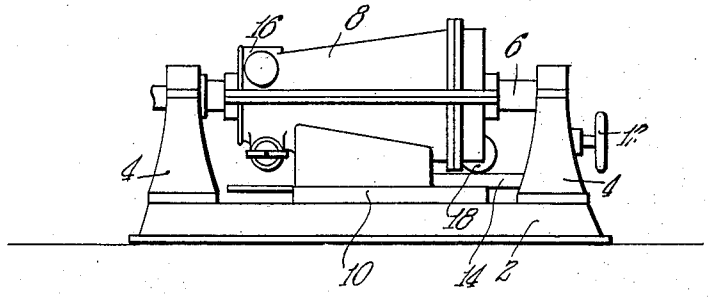
Dec. 29, 1942. E. C. TUCKER 2,306,672

STRUCTURE AND ARRANGEMENT OF THE CO-ACTING BARS OF JORDAN ENGINES

Filed Aug. 31, 1938 4 Sheets-Sheet 1

Fig. 1.



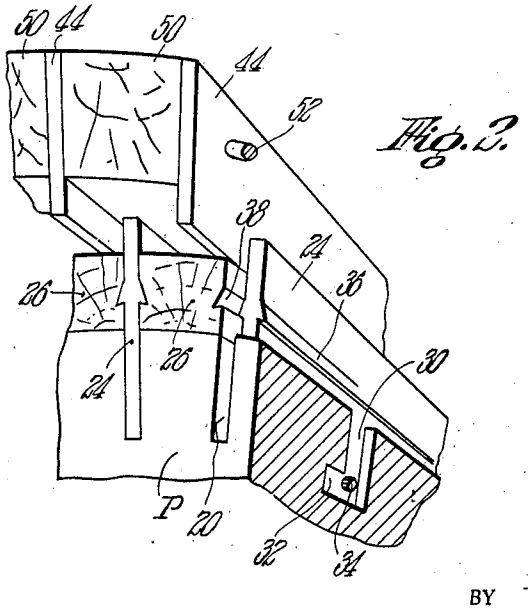


Fig. 2.

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STRUCTURE AND ARRANGEMENT OF THE CO-ACTING BARS OF JORDAN ENGINES

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Fig. 3.

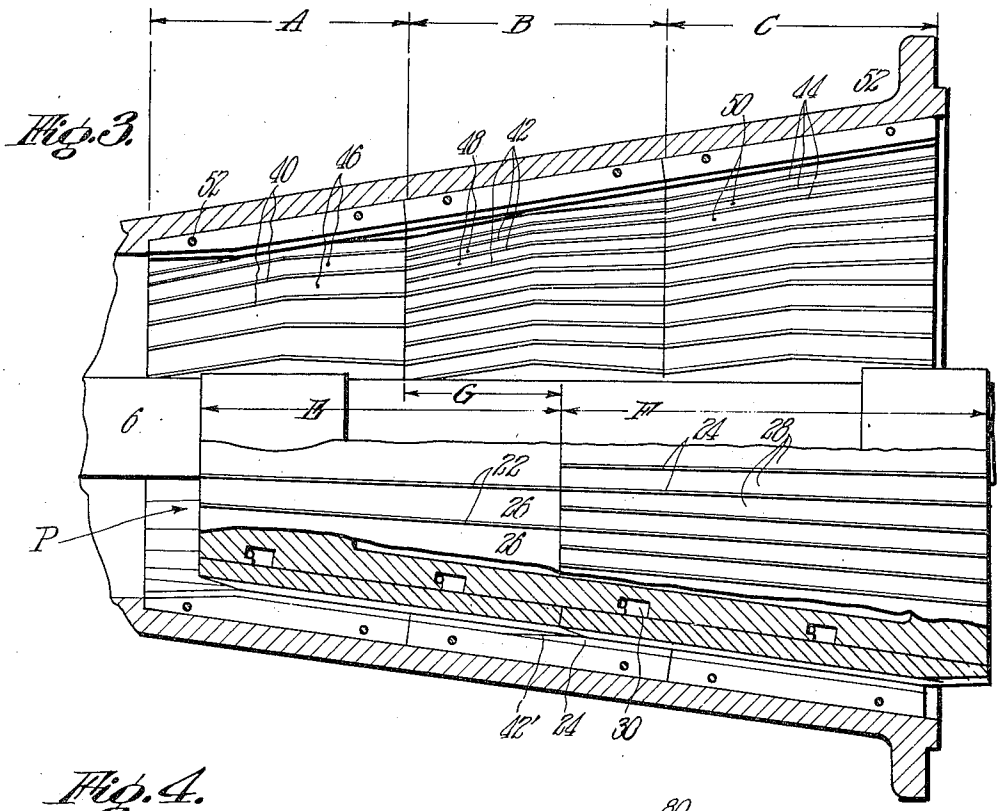
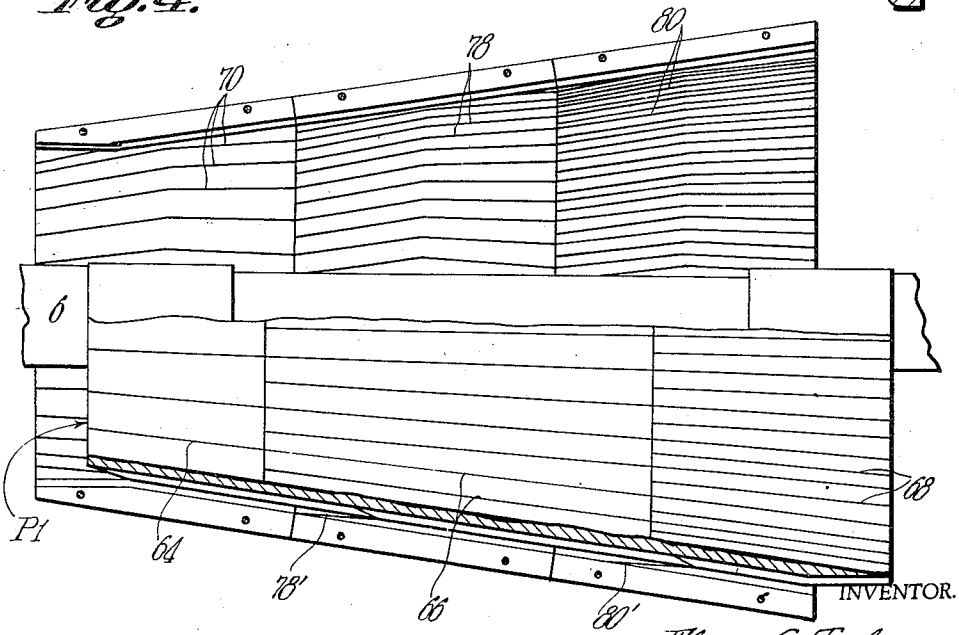


Fig. 4.



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STRUCTURE AND ARRANGEMENT OF THE CO-ACTING BARS OF JORDAN ENGINES

Filed Aug. 31, 1938 4 Sheets-Sheet 3

Fig. 5.

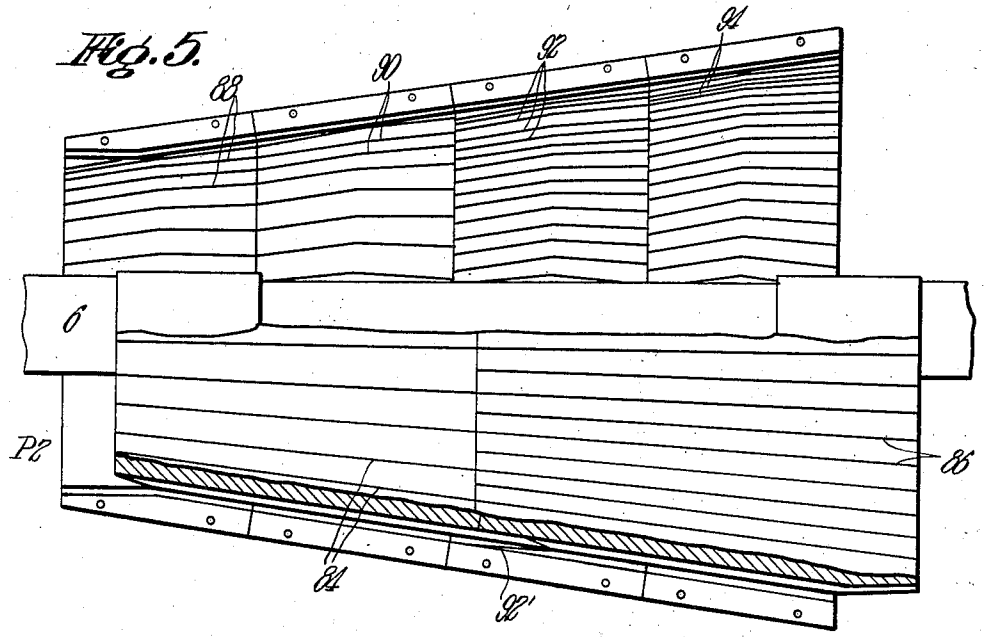
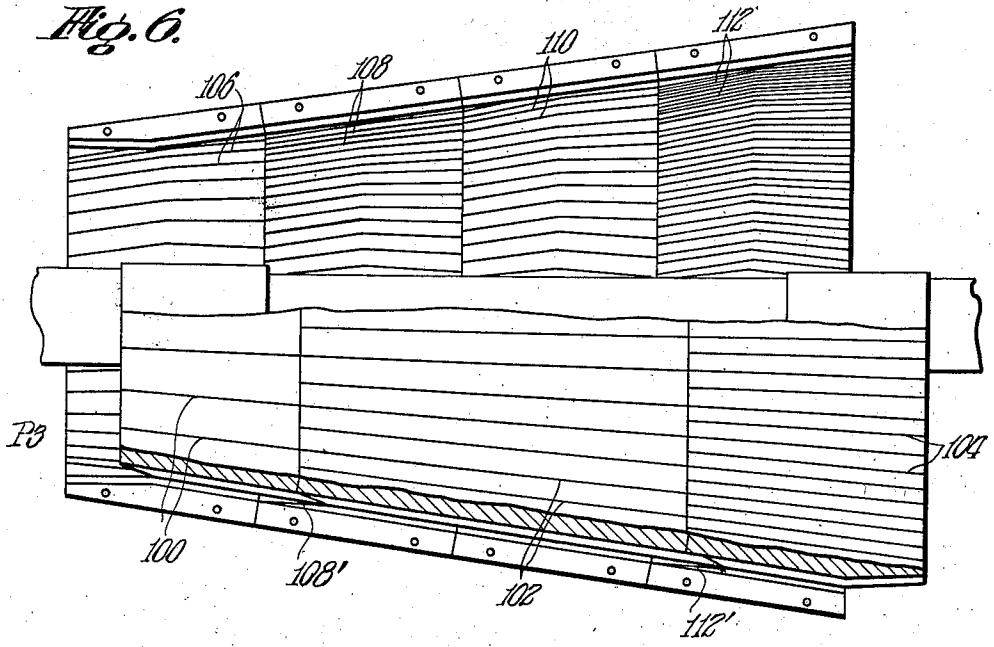


Fig. 6.



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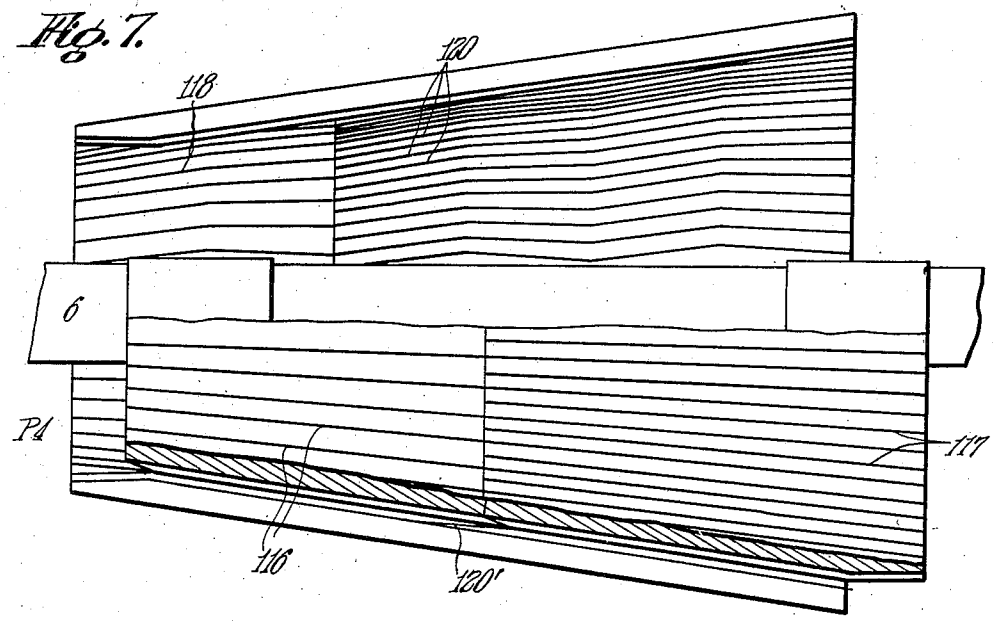
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Dec. 29, 1942. E. C. TUCKER 2,306,672

STRUCTURE AND ARRANGEMENT OF THE CO-ACTING BARS OF JORDAN ENGINES

Filed Aug. 31, 1938 4 Sheets-Sheet 4

Fig. 7.



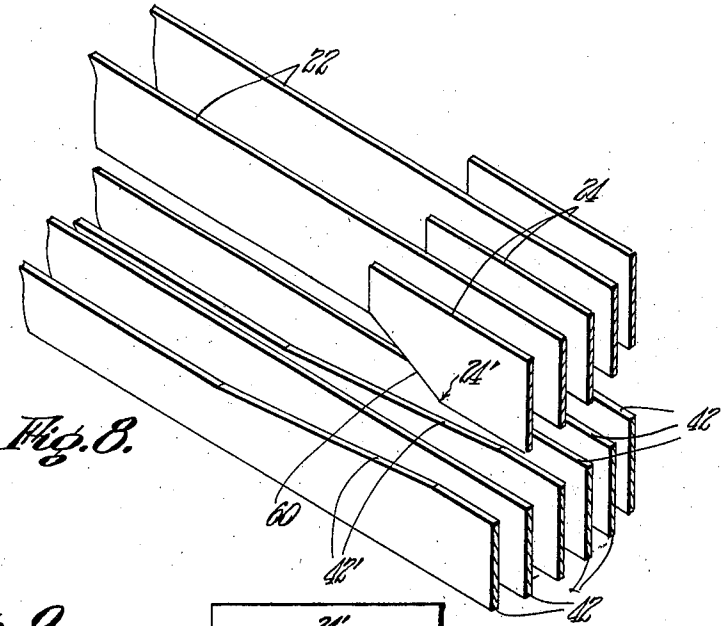
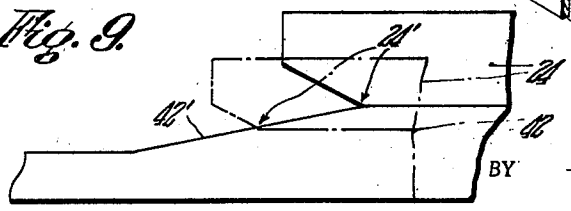


Fig. 8.

Fig. 9.



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UNITED STATES PATENT OFFICE

2,306,672

STRUCTURE AND ARRANGEMENT OF THE COACTING BARS OF JORDAN ENGINES

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Application August 31, 1938, Serial No. 227,794

5 Claims. (Cl. 92—27)

This invention relates to improvements in an apparatus, commonly called a Jordan engine, such as is used in the paper industry for working on or refining paper stock and the invention is directed particularly to the provision of an improved arrangement of coacting bars for the so-called plug and shell of such an apparatus.

The principal objects of the invention are the provision of an improved construction and arrangement of the coacting bars of a Jordan adapted and intended to facilitate economy and efficiency in the manufacture thereof, as well as in the operation and maintenance of an apparatus with which the bars are used.

Apparatus of the type to which this invention relates consists in part, of a relatively rotatable shell and plug having circumferentially spaced and longitudinally extending bars or knives which coact or act on paper-making material or the like. The plug and shell are conical in shape or at least the working surfaces of their bars are arranged in a conical manner.

The said shell and plug are axially adjustable relative to one another to facilitate the desired coaction of the working faces or edges of the bars and to compensate for the wear thereof.

It is customary, with reference to both the shell and the plug, to provide a less number of bars at the smaller end of the cone than at a distance therefrom. With such an arrangement there is obviously a less circumferential area of metal, or less coacting working surfaces, at a given point around the small end of the plug or shell than at an intermediate point or larger end where there are a greater number of bars.

With reference to both the shell and plug, the parts having the different numbers of bars, or the parts having the different areas of coacting metal working edges or faces, may be called sections. That is to say, at one point there may be a certain number of bars of a certain width while at another point there are more or less bars of said certain width so that there is one section having a certain circumferential area of working metal, which is greater or less in area than the area of working metal in another section.

It would be desirable that a certain section of the plug operate with a certain section of the shell indefinitely but since the shell and plug are axially adjustable either to compensate for wear or for operating reasons this is impossible so that there results an unbalanced metal condition or there may be a certain ratio of metal or certain relationship of working surface around one part of the cone and different relationship around another part.

That is to say if at one point a certain number of bars on the plug are in operative relation with a certain number of shell bars and at another point these plug bars are in operative relation with a different number of shell bars there is an unbalanced metal condition which results in non-uniform wear. To express this in another way, it may be said that if at a smaller part of the plug there are a certain number of bars coacting with a certain number of bars of the shell to establish a certain ratio of metal or a certain ratio of working surfaces as between the plug and shell, and at another larger part the same plug bars operate with a greater or different number of shell bars there is a different ratio. As stated non-uniform ratios or varying ratios result in an unbalanced metal condition resulting in uneven wear of the bars. If in the beginning a suitable ratio is established, since the plug and shell are axially adjustable, the ratio would be disturbed by adjusting the plug and the shell.

This difference in ratios brings about uneven wear in the working surfaces of the bars so that the surfaces become more or less rough, uneven and wavy, and not only affects the operation of the apparatus but the useful life of the bars is shortened and the efficiency of the apparatus is impaired.

According to the novel features of this invention, the ratio of metal, or the ratio of the effective coacting working edges or surfaces of the bars in coacting sections of the plug and shell, is uniform despite the fact that there may be different sections of the shell and plug having different numbers of bars. The ratios of working faces of the bars of the different sections originally established is maintained regardless of the fact that the plug and shell are adjustable axially.

This is all to the end that the working parts of the bars wear smoothly and evenly, their longitudinal working edges or surfaces thereof at least wearing straight, as distinguished from the rough, wavy and uneven wearing of the prior art machines. Consequently, according to this invention, the bars of the plug move freely into and out of contact with those of the shell throughout their effective length in such a manner as to not only lengthen the useful life of the bars but also to facilitate efficiency and high speed in operation of the apparatus.

The invention will be hereinafter more fully described in connection with the accompanying drawings which illustrate some of the various

forms and modifications of the invention. It will be understood that various changes and other modifications may be made without departing from the spirit and scope of the invention.

Similar reference figures refer to like parts throughout the several views of the drawings, wherein:

Fig. 1 is a small scale side elevational view of one type of a Jordan having the novel features of the invention associated therewith;

Fig. 2 is a partial perspective view of the plug and shell filling of the invention to explain certain features of the construction;

Fig. 3 is a partial longitudinal sectional elevational view through the Jordan shown in Fig. 1 and showing the plug and the shell filling of the invention;

Figs. 4 to 7 inc. are views similar to Fig. 3 showing shell fillings and plugs associated therewith to illustrate some of the possible modifications of the invention;

Fig. 8 is a partial perspective view showing certain features of construction; and

Fig. 9 is an elevational view of certain coacting portions of bars of the shell and plug to explain certain features of the invention.

Referring now to the drawings in detail the invention will be fully described.

In Fig. 1 a Jordan of the type with which the novel features of the invention may be employed is shown and this has a bed or base **2** on which are bearing blocks **4**. A shaft **6**, rotatably journalled therein, is connected to any suitable source of power and on the shaft there is a plug from which there extends radially longitudinally disposed blades or bars, all as will presently be explained. A shell or casing **8** surrounding the plug has inwardly extending longitudinally disposed blades or bars for coacting with the said blades or bars of the plug.

The shell and plug are arranged for relative axial movements or adjustment. While in the form of the invention shown, the shell **8** moves axially of the plug, the plug may be moved relative to the shell if desired.

To facilitate this movement, the shell is guided at its lower part in a guide or guides **10** and a manually engageable member, such as wheel **12**, is operatively connected by gears, which are not shown, to a screw shaft **14** that threadedly engages the shell **8**. Thus, by rotating the wheel **12** in one direction or the other, the shell may be moved forwardly and rearwardly as desired.

The material to be operated upon or to be refined by the machine is fed thereinto. The bars of the relatively rotatable shell and plug coact for the desired function and the material thereafter flows from the machine. Ports **16** and **18** or any other means may be employed to facilitate the feeding and removal of material into and out of the machine.

However, it is desired to point out that the particular form of the machine is not important for the practice of the invention, the form just described being more particularly for purposes of disclosure.

The bars of both the shell and plug referred to may take any desired form and they may be associated with their respective parts in any desired manner. In another way the plug or shell may be cast integral so as to have the bars arranged in the relation desired, or the filling consisting of bars and fillers may be cast for associating with the plug and shell. In another way the filling for the plug or shell, having the bars, may be formed from lava, carborundum or any other natural or artificial stone or the like. For purposes of disclosure, the bars are shown as being spaced apart by fillers or spacers. The latter may be of wood or the like as will be hereinafter described in a general way with reference to Figs. 2 and 3.

The plug represented by P is tapering or conical and, as previously stated, is carried by shaft **6**. It is provided with circumferentially spaced and longitudinally extending grooves **20** for receiving blades or bars such as **22** and **24**. Blocks or fillers **26** and **28** are located between the said bars.

The plug shown in Figs. 2 and 3 is provided with circumferential grooves **30** which are formed to have recesses or seats **32** therein. Pins **34** of the bars seat in these recesses when the bars are in place in the slots provided therefor. The blades or bars **22** and **24** may also have beads **36** seating in grooves **38** provided in the blocks. This arrangement has been found to be satisfactory for anchoring or securing the bars to the plug but any other suitable means may be employed all to the same result.

Shell bars are indicated by **40**, **42**, and **44** and between these there are fillers or spacers **46**, **48** and **50**. The said fillers and bars are preferably tied together by circumferential rods **52** but various other means may be suitably employed.

Obviously, too, the shell filling and plug may be constructed in various ways so as to provide the radially disposed bars circumferentially disposed and spaced apart. It may be desirable to arrange the bars in groups, that is, there may be several bars closely spaced in groups which groups are more widely spaced from one another. Such is still within the scope of the invention.

The bars are preferably made of metal and arranged so that as the plug and shell are relatively rotated their inner edges coact as working surfaces.

At the small end of the cone shown in Fig. 3, that is on the plug as well as on the shell, there are a lesser number of bars than at an intermediate point or at the larger end. The number of bars around the cone at the smaller end, both with respect to the shell and plug, may vary within wide limits and there may be a more or less number of bars in the shell than in the plug.

For purposes of disclosure, it may be assumed that the bars of the plug at its small end provide a certain value of working surface circumferentially on a line therearound and that the bars on the shell at that line provide another value because there are more or less bars of the shell. Or it may be assumed that the number of bars on the shell and on the plug are the same and therefore the value is the same for the plug and shell.

Whether the values are the same or different at one end of the cone, such as the small end, is not so important as it is to maintain that same relationship or ratio throughout the entire length of the cone. By maintaining some specific ratio or relationship of the effective working surfaces of the bars of the shell and of the plug, there is a balance which results in uniform wear which is desired.

The plug in Fig. 3 is disposed relative to the shell before the bars have worn. As the bars wear the plug is moved inwardly to the left to compensate for the wear.

It is desirable for obvious reasons to employ a greater number of bars as the cone increases.

in diameter but should the adjustment of the plug relative to the shell cause a greater number of bars to operate on certain other bars with which a smaller number of bars have previously coacted, the relationship of working surface or the ratio thereof is thereby changed so that the wear is then generally uneven and non-uniform. This non-uniformity however is overcome notwithstanding that the plug and shell are adjustable and there may be more bars in a larger part of the cone than in a smaller part as will presently be described.

To facilitate a clear understanding, it will be assumed, still with reference to Fig. 3, that the bars at the small end of the cone are such that the certain ratio of working surfaces is in the order of 8 to 10 in the plug and shell respectively with respect to the sections indicated as A and E.

The reference to "section" pertains to the bars rather than to a construction wherein one set of bars and their blocks are separable from another set of bars and their blocks since in some cases certain bars and blocks may extend entirely along either the plug or shell. That is to say, it is preferred to be understood that reference to a "section" means one circumferential group or set of bars whether or not they extend into another "section" or group.

For example, the group of bars 40 constitute section A on the shell, and the group of bars 22 constitute section E on the plug. It will be understood therefore that the reference to any particular number of bars in a section is purely an arbitrary reference system and is merely for the purposes of disclosure.

As an example, in section B of the shell, there are twice as many bars as in section A and the same number in section C as in B. As to the plug, there are twice as many bars in section F as in section E thereof, and the bars in sections A and E establish an 8 to 10 ratio as stated.

For that portion of section E of the plug which overlies section B of the shell there is a section G which were it not for the novel features of this invention would obviously have a ratio of 8 to 20, instead of a ratio of 8 to 10 as desired. The different ratios produce the unbalance metal condition and the resulting uneven wear which this invention avoids.

However, to maintain the same relationship between the bars of sections A and B and the bars of section E as pertains to sections A and E obviously only one-half, or every other one, of the bars 42 of section B throughout section G can be in operation so as to produce the 8 to 10 ratio, established by sections A and E. In other words, every other bar 42 is out of coacting relation with the bars 22 of section E of the plug throughout section G. This is accomplished in the manner described with reference to Fig. 8.

The ends of the bars 24 of the plug adjacent the smaller end thereof are preferably bevelled or are angularly disposed as indicated by 60. Every other one of the bars 42 of the shell are bevelled as at 42' or are inclined away from the working surface of the bars 24. The taper may be a long taper or a slow taper as may be desired with the incline commencing at the end 24' of the working surface of the plug bars 24.

With this arrangement, the ratio in section G is the same as in cooperating sections, A and E. Obviously the ratio is the same throughout where the bars 22 and 24 of the plug coact with the bars 42 and 44 of the shell or to the right from the point where the working surfaces begin to coact as at point 24' since there are twice as many bars in sections B, C and F as in sections A and E.

In Figures 3 and 8, the plug is positioned to the right of its ultimate position relative to the shell as when the bars are new.

With this arrangement described and as the bars wear, the plug is moved forwardly into the shell or to the left. As the plug is moved into the shell, in order to keep the opposing wearing surfaces in contact with each other, the arbitrary point 24' moves to the left and down the incline 42' of the bars 42. The wear is at all times substantially straight and uniform since the ratio between the bars of the effective coacting working surfaces is constant.

With reference to Fig. 3 and Figs. 4 to 7, which are to be described presently, the bars are referred to as being in sections and it is not necessary that the blocks or fillers between the bars be of the same length as the bars, as some or all of the fillers may extend the entire length of the plug or shell and also some bars may extend from end to end with other bars arranged in any desired manner. The section arrangement has been found to be satisfactory, however, but it is not desired to be limited thereto.

While the bars of the shell are shown as being arranged in a herring-bone fashion, it will be appreciated that they may be otherwise arranged or shaped and the bars of the plug may likewise be arranged all within the scope of the invention.

The modifications of Figs. 4 to 7 inclusive will now be more fully described. In each figure the shell consisting of the bars and the blocks between the bars are shown in connection with the plug with its bars being indicated by single lines for the sake of clarity. It will be understood that the shell bars and the plug bars may be associated with the shell and plug in any desired manner.

In Fig. 4, the plug P1 has the bars 64, 66 and 68 arranged in three sections as shown. The bars 70, 78 and 80 are similar to those of the construction shown in Fig. 3. In this modification in order to maintain the ratio of bars in the shell and plug, every other one of the bars 78 is bevelled as at 78'. Every other one of the bars 80 is bevelled as at 80' forwardly from the commencement of the working surface of plug bars 68, as indicated.

In Fig. 5, the plug P2 has bars 84 and 86 while for the shell there are bars 88, 90, 92 and 94. Every other bar 92 is bevelled as at 92' but none of the bars 94 need be bevelled since the number of bars, or the working surfaces thereof, provides the ratio obtaining at the small end of the cone.

In Fig. 6, the plug P3 has three sections and the filling four sections. The plug bars are indicated at 100, 102, and 104 while the shell bars are indicated by 106, 108, 110 and 112. In this modification, every other bar 108 and every other bar 112 is bevelled at 108' and 112' because there are twice as many bars 108 as there are bars 106, while there are the same number of bars 110 as there are bars 108 and twice as many bars 112 as there are bars 110.

In Fig. 7, plug P4 has bars 116 and 117 while the shell bars are indicated at 118 and 120 with bars 118 extending the length of the filling. The bars 120 double the bars in the shell in which case every other bar 120 will be bevelled as at 120'.

In Fig. 9, it will be observed that as the work-

ing surfaces of the coacting bars become worn so as to necessitate the plug being moved forwardly or to the left into the shell in order to compensate for wear of the working surfaces, the point 24' advances to the left relative to the incline 42' and of course the length of section G in Fig. 3 becomes shorter and the ratio remains the same.

From the above it will be apparent that it will be possible to provide any desired arrangement of bars for the plug and shell by bevelling sufficient bars to obviate a change in the ratio of working surfaces, all to the end that by maintaining a constant ratio or relationship throughout the length of the working surfaces wear is made uniform which not only leads to a longer useful life of the apparatus but contributes to the efficiency thereof.

In a general way a certain ratio or relationship of bars of the plug and shell or a ratio of working surfaces is established in a section or at one end of the cone, such as the small end.

An increase of bars or working surfaces in an adjacent section would when the said surfaces coact with those of a less number of bars, disturb the established ratio except for the fact that sufficient of the working surface is removed to maintain the desired ratio.

It will be understood that various changes and modifications may be made in the form of invention without departing from the spirit and scope thereof. What it is desired to claim and secure by Letters Patent of the United States is:

1. Fillings of bars for the tapering shell and plug of a Jordan engine which are relatively adjustable longitudinally to compensate for wear of the working faces of the bars comprising, longitudinally-extending spaced bars having working faces for forward and rear shell and plug sections with a greater number of bars in the rear than in said forward sections, the forward plug-section bars adapted before wearing to overlie rear portions of the forward shell-section bars to establish therewith a certain ratio of plug and shell bars and to overlie forward portions of rear shell-section bars to provide a certain zone of a certain length wherein there is an excess of shell bars over plug bars to establish a different ratio of bars, the working faces of said excess shell bars in said zone being removed on an incline outwardly and forwardly of the ends of the working faces of the rear plug-section bars and at such an angle as provides and maintains the said certain established ratio of co-acting working faces of plug and shell bars in said certain zone as obtains where the forward section plug and shell bars overlie one another when the working faces of the bars wear and the plug and shell are relatively longitudinally adjusted to compensate for said wear.

2. An apparatus of the class described comprising in combination, a conical shell, and a conical plug rotatable in said shell, said shell and plug being adjustable longitudinally relative to one another to compensate for wear of the working faces of bars associated therewith, said shell and plug including longitudinally-extending spaced bars having working faces arranged in forward and rear shell and plug sections with a greater number of bars in the rear than in said forward sections, the forward plug-section bars before wearing overlying the rear portions of the forward shell-section bars to establish a certain ratio of bars and working faces and overlying the forward portions of the rear shell-section bars to provide a certain zone of a certain length wherein there is an excess of shell bars establishing a different ratio of bars, the working faces of said excess shell bars in said zone being removed and inclined outwardly and forwardly of the end of the plug bars of the rear section and at such an angle as provides and maintains the said certain established ratio of coacting working faces of plug and shell bars in said zone as the said zone is decreased in length by relatively adjusting the plug and shell so that the forward ends of the rear section plug bars advance towards the first section shell bars.

3. The combination of the tapering bar supporting plug and shell of a Jordan axially adjustable to take up for wear of the working faces of bars associated therewith with shell and plug fillings comprising, longitudinally extending circumferentially-spaced shell and plug bars having working faces forming forward and rear shell and plug sections with a greater number of bars in said rear than in forward sections, the working faces of the forward plug-section bars before wearing overlying rear portions of the working faces of the forward shell section bars to establish therewith a certain initial ratio of plug and shell bar working faces and overlying forward portions of rear shell-section bars to provide a zone of certain length wherein there is an excess of shell bars over plug bars establishing a different ratio of bars in said zone forwardly of the forward ends of the working faces of the rear plug section bars, the working faces of the excess shell bars in said zone being removed and inclined in straight lines at a certain angle forwardly from the forward ends of the working faces of the rear plug section bars, said certain angle being such that the ratio of coacting working faces of plug and shell bars in said zone corresponds to said certain initial ratio and such that as the plug and shell are adjusted relatively longitudinally for wear and the length of said zone is decreased by the forward ends of the working faces of the rear section plug bars advancing along said incline towards the forward shell section the forward ends of the rear section plug bars coincide with the commencement of said incline and maintain said certain initial ratio in said zone.

4. Fillings of bars for the tapering shell and plug of a Jordan engine which are relatively adjustable longitudinally to compensate for wear of the working faces of the bars comprising, longitudinally-extending spaced bars having working faces for forward and rear shell and plug sections with a greater number of bars in the rear than in said forward sections, the forward plug-section bars adapted before wearing to overlie rear portions of the forward shell-section bars to establish therewith a certain ratio of plug and shell bars and to overlie forward portions of rear shell-section bars to provide a certain zone of a certain length wherein there is an excess of shell bars over plug bars to establish a different ratio of bars, the working faces of said excess shell bars in said zone being removed on an incline outwardly and forwardly of the ends of the working faces of the rear plug-section bars and at such an angle as provides and maintains the said certain established ratio of coacting working faces of plug and shell bars in said certain zone as obtains where the forward section plug and shell bars overlie one another when the working faces of the bars wear and the plug and shell are relatively longitudinally ad-

justed to compensate for said wear, the forward end portions of the working faces of the plug bars being inclined outwardly and forwardly of the working faces of the shell bars with which they are adapted to co-operate.

5. An apparatus of the class described comprising in combination, a conical shell, and a conical plug rotatable in said shell, said shell and plug being adjustable longitudinally relative to one another to compensate for wear of the working faces of bars associated therewith, said shell and plug including longitudinally-extending spaced bars having working faces arranged in forward and rear shell and plug sections with a greater number of bars in the rear than in said forward sections, the forward plug-section bars before wearing overlying the rear portions of the forward shell-section bars to establish a certain ratio of bars and working faces and overlying the forward portions of the rear shell-section bars to provide a certain zone of a certain length wherein there is an excess of shell bars establishing a different ratio of bars, the working faces of said excess shell bars in said zone being removed and inclined outwardly and forwardly of the end of the plug bars of the rear section and at such an angle as provides and maintains the said certain established ratio of coacting working faces of plug and shell bars in said zone as the said zone is decreased in length by relatively adjusting the plug and shell so that the forward ends of the rear section plug bars advance towards the first section shell bars, the forward end portions of the working faces of each of said plug bars being inclined outwardly and forwardly of the working face of the shell bars with which they co-operate.

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