Feb. 11, 1941. C. D. BOUSMAN 2,231,491

ROCK CRUSHER

Filed Jan. 11, 1939 2 Sheets-Sheet 1

Fig 1

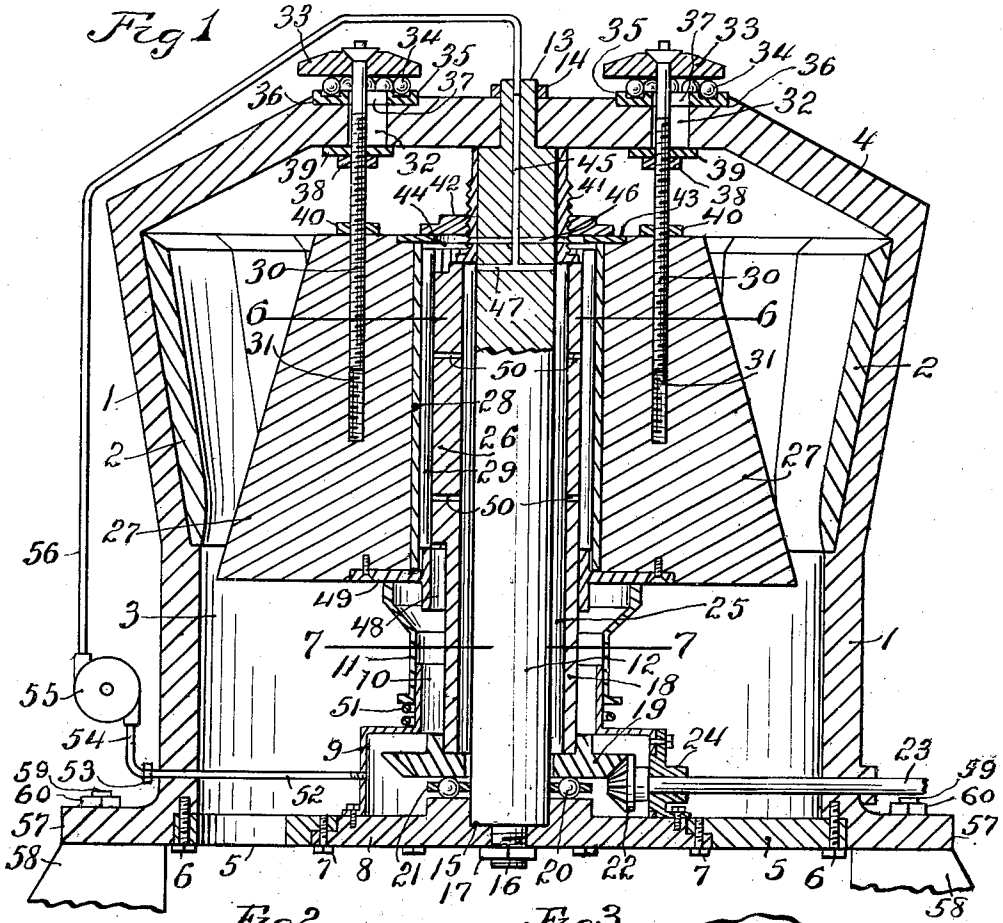


Fig 2

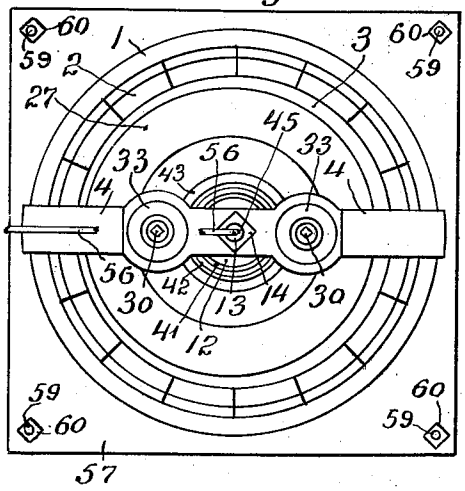
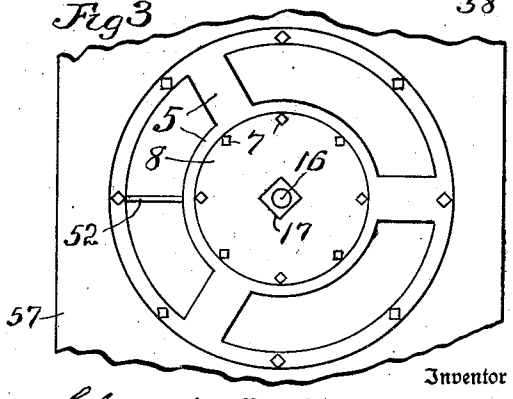


Fig 3



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ROCK CRUSHER

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Fig 4

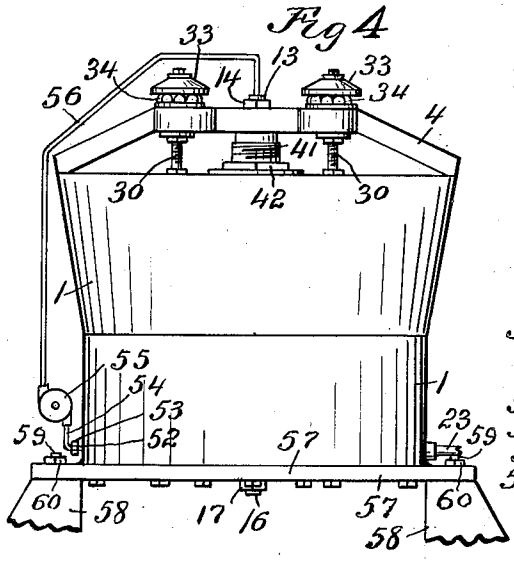


Fig 5

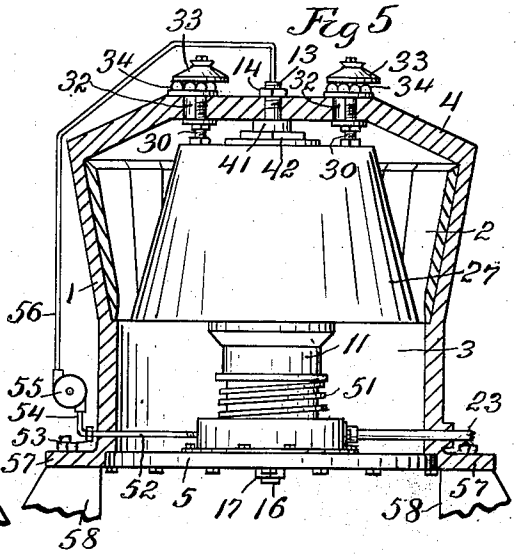


Fig 6

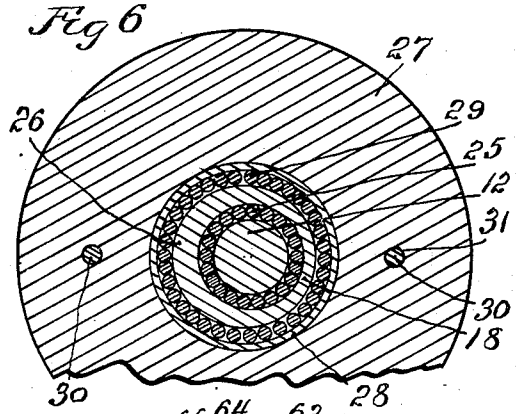


Fig 7

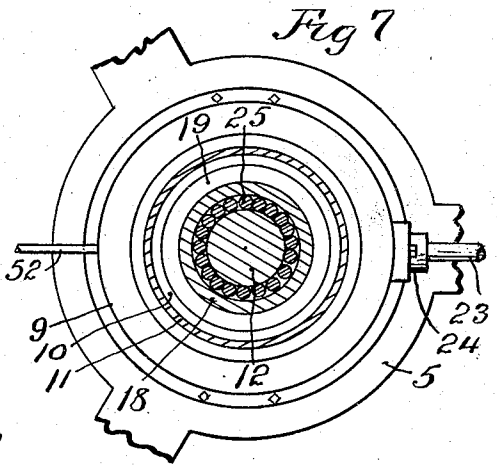
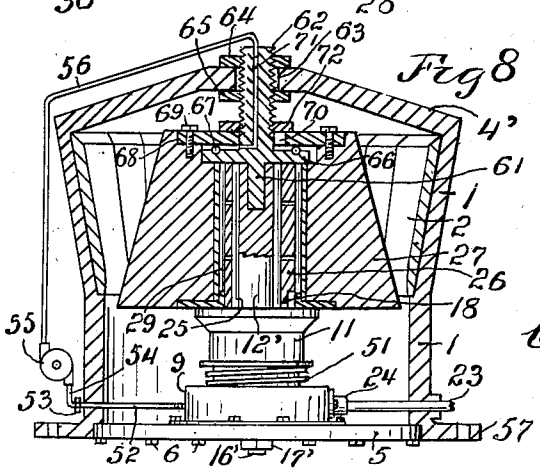


Fig 8



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Patented Feb. 11, 1941 2,231,491

UNITED STATES PATENT OFFICE

2,231,491

ROCK CRUSHER

Claude D. Bousman, Kansas City, Kans.

Application January 11, 1939, Serial No. 250,361

2 Claims. (Cl. 83—10)

My invention relates to improvements in rock crushers. It relates particularly to rock crushers of a type having an upwardly flaring crusher bowl having a passage extending downwardly therethrough, and a bridge across the passage at the top of the bowl; a spider across the passage below the bridge; an axial shaft in the passage having its ends anchored to the bridge and spider; a gyratory crusher cone vertically adjustable between the bridge and the spider and encircling the shaft; a rotary sleeve eccentric encircling the shaft and extending into the cone for gyrating the latter; bearings between the sleeve eccentric and the shaft and the cone; an oil receiver or tank disposed on the spider for catching oil dripping from the bearings, and means for circulating oil between the tank and bearings.

One of the objects of my invention is the provision of novel means by which the shaft may be partly supported by the bridge when the parts are operatively assembled, permitting the use of a lighter spider, and wholly supporting the shaft when the cone, spider, and tank are removed for any purpose.

Another object of my invention is the provision of a structure which vertically adjustably suspends the cone from the bridge.

Another object of my invention is the provision of a novel structure which permits, on disassembling, the removal of the spider and the supporting of the cone independently of the spider, thereby enabling a relatively light spider to be employed, which novel structure permits the removal downwardly from the crusher bowl of the cone, and enabling the crusher to be easily and quickly assembled or disassembled with relatively light tackle.

Another object of my invention is the provision of novel means for effecting the circulation of oil between the oil tank and the cone and eccentric bearings.

Another object of my invention is the provision of a novel oil tank structure and means for supporting it removably for repair and cleansing purposes.

Still another object of my invention is the provision of a novel rock crusher of the kind described, which is relatively simple, and economical to manufacture, which is strong, durable, not likely to get out of order, which can be easily and quickly assembled and disassembled, and which is efficient in operation.

The novel features of my invention are hereinafter fully described and claimed.

In the accompanying drawings, which illustrate my invention,

Fig. 1 is a central vertical sectional view of my improved rock crusher.

Fig. 2 is a reduced top view thereof, parts being broken away.

Fig. 3 is a reduced bottom view thereof, partly broken away.

Fig. 4 is a reduced side elevation of the same.

Fig. 5 is a reduced side view, partly in vertical section and partly in side elevation, showing the cone more elevated than in Fig. 1.

Fig. 6 is a section on the line 6—6 of Fig. 1, partly broken away.

Fig. 7 is a section on the line 7—7 of Fig. 1.

Fig. 8 is a reduced side view, partly in vertical section, and partly in side elevation of a modification of my invention.

Similar characters of reference designate similar parts in the different views.

1 designates a crusher bowl, the upper inner portion of which flares upwardly and has within it a hardened lining 2. The bowl 1 has extending downwardly through it a passage 3, the upper end of the bowl having extending across said passage a bridge 4.

The open lower end of the passage 3 has extending across it a spider 5, which is removably fastened to the lower end of the bowl 1 by bolts 6. The spider 5 has a central circular opening in which is removably fastened by bolts 7 a base plate 8 of an oil tank, which is open at its top and has side walls 9. Slidably fitted on the reduced upper end 10 of the oil tank is a connecting tube 11 adapted to catch oil from above, and convey it into the end portion 10 of the oil tank.

A stationary vertical shaft 12 is disposed axially in the passage 3, and has its upper end 13 of reduced diameter extending through a vertical central hole in the bridge 4. The upper end of the portion 13 is threaded, and has fitted on it a nut 14 which rests on top of the bridge 4, whereby the bridge partly supports the shaft 12, when the parts are operatively assembled, and which may be used to support the shaft 12 wholly on assembling or disassembling.

The lower end of the shaft 12 is fitted in a hole extending centrally through the base plate 8, the shaft having a shoulder 15 which rests on the base plate 8, the extreme lower end portion 16 of the shaft 12 being threaded and having fitted on it a nut 17 which bears against the bottom of the base plate 8, whereby the latter aids in supporting the shaft 12.

Revoluble around and spaced from the shaft 12 is a sleeve 18, on the lower end of which is fitted a bevel gear wheel 19, which rests on balls 20 supported on the base plate 8, and held spaced apart by a spacing ring 21, which encircles the shaft 12, and which has perforations respectively containing the balls 20.

A bevel pinion 22 meshing with the gear 19 drives the latter, which, being fastened to the sleeve 18 revolves the latter. The pinion 22 is

fastened on one end of a horizontal shaft 23, which is driven by any suitable power means, not shown. The shaft 23 extends through a bearing 24 attached removably to the side wall 9 of the oil tank, and closing a hole in said side wall, said hole having a diameter greater than the diameter of the pinion 22, whereby the latter can be withdrawn from the oil tank, when the shaft 23 is withdrawn with the bearing 24. The shaft 23 is rotatably and slidably mounted in a hole through the side wall of the bowl 1.

Between and bearing against the shaft 12 and the sleeve 18 are disposed circularly arranged bearing rollers 25. The upper portion of the sleeve 18 has an eccentric portion 26 disposed in a central vertical hole which extends through a crushing cone 27 having a hardened inner lining 28. Circularly arranged vertical rollers 29 are disposed between the eccentric portion 26 and the cone lining 28.

The crushing cone 27 is disposed within the upper portion of the bowl 1, and cooperates with the hardened lining 2 of the bowl for crushing rock which is fed into the upper end of the bowl.

Means are provided, as shown in Fig. 1, for suspending the cone 27 from the bridge 4 so that it can be vertically adjusted to limit the coarseness of the crushed rock discharged from between the bowl lining 2 and the cone 27 downwardly through the passage 3 and between the bowl 1 and the spider 5.

Such suspending means, as shown in Fig. 1, comprises the following described parts. Two vertical screws 30 have their lower threaded portions vertically adjustably fitted respectively in two threaded holes 31 which extend downwardly in the cone 27 from the upper end thereof. The screws 30 respectively extend through two vertical holes 32 in the bridge 4 at opposite sides of the axis of the cone 27. The holes 32 are of sufficient diameter to permit the screws 30 to gyrate therein, when the cone 27 is gyrated by the eccentric 26.

The screws 30 respectively extend through two circular bearing plates 33 which respectively rest on two sets of balls 34 mounted in the races of two bearing plates 35, which respectively rest in circular recesses 36 in the upper side of the bridge 4, said plates 35 having enlarged holes 37 through which extend the screws 30. The heads of the screws 30 rest in recesses provided therefor in the upper sides of the bearing plates 33. The bearing plates 33 gyrate on the balls 34, when the cone 27 and screws 30 are gyrated.

Two nuts 38 on the screws 30 respectively hold two collars 39 slidably against the under side of the bridge 4. Two lock nuts 40 on the screws 30 respectively bear against the upper end of the cone 27.

An externally threaded sleeve 41 fitted on the shaft 12 has its lower end resting on the top of the eccentric sleeve 18, its upper end bearing against the under side of the bridge 4. Fitted on the sleeve 41 is a threaded collar 42 adjustable on the sleeve 41 so as to rest on the upper side of a flat horizontal ring 43 disposed in a circular recess in the upper end of the cone 27. An oil space 44 is provided between the upper ends of the bearing rollers 29 and the upper end of the eccentric sleeve 18.

An axial oil passage 45 extends downwardly from the upper end of the shaft 12 to transverse passages 46 and 47 in the shaft 12. The passage 46 discharges oil into the oil space 44, and the passage 47 discharges into the annular space in which are located the bearing rollers 25. The rollers 29 rest at their lower ends on the upper end of a tube 48 encircling the sleeve 18, said ring having an annular peripheral flange 49, which is releasably fastened to the lower end of the cone 27.

Transverse oil passages 50 through the eccentric portion 26 of the sleeve 18 connect the annular passages respectively containing the bearing rollers 25 and 29.

Encircling and spaced from the tube 48 is the connecting tube 11, which catches the oil discharged from the lower end of the tube 48 and conveys the oil so caught into the oil tank. A coil spring 51 encircles the reduced upper end portion 10 of the oil tank, the lower end of the spring resting on the top of the oil tank, and its upper end bearing against the lower end of the connecting tube 11, the tension of the coil spring 51 serving to normally hold the upper end of the connecting tube 11 against the under side of the flange 49, which, with the cone 27, gyrates.

For supplying oil from the oil tank to the passage 45 in the upper end of the shaft 12, a horizontal pipe 52 has its inner threaded end fitted removably in a threaded hole in the side wall 9 of the oil tank, the pipe 52 being slidably extended through the side wall of the bowl 1, and being connected at its outer end releasably by a connection 53 with a pipe 54 which is connected to the intake of a pump 55, the outlet of which is connected to one end of a pipe 56, the other end of which is fitted and discharges into the passage 45. Any suitable means, not shown, may be used to operate the pump 55.

When the pump 55 is operated, oil is taken from the oil tank through the pipes 52, 54, pump 55, and pipe 56, and discharged into the passage 45 from which it passes by the 46 and 47 into the annular spaces containing the bearing rollers 25 and 25, from which the oil passes into and through the tube 48, thence through the tube 11 into the oil tank.

The lower end of the bowl 1 has an outer peripheral flange 57 which rests on pedestals 58 to which it is anchored by bolts 59 and nuts 60.

In operation, when the shaft 23 is rotated by a motor or engine, not shown, the pinion 22 will revolve the gear 19, thus revolving the sleeve 18 and with it its eccentric 26, thereby gyrating the cone 27, which with the bowl lining 2 will crush rock fed into the upper end of the bowl 1, the crushed rock falling through the passage 3, past the spider 5, to be caught or conveyed as desired.

The pump 55 being operated, the oil will be circulated from the oil tank 9, as hereinbefore described between the two sets of bearing rollers 25 and 29, tube 48 and connecting tube 11 back into the oil tank.

When it is desired to change the coarseness of the crushed rock, the nuts 38, 40 and 42 are loosened, and the screws 30 turned to adjust the crusher cone 27 upwardly, to make the crushed rock finer, or downwardly, to make the crushed rock coarser.

To disassemble the crusher, for any purpose, as for removing and replacing worn parts, as the sleeve 18, or bearing rollers 25 or 29, the nut 17 is removed from the lower end of the shaft 12, the connection 23 adjusted to separate the tubes 52 and 54, the tube 52 turned to withdraw it from the tank wall 9, and the bolts 7 removed. The bearing 24 is then released from the tank wall 9, and it, the pinion

22 and shaft 23 are then withdrawn outwardly beyond the base plate 8, following which the oil tank, connecting tube 11, bearing rollers 20, gear 19, spacing plate 21, sleeve 18, bearing rollers 25 and 29, and spring 51 may then be removed downwardly out of the bowl 1.

The cone 27 and the shaft 12 will still be suspended from the bridge 4.

If it is desired to remove the cone 27 and shaft 12, the bolts 6 are withdrawn, and the spider 5 removed. The nut 14 is removed and the shaft 12 removed downwardly. The screws 30 are then turned to withdraw them from the cone 27, following which the cone 27 removed downwardly out of the bowl 1, and with it the sleeve 41 and the nut 42.

To reassemble, this procedure is reversed. By means of the construction of the crusher, as it has been described, the crusher may be easily and quickly assembled or disassembled with relatively light tackle. As the bridge 4 is employed to wholly support the heavy cone 27, and to partly support the shaft 12, spider 5, oil tank, bearing rollers 25 and 29 and the eccentric sleeve 18, a relatively light spider 5 may be used, thus reducing the weight of the crusher and its cost of manufacture, while retaining the necessary strength to enable it to efficiently operate in doing heavy crushing work for a long period of time.

In the modification, shown in Fig. 8, most of the parts correspond in structure and mode of operation to the crusher shown in the other figures. The principal difference consists in the means for supporting the crusher cone 27 from the bridge 4'.

In the modified form, the shaft 12 of the other form shown is replaced by a shaft 12', the lower end portion of which corresponds to the lower end portion of the shaft 12 of Fig. 1, the upper end of the shaft 12' having an axial hole into which extends the lower end portion 61 of an axial shaft 62 which is threaded and extends through an axial hole 63 in the bridge 4'. Two nuts 64 and 65 on the shaft 62 respectively bear against the upper and lower sides of the bridge 4', thus suspending the shaft 62.

The shaft 62 has a circular peripheral flange 66 in a recess in the upper end of the cone 27. Balls 67 are disposed in a race in the upper side of the flange 66 and support a circular plate 68 fastened by bolts 69 to the upper end of and supporting the cone 27. The plate 68 has a hole 70 larger in diameter than the shaft 62 which extends through said hole, thus permitting the plate 68 to gyrate with the cone 27.

A sleeve 18, corresponding to the sleeve 18 of the other form of my invention, is disposed between bearing rollers 25 and 29, and has an eccentric portion 26 mounted between said rollers for gyrating the cone 27, in the manner hereinbefore described.

The upper end of the shaft 62 has an oil passage 71 which discharges laterally at its lower end onto the flange 66 and into the annular spaces containing the rollers 25 and 29. The oil tube 56 enters and discharges into the oil passage 71. In other respects, the structure and mode of operation corresponds to that of the form shown in Fig. 1.

When the shaft 23 is rotated, the eccentric sleeve 18 will be revolved, and gyrate the cone 27, in the manner already described.

The pump 55 being operated, oil will be circulated from the oil tank through the pipes 52, 54, pump 55 and pipe 56, oil passage 71 and its branches into the annular spaces containing the rollers 25 and 29, and thence through the connecting tube 11 back to the oil tank.

To vertically adjust the cone 27, the nut 65 is loosened and the nut 64 turned to raise or lower the shaft 62, which is slidable in the hole 63, thus vertically adjusting the cone 27 by means of the flange 66, bearing balls 67 and plate 68. The portion 61 of the shaft 62 is vertically slidable in the shaft 12'. A sealing nut 72 on the shaft 62 covers the hole 70 in the plate 68, which gyrates slidably under said nut 72, which nut 72 prevents oil passing upwardly through said hole 70.

Other modifications of my invention, within the scope of the appended claims, may be made without departing from the spirit of my invention.

What I claim is:

1. In a rock crusher, in combination, a crusher bowl having a passage extending downwardly therethrough, and having a bridge across said opening, a removable spider across said opening below said bridge, said spider having a central opening, an oil tank having a top opening and a base serving as a removable closure for said central opening, means releasably attaching said tank base to said spider, an axial stationary shaft supported at its lower end on said tank base and having its upper end releasably attached to said bridge, a driving sleeve encircling said shaft and having an eccentric portion, a crusher cone encircling said eccentric portion and removable downwardly through said passage when said spider is removed, bearing means between and engaging said eccentric portion and said cone by which said cone is gyrated, bearing means between and engaging said eccentric portion and said shaft, means independent of said shaft for revolving said sleeve, means for pumping oil from said tank and for conveying said pumped oil upon the upper end portions of said two bearing means, an oil conducting tube slidably engaging the upper end portion of said tank for discharging oil driping from said two bearing means into said tank, said tube encircling said sleeve and spaced therefrom, resilient means normally forcing said conducting tube upwardly with the upper end of said tube against the lower end of said cone, and means for vertically adjusting said cone in said bowl.

2. In a rock crusher, in combination, a crusher bowl having a passage extending downwardly therethrough, and having across said passage a removable spider having a central opening, a closure removably closing said opening, a vertical stationary shaft in said passage having its lower end supported by said closure, a crusher cone in said passage encircling said shaft above said closure, means for gyrating said cone around said shaft said means being in bearing engagement with said shaft and said cone, means vertically adjustably suspending said cone, a tubular member encircling said shaft and supported on and removable with said closure and forming therewith an oil tank, means for pumping oil from said oil tank and for discharging the oil between said shaft and said cone adjacent to the top of said cone, and means for catching oil passing downwardly between said shaft and said cone and discharging the oil so caught into said tank.

CLAUDE D. BOUSMAN.