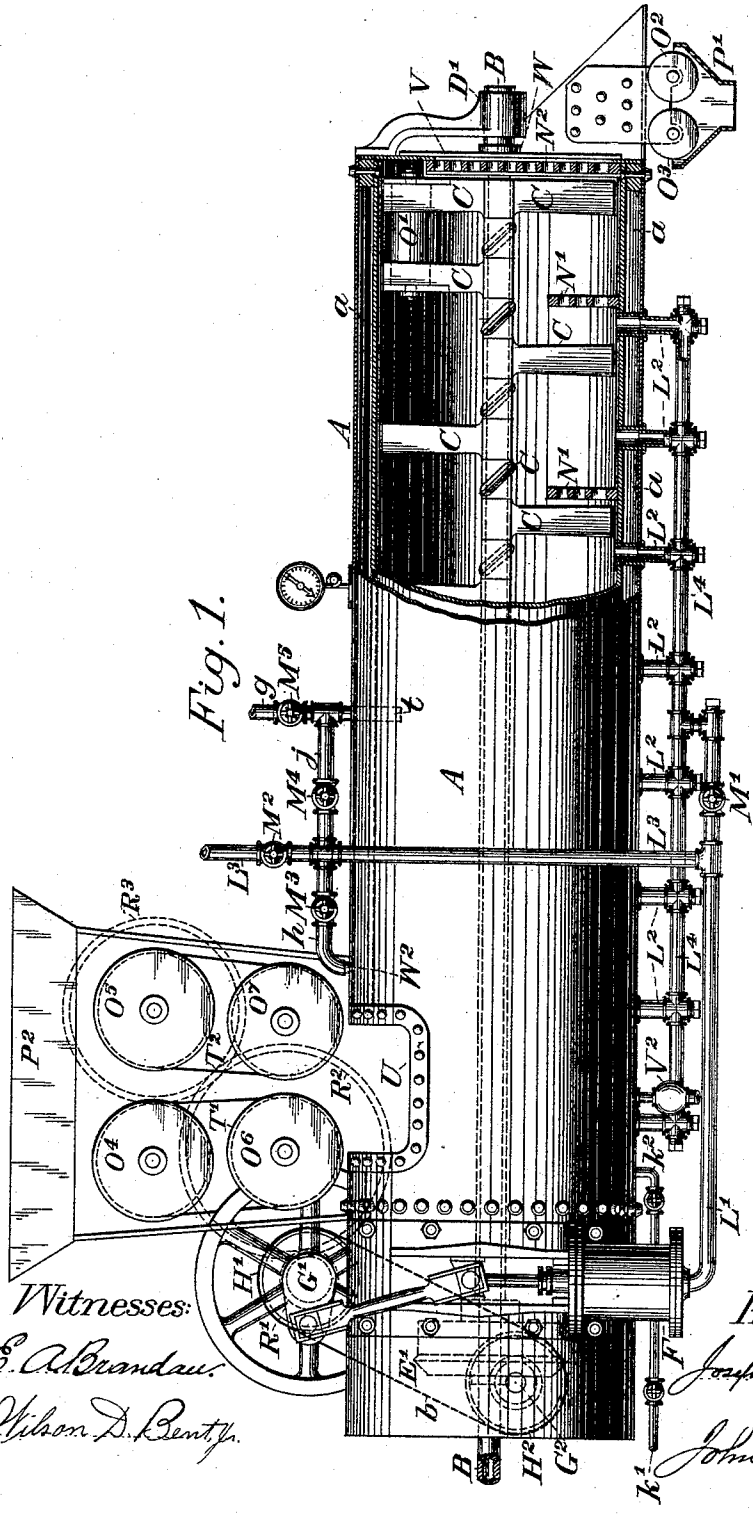
(No Model.) 2 Sheets—Sheet 1.

J. B. JARDINE.

APPARATUS FOR TREATING OR REDUCING BITUMINOUS SUBSTANCES.

No. 498,957. Patented June 6, 1893.

Fig. 1.



Witnesses:
E. A. Brandau.
Wilson D. Bentley.

Inventor:
Joseph B. Jardine
By
John Richards
Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

2 Sheets—Sheet 2.

J. B. JARDINE.

APPARATUS FOR TREATING OR REDUCING BITUMINOUS SUBSTANCES.

No. 498,957. Patented June 6, 1893.

Fig. 4.

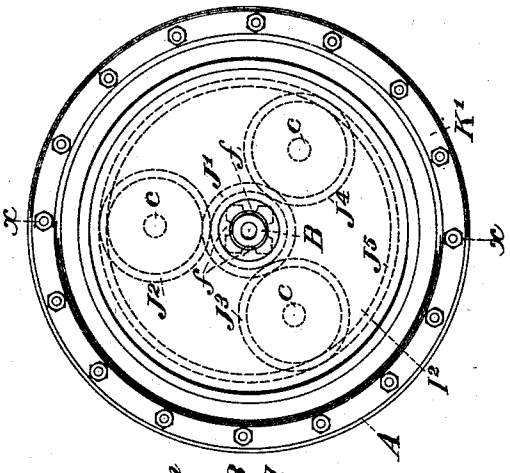


Fig. 5.

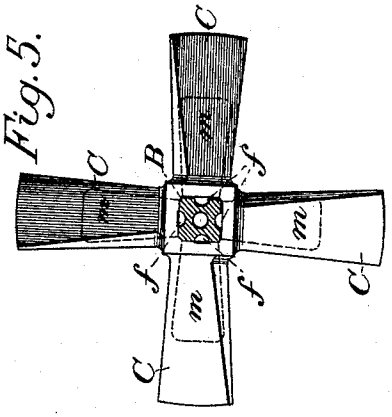


Fig. 3.

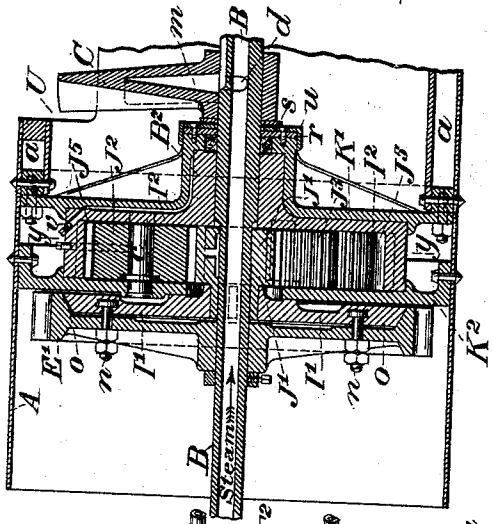


Fig. 6.

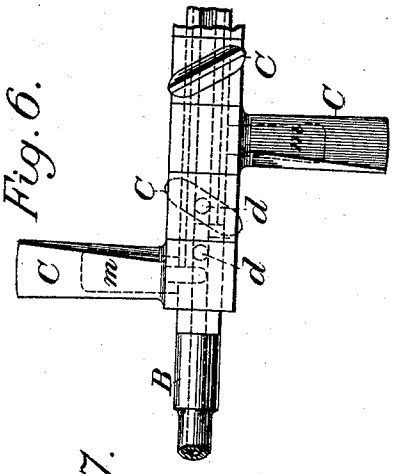


Fig. 7.

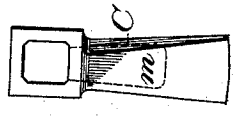
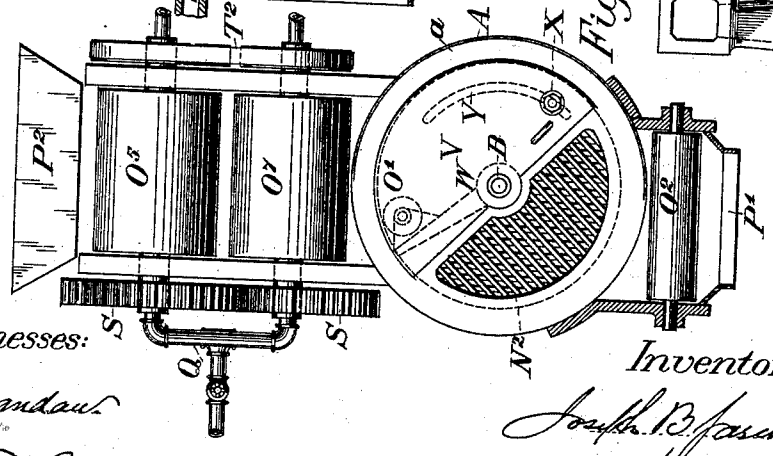


Fig. 2.



Witnesses:

E. A. Brandau

Hubert D. Bentley

Inventor:

Joseph B. Jardine

by

John Richards

Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH BOYES JARDINE, OF SAN FRANCISCO, CALIFORNIA.

APPARATUS FOR TREATING OR REDUCING BITUMINOUS SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 498,957, dated June 6, 1893.

Application filed May 25, 1892. Serial No. 434,355. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH BOYES JARDINE, a subject of the Queen of Great Britain, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Apparatus for Treating or Reducing Bituminous Substances; and I hereby declare the following specification, with the drawings therewith and forming a part of the same, to be a full and exact description of my invention.

My present invention relates to treating or reducing bituminous matter, such as asphaltum or the hard products of petroleum mixed with earthy matter, by means of heat and macerating apparatus, and consists in various improvements on an invention for which Letters Patent of the United States, No. 442,441, were granted to me on December 9, 1890, for "apparatus for reducing, laying, and rolling bituminous rock, asphalt, &c."

My present invention includes a more effective method of macerating or reducing the material by means of mechanical agents, acting thereon when at its highest temperature; also in a more efficient method of applying steam or heat thereto.

My invention also includes supplementary crushing rollers applied at the rear or discharge end of the machine, and in diaphragms or baffling plates in the main vessel or cylinder through which the heated material is forced by the action of the conveyer.

My invention also includes improved means of driving the main conveyer or other parts subject to obstruction, and various other details that will be more fully pointed out and explained in connection with the drawings, in which—

Figure 1 is a side elevation, partially in section, showing one of my improved machines for treating or reducing bituminous substances. Fig. 2 is an end view of the same with some of the details omitted. Fig. 3 is a longitudinal section through the driving gearing that operates the conveyer shaft. Fig. 4 is an end view of the cylinder or case that contains the inclosed driving gearing, showing the position of the reducing pinions and wheels therein. Fig. 5 is a transverse view and section of the conveyer shaft, and the hollow vanes mounted thereon. Fig. 6 is a side view of the same, and Fig. 7 is a side view of one of the hollow vanes detached.

Similar letters of reference on the different figures indicate corresponding parts of the apparatus.

The main cylinder A is made with a double shell so as to form a steam or heat jacket *a a* all around it, and can be supported on wheels if for portable purposes, or mounted on a foundation if employed for stationary work. It can be set level, as indicated in the drawings, or can be arranged with an inclination upward toward the discharge end, so as to offer some resistance by gravity to the progress of the material from the feed to the discharge ends, and thus regulate the depth or quantity of the material in the cylinder while being treated.

Through the axis of the main cylinder A there is a hollow shaft B, rectangular in its middle section where the vanes C are mounted thereon, and supported in the bracket bearing D′, at the discharge end, and also in the plates or diaphragm K′ and clutch plate I′ at the driven end, as shown in Fig. 3. Steam is admitted through the shaft B, as indicated in Fig. 3, and makes its way out through apertures *d* into the chambers *m* of the vanes C, in the manner set forth in my previous Letters Patent, hereinbefore referred to. To drive this shaft or conveyer I employ, preferably, a steam engine F, constructed integrally with, or mounted on the machine to drive a crank shaft G′. By means of pulleys H′ and H^2, and the band or chain *b*, power is conveyed to the shaft G^2, which has a bevel-skew pinion meshing into the large wheel E′, Fig. 1, which corresponds to the spur wheel E′, Fig. 3. The method of connecting here not being important, and varied to suit the conveniences of construction or use, I have shown in one case a bevel wheel, and the other case a spur wheel, the functions being identical.

At the back of the main driving wheel E′ is placed a clutch plate I′, fitting in and attached to the rim of the wheel E′, with oblique faces at *o*, as shown in Fig. 3. This plate I′ is connected to wheel E′ by means of the bolts *n*, the heads of which fit into a continuous circular slot in the clutch plate I′, so that in case of positive obstruction of the main axis B these bolts will slide in the groove

and permit the plate I′ to stop while the wheel E′ continues in motion.

The pinion J′ is keyed into, or formed integrally, with the friction plate I′, and meshes into the three pinions J^2, J^3 and J^4 mounted on studs *c* fixed in the plate K^2. These pinions in turn mesh into an internal, annular gear wheel J^5, attached to or inserted in the driving disk I^2, as indicated by dotted lines in Fig. 4. This driving disk I^2 is keyed on the shaft B, and its hub or boss B^2 has a bearing in the diaphragm plate K′, which forms one end of the main cylinder A, thus providing support for both the driving disk I^2 and also for the shaft B at that end.

To prevent the bituminous substance under treatment from finding its way into this bearing of the driving disk I^2, I employ a covering plate *r*, confining the fibrous packing *s*, and over the whole a cap or covering *u*, as shown in Fig. 3. In this method of driving, which is also applicable to the first crushing rollers O^4, O^5, O^6 and O^7, there is attained a slow motion of the main axis, and the reducing gearing consisting of the pinions J′, J^2, J^3, J^4 and internal gear wheel J^5, all being closely incased, they can be flooded with oil and thus maintain a thorough lubrication of these parts. The bearing of the hub or boss of the driving disk I^2, which forms also the bearing of the main axis B is lubricated by an oil way *v*, as shown in Fig. 3.

Steam is admitted by means of a common trunnion joint into the hollow main axis B, from where if flows outward through holes *d* into grooves *f* and into the hollow chambers *m* in the vanes C, so the main axis B, vanes C, and external shell or main cylinder A are all maintained at a high temperature.

The steam for heating the main cylinder A, I take from the boiler, by means of the pipe *g* and branch *j* and *h* connecting with the annular space or jacket *a* at W, as shown in Fig. 1.

In the treatment of certain kinds of material, I find it necessary to inject steam directly into the substance itself; either initial or exhaust steam, both of which are provided for. When initial steam, it is injected by means of the nipple *t*, closing the valves M^3 and M^4 for that purpose. Exhaust steam is injected by means of the vertical pipe L^3, connected with the branch pipes *h* and *j*, as will be explained farther on.

The engine F I supply by steam either directly from the boiler, or by means of a pipe *k*′ connecting with a steam boiler or the pipe k^2, connecting with the steam space or jacket *a;* in the latter case the steam first surrounds and heats the main chamber and then passes to the engine F. As considerable condensation occurs in the jacket or space *a*, when operating in this manner I employ a steam trap V^2 from which the condensed water is conducted back to the boiler, or to the supply for the same.

The exhaust steam from the engine passes first through the pipe L′ and thence to either the pipe L^3, or, if to be injected among the material is sent to the pipe L^4, as the valves M′ and M^2 may determine. If the valve M^2 is closed and the one M′ is open, then the exhaust steam passes into the pipe L^4 and up through the short pipes L^2 into the main chamber of the cylinder A, into and mingling with the material being treated therein. If the valves M′, M^2, M^3 and M^5 are closed, then the exhaust steam passes through the pipe *j*, into the main chamber as before, but on the top of the material being treated. If the valves M′, M^2, M^4 and M^5 are closed, then the exhaust steam passes through the valve M^3 and the pipe *h*, into the steam-jacket space *a*, around the main chamber A, and the pressure therein can be increased at pleasure, until the back pressure on the engine hinders its performance of the work of driving. By closing all valves except M^2, the exhaust steam passes off through the pipe L^3 to the air or to a condenser. In this manner it may be seen that, when required, I can use the exhaust steam in the mass of the material being treated, or on the top of the material in the main chamber of the vessel A, or the exhaust steam can be discharged into the steam jacket *a* surrounding the main vessel A, and in the latter case with any degree of pressure that resistance, or back pressure, the steam engine F will permit, this being regulated by the valves M′ and M^2.

In the main chamber of the cylinder A there is placed at intervals diaphragms or screens N′ N^2 perforated, as shown in section in Fig. 1, and in side view Fig. 2, or these screens may be corrugated so that the material instead of passing through, may pass over them when thin or fluid enough for treatment in that manner. I however prefer, for common working, perforations, as shown in the drawings. These diaphragms or screens N′ are so placed that the vanes C pass near to their flat faces, forcing the heated meaterial through the perforations, or over them because of the angle of the vanes on the forward or feeding side, and scraping it away on the delivery side. Perforations through these screens N′ can be varied in size, being made smaller or finer, progressively, from the feed to the discharge end of the machine, or, as before remarked, may, in some cases, be omitted altogether.

At or near the discharge end of the main cylinder A, I place a roller O′, supported on or connected to two of the vanes C, or to other sufficient support. This roller O′ is carried around the main axis B, and mounted so as to revolve on its own axis in close contact with the inner shell or wall of the main chamber, and to crush any lumps or nodules of a given size that may have passed through the screens N′, or have not been dissolved by heat, as the material passed through the machine to this point. Instead of a single roller O′, two or more can be applied, so as to re-

lieve the shaft B from lateral strain. The material, after receiving the action of this roller O′, is next expelled through the screen N^2, falls on and passes between the rollers O^2 O^3, where nodules, if any remain, are finally crushed, and the completed product passes out of the hopper P′ ready for laying, or to be packed for future use. The last or final discharge screen N^2 is set in the head of the main containing vessel A, in a diagonal position as shown in Fig. 7, and is provided with a pivoted or hinged cover V, that can be swung around so as to cover any portion, or all of the screen N^2. This plate is mounted loosely at W, on the shaft B, and when set in the required position, is fastened by means of the screw X, set in the curved slot Y, as shown in Fig. 2. By partially closing this plate and obstructing the passage of the material through the screen N^2, the depth or amount retained in the main vessel can be regulated so as to secure a proper action of the vanes C, rollers O′, and internal diaphragms N′, as the nature of the material or its subsequent uses may demand.

Following now the operation of the machine, and the passage of material through it: the crude material, usually petroleum mixed with earthy matter, or bituminous rock, as it is commonly called, is fed in at hopper P^2, falling on the first pair of rollers O^4 O^5, by which it is crushed to a predetermined size, according to the space between the rollers. It then falls to the second pair of rollers O^6 O^7, and is further reduced by crushing; these second rollers being set nearer together. At the same time the material, being softened by the heat of these rollers, all of which are filled by hot steam, injected therein by means of the pipes at Q, Fig. 2, and as set forth in my Letters Patent hereinbefore referred to. These rollers are geared to the engine F, by means of a pinion R′ on the engine shaft, and wheels R^2 and R^3, on the axis of the rolls O^5 and O^6, as indicated by dotted lines in Fig. 1. These rollers O^4 O^5 also O^6 O^7 are connected together by spur wheels S S, and the other rollers O^4 and O^7, are driven by belts or pitch chains T′ T^2 as shown in Fig. 2. From these rollers O^4 O^5 O^6 O^7, the material, after being crushed and partially softened by heat, falls through the inlet U into the main chamber A′, where it meets the heat and moisture imparted by the exhaust steam flowing in through the pipes L^2, or direct steam entering through the pipe *t*, and is crushed, mixed and macerated by the action of the revolving conveyer vanes C, also by being forced through, or over, the diaphragms N, until it reaches the final processes performed by the rollers O′, O^2 and O^3, and is discharged.

In the construction of the apparatus, as here shown, it will be seen that the material is progressively treated and is all the time in contact with hot surfaces, crushed by rollers, macerated by rubbing, and passed through screens, also when required is saturated by hot steam, and moisture injected into and mingled with the mass in the main vessel.

Having thus explained the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In apparatus for reducing bituminous substances, a main containing vessel, a steam jacket surrounding the same, connections from the steam jacket to the boiler and also to a steam engine so arranged that the steam supply for the engine can be first passed through the steam jacket and then to the engine, a revolving helical conveyer within the main vessel, having a hollow axis and hollow vanes or plates so that the whole can be heated by steam introduced through the axis of the shaft, substantially as described.

2. In an apparatus for reducing bituminous substances, a main containing vessel having double walls and a steam jacket around its exterior, a steam engine in connection therewith so arranged that the exhaust steam of the engine can when required be injected upward from the bottom into the material being treated or discharged on the top thereof by means of pipes and valves and a steam trap connected with the steam jacket space so that the water of condensation from the steam jacket will not pass into the engine, substantially as described.

3. An apparatus for reducing bituminous substances, a main containing vessel having double walls, and a steam jacket around its exterior, connected with a steam boiler, and also a steam engine, so the steam will pass through the jacket on its way from the boiler to the engine, a steam trap connected with the steam jacket space so that the water of condensation from the steam jacket will not pass into the engines in the manner substantially as and for the purposes described.

4. In apparatus for reducing bituminous substances, a main containing vessel with double walls, and surrounded by steam to maintain a high temperature, a helical conveyer therein, having a hollow axis and hollow vanes or blades, so the whole can be heated by steam introduced through the axis of the shaft; screens or baffle plates set at intervals in the main vessel, between the vanes, and transverse to the axis of the conveyer, so the material will, on its passage through the machine, be forced through or over these plates or screens by the action of the vanes, and thus more effectually reduced, in the manner substantially as and for the purposes specified.

5. In a machine for reducing bituminous substances, a main containing vessel, a revolving helical conveyer therein; screens or baffling plates between the vanes, and transverse to the axis of the conveyer, a final screen or grated plate in the end of the main containing vessel having a hinged slide or cover as herein described, so the discharge area through the screen, and the amount of material retained in the main containing vessel, can be regulated by adjustment of the slide cover,

in the manner and for the purposes substantially as described.

6. In apparatus for reducing bituminous substances, a main containing vessel surrounded by steam, a revolving helical conveyer therein, so arranged as to slowly convey the material from the receiving to the discharge end of the main vessel, baffling plates or screens interposed between the vanes of the conveyer and a roll or rolls mounted on and at the discharge end of the conveyer, so as to crush any lumps that may pass through the screens or plates, in the manner and for the purposes herein described.

7. In apparatus for reducing bituminous substances, a main containing vessel surrounded by a steam jacket, a hollow, steam-heated, helical conveyer revolubly mounted therein, screens or baffling plates fixed to the main containing vessel, and a roll or rollers radially supported at the end of and revolving with the conveyer shaft, an adjustable discharge screen or grating, and a final pair of finishing rollers through which the material will pass after leaving the discharge screens, in the manner substantially as and for the purposes specified.

8. In apparatus for reducing bituminous substances, a main containing vessel, surrounded by steam, a revolving, helical conveyer therein, and a steam engine connected therewith, so the exhaust steam can be discharged into the main chamber through a series of pipes, and at a number of points along the main cylinder, and among the material being treated, valves to control the exhaust steam so as to regulate the flow of exhaust steam, and the amount which is injected, a steam trap connected with the steam jacket space so that the water of condensation from the steam jacket will not pass into the engine substantially in the manner and for the purposes described.

9. In apparatus for reducing bituminous substances, a double walled containing vessel, surrounded by steam, a revolving helical conveyer therein, connected to the driving power by means of a slip clutch, as herein described, so that in case of obstruction the conveyer may stop and the driving power continue in motion without danger of breaking the gearing or other parts, in the manner substantially as and for the purposes set forth and described.

10. In apparatus for reducing bituminous substances, a main containing vessel, a revoluble helical conveyer therein, mounted on and supported by the ends of the main vessel, a main driving wheel connected by a friction clutch to the conveyer, a central driving pinion driven by the clutch plate, three or more pinions mounted on a fixed plate meshing into the pinion and into an internal gear wheel keyed to the conveyer shaft, so as to reduce the motion and give the required force for operating the conveyer in tough plastic material, in the manner substantially as and for the purposes specified.

11. In apparatus for reducing bituminous substances, a main containing vessel, surrounded and heated by steam, a steam heated conveyer revolving therein, connected to the driving power by means of an internal gear wheel, interposed pinions, and a central driving pinion, as herein described, the reducing gearing incased and protected from grit, dirt and the material treated, and so as to be flooded with lubricating oil, in the manner substantially as and for the purposes set forth and described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

JOSEPH BOYES JARDINE.

Witnesses:

ALFRED A. ENQUIST,

WILSON D. BENT, Jr.