March 3, 1953 E. RIVOCHE ET AL 2,629,896

APPARATUS FOR FORMING GRANULAR CONGEALED FUEL

Filed Nov. 15, 1947 3 Sheets-Sheet 1

Fig. 1

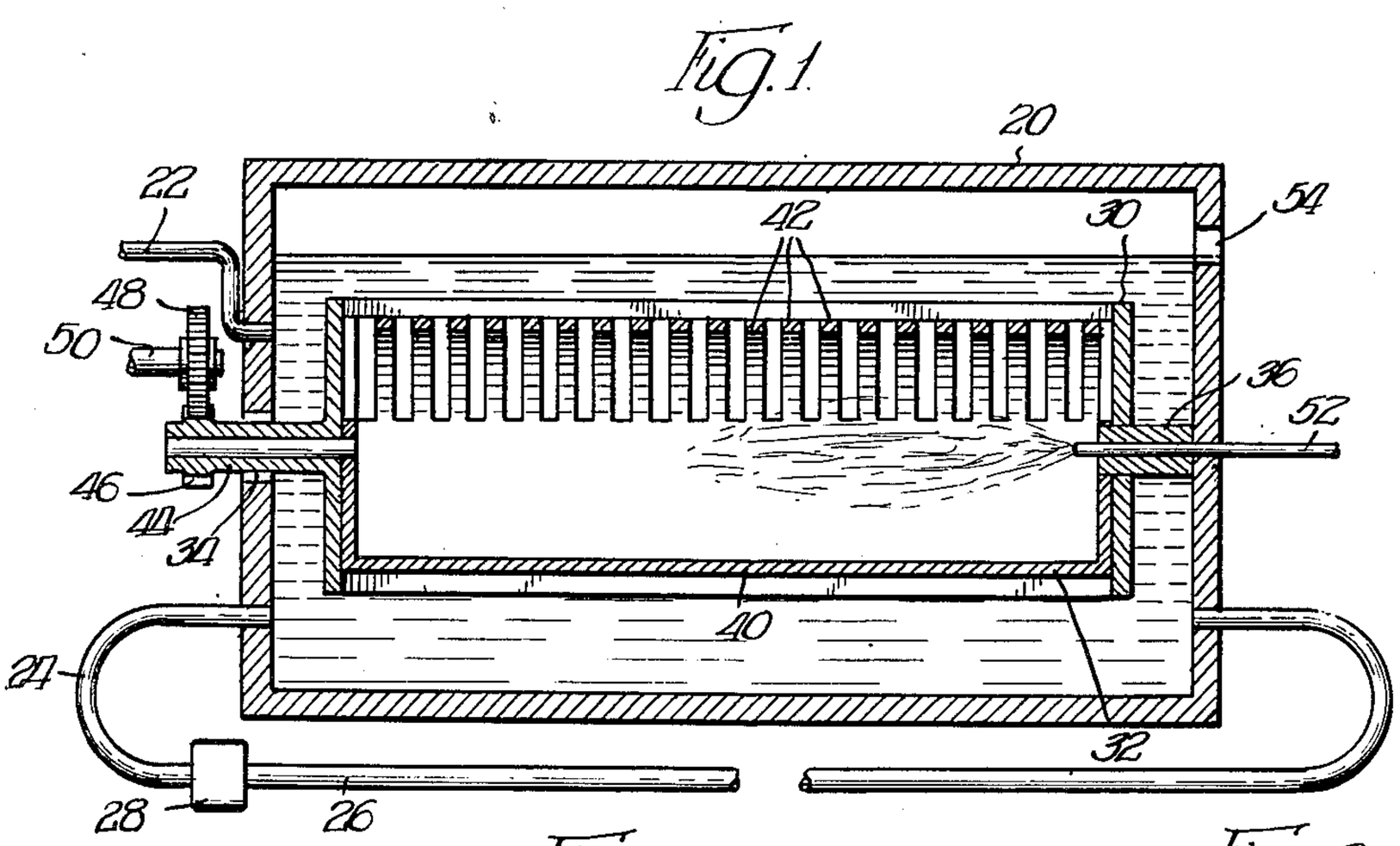


Fig. 2

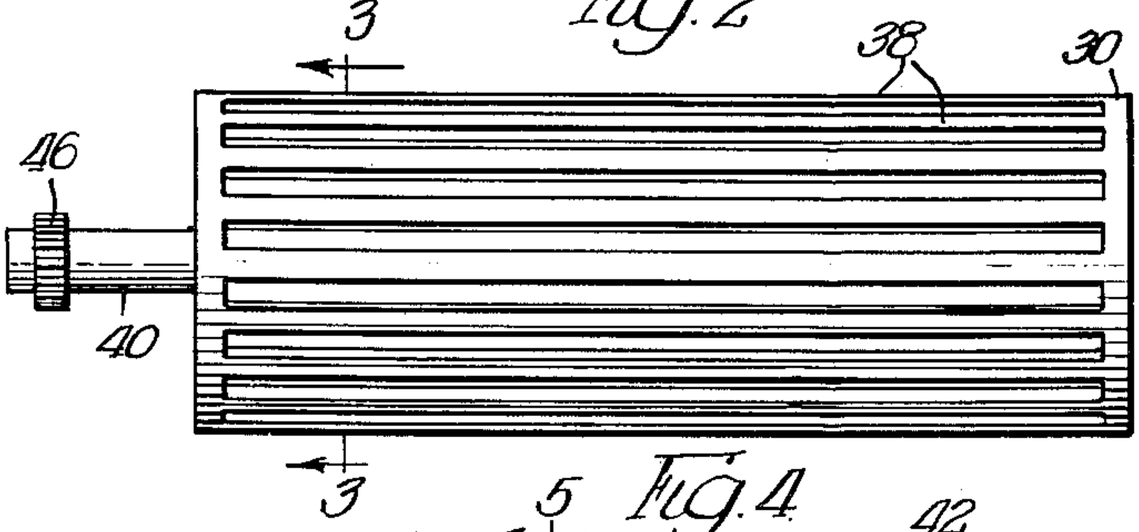


Fig. 3

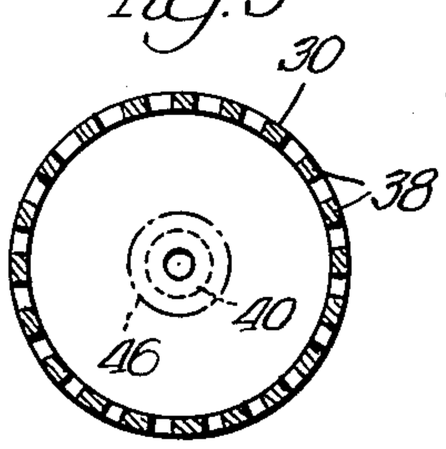


Fig. 4

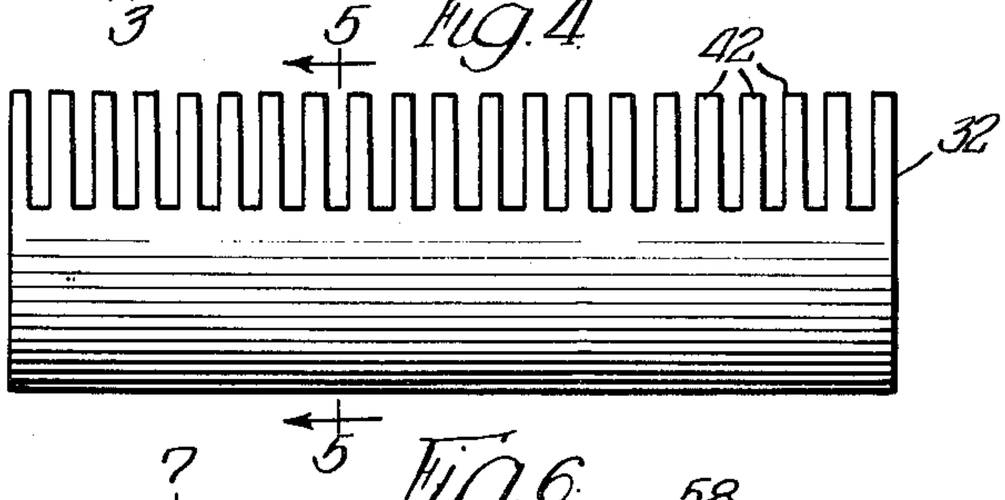


Fig. 5.

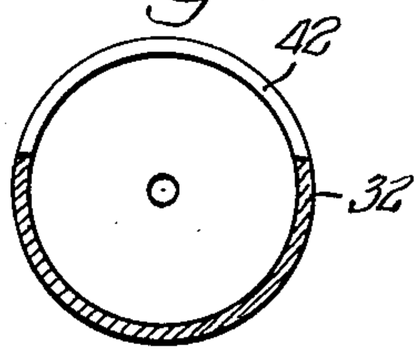


Fig. 6

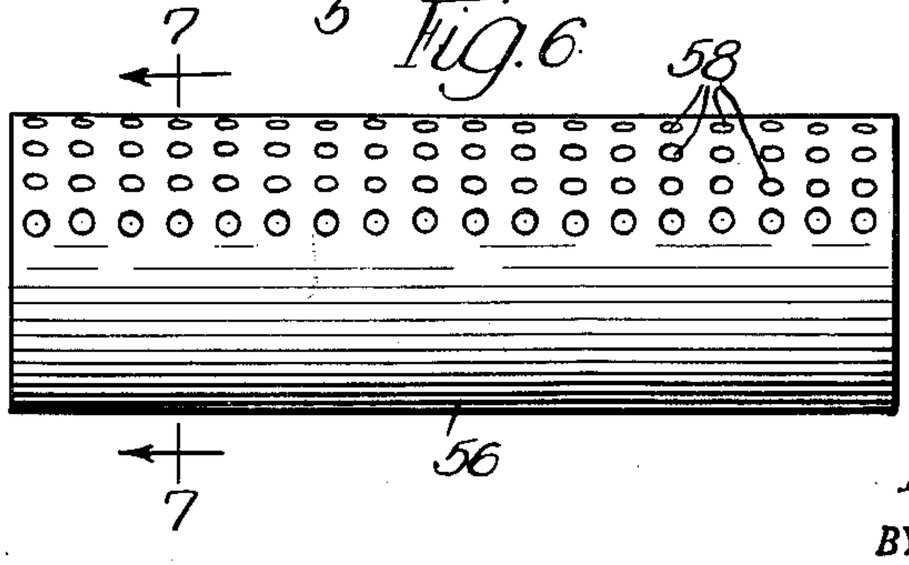
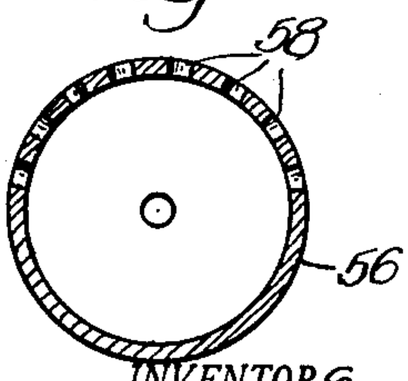


Fig. 7.



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APPARATUS FOR FORMING GRANULAR CONGEALED FUEL

Filed Nov. 15, 1947 3 Sheets-Sheet 2

Fig. 8

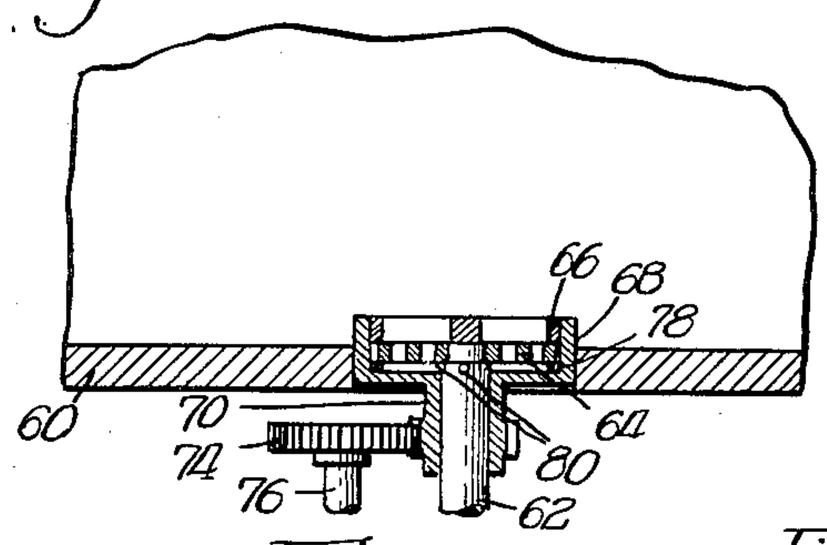

Fig. 12.

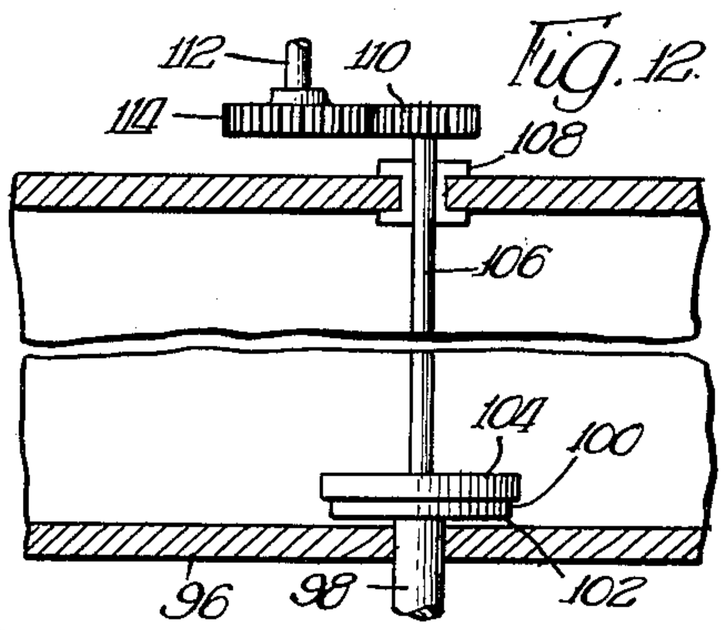

Fig. 9

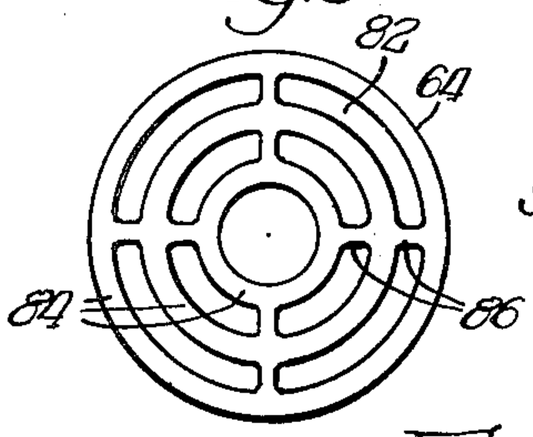

Fig. 10

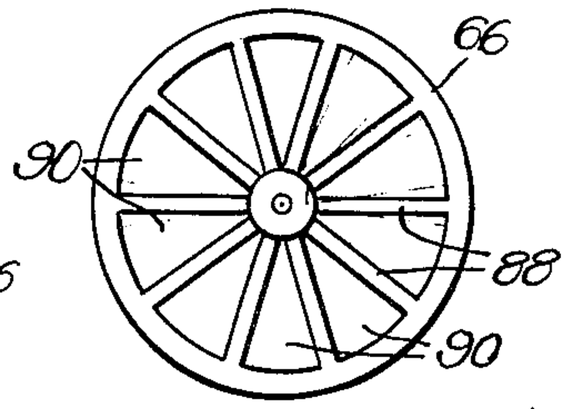

Fig. 11

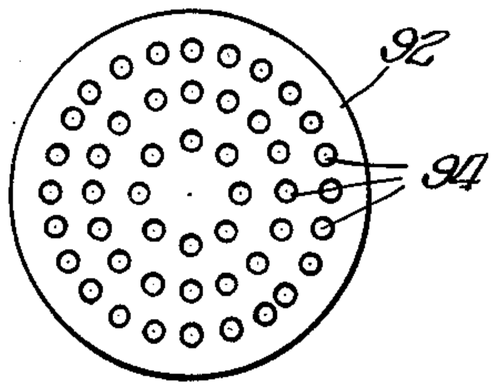

Fig. 13.

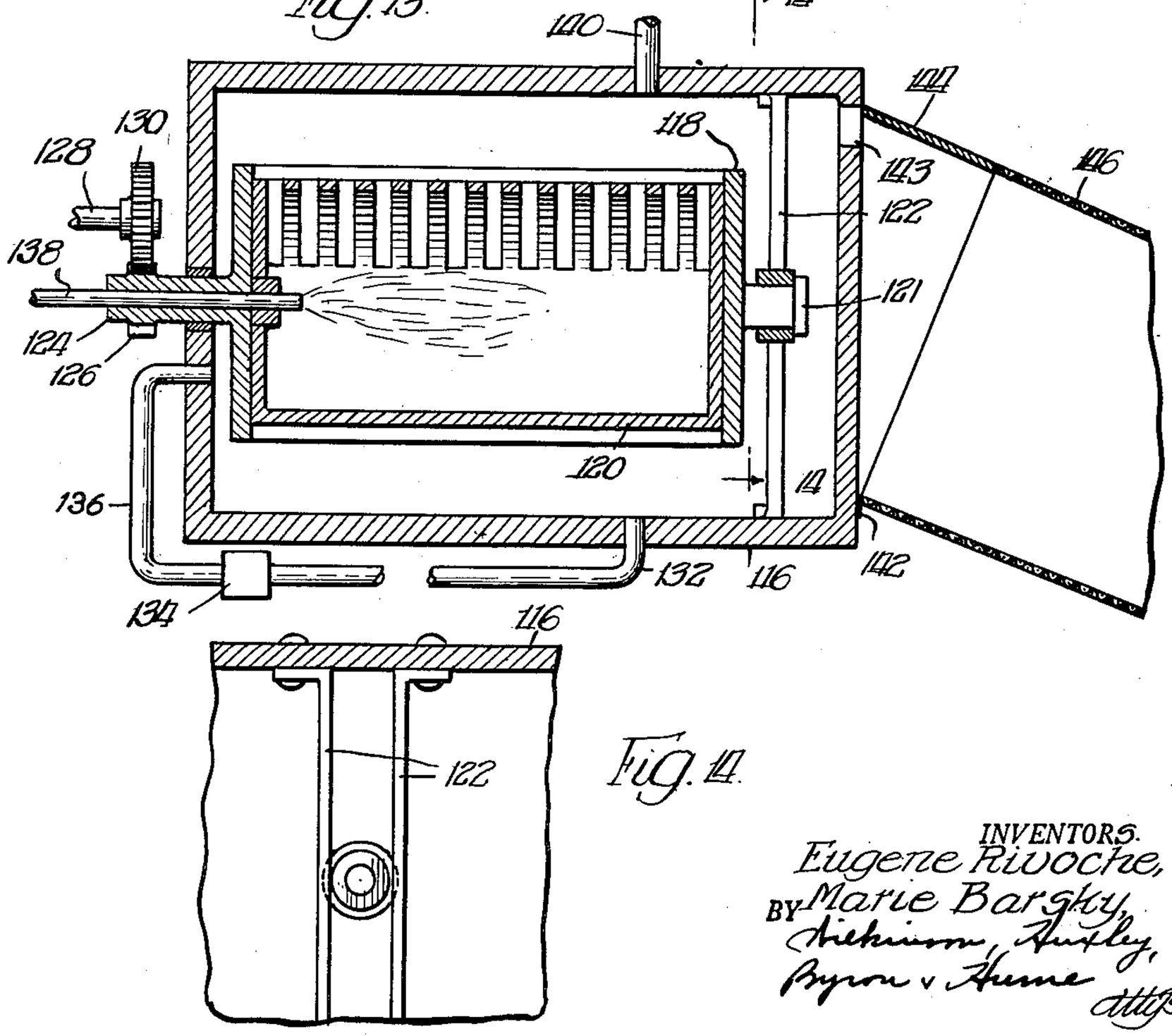

Fig. 14.

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March 3, 1953 E. RIVOCHE ET AL 2,629,896

APPARATUS FOR FORMING GRANULAR CONGEALED FUEL

Filed Nov. 15, 1947 3 Sheets-Sheet 3

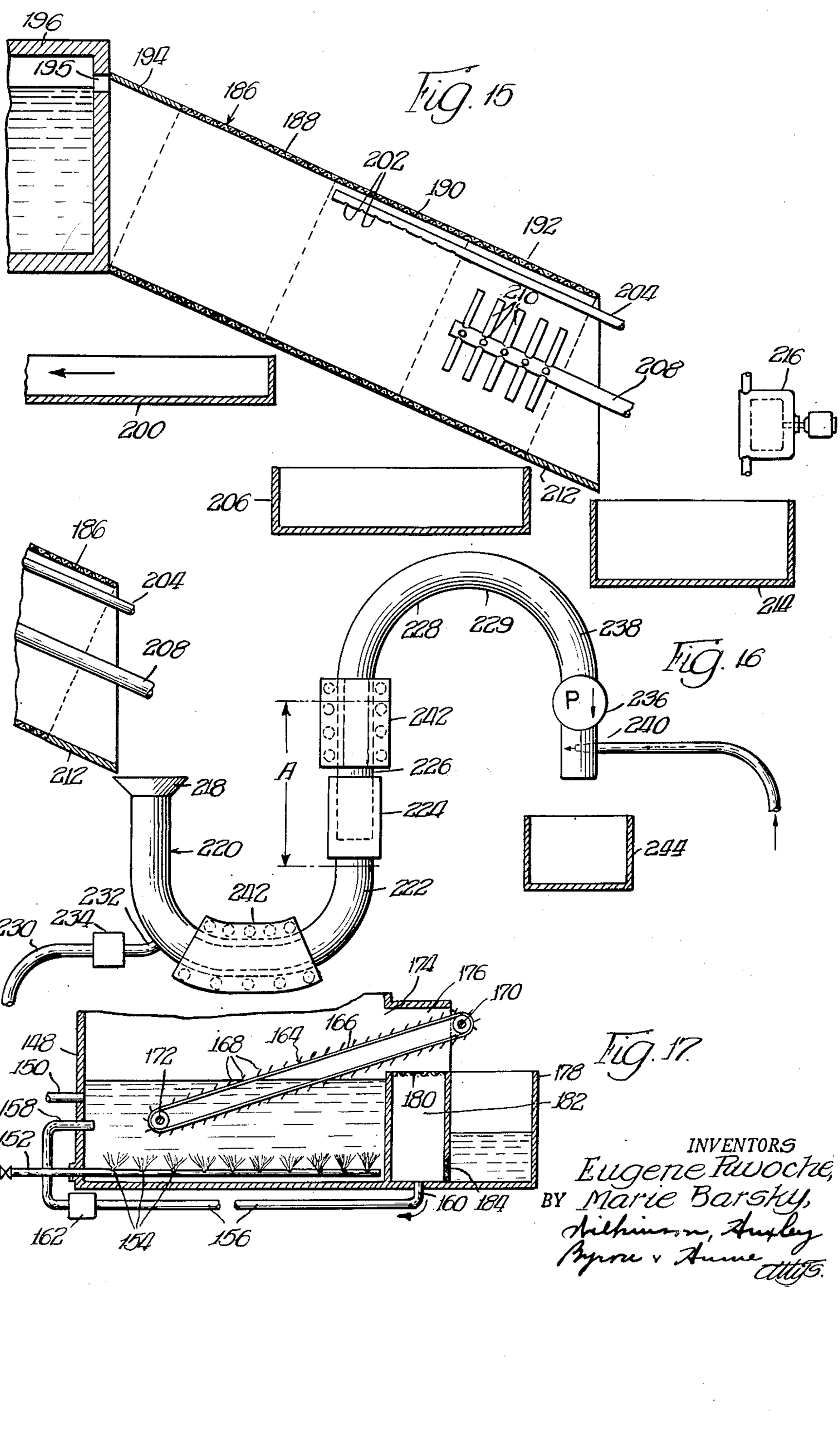

Fig. 15

Fig. 16

Fig. 17.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR FORMING GRANULAR CONGEALED FUEL

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Application November 15, 1947, Serial No. 786,280

20 Claims. (Cl. 18—1)

1

This invention pertains to an apparatus for producing congealed fuels in fragments, particles, or globules as by atomization.

Various methods are known for transforming liquid fuels, and more particularly gasoline or alcohols, into solid or congealed combustibles, which are used as such for the purpose of preventing numerous inconveniences. In many cases, as particularly during transportation and storage, liquid fuels are inconvenient and dangerous as they are volatile, have a low firing point, so are explosive and are subject to vapor, and there is great difficulty in preventing losses through leakages and the formation of explosive mixtures by the gases evolved by them. Moreover, with the processes known and used up to the present, the liquid fuels, after having been transformed into the solid state, can no longer be brought back again to their former liquid state and quality.

The first or gelatinizing stage of the process consists in mixing cold and with strong agitation the liquid fuel with one or more gelatinizing substances such as keratine, gluten, algin, pectine and the like, during a period of fifteen to twenty minutes, thus obtaining a product having a gelatinous consistency.

This emulsion is then brought into contact, by the apparatus and methods hereinafter described, with a bath of suitable metallic salts rich in oxygen, which may be peroxides, sulphates, persulphates, chromates, bichromates, borates, perborates, manganates, permanganates, and the like, or tannin, oxymethylene, calcium chlorate, sodium chlorate, etc., in a liquid state.

In recent years, much progress has been made in technique of producing congealed, solid gasoline and hydro-carbons generally, and processes are known in which presentation of fluid fuels in such sufficient solid form to keep them in shape without special packing and susceptibility to transportation to storage. These are essentially processes using basic raw products for solidification of alginates, algins and other similar products on which the action of metallic salts is used to provoke the jellification of the algin solutions. Most of these products are presented in ball or globule forms and sizes. However, there are still many difficulties to overcome.

First

The stabilization of the congealed product and the establishment of a stable equilibrium is characterized with a contacting action and rejection of supplemental or surplus water. This is a long

2

process as much time is required for the stabilization of the product and the elimination of the moisture content of the particles proportionate to the diameter or thickness of the particles formed.

Second

A standard content of moisture in the individual particles is difficult to obtain by drying in conventional tray or conveyor systems, without the aid of apparatus and methods in accordance with the present invention, as the particles do not have the same moisture content. In such systems, they fail to acquire a homogeneous drying of each particle but there occurs a general loss of a certain percentage of moisture from the whole mass of dried particles without the guarantee that each individual particle will have the same elimination of moisture.

Third

In the presentation or production of the particles in spherical formation, like balls or globules, an inevitable loss of volume of substantially twenty-five per cent (25%) average will occur, and the formation of the balls or globules of congealed fluid by projecting or dropping the fuel emulsion into the congealing bath causes a substantial evaporation loss.

It is an object of this invention to provide an apparatus to produce particles of more or less uniform size and formation.

Another object of the invention is to provide means for congealing fuel wherein there is substantially no evaporation during the formation of the congealed fuel.

A further object, after the gel is produced, is to obtain and maintain, as rapidly as possible, a uniform elimination of the moisture content of the individual particles.

An additional object is to provide additional moisture elimination means such as a centrifuge or cyclon construction, alone or in combination, to be used if the initial steps do not completely and equally reduce the moisture content to the standard desired.

With these and various other objects in view, the invention consists of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings, which illustrate embodiments of the device and wherein like reference characters are used to designate like parts—

Figure 1 is a longitudinal sectional elevation through a form of apparatus embodying the invention for forming congealed fuel particles submerged in the congealing bath;

Figure 2 is an elevation of the rotatable cylinder utilized in the device shown in Figure 1, showing the longitudinal openings therein;

Figure 3 is a transverse sectional elevation of the cylinder illustrated in Figure 2, the same being taken substantially in the plane as indicated by the line 3—3 of Figure 2;

Figure 4 is an elevation of the stationary cylinder utilized in the device shown in Figure 1, showing the partial circumferential openings therein;

Figure 5 is a transverse sectional elevation of the cylinder illustrated in Figure 4, the section being taken substantially in the plane as indicated by the line 5—5 of Figure 4;

Figure 6 is a modified form of stationary cylinder adapted to be utilized in the device illustrated in Figure 1, the openings therein being shown as spaced apertures;

Figure 7 is a transverse sectional elevation of the cylinder illustrated in Figure 6, the section being taken substantially in the plane as indicated by the line 7—7 of Figure 6, the cylinder illustrated in Figures 6 and 7 being adapted to be used with the rotatable cylinder illustrated in Figures 2 and 3;

Figure 8 is a fragmentary, sectional elevation taken at the bottom of an emulsion receiving tank, such as shown in Figure 1, showing another means of introducing the emulsion thereto;

Figure 9 is an enlarged, top plan view showing the stationary disk associated with the inlet mechanisms illustrated in Figures 8 and 12;

Figure 10 is an enlarged, top plan view showing the rotatable disk associated with the inlet mechanisms illustrated in Figures 8 and 12;

Figure 11 is an enlarged, top plan view of a modified form of rotatable disk adapted to be associated with the inlet mechanisms illustrated in Figures 8 and 12;

Figure 12 is a fragmentary, sectional elevation taken at the bottom of an emulsion receiving tank showing another modified form of means for introducing emulsion thereto;

Figure 13 is a longitudinal sectional elevation of another modified form of apparatus embodying the invention for forming congealed fuel particles;

Figure 14 is an enlarged, fragmentary, sectional elevation taken substantially in the plane as indicated by the line 14—14 of Figure 13, showing the yoke construction for suspending one end of the inner cylinders illustrated in said Figure 13;

Figure 15 is a sectional elevation showing moisture reduction mechanism for use particularly with the apparatus shown in Figure 13;

Figure 16 is a fragmentary elevation through mechanism for additionally reducing moisture in congealed fuel, the same being adapted to be used with the apparatus shown in Figure 13 or with the apparatus shown in Figures 13 and 15; and

Figure 17 is a sectional elevation of an apparatus embodying the invention for introducing emulsions or gelatinous fuel substance through jets into the metallic salts bath.

Referring first of all to the construction shown in Figures 1 to 5, inclusive, a tank 20 is shown adapted to be filled with the liquid metallic salts. Tank 20 is provided with an inlet 22 and a re-

circulation of the metallic salts is adapted to take place through pipes 24 and 26, each pipe being connected at one of its ends to tank 20, and at the other of its ends to a suitable pump 28, adapted to be operated by suitable means for causing the desired recirculation. Tank 20 is so constructed that ingress can be readily had to the interior thereof, as by making the tank in sections, hinged or otherwise connected (not shown).

Two cylinders or drums 30 and 32 are mounted in the tank as on bearing 34 and trunnion bearing 36, the outer or rotatable cylinder comprising a plurality of spaced longitudinal vanes 38 around the entire periphery. The inner cylinder 32 is solid around the lower half 40 of the cylinder, while the upper half comprises a plurality of spaced semi-circular vanes 42. The width of the vanes and the spacing thereof is identical in both cylinders and as shown are substantially $\frac{1}{16}$ of an inch whereby substantially square openings of approximately $\frac{1}{16}$ of an inch are obtained except at the first and last rows, as the openings are formed and concealed. The dimensions and spacing of the vanes are selected according to the size of the fuel particles desired and the speed at which the rotatable cylinder is to be rotated.

The two cylinders are mounted in the tank so that the inner cylinder 32 is stationary and the outer cylinder 30 is rotatable. Rotation is effected by providing trunnion 44 of cylinder 30 with a gear 46 meshing with gear 48, rotated by shaft 50 which in turn is rotated by a suitable source of power (not shown). The outer cylinder 30 is adapted to be rotated at a selected rate of speed depending upon the size of the fuel fragments desired and spacing between vanes.

An inlet 52 for the introduction of the emulsion is provided shown as extending through fixed trunnion bearing 36 whereby the inner periphery of the cylinder 32 may be constantly sprayed and maintained under pressure. It can be appreciated that as the cylinders are moistened by immersion in the bath of metallic salts and contact with the emulsion sprayed into the inner cylinder 32, that by rotation of the outer cylinder 30, intermittent openings are formed which produce the globules of solidified fuel (gasoline) which float to the surface and are carried out of the tank at the overflow openings 54 to be disposed of in a suitable manner as will be more particularly described.

Inner and outer cylinders 30 and 32 may have a bearing fit, and may be assembled by making outer cylinder 30 in section or the inner cylinder may be inserted through an end of the outer cylinder.

In Figures 6 and 7, a modified form of inner cylinder 56 is shown. This cylinder 56 is provided with a plurality of aligned spaced apertures 58 extending around the upper half of the cylinder. These apertures 58 are so disposed that when cylinder 56 is disposed within cylinder 30 openings are provided connecting the inside of cylinder 56 with the inside of tank 20 as the outer cylinder 30 is rotated, the openings thus formed being comparable to those formed by the association of cylinders 30 and 32.

In the construction shown in Figures 8 to 11 inclusive, another method of introducing the emulsion under pressure is shown. In this construction the tank 60 is provided with one or more inlets 62 (only one being shown) in the bottom of said tank 10 as shown in Figure 8, one disk 64 be-

ing shown as stationary and connected to the inlet, while the second disk 66 is rotatable being provided with a casing 68 secured to said disk 66 and integral with sleeve 70. Sleeve 70 is suitably journalled in the tank 60 and is provided with gear 72 adapted to be rotated by a gear 74 mounted on power shaft 76. A spacer 78 is disposed between disk 64 and casing 68 and apertures 80 are provided in inlet 62 to permit supply from inlet 62 to reach entirely under disk 64. In this construction we have a cutting or particle forming apparatus which operates in a manner similar to that acquired by the cylinders 30 and 32 in Figure 1, inasmuch as disk 64 is formed with a plurality of circular openings 82 formed by rings 84 connected by bridges 86 whereby spiders are formed, while the disk 66 is provided with a plurality of substantially triangular closure portions 88 to form openings 90, radiating outwardly from its center and substantially parallel sided.

The triangular form is selected to obtain equal spaces in the moving disk between the cutting surfaces, in the center as well as the peripherical part in order to obtain uniform fragments, compensating in this way for the speed of the cutting elements in the center or in the peripheral portion.

In the construction shown in Figure 11, stationary disk 92 is shown having apertures 94, the apertures preferably being disposed in substantially the same triangular alignment relationship to correspond to the cutting edges of the disk 66 to obtain the same uniform fragments regardless of the cutting location within the disk. That is, the apertures 94 in disk 92 are all arranged in triangular formation, radiating outwardly from the center, so that when in contact with the cutting disk, the fragments are formed of equal size in the center as in the peripheral portion of the disk.

As the disk 66 is rotated at a rapid rate of speed, intermittent openings are caused which create globules formed by contact of the emulsion with the metallic salt bath. Again, the globules created float to the surface and are disposed of in the manner described herein.

In Figure 12 a modified form of operating means is illustrated for the disk type device shown in Figure 8. In this construction tank 96, similar to tank 60 is provided with a desired number of inlets 98 connected to disk 100, similar to disks 64 or 92, a spacer 102 being provided, similar to spacer 78 to permit pressure supply of fluid over the entire undersurface of disk 100. Rotary disk 104 has a sliding tight fit over the upper surface of disk 100 and is similar to disk 66 for the same purpose. Disk 104 is provided with shaft 106 extending through a suitable stuffing box 108 and has gear 110, driven by drive shaft 112 through gear 114.

It is of course understood that tanks 60 and 96 are provided with inlet, outlet and recirculating means in the same manner as the construction shown in Figure 1.

In Figure 13 a modification is shown wherein a cylindrical tank 116 is provided with cylinders or drums 118 and 120 similar to cylinders 30 and 32 (Figure 1). Outer cylinder 118 is provided with bearing 121 journalled in the brace 122 secured in said tank 116, and at its other end cylinder 118 is provided with a trunnion bearing 124 suitably journalled in tank 116. Trunnion bearing 124 is provided adjacent its outer end with gear 126, the gear and trunnion bearing being rotated by drive shaft 128 having

gear 130 meshing with gear 126. Inner fixed cylinder 120 is assembled with the outer cylinder 118 in any desired manner as described above and is prevented from rotating in any desired manner. Recirculation means is provided for the metallic salts liquid, which means as shown is piping 132 connected at one end to tank 116 and at its other end to pump 134, piping 136 being also connected at one end to said pump and at the other end to tank 116.

Emulsion under pressure is introduced into the tanks 118 and 120 through piping 138, the pipe 138 extending into said tanks through trunnion bearing 124. A metal salts inlet 140 is connected to tank 116 adjacent the top thereof in a similar manner to inlet 22 (Figure 1).

One end 142 of tank 116 is open as at 143 and connected through passage 144 with a rotatable screen cylinder 146 to provide another step in the process to be more fully described. The operation of this form of device is otherwise similar to that described with respect to Figure 1.

In Figures 1 to 7 and 13 while one inner drum is described as being fixed and the other inner drum is described as being rotatable, it is, of course, understood that either may be stationary and the other rotatable, or they may be rotated in a chosen way with respect to each other to accomplish the desired result.

In the construction shown in Figure 17, a receptacle or tank 148 is provided with an inlet 150 for the bath of metallic salts. The emulsion under pressure is supplied through pipe 152 provided with spray nozzles 154 along the length of the pipe within the tank. Recirculation pipe 156 is provided having inlet 158 and outlet 160 connected to tank 148, a pump 162 being provided in said pipe 156.

As the fuel emulsion is sprayed into the metallic salt bath, the particles of congealed fuel formed float to the surface, and are conveyed away. The conveying apparatus 164 comprises a perforated belt 166 having vanes 168 angularly disposed in the direction of travel, said belt being moved by suitable means by rollers 170 and 172, the top of said belt being disposed in a plane approximately that at the level of the metallic salt bath and as the gel or particles float to the surface they are carried off through the overflow opening 174, and trough 176 where they drop into the container 178. In place of a conveyor, an overflow or other conveying means may be provided. In passing through trough 176 some moisture will drop through screen 180 into tank 182 associated with tank 148, and tank 178 may also be connected to tank 182 through a screen 184 so that moisture may be drained from tank 178, but the particles are retained in tank 178.

In order to obtain a drying or reduction of the moisture content of the solidified or congealed particles so that the particles are of uniform dryness, the apparatus shown in Figure 15 is utilized, it being understood this may be used with any of the forming apparatus described in Figures 1 to 14 and 17.

In order to dry the formed particles an inclined rotating cylinder or drum 186 having three areas or sections 188, 190 and 192 is provided. The first section 188 is connected through chute or passage 194 (Figure 15) (or 144 in Figure 13) to the tank 196 which may be in the form of any of the tanks shown in Figures 1, 8, 12, 13 or 17, said section being formed of screening to permit the fluid to drain off into a trough 200 and sub-

sequently returned to a source of salt bath supply or may be recirculated. In the case of the apparatus shown in Figure 17 passage 194 may take the place of trough 178 or may be used in conjunction therewith. Due to the inclination of the cylinder 186, the particles supplied from outlet 195 gravitate into the second area 190 where they are subjected to a cleansing by water jets 202 supplied by pipe 204, the water draining off through the screening of section 190 to waste trough 206. Continued gravitation of the particles deposits them in the third section 192 which is open screening and means may be provided for circulating hot air or air pressure therethrough as from air pipe 208 provided with nozzles 210. Rotation of cylinder 186 and passage of the particles therethrough eliminates the surface moisture, and the particles are moved through the cylinder to the stationary exit passage 212 from which they pass into receptacle 214. If desired the particles may be supplied from passage 212 to motor driven centrifuge 216 which is operated in the well known manner to eliminate moisture without the use of heat, thus preventing loss of fuel through evaporation. The centrifuge may be used in place of cylinder 186, or with it, or in conjunction with the cyclon shown in Figure 16. In using the centrifuge, its speed is controlled so that water above the desired amount is eliminated. The water, being heavier than the fuel, as gasoline, is first thrown out and when fuel elimination becomes evident, the speed of the centrifuge is reduced or it is completely stopped. The control of the desired dryness can be attained as the desired speed and time necessary for the desired conditioning process is determined by the use of the machine with the known product.

If it is desired to obtain a drier product, the apparatus shown in Figure 16 is used. This may be used in place of the cylinder 186, or the motor drive centrifuge 216, or in conjunction with either.

If used with the cylinder 186, as shown in Figure 16, as the particles fall from the stationary passage 212, they enter the inlet 218 of a cyclon construction indicated generally at 220. Inlet 218 communicates with U-shaped section 222 which is provided with sleeve 224 which in turn telescopically fits the lower end 226 of the upper curved or inverted U-shaped section 228 to enable the height of the dam 229 formed by the section to be adjusted.

An inlet 230 for heated air is provided connected at 232 to the U-shaped section 222, a pump or fan 234 being provided for pumping from a suitable source to section 222, and an aspirator or suction device 236 is provided on the vertical portion 238 of the section 228. Means 240 is provided for entraining air and carrying the air to a condenser and/or separator (not shown) where it is dried and the fuel particles separated from the air for resupply of the clean air to the inlet 230 from a suitable source as that to which inlet 230 is connected. It can be appreciated that the height of the dam 229 will help determine the moisture content of the rising particles passing thererover. The degree of moisture in the air and the pressure of the air, which determines the speed of the particles is important, because by properly relating these factors it is possible to obtain particles of uniform and selected weight and moisture content.

Additional drying means are provided in the vertical portion 226 of section 228 and in section 222 after the connection 232 in the form of infra-red lights 242, the number used being controlled by a suitable switch and when used the adjacent portion of the conduits are provided with windows to permit the ready passage of light rays therethrough.

At the end of the travel of the particles through the above apparatus, they are deposited in a receptacle 244 for subsequent transportation and storage.

It can be appreciated that a standardized product is obtained by the use of a controlled quantity of air, regulated temperature, and the determined residence of the particles in the area A of the cyclon, the absorption power of the air being dependent upon the humidity coefficient of the circulated air and its temperature.

For purpose of speed and economic production in certain commercial fields, the use of the centrifuge alone is sufficient to obtain a satisfactory product. Where the cyclon is used, a product having a higher degree of moisture elimination is obtained not achieved by the use of the centrifuge alone. Obviously, use of both means results in a product from which a higher percentage of fuel in relation to weight can be recovered.

It will be appreciated that with the use of the atomizing process disclosed herein, inasmuch as the jets are under the surface of the liquid in the tanks, that the sprayed product (a mixture of air and gasoline emulsion) does not reach the air as a spray so there is substantially no evaporation of the fuel, further all danger from explosion is eliminated.

The fuel products to be congealed by the herein disclosed apparatus may be congealed by the use of the fuel products and chemicals as set forth in application Serial Nos. 12,153 and 12,154, Jean Pathus Labour, filed February 28, 1948, and French patent de Granville, Patent No. 802,727, published September 14, 1936.

It is to be understood that this application is not to be limited by the exact embodiments of the device shown, which are merely by way of illustration and not limitation as various and other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

We claim:

1. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, said tank having an outlet, a pair of drums mounted in said tank, one of said drums being within the other, one of said drums being stationary and the other rotatable, means for rotating the rotatable drum, said drums having openings of a predetermined shape, the openings in one drum being adapted to be moved over the openings in the other drum intermittently into and out of register, and means for supplying fuel into said drums to be acted on by said solution to congeal said fuel into a lighter than solution mass causing it to float to the openings and be cut thereby and float towards the surface of the solution in said tank from said drums whereby the cut congealed substance may be withdrawn from the outlet of the tank.

2. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, said tank having

an outlet, a pair of drums mounted in said tank, one of said drums being within the other, one of said drums being stationary and the other rotatable, means for rotating the rotatable drum, said drums having openings of a predetermined shape, the openings in one drum being adapted to be moved over the openings in the other drum intermittently into and out of register, and means for supplying fuel into said drums to be acted on by said solution to congeal said fuel into a lighter than solution mass causing it to float to the openings and be cut thereby and float towards the surface of the solution in said tank from said drums whereby the cut congealed substance may be withdrawn from the outlet of the tank, and means for circulating said solution in said tank.

3. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, said tank having an outlet, a pair of drums mounted in said tank, one of said drums being within the other, the inner drum being a stationary drum having a lower and an upper section comprising arcuately disposed spaced straps, the outer of said drums being rotatable and having the peripheral surface thereof comprising spaced axially disposed straps, movement of the outer drum over the inner drum causing the straps of said drums to form openings of a predetermined shape, means for rotating the rotatable drum and means for supplying fuel into the inner drum to be acted upon by said solution to congeal said fuel into a lighter than solution mass, causing the mass to float to the openings and to be cut, whereby the cut substance floats towards the surface of the solution in said tank so that it may be removed from said outlet.

4. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, said tank having an outlet, a pair of drums mounted in said tank, one of said drums being within the other, the inner of said drums being stationary and the outer of said drums being rotatable, said inner drum having a lower closed portion and an upper portion perforated by spaced holes of a predetermined shape, means for rotating the outer drum, the surface of said outer drum comprising axially disposed spaced straps spaced substantially an amount equal to the diameter of the holes in the inner strap, means for supplying fuel into said inner drum to be acted upon by said solution to congeal said fuel into a lighter than solution mass, causing it to float to the openings and be cut thereby and float towards the surface of the solution in said tank from said drums, whereby the congealed substance may be withdrawn from the outlet of the tank.

5. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, and means for supplying a fuel emulsion to said tank in measured amounts, said means including fuel cutting means positioned below the surface of said solution and comprising a stationary and a rotatable plate both having openings and being adapted to be rotated intermittently into and out of register.

6. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected solution thereto to maintain the solution at a predetermined level therein, said tank having an outlet, a pair of drums mounted in said tank, one of said drums being within the other, the inner drum being a stationary drum having a lower and an upper section comprising arcuately disposed spaced straps, the outer of said drums being rotatable and having the peripheral surface thereof comprising spaced axially disposed straps, movement of the outer drum over the inner drum causing the straps of said drums to form openings of a predetermined shape, means for rotating the rotatable drum and means for supplying fuel into the inner drum to be acted upon by said solution to congeal said fuel into a lighter than solution mass, causing the mass to float to the openings and to be cut, whereby the cut substance floats towards the surface of the solution in said tank so that it may be removed from said outlet, and means for circulating said solution in said tank.

7. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, said tank having an outlet, a pair of drums mounted in said tank, one of said drums being within the other, the inner of said drums being stationary and the outer of said drums being rotatable, said inner drum having a lower closed portion and an upper portion perforated by spaced holes of a predetermined shape, means for rotating the outer drum, the surface of said outer drum comprising axially disposed spaced straps spaced substantially an amount equal to the diameter of the holes in the inner strap, means for supplying fuel into said inner drum to be acted upon by said solution to congeal said fuel into a lighter than solution mass, causing it to float to the openings and be cut thereby and float towards the surface of the solution in said tank from said drums, whereby the congealed substance may be withdrawn from the outlet of the tank, and means for circulating said solution in said tank.

8. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, means for supplying a fuel emulsion to said tank in measured amounts, said means including fuel cutting means positioned below the surface of said solution and comprising a stationary and a rotatable plate both having openings and being adapted to be rotated intermittently into and out of register, and means for circulating said solution in said tank.

9. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, fuel supply means for supplying fuel to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into a lighter than solution mass, and relatively rotatable members for cutting the fuel mass into particles, said members having openings of a predetermined shape, the openings in one member being adapted to be moved over the openings in the other member intermittently into and out of register.

10. In a device of the character described, the

combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, fuel supply means for supplying fuel to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into a lighter than solution mass, and relatively rotatable members for cutting the fuel mass into particles, said members having openings of a predetermined shape, the openings in one member being adapted to be moved over the openings in the other member intermittently into and out of register, and means for circulating said solution in said tank.

11. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, and means for supplying comminuted particles of fuel emulsion to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into a congealed mass which is lighter than the congealing solution, said means including fuel cutting means positioned below the surface of said congealing solution and comprising a stationary and a rotatable plate both having openings and being adapted to be rotated intermittently into and of register.

12. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, fuel supply means for supplying fuel to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into a lighter than solution mass, and relatively rotatable members for cutting the fuel mass into particles, said relatively rotatable members comprising a stationary disk member having passages of a given configuration, a rotatable disk member rotatably mounted on said stationary disk member having passages of a certain configuration, the configurations of the passages being chosen so that a desired size of particle is produced by passing fuel therethrough, and means for rotating said rotatable disk member, said disk members being so disposed with respect to said fuel supply means that the fuel passes through at least a passage in each disk before entering the solution.

13. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, fuel supply means for supplying fuel to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into a lighter than solution mass, and relatively rotatable members for cutting the fuel mass into particles, said relatively rotatable members comprising a stationary disk member having passages of a given configuration, a rotatable disk member rotatably mounted on said stationary disk member having passages of a certain configuration, the configurations of the passages being chosen so that a desired size of particle is produced by passing fuel therethrough, and means for rotating said rotatable disk member, said disk members being so disposed with respect to said fuel supply means that the fuel passes through at least a passage in each disk before entering the solution, and means for circulating said solution in said tank.

14. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, fuel supply means for supplying fuel to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into a lighter than solution mass, relatively rotatable members for cutting the fuel mass into particles, and drying means for receiving the particles from said tank and washing and drying said particles.

15. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, means for supplying comminuted particles of fuel emulsion to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into lighter than solution congealed particles, said means including fuel cutting means positioned below the surface of said solution, and drying means for receiving the particles from said tank and washing and drying said particles, said last named means comprising a rotatable drum, said drum having a plurality of reticulated sections, a spraying device disposed in one of said sections, and a drying device disposed in a succeeding section.

16. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermiend level therein, means for supplying comminuted particles of fuel emulsion to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into lighter than solution congealed particles, said means including fuel cutting means positioned below the surface of said solution, and drying means for receiving the particles from said tank and washing and drying said particles, said last named means comprising a rotatable drum, said drum having a plurality of reticulated sections, a spraying device disposed in one of said sections, a drying device disposed in a succeeding section, and additional drying means for receiving particles from the last named drying means comprising a substantially U-shaped member having an inlet for receiving the particles to be dried, a substantially inverted U-shaped member having an inlet connected to the outlet of the first named member, means between the outlet of said first member and the inlet of the second member permitting relative bodily movement therebetween, means for supplying heated air under pressure to said first member to move the particles to the outlet of the second member, a suction device connected to said second member adjacent the outlet thereof, and means connected to the outlet of said second member for entraining air and moisture.

17. In a device of the character described, the combination of a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, means for supplying comminuted particles of fuel emulsion to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into lighter than solution congealed particles, said means including fuel cutting means positioned below the surface of said solution, and drying means for receiving the particles from said

tank and drying said particles, said last named means comprising a substantially U-shaped member having an inlet for receiving the particles to be dried, a substantially inverted U-shaped member having an inlet connected to the outlet of the first named member, means between the outlet of said first member and the inlet of the second member permitting relative bodily movement therebetween, means for supplying heated air under pressure to said first member to move the particles to the outlet of the second member, a suction device connected to said second member adjacent the outlet thereof, and means connected to the outlet of said second member for entraining air and moisture.

18. A device according to claim 16, wherein controllable heating means are disposed adjacent said first and second members.

19. A device according to claim 17, wherein controllable heating means are disposed adjacent said first and second members.

20. In a device of the character described, comprising a tank having an inlet for supplying a chosen amount of selected fuel congealing solution thereto to maintain the solution at a predetermined level therein, and means for supplying comminuted particles of fuel emulsion to said tank below the surface of the solution therein to be acted on by said solution to congeal said fuel into lighter than solution congealed particles: drying means for receiving the particles from said tank and washing and drying said particles, said last named means comprising a rotatable drum, said drum having a plurality of reticulated sections, a spraying device disposed in one of said sections, and a drying device disposed in a succeeding section, a receptacle for receiving the dried particles, and a centrifuge

interposed between said tank and receptacle for receiving and drying said particles.

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