

J. E. MILLS.
 APPARATUS FOR EXTRACTING OIL FROM OLEAGINOUS MATERIAL.
 APPLICATION FILED NOV. 25, 1908.

1,005,733.

Patented Oct. 10, 1911.

3 SHEETS—SHEET 1.

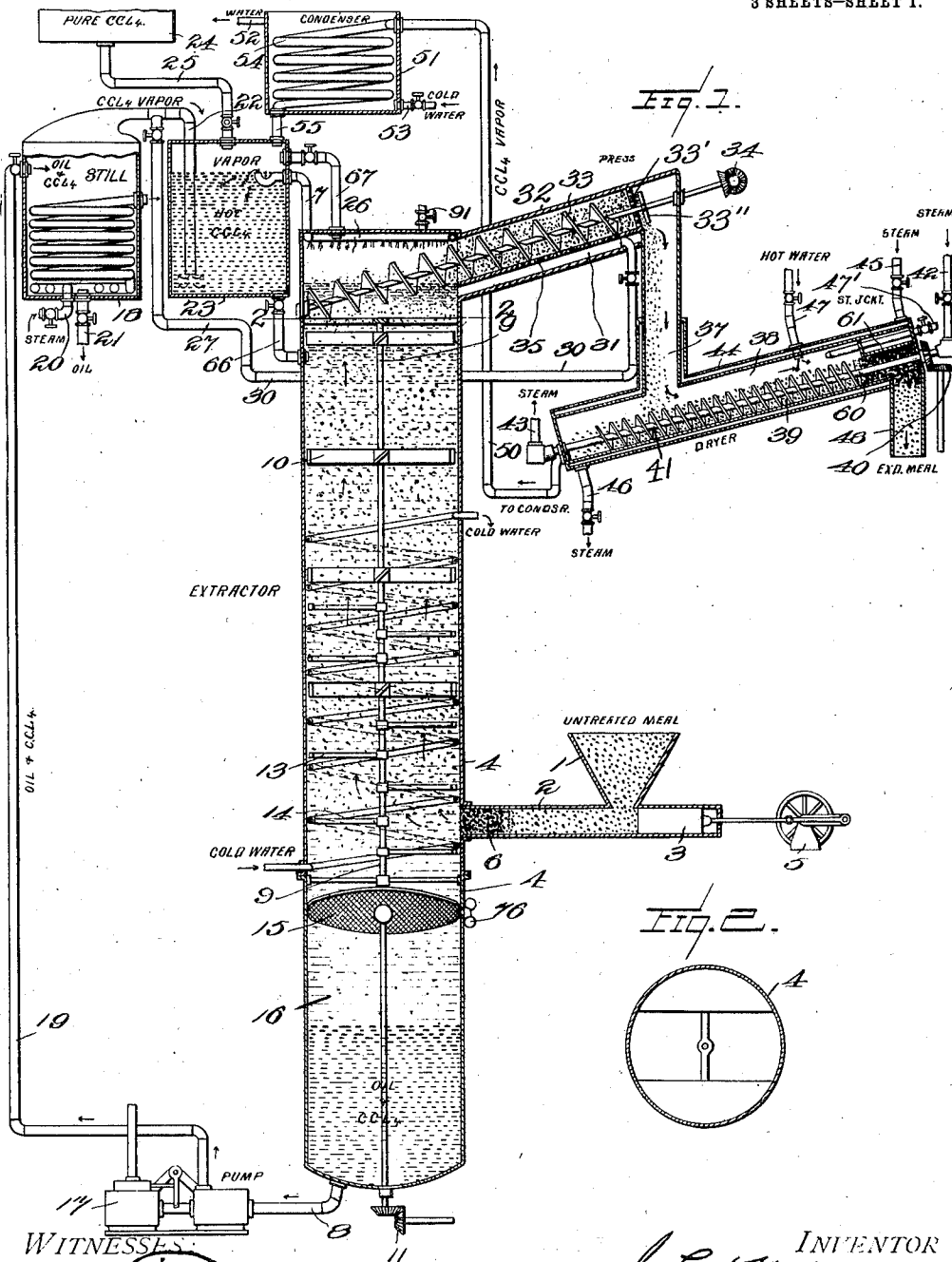
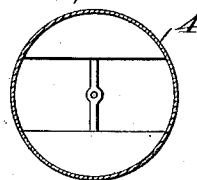


FIG. 2.



WITNESSES:

H. F. Roy Co.
Mr. Map. Dwall

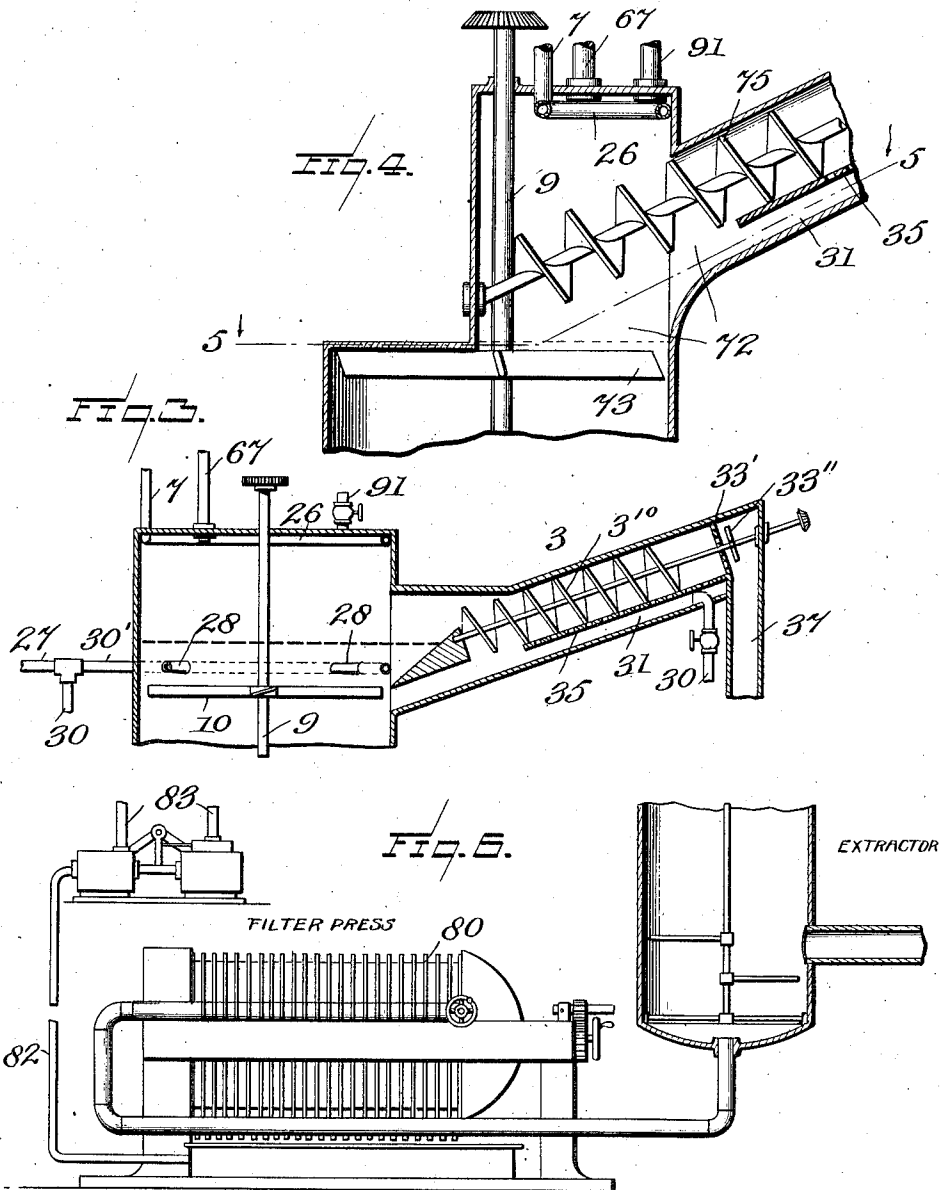
INVENTOR
J. E. Mills
 BY *William Fisher*
Wichitson
 Attorney

J. E. MILLS.
 APPARATUS FOR EXTRACTING OIL FROM OLEAGINOUS MATERIAL.
 APPLICATION FILED NOV. 25, 1908.

1,005,733.

Patented Oct. 10, 1911.

3 SHEETS—SHEET 2.



Witnesses
 W. May Durrall.
 W. Neale Jr.

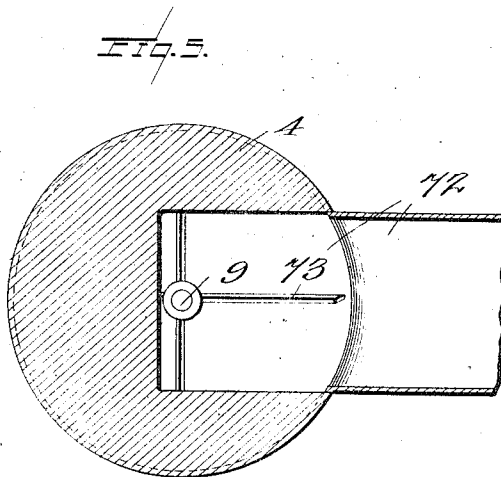
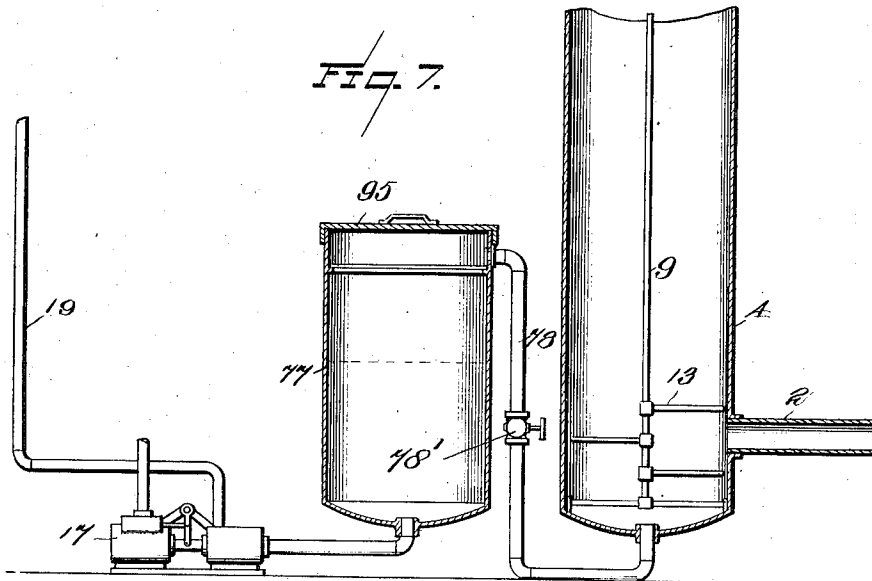
Inventor
 J. E. Mills by
 Wilkinson Fisher &
 Witherspoon
 Attorneys

J. E. MILLS.
 APPARATUS FOR EXTRACTING OIL FROM OLEAGINOUS MATERIAL.
 APPLICATION FILED NOV. 25, 1908.

1,005,733.

Patented Oct. 10, 1911.

3 SHEETS—SHEET 3.



Witnesses
 W. Map. Dural
 A. W. Neal, Jr.

Inventor
 J. E. Mills by
 W. E. Hanson Fisher &
 W. E. Hanson
 Attorneys

UNITED STATES PATENT OFFICE.

JAMES E. MILLS, OF CHAPEL HILL, NORTH CAROLINA, ASSIGNOR OF ONE-FOURTH TO
H. B. BATTLE, OF MONTGOMERY, ALABAMA.

APPARATUS FOR EXTRACTING OIL FROM OLEAGINOUS MATERIAL.

1,005,733.

Specification of Letters Patent.

Patented Oct. 10, 1911.

Application filed November 25, 1908. Serial No. 464,478.

To all whom it may concern:

Be it known that I, JAMES E. MILLS, a citizen of the United States, residing at Chapel Hill, in the county of Orange and State of North Carolina, have invented certain new and useful Improvements in Apparatus for Extracting Oil from Oleaginous Material; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an apparatus for extracting oil or fat from cotton seed, its meats, or meal, or from other oleaginous seeds or materials, by the use of a solvent such as carbon tetrachlorid, tetrachlorethane, pentachlorethane, or perchlorethane, or other heavy solvent which is specifically heavier than the material to be extracted, and the object of the invention is to produce such an apparatus as will be more efficient for its purpose, and less expensive to operate than heretofore.

Among the many forms of extracting apparatus which have been known prior to this invention, there are none which have been suitably designed to utilize certain natural laws more fully detailed below, and which come into action when the specific gravity of the solvent used for the extraction is greater than that of the material from which the oil is to be extracted. When such specific gravity obtains the oleaginous material, if mixed with the solvent, will rise more or less rapidly to the top of the said solvent, and the latter more or less saturated with the extracted oil can be made to collect at the bottom of the container. It is evident, therefore, that in an apparatus suitably arranged the oleaginous material may be introduced into the extraction chamber at a sufficient distance underneath the surface of the solvent, and advantage may be taken of the difference between the specific gravities of the oleaginous material and solvent and the consequent rise of the former in the latter, to obtain a more or less automatic circulation of the solvent through the material.

Therefore this invention consists in an apparatus adapted to take advantage of these well known physical laws, all as will be more fully disclosed hereinafter and particularly pointed out in the claims.

Referring to the accompanying drawings

forming a part of this specification:—

Figure 1 represents an elevational view, partly in section, of one form of the invention, Fig. 2 a sectional detail view taken on the line 2—2 of Fig. 1, with certain parts omitted, Fig. 3 a sectional elevational detail view showing a modified form of apparatus for removing the exhausted material from the extraction chamber, Fig. 4 a like view of another modified means for removing the exhausted material, Fig. 5 a sectional view on the line 5—5 of Fig. 4, and Figs. 6 and 7 are sectional elevational views of modified means of removing the oil and solvent from the extraction chamber.

Like numerals refer to like parts in all the views.

1 represents a suitable hopper into which the material whose oil is to be extracted is delivered, and 2 a suitable passage through which it may be forced by the reciprocating plunger 3, into the extraction chamber 4. The plunger may be operated by any suitable means 5, and the reciprocations may be rapid enough and the passage sufficiently restricted to cause the end of the column of material to become caked as at 6, before it enters the extraction chamber. This chamber is provided with a main inlet 7 for the solvent, and an outlet 8 for the solvent and extracted oil. Passing along the axis of said chamber is the shaft 9, provided with paddles 10, revolved by the power gear 11. The paddles may or may not be unequally spaced along the shaft, as desired, and between the same the said shaft is provided with the mixers or stirrers 13, all for a purpose that will presently appear. The chamber 4 is or may be further provided with a cooling coil 14, a rotatable screen 15, and a collecting chamber 16 for the solvent and extracted oil, as shown.

17 represents a pump or other means for raising the oil and solvent to the still 18 through the pipe 19, while 20 represents a steam inlet, 21 an oil outlet, and 22 a delivery from the still 18 to the collecting tank 23.

24 represents a storage tank for the solvent connected to the collecting tank 23, by the pipe 25, and 26 a spraying means for the solvent connected to the inlet 7.

A connection 27 from the delivery 22 leads to the pipe 30 which connects with the passage 31 in the bottom of the conveyer press

32, as shown. This conveyer press is preferably provided with a screw 33, driven by the gear 34, and a perforated bottom 35, while the screw leads into the top of the extraction chamber, as illustrated. It is also provided with a delivery 37, leading into the drier 38, which is inclined as shown and provided with a screw 39 driven by the gear 40. The shaft 41 on which screw 39 is mounted is hollow and connects with the steam inlet 42, and outlet 43. Said drier is also provided with the steam jacket 44, having the steam inlet 45, and outlet 46; while 47 represents a hot water supply passing through said jacket into said drier, and 48 a delivery exit through which the exhausted material passes out of the apparatus.

Since the vapors of the solvent are heavier than steam, those that are liberated from the exhausted material in the drier 38, will descend, and a pipe 50 leads the same to the condenser 51, provided with the cold water outlet 52 and inlet 53, as shown. These vapors are condensed in the coil 54, and at 55 are returned to the tank 23.

The operation of the apparatus so far described is as follows:—The oleaginous material suitably prepared is caused to enter the hopper 1, whereupon it is forced by the reciprocating plunger 3 through the passage 2 into the extracting chamber 4, beneath the solvent therein; the action being sufficiently rapid and the passage 2 sufficiently restricted to cause the material to form a cake, as shown at 6, and this cake prevents said solvent from leaking out. The material being lighter than the solvent, will tend to rise in the chamber 4, but is partially restricted by the paddles 10, for a purpose that will appear below, and finally reaches the top of chamber 4, having first met the solvent more or less saturated with oil from the material that has passed before, and having as it became more and more exhausted of oil successively met purer and purer layers of solvent. Therefore the fresh and preferably hot solvent at first comes in contact with material almost exhausted of its oil, and thereupon exerts its most powerful action on the last remaining portions of oil which are the most difficult to remove from the material. The oleaginous material is nearly free from oil when it arrives at the top of the chamber, and it is subjected at once to the screw 33, and the solvent together with more or less oil is squeezed therefrom. This solvent and oil is allowed to pass through the perforated bottom 35 of the press into the channel 31 and back into the chamber 4. To aid this passage, solvent in the form of vapor or liquid is or may be admitted through the pipes 27 and 30.

In order to grind up the slightly compacted cake of meal at the upper end of the screw, there is provided the perforated sep-

tum 33', through which the meal is forced, and on the shaft of the screw is located the revolving prongs 33'', which serve to break up the compacted meal as it enters the passage 37. The material next passes into the drier 38 where it is subjected to a temperature sufficiently high to evaporate the solvent still remaining on the same, and the vapors of the said solvent are returned through the pipe 50 to the condenser 51, as above stated. The material passes upwardly through the drier, as shown, in order to aid the heavy vapors to descend, and the screw 39 does not extend along the shaft at 60, in order that a slightly compacted cake 61 may be there formed, and consequently prevents the vapors from passing out of the exit 48. The passage for the material is slightly reduced at this point, as shown, to aid in this action. Hot water is, or may be sprinkled on the material through pipe 47 in order that its evaporation may more effectually dislodge the solvent it still contains; and live steam may enter at 47'. The solvent more or less saturated with oil passes through the pivoted filter 15, into the settling chamber 16, from which it is forced through the pipe 19 to the still 18, where the solvent is evaporated and recovered into the tank 23, while the oil is drawn more or less free from the solvent out of the still at 21, after which it may be refined if desired.

If carbon tetrachlorid is used as the solvent and cotton seed material as the source of oil, and should the said tetrachlorid be at or above 25° C., and contain more than about 10% of oil, the mixture of oil and solvent will be specifically lighter than the hot and pure tetrachlorid entering at the top of the chamber 4, and undesirable counter currents would commence, were it not for the restraining action of the paddles 10. But these paddles are mounted at such an angle and are revolved at such a speed that these counter currents are prevented by layers of material formed underneath the paddles, while the stirrers insure an intimate contact between the solvent and material, and also prevent the same from clogging. The said layers of material offer a material obstruction to any counter currents that might form the layers at the bottom opposing the most highly saturated and therefore the lightest mixture of solvent and oil. Also the cooling coil 14 may be employed, when desired, to keep the solvent at a temperature that will prevent counter currents.

The shaft 9 instead of extending only partially through the chamber 4, may pass out of the top of the vessel, as shown in Figs. 3 and 4, and it may have its power applied at any suitable point so long as it does not interfere with the passage of the material, or it may be operated from the gear 11 located at the bottom of the cham-

ber 4, as illustrated in Fig. 1, as may be desired.

When the amount of solvent through the main supply 7 is insufficient, an additional quantity may be admitted through the pipe 66; and of course additional supplies in the form of vapor can be admitted under control through the pipes 27 and 30.

The uncondensed vapors in the extracting chamber 4, may escape through the pipe 67, and pass up into the coil 54 of the condenser 51, whence they will be returned in a liquid state to the tank 23.

Instead of drawing the exhausted material into the conveyer press 32 by the screw 33, as above described, the same may be caused to enter said press by means of the nozzles 28, set preferably longitudinally to the circumference of the extraction chamber 4; the action of course being aided by the paddles 10, and the screw 33', as illustrated in Fig. 3.

The jets 28 are fed by the pipe 30', which may be joined to the pipe 27 at its juncture with the pipe 30, as illustrated in Fig. 3. Or, as shown in Figs. 4 and 5, the top of the chamber 4, may be provided with the constricted passage 72, and the shaft 9 with the paddles 73, and the screw 75 may extend through and along the said passage 72 and draw the material into the press, in the manner above disclosed.

In Fig. 1 the filter 15 separates the mixture of solvent and oil from the finely ground particles of material, as the said mixture passes into the chamber 16, and since said filter is pivotally mounted as shown, it may be turned from time to time on its axis, by means of the handle 76, in order to clear it of finely divided material. The modification shown in Fig. 7, however, shows how the chamber 16 may be dispensed with. Here the collection chamber 77 is provided, which is connected by means of the pipe 78 with the bottom of the extraction chamber 4. In this form of apparatus, the paddles and layers of material, with the proper regulation of the temperature as described, will aid in keeping the mixture of oil and solvent at the bottom of chamber 4. Said mixture under the action of gravity, when permitted by the stop cock 78', will pass into the reservoir 77, whence it is removed by the pump 17 through the pipe 19 to the still, as above disclosed. In the modification shown in Fig. 6, the collection chamber 16 is likewise done away with, and the solvent and oil is drawn by any suitable means into the filter press 80, through the pipes 82 and 83 to any suitable separator.

In all the forms it will be observed that there occurs:—first a separation of the oleaginous material more or less exhausted of oil near the top of the extraction chamber, whence it may be removed by suitable ma-

chinery for further treatment; and second, a separation of the solvent, more or less saturated with the extracted fat or oil, near the bottom of said compartment or chamber, whence it may be likewise removed for further treatment. Under the term oleaginous material I mean to include especially cotton seed, its meats, or meal, or any other oil or fat bearing material possessing the property of being specifically lighter than the solvent used in the apparatus. And under the term carbon tetrachlorid or solvent, I wish to be understood as including any suitable solvent which is specifically heavier than the material whose oil is to be extracted.

For the same material and the same solvent the rapidity of the extraction of the oil will depend not alone on the temperature of the solvent, which in the apparatus disclosed may be varied to suit the conditions, but, also, on the fineness of division of the oleaginous material. Furthermore, the more finely divided particles of material will rise more slowly through the solvent than will the coarser ground particles, and some are liable to pass out with the mixture of oil and solvent, unless special precautions are taken. Especially is this the case, when the seed are ground very fine.

Under some conditions water at any suitable temperature may be admitted through the pipe 91, to form a layer at the top of chamber 4; this water being lighter than the solvent, will always remain at the top.

Since any fine particles of material that may find themselves carried over with the oil, will rise to the top of the settling or collection chambers, it is preferable to arrange the tops 95 of said chambers so that they can be removed, as indicated in Fig. 7.

It is evident that various changes could be made in the details throughout this apparatus by those skilled in the art without departing from the spirit of my invention, and therefore I do not wish to be understood as limiting the same to the exact details of construction disclosed.

What I claim is:—

1. In an oil extracting apparatus, the combination of an extraction chamber adapted to hold a suitable quantity of solvent at a normal level; an inlet for said solvent; an outlet for the mixed solvent and oil; an inlet for the material whose oil is to be extracted, located and adapted to deliver said material, below the normal level of said solvent; and mechanically operated means for withdrawing the treated material from the top of said solvent, substantially as described.

2. In an oil extracting apparatus, the combination of an extraction chamber adapted to hold a suitable quantity of solvent; a solvent inlet near the top of said

chamber; a mixed oil and solvent outlet at the bottom of said chamber; and an inlet for the material whose oil is to be extracted located between said solvent inlet and outlet, whereby the said material when admitted to said chamber may automatically rise in said solvent through its own buoyancy; mechanically operated means for forcing said material into said chamber; and mechanically operated means for withdrawing the treated material from the top of said solvent, substantially as described.

3. In an oil extracting apparatus, the combination of an extraction chamber adapted to hold a solvent specifically heavier than the material whose oil is to be extracted at a suitable level; a solvent inlet; an oil and solvent outlet; an inlet for the said material located between said inlet and outlet, and below the normal level of said solvent; a screw conveyer for withdrawing the treated material from the top of said solvent; a shaft in said chamber; and a series of paddles attached to said shaft, substantially as described.

4. In an oil extracting apparatus, the combination of an extraction chamber adapted to hold a solvent specifically heavier than the material whose oil is to be extracted, and at a suitable level, a solvent inlet near the top of said chamber, an oil and solvent outlet near the bottom of said chamber, an inlet for said material between said solvent inlet and outlet, mechanically operated means for withdrawing the treated material from the top of said solvent, a vertical shaft in said chamber, paddles on said shaft, and stirrers on said shaft between said paddles, substantially as described.

5. In an oil extracting apparatus, the combination of an extraction chamber adapted to hold a solvent specifically heavier than the material whose oil is to be extracted and at a suitable level; a solvent inlet near the top of said chamber; an oil and solvent outlet near the bottom of said chamber; an inlet for the said material between said solvent inlet and outlet; means for periodically and positively forcing said material through said inlet into said chamber; means for discharging said material from said chamber; a shaft in said chamber; and paddles on said shaft, substantially as described.

6. In an oil extracting apparatus, the combination of an extraction chamber adapted to contain oleaginous material and solvent; an inlet for the solvent; an outlet for the solvent and oil; an inlet for the material to be extracted situated between said solvent inlet and oil and solvent outlet; means for forcing said material through said inlet; means for separating said material from said solvent near the top of said chamber; means for compressing said separated material; means for drying the same;

a shaft in said extraction chamber and paddles on said shaft; and a settling chamber below said extraction chamber, substantially as described.

7. In an oil extraction apparatus, the combination of an extraction chamber adapted to contain oleaginous material and solvent; an inlet for said material situated between a solvent inlet and an oil and solvent outlet; means for separating said material from said solvent near the top of said chamber; paddles in said chamber; a shaft on which said paddles are mounted; stirrers on said shaft; a settling chamber for the mixed oil and solvent; means for separating the mixed oil and solvent from said solvent; means for separating the oil from said mixed oil and solvent; means for returning the solvent so recovered to said chamber; means for compressing said separated material; and means for drying the same, substantially as described.

8. In an oil extracting apparatus, the combination of an extraction chamber adapted to contain oleaginous material and a solvent; means for separating said material from said solvent at the top of said chamber; restraining paddles in said chamber; means for separating the mixed oil and solvent from said solvent; means for separating the oil from said mixed oil and solvent; means for returning the solvent so recovered to said chamber; means for compressing said separated material; and means for drying the same, substantially as described.

9. In an oil extracting apparatus, the combination of an extraction chamber adapted to contain oleaginous material and a solvent; an inlet for said material near the bottom of said chamber; means for separating said material from said solvent at the top of said chamber; restraining paddles in said chamber; a shaft on which said paddles are mounted; stirrers on said shaft; means for separating the mixed oil and solvent from said solvent; means for separating the oil from said mixed oil and solvent; means for returning the solvent so recovered to said chamber; means for compressing said separated material; and means for drying the same, substantially as described.

10. In an apparatus for extracting oil from oleaginous material, the combination of an extraction chamber adapted to contain a solvent; an inlet for the material near the bottom of the same; an outlet for said material above said inlet; means for forcing said material out of said chamber; compressing means for said material; connections between said compressing means and said chamber adapted to return to said chamber any solvent and oil that enters therein; a drier connected to said compressing means; means adapted to separate the dissolved oil from the solvent and to recover the solvent;

a tank for holding the recovered solvent; and means connecting said drier with said tank, substantially as described.

11. In an apparatus for extracting oil from oleaginous material, the combination of an extraction chamber adapted to hold a solvent; an inlet for the material; an outlet for the same above said inlet; and a cooling coil for regulating the temperature of said solvent; substantially as described.

12. In an apparatus for extracting oil from oleaginous material, the combination of an extraction chamber adapted to hold a solvent; an inlet for the material; an outlet for the same above said inlet; a rotatable filter in said chamber; a collection chamber below the filter; and a cooling coil for regu-

lating the temperature of said solvent; substantially as described.

13. In an apparatus for extracting oil from oleaginous material, the combination of an extraction chamber adapted to hold a solvent; an inlet for said material; an outlet located above said inlet; a shaft provided with paddles and stirrers in said chamber; a cooling coil for the solvent; a filter; and a collection chamber below the same, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

JAMES E. MILLS.

Witnesses:

W. M. OATES,

L. A. BLACKBURN.