranged to enter the boss recess 56 in liner 32. The segments of this invention are held to the liner 32 by a wedging engagement at each opposite end, rather than by being bolted to the conical face of the plug itself, as in the prior art. The boss 79 prevents any possibility of the segments 33 rotating with relation to the liner 32, a single boss having been found to be sufficient for the purpose.

The single detachable end ring 34 is mounted at the small end of liner 32 and includes the countersunk bolt holes 81 for the threaded attachment bolts 82 whereby it may be attached and detached from the threaded holes 49 in the liner end face 47. Ring 34 is cast in one piece and includes the annular flange 83, which overhangs the exterior of the small end of liner 32 to form an annular, beveled seat, or groove, 84 preferably at an angle of about 45° relative to the longitudinal axis of the shaft 23.

Each individual end clamp 35 is of arcuate shape, curved to form a part of a circle of about the diameter of the large end face 48 of liner 32 and includes at least two countersunk bolt holes 90 for the threaded attachment bolts 91 whereby each segment may be individually attached and detached from face 48. The outer portion of each clamp 35 overhangs the adjacent rim portion of liner 32 and is formed with an arcuate beveled seat, or face, 92, preferably at an angle of about 22° relative to the longitudinal axis of the shaft 23. The inner portion of each clamp 35, also includes an arcuate, beveled, seat or face, 93, preferably at an angle of about 30° relative to the longitudinal axis of the shaft 23.

In assembling the composite filling 31 the liner 32 is first sleeved onto plug 20 and the tapered pins 26 and 27 are tightened to secure the liner 32 against endwise or rotational movement. The end ring 34 is attached to the small end of the liner 32 by the bolts 82. The segment 78 is then placed on liner 32 with its flange 68 slidably wedged under the annular seat 84 of ring 34 and the boss 79 seated in the boss receiving recess 56 of liner 32. Thereafter the plurality of segments 33 are each mounted around liner 32, each with its flange 68 under the seat 84 and its flange 69, held in place by the corresponding seat 92 of an individual clamp 35. The seat 93 of each clamp 35 engages the inner face 36 of liner 32, at the rim portion thereof and tightening of the bolts 91 wedges each segment 33 into the ring 34, wedges the clamp against the flange 69, the segment against the liner and the clamp is drawn tightly against the liner.

It should be noted that when the segments 78 and 33 are mounted around the liner 32 with the end flanges 68 slidably engaged under the annular seat 84 of end ring 34 the flange 68 is elongated and gradually beveled with relation to seat 84 so that it is almost entirely seated in the groove formed by seat 84. However, the bevel of flange 69 at the large end 70 of the segments is sharper and shorter so that only a limited travel of the clamps 35 is required to tightly grip the segments against the liner. The clamps 35 form a strong barrier against movement of segments 33 toward the large end of the plug when the plug is advanced into the shell to take up wear on the knives and eliminate the fastening bolts of the prior art which might shear under such stress. Each clamp 35 is readily accessable for removal and substitution of a segment from the large end of the engine, thereby reducing down time and lowering the cost of operation.

In the prior art it has been the custom in Jordan engines to longitudinally slot the plug for each individual knife and to hook the knives under laterally spaced rings to prevent radial and circumferential movement of the knives relative to the plug body. In "Claflin" engines, when triangular segmental knife plates have been used, it has been the custom to bolt each segment to the plug body to prevent radial, circumferential and longitudinal movement of the plates relative to the body. However, removal of a damaged knife or plate has required the removal of the entire plug and its shaft from the shell, a time consuming, costly operation using much space.

In this invention only a single boss prevents circumferential movement of the plates and only the removal of a single end clamp 35 is required to slidably draw a damaged plate from the liner out through the large end of the engine. There are no fastenings intermediate of the length of the plates which must be unhooked or unthreaded and it is not necessary to chip out the wood fillers to gain access to any fastenings. In addition, the elimination of fastening bolts avoids the danger of the rusting of such bolts and the shearing thereof under the stress of constant axial pressure of the plug into the shell.

The truncated conical liner 32 permits plugs already in use in the trade to be remodeled in accordance with this invention. A new plug, however, can either be provided with the liner, or made of sufficiently large diameter to permit the segments to be attached directly thereon by the individual end clamps 35 and an end ring 34.

The fillers 66, are well known in the trade and function to restrict the flow of stock through the channels when the knives 61 are full height. As the knives wear down, the individual segments may be removed without removing the entire plug, the fillers chipped to maintain the desired cross sectional area of the channels and the fillers can be entirely removed when the knives approach fully worn condition.

I claim:

1. A filling for the plug of a truncated conical refining engine, said filling comprising a one piece, truncated conical, liner sleeved on the outside face of said plug; means for detachably securing said liner on said plug; a plurality of individual filling segments of generally triangular configuration mounted around said liner, each having a plurality of integral upstanding knives thereon; a beveled flange at each opposite end of each said segment; an end ring detachably secured to the small end of said liner, said ring having an annular beveled seat in slidable engagement with the adjacent beveled flanges of said segments; a plurality of individual, parti-circular, clamps spaced around the large end of said liner, each said clamp having an arcuate, beveled seat in slidable engagement with the adjacent beveled flange of a single one of said segments and means for tightening said clamps individually on said liner to wedge said segments into said ring and tightly against said liner.

2. A combination as specified in claim 1 wherein each said clamp includes a second arcuate beveled seat in slidable engagement with the inner face of said liner whereby tightening said clamp draws both the clamp and the segments toward said liner.

3. A combination as specified in claim 1 wherein the knives of said segments are of greater thickness at the tip than at the base for retaining fillers therebetween.

4. A combination as specified in claim 1 plus a boss on the bottom face of at least one said segment and a recess in said liner receiving said boss for fixing all of said segments against rotation relative to said liner.

5. A combination as specified in claim 1 wherein the truncated conical face of said liner includes a plurality of longitudinally spaced, annular, integral ribs and the adjacent faces of said segments each include opposite corresponding, integral pads whereby said segments are

in supporting contact with said liner only at said spaced, annular ribs.

6. A cast, unitary, filling segment for the plug of a truncated conical refining engine, said segment comprising a generally triangular plate of cast material; a plurality of straight, parallel, upstanding knives integral and homogeneous with said plate, each of said knives converging in width from a tip of predetermined width to a base of lesser width, proximate said plate; an elongated, gradually beveled, integral flange at the small end of said plate and a shorter, sharply beveled, integral flange at the large end of said plate.

7. A cast, unitary, filling segment as specified in claim 6 wherein the lower face of said plate is recessed to form two arcuate end pads and an arcuate intermediate pad, said pads being spaced longitudinally for forming three longitudinally spaced areas of support for said segment.

8. A filling for the plug of a truncated conical refining engine, said filling comprising a plurality of individual filling segments of generally triangular configuration mounted around said plug, and having a plurality of integral, upstanding knives thereon, each said knife converging in width from a tip of predetermined width to a base of lesser width to form a channel of inverted, keystone cross section between each adjacent pair of knives; a beveled flange at each opposite end of each

said segment; an end ring detachably secured proximate the small end of said plug, said ring having an annular beleved seat in slidable engagement with the adjacent beveled flanges of said segments; a plurality of individual, parti-circular, clamps spaced around the large end of said plug, each said clamp having an arcuate beveled seat in slidable engagement with the adjacent beveled flange of a single one of said segments; means for tightening said clamps individually on said plug to wedge said segments into said ring and tightly against said plug and a plurality of fillers of inverted keystone cross section, each mounted in one of said channels between pairs of adjacent knives.

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