Jan. 19, 1960 C. W. BRINK, JR., ET AL 2,921,749

FLOW DIVERSION DEVICES FOR FRUSTO CONICAL ENGINES

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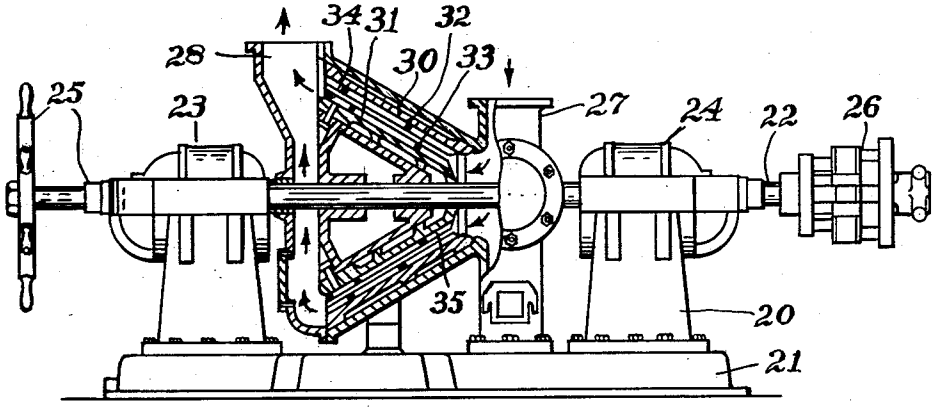


Fig.1.

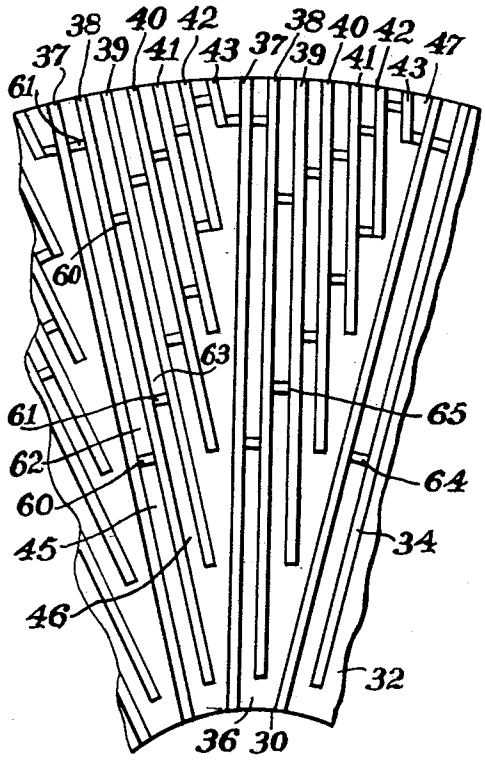


Fig.2.

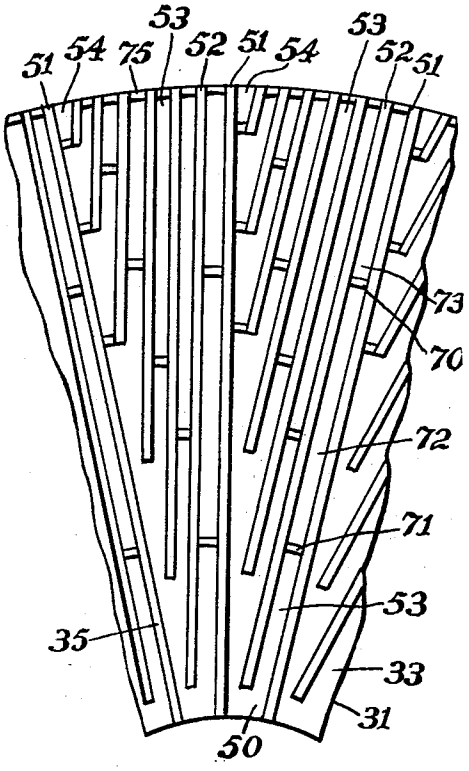


Fig.3.

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Fig. 4.

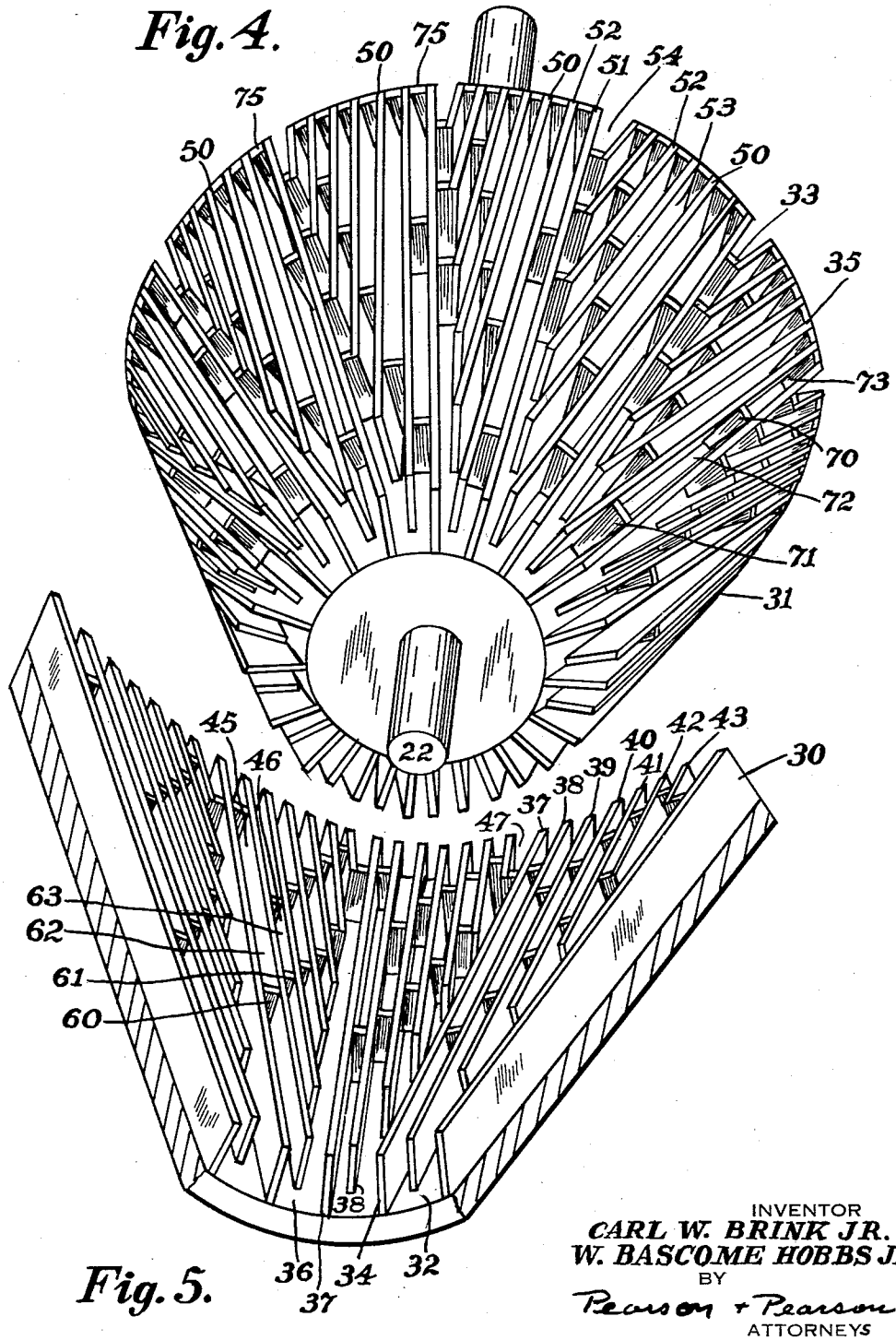


Fig. 5.

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Filed Sept. 29, 1955 3 Sheets-Sheet 3

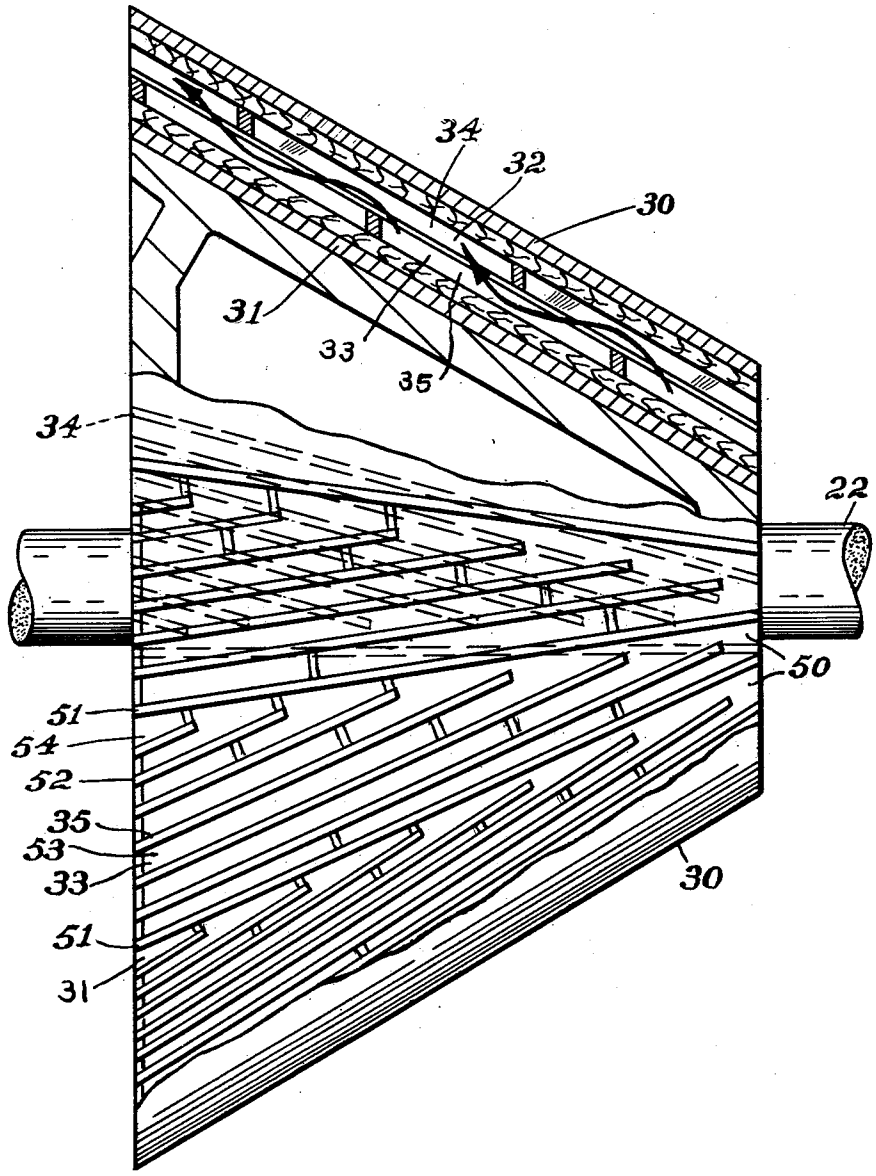


Fig. 6.

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United States Patent Office 2,921,749 Patented Jan. 19, 1960

2,921,749

FLOW DIVERSION DEVICES FOR FRUSTO CONICAL ENGINES

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Application September 29, 1955, Serial No. 537,421

10 Claims. (Cl. 241—260)

This invention relates to Jordan engines and particularly to a short, wide angle Jordan engine known in the paper trade as a "Claflin."

Jordan engines comprise a frustro conical plug, axially movable, and rotatable within a frustro conical shell, the angle of the plug and shell knives being acute and the knife clearance being minute. The shell knives are obliqued whereby at high speed a shearing cut is achieved to separate and distribute each bundle of fibres into paper stock of uniform consistency. The "Claflin" engine is shorter than an ordinary Jordan refiner and the angle of the plug and shell knives is obtuse. The "Claflin" requires less horsepower than a Jordan and is usually adjusted for considerable clearance between the plug and shell knives. The knives on both plug and shell are obliqued and in addition to its refining action, the "Claflin" also performs an important beating function.

Both the Jordan and the "Claflin" are continuous machines with the stock moving continuously therethrough. Because of the minute clearances of the knives of an ordinary Jordan all of the fibre bundles tend to be broken down in a passage through the machine. In a "Claflin" engine, however, it is more possible for stock to move through the machine without receiving the proper beating, defibering or refining action. Increasing the dwell of the stock in both the Jordan and the "Claflin," while maintaining continuity of production, is therefore desirable and especially so in a combined beater and refiner such as the "Claflin."

It is the principal object of this invention to provide a plurality of dams in a predetermined pattern on both the plug and the shell of a Jordan engine to cause the stock to follow a tortuous path toward and away from the plug axis as it moves through the engine.

Another object of the invention is to provide a pattern of dams across the channels between the knives of the plug and shell of a Jordan engine with the dams being perpendicular to the knives and equal in height thereto, thereby forming a plurality of longitudinal pockets of rectangular cross section in both the plug and the shell.

A furthed object of the invention is to provide a plurality of pockets between the knives of the plug and shell of a Jordan engine, the pockets being longitudinally staggered to cause each plug pocket to overlap one or more shell pockets.

Still another object of the invention is to provide each section of a plug or shell filling of a "Claflin" type Jordan engine with a predetermined pattern of dams in staggered relation to each other, thus creating a predetermined repeat pattern of such dams entirely around the filling for achieving a novel and beneficial stock path.

A still further object of the invention is to provide a Jordan engine with a plurality of laterally extending dams bewteen the knives of both plug and shell, the dams being located centrally and at the large or outlet end, but not at the small or inlet end of the engine. Thus paper stock which may comprise, for example, wood chips, is

freely permitted to enter the knife area, but is retarded from leaving the same while, and until, the fibre bundles and specifically any wood knots which may have entered the engine, are properly defiberized, brushed out or otherwise treated as intended.

In the defibering operation of paper mills, "Claflin" engines are commercially employed to reduce the wood chips to coarse brown stock for feeding to stock washers and thereafter to refiners for producing fine pulp. Some knots, however, pass through the defiberizing engines. While it has been known to introduce partial barriers or dams extending across the channels between the knives of Jordan engines, such dams have not been found generally useful in that the rate of passage of pulp through the engine has been greatly reduced, or in that the barriers have been proportioned to provide only a very incomplete restriction and, accordingly, no appreciable advantage. It has been found, however, that dams extending between knives and completely filling the channels can be arranged in a "Claflin" type Jordan engine in certain patterns as hereinafter more fully described with the unexpected result that, although each channel of the plug and shell has at least one dam, whereby no knot can pass through a plug channel without being deflected at least once across the cutting edges into a shell channel, or vice versa, the chip defibering capacity, in tons of chips per hour, is reduced by only a small percentage.

It is, accordingly, an additional and specific object of the invention to minimize, in a "Claflin" type Jordan engine utilized in the production of brown stock from cooked wood chips, the possibility of knots passing through the engine without being defibered or cut into small pieces.

Other objects and advantages of the device will be apparent from the claims, the description of the drawings and from the drawings in which

Fig. 1 is a side view of a Jordan of the "Claflin" tvpe with the shell broken away to show the plug and shell fillings and knives.

Fig. 2 is a developed view of a portion of a frusto conical shell filling showing the preferred pattern of dams therein according to this invention.

Fig. 3 is a view similar to Fig. 2 of a portion of a frusto conical plug filling according to this invention.

Fig. 4 is a perspective view of a plug filling having dams such as shown in Fig. 3.

Fig. 5 is a perspective view of the inside of a portion of a shell filling, such as shown in Fig. 2, to illustrate the relative position of the plug and shell in use.

Fig. 6 is a diagrammatic side elevation illustrating the relative positions of the plug and shell knives in operation.

As shown in the drawing, **20** is a Jordan engine of the "Claflin" type having a base **21**, a plug shaft **22**, shaft bearings **23** and **24**, a hand wheel and thrust screw assembly **25** and a flexible coupling **26**. Coupling **26** is connected to a source of power such as an electric motor, not shown, all in a manner well known and forming no part of this invention. The inlet conduit is designated **27** and the outlet or discharge conduit is designated **28**.

In the engine shown, the frustro conical shell **30** and the frustro conical plug **31** are at an obtuse angle and relatively short as compared to an ordinary Jordan. The shell **30** is broken away to reveal plug **31**, the shell filling **32** and the plug filling **33**. Shell filling **32** is formed of a plurality of inwardly projecting knives or bars **34** connected together at their bases and spaced apart at their free terminal ends to form channels therebetween. Similarly the plug filling **33** is formed of a plurality of outwardly projecting knives or bars **35** connected together at their bases and spaced apart at their free terminal ends to form channels therebetween. The

knives may be integral with a unitary filling, welded to a frustro conical liner, separated by wooden separators, formed in sections of the frustrum of a cone for assembly in a unit or otherwise assembled in various ways well known in the art.

In an ordinary Jordan engine the plug knives are straight and not angularly offset from the longitudinal axis of the plug while the shell knives are obliqued to the longitudinal axis of the plug. As shown in Figs. 2–5 both the plug and the shell knives of the "Claflin" are obliqued or offset from the longitudinal axis of the plug and the knives are arranged in a repeat pattern of parallel, successively shorter, knives. The shell knives **34** are divided into groups such as group **36**, each group **36** including a full length knife **37** offset from the longitudinal plane of the plug axis and a plurality of successively shorter knives **38**, **39**, **40**, **41**, **42** and **43** each spaced from the other and parallel to knife **37**. Thus the shorter knives are progressively more offset from the plane of the plug axis and each terminates proximate the next long knife **37** of an adjacent group **36**. A plurality of longitudinally extending channels such as **45** and **46** are thus formed between the side faces of the knives, which are of rectangular cross section and which except for the last channel **47** of each group are of rectangular outline in plane.

The plug filling **33** of a "Claflin" is similarly formed in groups of knives such as group **50**, each including a full length, axially offset knife **51**, successively shorter knives such as **52**, elongated channels **53** and a single channel **54** of non-rectangular outline in plan. When the channels of a "Claflin" are unobstructed as has been the case heretofore, it will be obvious that stock will normally be thrown outwardly by the revolving plug and tend to move from the small to the large end of the engine because of the pumping action of the frustro conical plug and shell. However, a longitudinally direct path of the stock between plug or shell knives exists and the stock may pass through the engine without sufficient beating, defibering or refining.

More particularly, it has been found that knots sometimes travel only through one channel or through successively communicating channels of the plug without being subjected to the shearing action which would occur whenever such a knot passed from a plug channel into a channel of the filling. Alternatively, the knot may travel only along a channel or channels of the filling, and may not pass over into a plug channel.

It has heretofore been proposed to provide barriers to the path of the stock through a Jordan engine sometimes between the plug knives only, sometimes between the shell knives only and more often when grinding blocks are substituted for the knives and a definite grinding action is desired.

However, as shown in Figs. 2–5, in this invention the treatment members are knives rather than abrasive blocks, the dams are equal in height to the knives and the dams are provided in a novel predetermined pattern on both the plug and the shell. Preferably, there are no dams near the small or inlet end of the plug or shell, thereby permitting stock to freely enter the knife area for treatment therein. The shell filling **32** is provided with a plurality of lateral, radial, dams such as **60** or **61**, each extending across a channel such as **45** or **46** and dividing all but the shortest channels into at least one double ended pocket such as **62** or **63** of rectangular cross section and rectangular outline in plan. The dams **60** or **61** are longitudinally staggered in position as are the resulting pockets **62** or **63** whereby the pockets overlap each other laterally preferably in the pattern shown. The pattern of dams in each group of knives **36** is identical to create an overall repeat pattern and the corresponding dams of each group outline an annular dam entirely around the shell indicated at **64** and **65**.

The plug filling **33** is provided with a plurality of lateral, radial dams such as **70** or **71**, similar to dams **60** or **61** and forming at least one double ended pocket such as **72** or **73** in each channel such as **53**. The pockets **72** or **73** are generally rectangular in plan except between the shorter knives near the outlet end of the engine. The pattern of dams in the plug is similar to that of the shell except that the plug dams are longitudinally so positioned as not to overlie a shell dam.

Stated in another way, the dams of the plug filling are disposed in predetermined frustro-conical surface bands or zones, while the dams of the shell filling are disposed in zones interspersed between or beyond, and not overlapping, the plug filling dam zones. Measuring from the imaginary apex of the cone along the cone in which lie the shearing edges of the knives of the plug and shell fillings, zones for plug dams might lie between 10 and 14 inches, between 20 and 23 inches, between 27 and 29 inches and between 33 and 35 inches from the apex, while zones for shell dams might lie between 15 and 19 inches, between 24 and 26 inches, and between 30 and 32 inches from the apex. Thus, while shell dams **64** are shown as being equally spaced from the apex, or all within a single plane perpendicular to the shaft axis, these dams may be positioned at respectively different distances from the apex so long as they do not extend into the zones established for the positions of the dams **71** or **72** of the plug filling.

Each channel of each of the fillings is seen to have at least one dam therein, but the dams are distributed in a plurality of spaced zones to minimize reduction in rate of passage of stock through the engine and to minimize concentrated wear on any particular sections of the knives.

Thus the dams of both the plug and shell are not only longitudinally staggered but the dams of one element are positioned longitudinally in the space between dams or beyond dams of the other element. Consequently, the pockets of the plug overlap the opposite pockets of the shell in addition to the pockets of each element overlapping the other pockets in that element.

Preferably the dams such as **60** and **70** are substantially perpendicular to the side faces of the knives and of the same thickness as the knives. Thus the stock entering a pocket in the plug is diverted outwardly into a pocket in the shell and thence back into a pocket of the plug to follow a tortuous path around and along the space between the plug and shell fillings. Preferably also the plug is provided with a continuous ring of end dams such as **75** around the large end thereof to further bar direct flow of stock through and out of the engine. Throughput of the device can be varied by omission or inclusion of certain of the dams. For example, the large end of the plug may have a continuous ring of dams or every other dam in the ring may be omitted to increase the flow.

It has been found that with dams arranged in the pattern shown on both the plug and shell of a "Claflin," knots contained in hot paper stock treated in the engine are unable to travel completely through and are not only broken up but the stock is better refined with great saving in horsepower. In fact, rejects are reduced to a fraction of one percent because of the cooperative action of the pattern of dams and pockets in deflecting stock radially toward and away from the longitudinal axis of the plug as the stock is moved around and along the engine. While the dams of this invention may reduce throughput as much as fifty percent, only one pass through the engine is required rather than two or more passes and the rejects in that single pass are reduced from about seven percent to the fraction of one percent mentioned above.

In Fig. 6 a plug and a shell filling is illustrated diagrammatically with the shell filling broken away to reveal the

plug filling. In dotted lines the knives of the shell filling on the same side are illustrated together with the dams of this invention to further illustrate the path of stock through the engine.

We claim:

1. In a stock engine of the type having an axially movable, frusto conical plug revoluble within a frustro conical shell, the combination of a plurality of longitudinally extending straight knives, angularly spaced around said plug and shell to form a plurality of longitudinally extending channels of substantially uniform depth between adjacent side faces of said plug and shell knives and a plurality of laterally extending dams, equal in height to said knives, and positioned in longitudinally staggered relationship between adjacent pairs of knives lengthwise of said plug and shell to form a plurality of elongated pockets equal in depth to, and along said channels for causing stock to dwell alternately in the plug pockets and the shell pockets as the stock traverses the length of said engine and rotates around the axis of the plug.

2. A combination as specified in claim 1 wherein the shell and plug knives are arranged in identical groups therearound each group including a long member in a plane offset from the axis of the longitudinal axis of the plug and a plurality of successively shorter members, each parallel to said long member but increasingly offset angularly from said axis and said dams extend perpendicularly across the channel between adjacent knives.

3. A combination as specified in claim 1 wherein said knives and dams on the plug are formed by a plurality of identical filling groups and the knives and dams on the shell are formed by a plurality of identical filling groups but the dams on each plug filling group are positioned longitudinally thereof in the longitudinal spaces between the dams on the shell filling when said fillings are in operative position.

4. A combination as specified in claim 1 wherein the dams on said plug and shell are arranged in substantially identical groups therearound with the dams of each group being staggered longitudinally relative to each other but with corresponding dams of each group outlining a series of rings lengthwise of the engine, the dams of each ring being within a single plane perpendicular to the plug axis.

5. A combination as specified in claim 1 wherein the dams on said plug and shell form double ended pockets only intermediate of the length of, and at the large end of, said engine.

6. A combination as specified in claim 1 wherein the channel ends at the large end of the plug are closed by a continuous ring of end dams to increase the dwell of the stock in said engine.

7. In a Jordan engine, a frustro conical plug, a frustro conical shell therefor; a plurality of plug fillings each including spaced apart radial knives of varying length obliqued to the axis of the plug; a plurality of shell fillings each including spaced apart radial knives of varying length obliqued to the axis of the shell; a plurality of laterally extending dams, longitudinally staggered along and extending across the space between adjacent knives of each plug filling and a plurality of laterally extending dams longitudinally staggered along, and extending across the space between adjacent knives of each shell filling, said plug and shell dams being at predetermined different longitudinal positions and forming longitudinally and laterally overlapping pockets between adjacent knives for directing stock alternately in and out from the longitudinal axis of the engine in a tortuous path as the stock progresses through said engine.

8. In a "Claflin" type Jordan engine having a knife-carrying frustro-conical plug and a knife-carrying frustro-conical shell for rotational cooperation therewith, the cooperating cutting edges of said knives lying substantially in and defining a cone, the combination of, a respective plurality of plug channel dams located between the knives of said plug within each of a plurality of spaced limited frustro-conical zones, said zones being at respectively different distances from the point representing the apex of said cone, and a respective plurality of shell channel dams located between the knives of said shell within each of a plurality of different limited frustro-conical zones interspersed between said first mentioned zones.

9. In a Jordan engine the combination of a plug and a shell each having a plurality of generally radial knives defining channels; a plurality of staggered dams in the channels between said knives forming pockets in the respective channels of the plug and shell so that when the pockets of the plug and shell overlap, the respective dams of the plug and shell are spaced longitudinally from each other.

10. In a Jordan engine the combination of a conical plug and shell each having a plurality of oblique, generally radial knives defining longitudinally extending channels; a plurality of longitudinally staggered dams in the channels between said knives, said dams being equal in height and thickness to said knives and forming a predetermined pattern of longitudinally extending pockets in the respective channels for cooperatively directing stock radially inwardly and outwardly as the stock traverses the length of said engine and rotates around the axis of the plug.

References Cited in the file of this patent

UNITED STATES PATENTS

76,270	Taggart	Mar. 31, 1868
282,098	Manning	July 31, 1883
864,359	Claflin	Aug. 27, 1907
933,582	Quantz	Sept. 7, 1909
984,664	Harris	Feb. 21, 1911
1,152,690	Bahr	Sept. 7, 1915
1,166,310	Bahr	Dec. 28, 1915
1,583,771	Bidwell	May 11, 1926
2,120,697	Finnegan	June 14, 1938
2,197,182	Keating	Apr. 16, 1940
2,222,073	Hauge	Nov. 19, 1940
2,409,453	Stuck et al.	Oct. 15, 1946