July 1, 1969 C. A. JOHNSON 3,452,939

ROUGH CAST SEGMENTAL FILLINGS FOR PULP REFINERS

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Fig. 4

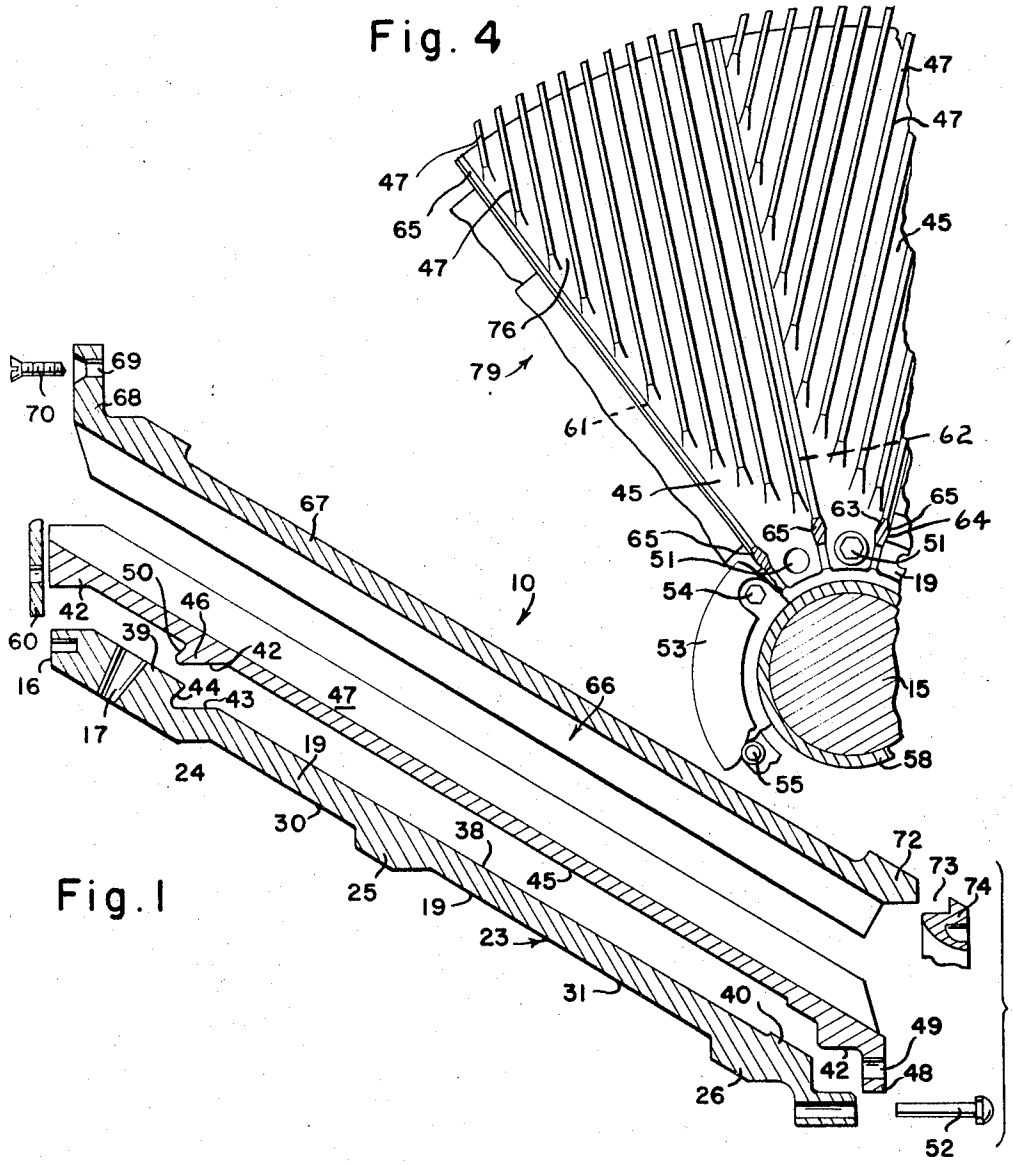
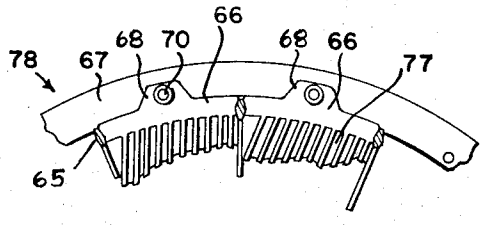



Fig. 1

Fig. 3



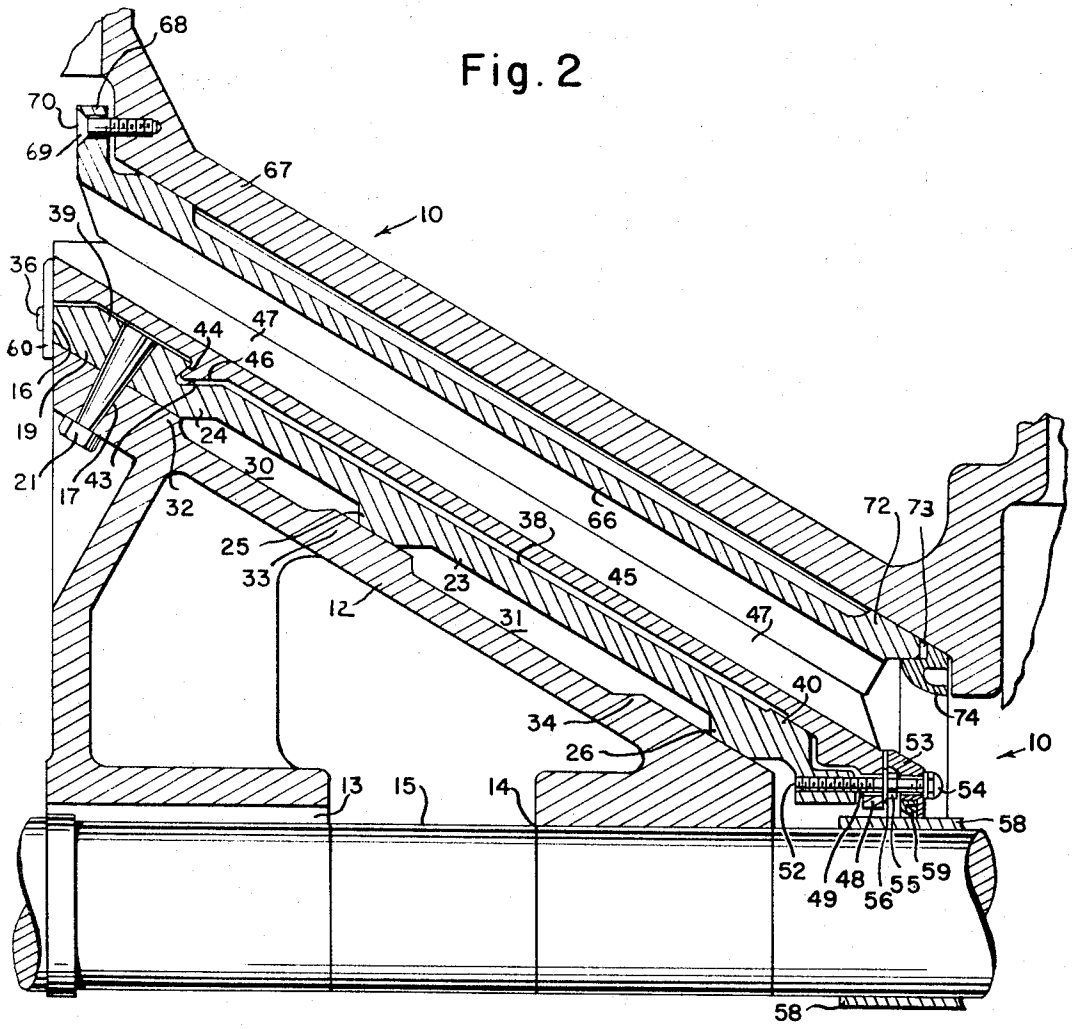

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Fig. 2




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# ROUGH CAST SEGMENTAL FILLINGS FOR PULP REFINERS

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U.S. Cl. 241—255 8 Claims

## ABSTRACT OF THE DISCLOSURE

A frustoconical refining engine of the type having segmented fillings wherein said segmented fillings are rough cast with no machining and are separated by expansible spacers subject to swelling by moisture thereby providing means to hold the segmented fillings tightly in service and also providing means for relatively easy assembly. Preferred embodiments of the apparatus include plug or shell filling segments having integral tapered tang means at one end for seating in a wedging groove, or recess, and having integral angularly disposed flange means for threaded attachment of the other end.

### *Background of the invention*

This invention relates to a paper refining apparatus useful in the paper-making industry.

Segmental fillings for pulp refiners such as Claflin engines are already known in the art. Such segmented fillings have received wide acceptance proving popular with the fabricators thereof because they can be successfully cast, or molded, at reasonable cost and with the exercise of less care, and proving popular with the users thereof because apparatus utilizing segmented fillings, especially those advantageously mounted according to U.S. 3,059,863, or some other such means can be maintained and repaired with greater ease than apparatus of the old single-casting design.

However, there are still some difficulties in manufacturing and maintaining these segmented fillings. For example, very close tolerances must be maintained so that the fillings can be mounted properly on the shell and plug of the apparatus. Many foundry operations cannot meet these tolerances without excessive production of unacceptable castings. Moreover, assembly of such closely matched segmental fillings must be done with much care. The machining operations required for close fit are costly and time consuming.

Therefore, it is an object of the instant invention to provide improved plug and shell filling assemblies for pulp refining apparatus comprising segmental fillings which are rough cast only, with no machining, but are capable of easy, close fitting assembly.

Moreover, it is an object of the invention that the novel apparatus thereof be comprised of unitary segments which may be easily cast with suitable tolerances, tightened in place by expansible wood fillers and easily removed for replacement.

### *Summary of the invention*

These objects have been substantially accomplished by the novel Claflin type filling segment assemblies of the invention wherein the triangular segments are separated one from the other by relatively thin, solid, water-swellable spacers which hold the segments tightly onto the plug and in the shell and compensate for what would otherwise be intolerable dimensional variability among the rough cast, unmachined segments.

To obtain a maximum advantage in assembling the plug and shell segments according to the invention, a novel configuration of both the plug and shell have been devised for holding the segmental fillings onto the plug and for attaching and holding the segmental fillings in the shell. Thus, the segmental plug fillings each include an integral, inwardly-turned lip or flange, at the small diameter end of the refiner plug which flange is positively held in place by bolt means with respect to its supporting plug liner. Moreover, each plug filling segment includes tapered tang means in the form of an inwardly projecting circumferential rib which seats into an undercut groove on the supporting plug liner. This seating not only provides a positive positioning check but also helps to hold the filling segment assembly against centrifugal forces exerted thereupon.

The segmental shell fillings each include an outwardly turned flange, or lip, at the large diameter end of the refiner shell which flange is held in place with respect to the shell by a bolt fastened through the flange into the shell. Moreover, shell segment tang means extends axially of each shell segment and is seated in the groove, or recess of a segment retaining ring to hold each shell filling segment at the small diameter end of the shell.

### *Brief description of the drawing*

FIGURE 1 is a schematic, exploded, sectional view of a plug segment opposed by a shell segment and showing the essential parts diagrammatically except for the wood spacers.

FIGURE 2 is a side elevation in half section of the top half of a novel Claflin-type refiner according to the invention.

FIGURE 3 is a fragmentary end elevation of the shell fillings.

FIGURE 4 is a partial view, in elevation, of the plug fillings.

### *Description of the preferred embodiment*

Referring to FIGURE 1 it is seen that, in a Claflin pulp refining engine **10**, a truncated conical plug body **12** has bores **13** and **14** for plug shaft **15**. Plug **12** is cast of metal and has a pair of oppositely disposed tapered holes **17**, one of which is shown in FIGURE 1. A frustoconical plug liner **19** is held to plug body **12** by bolts **21** through hole **17**.

Liner **19** is cast in one piece with an interior face **23** having longitudinally-spaced, inner annular ribs **24**, **25** and **26** separated by annular recesses **30** and **31** whereby the liner is sleeved onto plug body **12**. These ribs are in supporting engagement only with corresponding outer annular ribs **32**, **33** and **34** of plug body **12** when liner **19** is sleeved thereupon. The large diameter end face **16** of liner **19** includes threaded holes for receiving bolts **36**.

The exterior face **38** of liner **19** is provided with ribs **39** and **40** and a relatively deep, circumferential groove **43** which is cast therein in the shape of an undercut groove.

Groove **43** is cast into liner **19** so that it provides an inwardly-facing, overhanging surface **44** proximate the large end of the liner **19**.

Each plug filling segment **45** includes tapered tang means in the form of an inwardly projecting, integral tang **46** for axially, slidable wedging engagement with groove **43**. Moreover, and as known in the art, each segment **45** includes a plurality of integral upstanding plug knives **47** on the outside face thereof. In addition, each plug filling segment **45** includes an integral, inwardly-turned flange, or lip **48** including an aperture **49** therein for receiving plug-clamping bolts **52**. Tang **46** includes a locking face **50**, angularly disposed to the plane of segment **45** for engaging overhanging wall **44** and axially extending seats such as **42** are provided on both segment **45** and liner **19**.

A circular covering ring **53** is preferably mounted around plug shaft **15** and acorn nuts **54** and four long, spaced plug covering ring bolts **52** are utilized as means for fastening ring **53**. Before this is done, however, hexagonal nut **55**, bearing on washer **56**, is tightened on long bolts **52** to bring each of the four segments **45** into snug relationship with liner **19**. Except for four quadrantal positions at which bolts **52** are used, shorter bolts **51** are used to secure the remaining plug filling segments **45** to plug liner **19**.

At the larger diameter end of the frustoconical plug assembly a circumferential ring **60** is held tightly against end face **16** of liner **19** and in overlapping relationship adjacent the truncated conical assembly of plug filling segments **45** by bolts **36**. Ring **60** is sectionalized into four 90° arcs corresponding to each quadrant of the assembly of segmented fillings **45**. There are four bolts **36** for each said ring section.

The longitudinal side edges **61** and **62** of each plug segment **45** are angularly grooved as at **63** to receive the adjacent angular side wall **64** of one of a plurality of relatively narrow fillers **65** of expansible material such as wood.

*About the shell*

A plurality of identical shell filling segments **66** are mounted directly on shell **67** by means of an integral, outturned flange **68** having an aperture **69** therethrough for threaded fastening means in the form of bolts **70**. Shell segment tapered tang means **72** extending in the plane of each filling **66** is utilized in maintaining the fillings in position by wedging engagement in a groove, or recess **73** in a truncated conical retaining ring **74** sleeved within the shell. Wood spacers **65** are inserted between each pair of adjacent shell filling segments **66** and function similarly to spacers **65** inserted between each pair of adjacent plug filling segments **45** in permitting the rough cast segments to be assembled with clearance spaces therebetween and to be tightened by the expansion of the fillers.

The convenience of the apparatus constructed according to the invention will be evident on considering the following description of suggested methods for assembly of the shell and plug fillings:

Plug body **12**, liner **19** and shaft **15** are first removed from shell **67**. Then segment retaining ring **74** is sleeved within the small-diameter end of shell **67**. Then the shell segment tang means **72** of each filling segment **66** is wedged into groove **73** between shell **67** and ring **74**. Bolts **70** are then threaded in the large diameter end face of shell **67** enough to seat each segmented filling **66**. As each filling **66** is placed into position, a ¼ inch thick wooden spacer **65** is placed next to it; after the last filling segment **66** has been installed, the last spacer **65** is fitted to the remaining space and driven thereinto.

The entire plug assembly comprising plug body **12**, liner **19**, and shaft **15** are removed from shell **67** and placed on a suitable temporary mounting.

Normally there will be keyways in the plug lining **19** suitable for placing a first filling segment **45** having matching protrusions to fit the keyways, in a particular position. This technique of the mechanical art is well known and therefore no indication of these keyways have been made in the drawing and no further elaboration of a keying technique is made in this specification.

A first plug filling segment **45** is placed in position on plug liner **19** with plug segment tang means axially and slidably received under overhanging surface **44** of groove **43** on liner **19**.

Bolts **51** and **52** with washer **56** providing the bearing surface, are used to tighten the small end of each filling segment **45** against liner **19** with sufficient tightening to cause the seating of the assembly of segmental fillings **45**. A space is left between each pair of adjacent segments and a wooden spacer **61** placed in each such space. The covering ring **53** is then placed over bolts **51** and **52** and



tightened by means of acorn nuts **54**. A split seal **59** of the type sold under the trade designation 13475RPD by Johns Manville Company is mounted between shaft sleeve **58** and covering ring **53**.

A single plug filling segment **45** can be removed for repair or replacement by the following procedure:

(1) Remove the four acorn nuts **54** and slide covering ring **53** along shaft **15** away from the plug for about four or five inches.

(2) Remove the bolt **52** from flange **48** of the filling segment **45** to be removed.

(3) Remove the bolts **36** holding that quadrantal section of the ring **60** which overlaps the filling segment **45** to being removed.

(4) Tap the filling segment **45** being removed forward toward the small end of the plug and this will unseat the filling and remove it completely.

The removal of a single shell filling segment **66** is performed in a similar manner by unthreading bolts **70** and withdrawing the segment from the large end of the refiner.

The rough cast, unmachined, filling segments **45** and **66** each include a plate-like body **76** or **77** of generally triangular configuration and arcuate cross section, an integrally cast attachment flange **48** or **68**, angularly turned from one end and affixed by axially extending bolts and an integral tapered tang means **46** or **72** at the other end, wedge anchored in a recess **43** or **73** formed by an exterior liner **19** or an interior ring **74**. When the expansible fillers, or spacers **65** have been inserted between the segments and immersed for about eight hours in water, the shell assembly **78** and the plug assembly **79** become tight truncated conical fillings. The shell assembly **78** is backed by shell **67** and while plug assembly **79** depends principally on bolts **51** and **52** to resist centrifugal forces, the bolts do not shear because the plug assembly is in contact with the shell assembly when working and the centrifugal force is taken by the shell **67**.

What is claimed is:

**1.** A cast unitary filling segment for a truncated, conical, refining engine of the shell and plug type, said segment comprising:

a generally triangular plate of cast material and of arcuate cross section, adapted to be assembled with similar segments into a filling assembly of truncated, conical configuration, said plate having opposite faces and longitudinally extending side edges diverging from a small end edge to a large end edge;

a plurality of straight, parallel, outstanding knives cast integrally in one said face of said plate;

an integrally cast attachment flange angularly turned from one end of the opposite face of said plate, said flange having at least one bolt aperture therein for threadedly anchoring said one end,

and tapered tank means, proximate the other end of the said opposite face of said plate for axially and slidably anchoring said other end;

said cast segment being substantially free of machined faces.

**2.** A cast unitary filling segment as specified in claim **1** wherein:

the longitudinally extending edges of said segment includes full length, angular groove means for receiving the adjacent side wall of a narrow expansible filler of corresponding configuration.

**3.** A cast unitary filling segment as specified in claim **1** wherein:

said segment forms part of a shell filling assembly;

said tapered tang means is a tongue extending in the plane of said plate from the small end of said plate and

said integrally cast, angularly turned attachment flange extends outwardly from the central portion of the large end of said plate.

4. A cast unitary filling segment as specified in claim 1 wherein:

said segment forms part of a plug filling assembly;

said tapered tang means is a tongue extending in a plane angularly disposed to the plane of said plate at a spaced distance from the large end of said plate and

said integrally cast, angularly turned attachment flange extends inwardly from the small end of said plate.

5. A filling assembly for the plug or shell member of a truncated, conical pulp refiner, said assembly comprising:

a plurality of identical, rough cast, unitary filling segments of arcuate cross section adapted when assembled edge to edge with a slight longitudinal space between adjacent segments, to define a truncated, conical filling assembly fitting said member; each said segment having a plurality of integral, cast, parallel knives thereon;

a plurality of identical, narrow fillers of material expansible in liquid, each filler being positioned in one of said spaces between the longitudinal edges of adjacent segments, for expanding to tighten said filling on said member;

integrally cast, attachment flanges angularly turned from one end of each said segment and each having bolt apertures therein for threadedly anchoring said one end;

integrally cast tapered tang means proximate the other end of each said segment for axially and slidably anchoring the said other end;

and annular retaining ring means at said other end of each said segment, cooperable with said tang means in achoring the said other end of said segments.

6. A filling for the truncated, conical plug body of a shell and plug type refiner, said plug filling comprising:

a one piece, truncated, conical liner sleeved on said plug body, said liner having an undercut groove extending continuously therearound proximate the large diameter end thereof;

a plurality of identical, individual, rough cast, filling segments, of generally triangular configuration and of arcuate cross section, mounted around said liner with a space between the longitudinal edges of each adjacent pair of said segments to outline a truncated, conical assembly, each said segment having cast integral knives on the outer face thereof;

a cast, integral, tapered tang extending inwardly from the inner face of each said segment, at an angle to the plane thereof, proximate the large end thereof, said tang being received in the undercut groove of said liner for anchoring said segments against centrifugal forces during rotating;

a cast integral flange extending inwardly from the small end of each said segment at an angle to the plane thereof, each said flange having a bolt aperture therethrough and being bolted to the adjacent small end of said liner,

and expansible filler means in each said space between adjacent segments for tightening said assembly when expanded by the immersion thereof in liquid.

7. A filling for the truncated, conical shell of a shell and plug type refiner, said shell filling comprising:

a plurality of identical, individual, rough cast filling segments of generally triangular configuration and



of arcuate cross section, mounted within said shell with a space between the longitudinal edges of each adjacent pair of said segments to outline a truncated, conical assembly, each said segment having cast, integral knives on the inner face thereof;

a one piece truncated, conical, ring sleeved within the small end of said shell, said ring having a groove extending continuously therearound for forming a wedging recess with the inner face of said shell;

a cast, integral, tapered tang extending from the small end of each said segment, in the plane thereof, each said tang being slidably received in said wedging recess for anchoring the small ends of said segments between said ring and said shell;

a cast integral flange extending outwardly from the large end of each said segment, at an angle to the plane thereof, each said flange having a bolt aperture therethrough and being bolted to the adjacent large end of said shell;

and expansible filler means in each said space between adjacent shell segments, for tightening said assembly when expanded by the immersion thereof in liquid.

8. In a pulp-refining engine of the truncated, conical shell-and-plug type having plug filling segments, shell filling segments and a plug liner, the improvement consisting of:

inwardly-turned, integral, flange means at the small diameter end of each said plug filling segment for bolting said end to said liner;

a circular clamping ring mounted adjacent said flanges at the small end of said liner;

a plurality of bolts fastening said ring, said plug filling flanges and said plug liner together;

a continuous undercut groove around said plug liner proximate the large end thereof;

plug segment tang means extending inwardly from each said plug segment and seated in said groove, for holding the large ends of said plug filling segments on said plug liner;

shell segment tang means on the small-diameter end of each of said shell filling segment forming an inward-facing surface;

a shell segment retaining ring within the small end of said shell, said ring having an outward facing surface engaging said inward facing surface for holding the small ends of said shell segments, and

outwardly turned flange means at the large diameter end of each said shell filling segment for bolting said end to said shell.


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