No. 874,181. PATENTED DEC. 17, 1907.

E. GARBIN.

APPARATUS FOR UTILIZING THE WASTE OF CELLULOID AND SIMILAR SUBSTANCES.

APPLICATION FILED JUNE 14, 1905.

3 SHEETS—SHEET 1.

Fig. 1

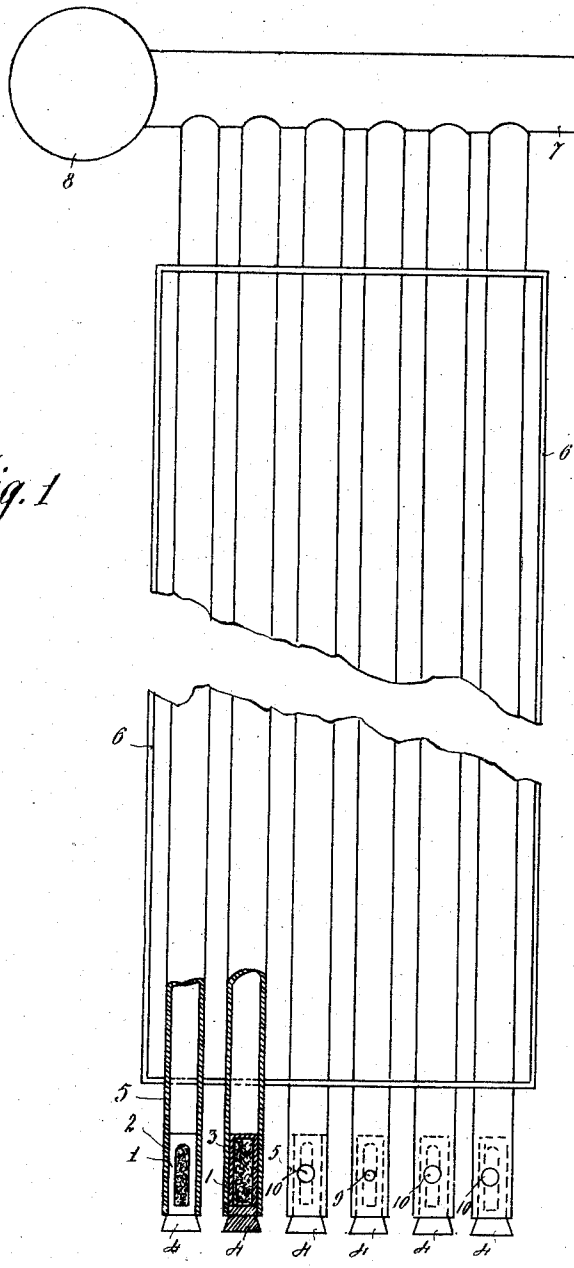

Fig. 2.

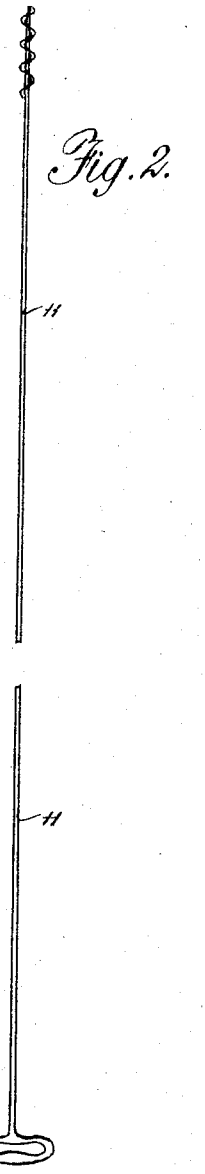

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Fig. 3

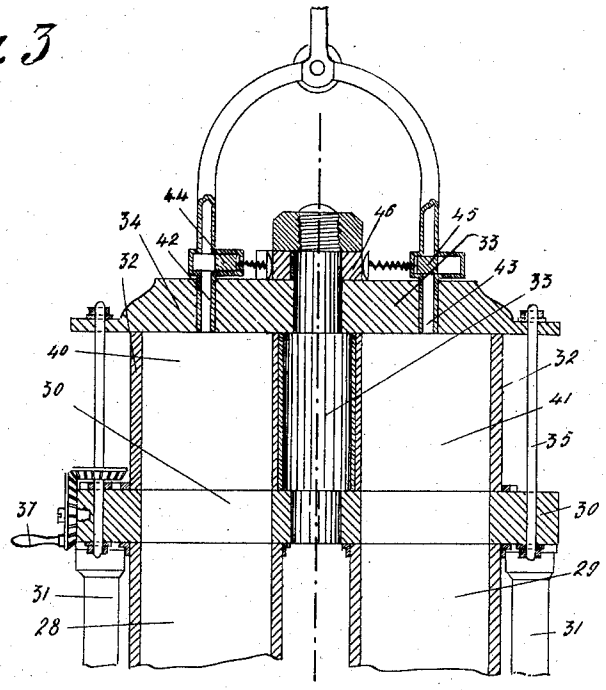
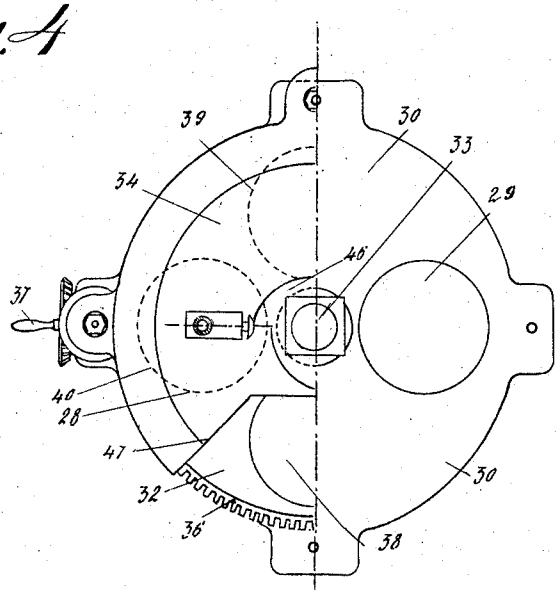


Fig. 4



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3 SHEETS—SHEET 3.

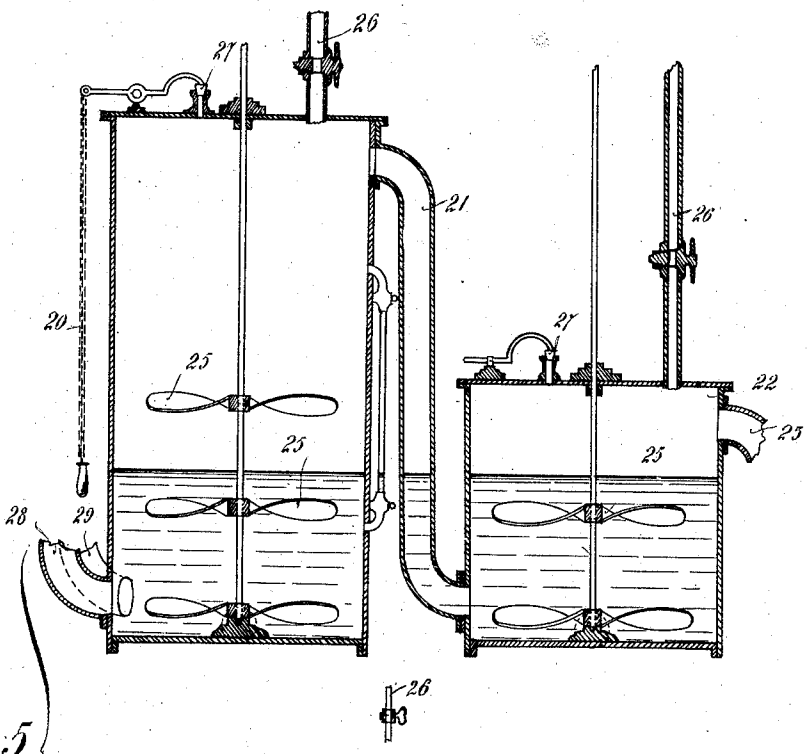
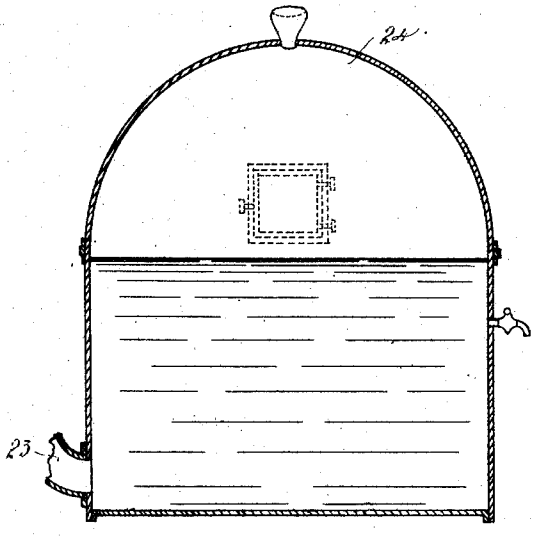


Fig. 5



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR UTILIZING THE WASTE OF CELLULOID AND SIMILAR SUBSTANCES.

No. 874,181. Specification of Letters Patent. Patented Dec. 17, 1907.

Application filed June 14, 1905. Serial No. 265,232.

To all whom it may concern:

Be it known that I, ERNESTO GARBIN, manufacturer, citizen of the Kingdom of Italy, residing at Genoa, Piazza Porta Vecchia N. 11, Italy, have invented certain new and useful Improvements in Apparatus for Utilizing the Waste of Celluloid and Similar Substances, of which the following is a specification.

The object of the present invention is a process for utilizing the waste of celluloid, and other similar substances containing nitro cellulose which process permits of obtaining a better result than any which has been obtained up to the present.

The essential characteristic of this process is to obtain as the final product the isolated ingredients which compose the celluloid,—principally camphor, nitric acid, cellulose, naphthalene, coloring matters, fatty acids, etc.

Explained in a few words, the process comprises two operations, the one by dry process and the other by wet process. A portion of the material is submitted to the first operation or dry process and another portion of the material to the other operation or wet process, using a portion of the products obtained by the first operation for completing a reaction which forms part of the second operation, for the purpose of obtaining the maximum produce of the entire process.

According to the operation by dry process, a certain quantity of the waste celluloid, selecting by preference the fragments and pieces which are not too small, is inclosed in a space, which is little accessible to air and a decomposition or combustion is slowly produced there by plunging into the material a body which is at a high temperature. In consequence of this operation, the camphor contained in the celluloid is distilled unaltered and deposits itself partly in the form of incrustations on the walls, partly it is dissolved in the rising nitrites, and the remainder combines with the other gases in suitable collectors. These gases are then submitted to a cooling process and the parts which can condense, condense into a strongly acid liquid, which contains a large proportion of nitric acid and of camphor dissolved in nitrites.

According to the second operation or wet process, another portion of the waste of celluloid is treated with a concentrated solution of soda or caustic potash and will form nitrate of soda or of potash, cellulose, coloring matters and soaps of the different fatty acids, which remain in the bath, besides the camphor, and eventually the naphthalene, which are projected by a steam jet into a bath of bisulfite of soda, in which they are purified by depositing the acetones, and aldehydes, etc. The same steam jet carries the camphor and the naphthalene into a bath of cold water, where they condense on the surface in the form of very white snow.

Into the first bath of soda or caustic potash, after the waste has been introduced, and as soon as it is seen that it has reached a density of 1.45, the acid liquid obtained from the dry process operation is added to it. The soda is thus completely saturated in the state of nitrate, and, after another passage of steam (the same as before) the process is finished and there remains only the separating from each other, by known processes, the different products that have been obtained.

It must be observed, before commencing either the dry process operation or the wet process operation, that the material to be treated must first be submitted to purification, which is done by washing it with slightly alkaline water at a temperature of 40 to 50°. In this bath a portion of the foreign matters (such as sand, mold, metallic particles, etc.,) are precipitated, another portion (small pieces of wood, straw, paper, etc.) floats on the surface, and the celluloid waste remains perceptible in the water. At this washing the grease is also removed from the material.

In the process explained, use may be made of apparatus of different shapes or kinds, but the apparatus which is hereinafter described and is shown in the drawings, is the one that is preferred, and it also forms part of the invention.

Figure 1 is a plan partly in horizontal section of an apparatus for performing the "dry" part of the process provided by my invention. Fig. 2 is a view of the tool used in connection with Fig. 1. Fig. 3 is a vertical section of the feeding device used in connection with the apparatus for performing the "wet" part of my improved process. Fig. 4 is a plan of Fig. 3, the right hand portion showing the drum removed. Fig. 5 is a vertical section of the main portion of the apparatus used for the "wet" process.

Material to be dealt with by the dry process is deposited in a small cylinder 1, which has a window or opening 2 in the wall and which has an end perforated with holes 3, while at the other end the cylinder terminates in a stopper head 4. This small cylinder, thus filled, is introduced into the mouth of a tube 5 so that one tube hermetically seals the other.

The tubes 5 are arranged in series or groups, for instance of six, as shown in the drawing and they pass through a refrigerator 6, they enter then into a collecting tube 7, which abuts on the one side into a receiver 8 and on the other side it passes into a suitable exhaust chimney. The whole series, shown in plan in the drawing, and the collecting tube, form a suitable slope towards the receiver 8. Each of the tubes 5 has, in connection with the window 2 of the cylinder 1, a hole 9, which is capable of being hermetically closed by a stopper 10, the stem of which is long enough to enter into the material contained in the small cylinder 1.

In order to start the operation, the stopper 10 of the corresponding hole 9 is removed and its stem is heated to a temperature of about 300°. Then the stem is put in its place again and thus commences a slow combustion of the material, the products of combustion passing through the perforated end 3 and then expanding in the tube 5. A portion of these products precipitates on the walls, another portion condenses and combines in the liquid state in the receiver 8, and the remaining products, in the state of gas, escape into the air through the exhaust chimney. From time to time the incrustations are removed from the tubes 5 and they are passed into the collectors 7 and 8, by means of an instrument 11, composed of a rod provided with a screw, with lengthened thread, and of a diameter slightly less than that of the tubes 5.

The operation by wet process is carried out in the apparatus shown in Figs. 3, 4 and 5. 20 is the reservoir, in which the reaction of the caustic soda on the waste celluloid or the matter to be treated is performed, which reservoir communicates at its top by means of tube 21 with the bottom of the reservoir 22, where the bath of bisulfite of soda is placed; the reservoir 22 communicates similarly at its top, by means of the tube 23, with the bottom of condensing reservoir 24, which is placed lower down than the other apparatus and contains cold water. The reservoirs 20 and 22 are provided with stirrers or agitators 25, 25, suitably operated from the outside. The said reservoirs 20 and 22, respectively, are charged with caustic soda or caustic potash and with bisulfite of soda and water, by means of the inlet pipes 26, operating, if this should be necessary, escape valve 27. The material is fed from the bottom, by means of two twin-tubes 28, 29, with the assistance of the distributer shown in Figs. 3 and 4.

The upper ends of the tubes 28 and 29 coincide with corresponding holes drilled in the plate 30, which is stationary and suitably supported, for instance by means of the legs 31. On this plate a drum 32 is arranged which can revolve on a shaft 33, which has its bearings in holes in the table 30 and in the covering plate 34, which reposes on the drum 32 and is fastened to the plate 30, by means of bolts 35.

The drum 32 is provided with a rack 36, by means of which it can be put in rotation through the intermediary of suitable gearing, operated by the handle 37. This drum is perforated with four holes 38, 39, 40, 41 which during the rotation of the drum 32 successively coincide, two and two, with the ends or openings of the tubes 28 and 29.

The plate 34 is traversed in correspondence with the openings 28 and 29 with steam pipes, the inlet valves of which are operated by the cam 46 in such a manner, that the valve 44 opens, when a couple of the holes say 40, 41, are in correspondence with the tubes 28, 29, and close soon after in order to reopen as soon as the successive couple 38, 39 arrive at the place of the preceding couple, and so on; the other valve follows a similar movement, the phases of which are however in opposition.

The plate 34 has an opening 47 which extends over the space of about a quarter of a circle and becomes narrower radially almost up to the center in such a manner that at each quarter of a revolution one of the holes of the drum 32 (in the drawing the hole 38 is shown) arrives in correspondence with this opening and consequently becomes uncovered. The workman then fills it with the waste material, which according to the rotation of the drum, slides on to the plate 30, until it arrives at the opening of the tube 28. At this moment the valve 44 opens and admits the steam which forces it to enter from below into the chamber 20. In the meantime the workman has filled the following hole 41, and in proportion as the latter advances and the valve 44 closes again, the valve 45 opens in order to admit fresh steam to the reservoir 20 through the tube 29, until, as more waste material arrives in the tube 29, the primitive phases recommence.

For the qualities of waste material which do not contain camphor, for instance in the waste of velvril, artificial silk, artificial cork, collodion, pyroxylin, and the like, the operation is confined to a simple hot treatment with caustic soda in the reservoir 20, and the steam jet and the baths 22 and 24, which cause the recovery of the camphor, and eventually of the naphthalene, become unnecessary.

In the case of explosive substances, cord-

ite, filite, ballistite, panclastite, guncotton etc., special precautions must be taken and especially that the temperature does not rise above 60° and it is also necessary to introduce such substances by hand into the bath 20 and not by means of the automatic distributer shown in Figs. 3 and 4.

I do not claim herein the improved process set forth, as such process forms the subject matter of a divisional application filed by me March 29, 1906, Serial No. 308,697.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In an apparatus for utilizing the waste of celluloid and similar substances, a series of containers for such substance, and stoppers adapted to be heated and placed in such containers for producing a combustion of such substances therein.

2. In an apparatus for utilizing the waste of celluloid and similar substances, a series of tubes, a series of cylinders fitting therein, and stoppers adapted to be heated and placed in such cylinders to produce a combustion of the substance therein.

3. In an apparatus for utilizing the waste of celluloid and similar substances, a series of tubes, a series of cylinders fitting therein, stoppers adapted to be heated and placed in such cylinders to produce a combustion of the substance therein, and a refrigerator surrounding such tubes.

4. In an apparatus for utilizing the waste of celluloid and similar substances, a series of tubes, a series of cylinders fitting therein, stoppers adapted to be heated and placed in such cylinders to produce a combustion of the substance therein, a refrigerator surrounding such tubes, and a receiver connected with such tubes.

5. In an apparatus for utilizing the waste of celluloid and similar substances, a feeding mechanism comprising a rotating drum having a plurality of holes adapted to successively receive the material to be acted upon, and a feed pipe arranged beneath said drum and adapted to successively receive the contents of said holes and means for covering said holes when in coincidence with such feed pipe.

6. In an apparatus for utilizing the waste of celluloid and similar substances, a feeding mechanism comprising a rotating drum having a plurality of holes adapted to successively receive the material to be acted upon, a feed pipe arranged beneath said drum and adapted to successively receive the contents of said holes, a steam pipe, and an automatic valve adapted to open to permit the steam to force the material from said holes as they successively register with said feed pipe, and to close when such holes are out of register therewith.

7. In an apparatus for utilizing the waste of celluloid and similar substances, a feeding mechanism comprising a rotating drum having a plurality of holes adapted to successively receive the material to be acted upon, a plurality of feed pipes arranged beneath said drum and adapted to receive the contents of said holes when the latter are brought into registering position therewith, a steam pipe, and a plurality of valves adapted to open to permit the steam to force the material from said holes as they register with such feed pipes and to close when said holes are out of register therewith.

8. In an apparatus for utilizing the waste of celluloid or similar substances, a feeding mechanism comprising a top plate having an opening, a receiving device below said plate and having an opening which is out of register with the opening of said top plate, and a member interposed between such plate and device and having a passage adapted to be brought into coincidence with either of said openings when said member is moved, said top plate covering the top of said passage when the latter is in coincidence with the opening in said receiving device.

9. In an apparatus for utilizing the waste of celluloid or similar substances, a feeding mechanism comprising a top plate having an opening, a receiving device below said plate and having a plurality of openings, which are out of register with the opening of said top plate, and a rotative member interposed between such plate and device and having a plurality of passages, said member being adapted to be rotated to successively bring such passages into coincidence with the openings of said plate and said member, said top plate covering the tops of said passages when the latter are in coincidence with the openings of said receiving device.

10. In an apparatus for utilizing the waste of celluloid or similar substances, a feeding mechanism comprising a top plate having an opening, a receiving device below said plate and having an opening which is out of register with the opening of said top plate, and a member interposed between such plate and device and having a passage adapted to be brought into coincidence with either of said openings when said member is moved, said top plate covering the top of said passage when the latter is in coincidence with the opening in said receiving device, and means for forcing the contents of said passage into the opening of said receiving device.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

ERNESTO GARBIN.

Witnesses:
GIOVANNI GÉRARD,
CARLO GERARD.