No. 611,047. Patented Sept. 20, 1898.

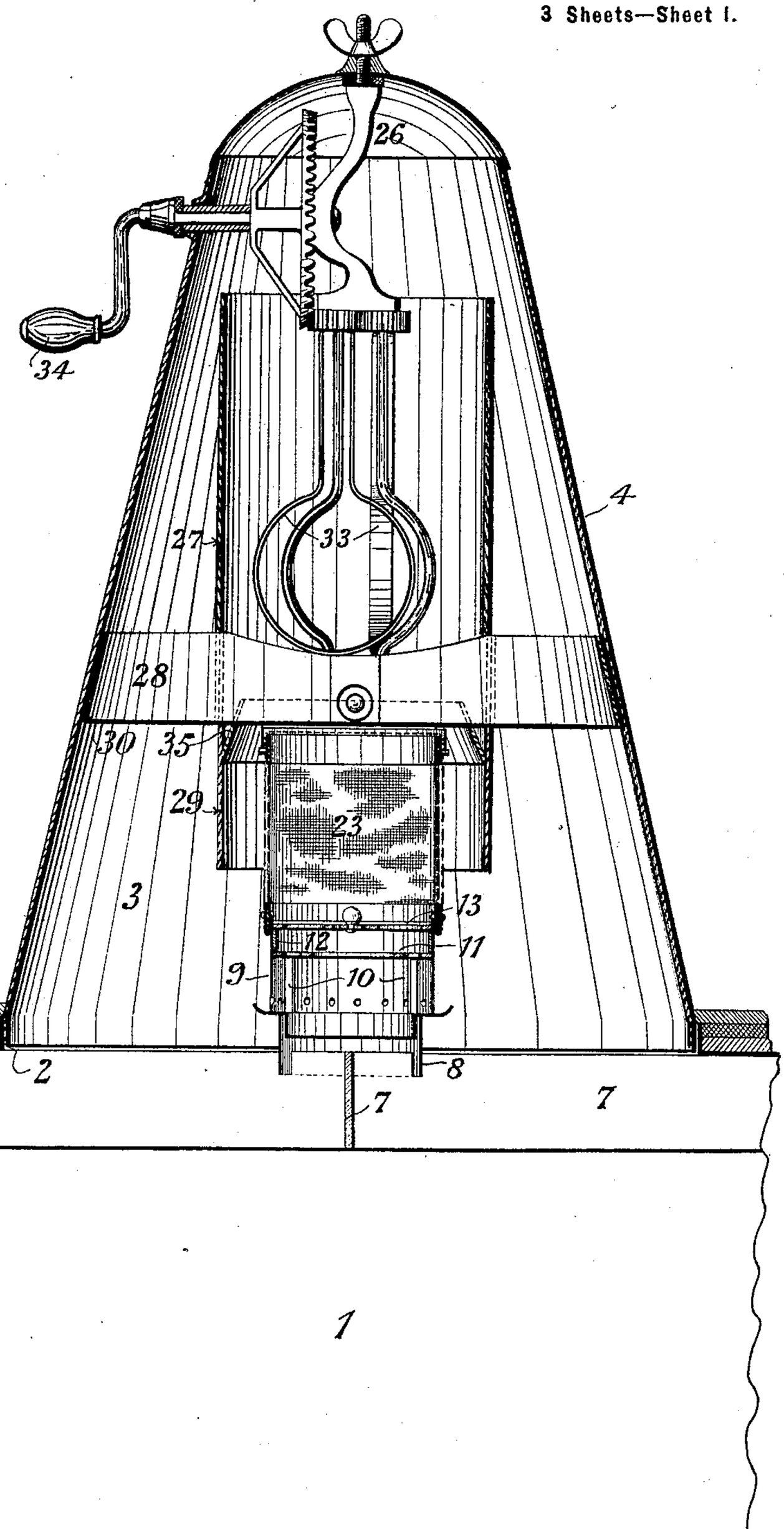
J. WHEELER.

METHOD OF AND APPARATUS FOR PRODUCING FILMS.

(Application filed June 16, 1897.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses
Geo. E. Fisch.
Hubert E. Rick

Inventor.
James Wheeler,
by Pattison & Nesbit, attys.

No. 611,047. Patented Sept. 20, 1898.

J. WHEELER.

METHOD OF AND APPARATUS FOR PRODUCING FILMS.

(Application filed June 16, 1897.)

(No Model.) 3 Sheets—Sheet 2.

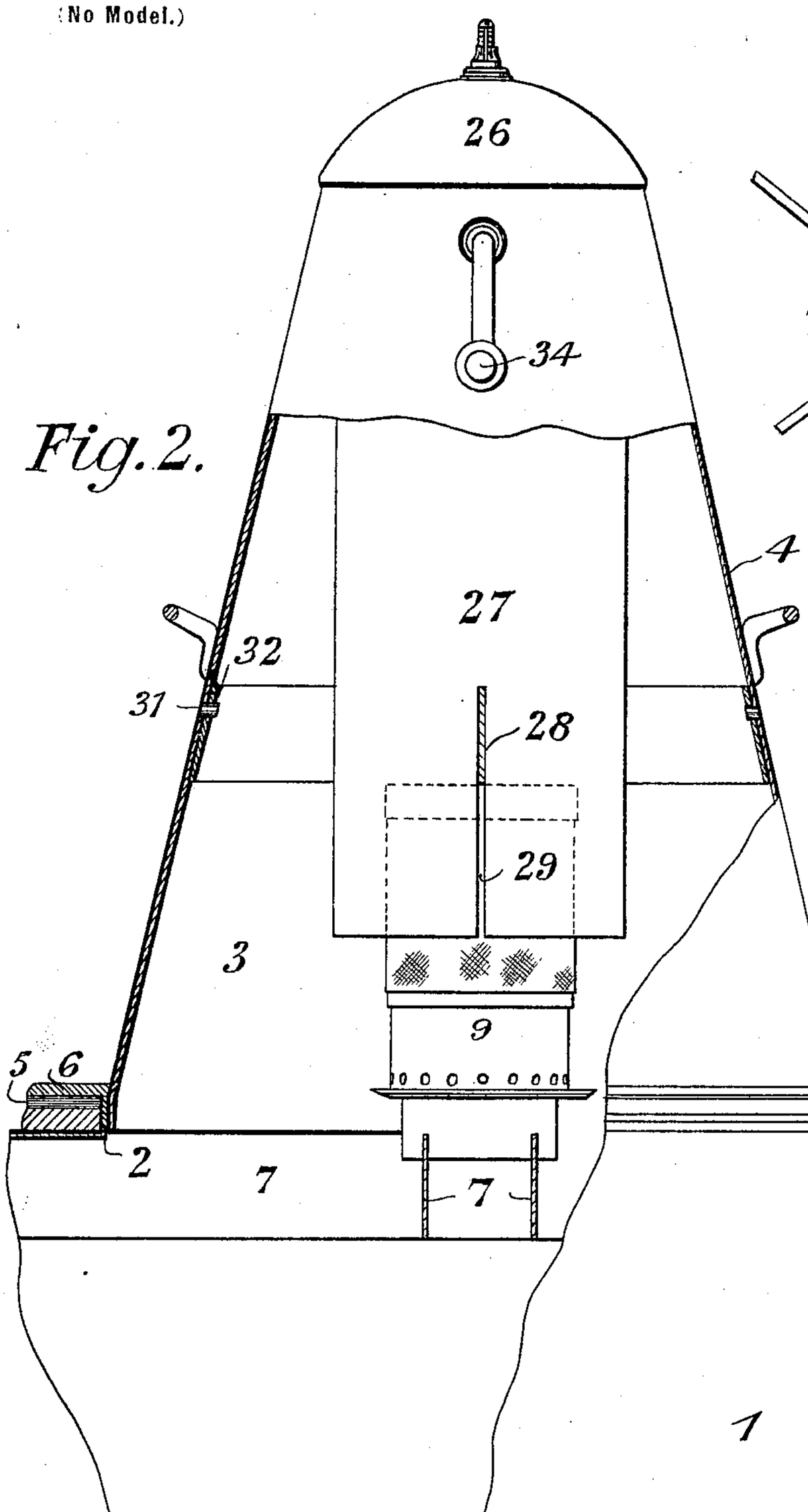


Fig. 2.

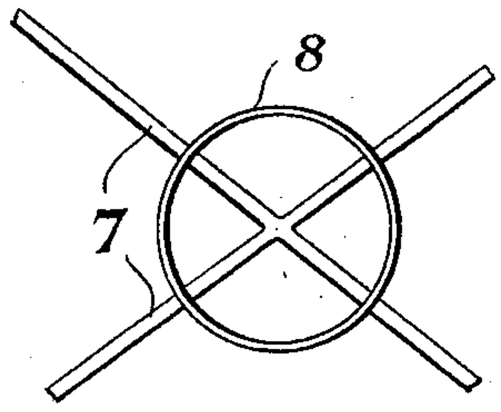


Fig. 3.

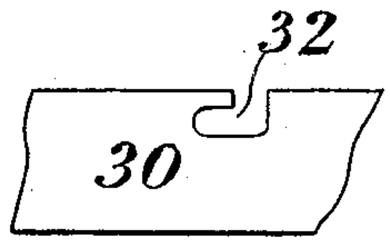


Fig. 4.

Witnesses
Geo. E. Frech.
Hubert E. Peck

Inventor.
James Wheeler
by Pattison & Neblett Attys

No. 611,047. Patented Sept. 20, 1898.

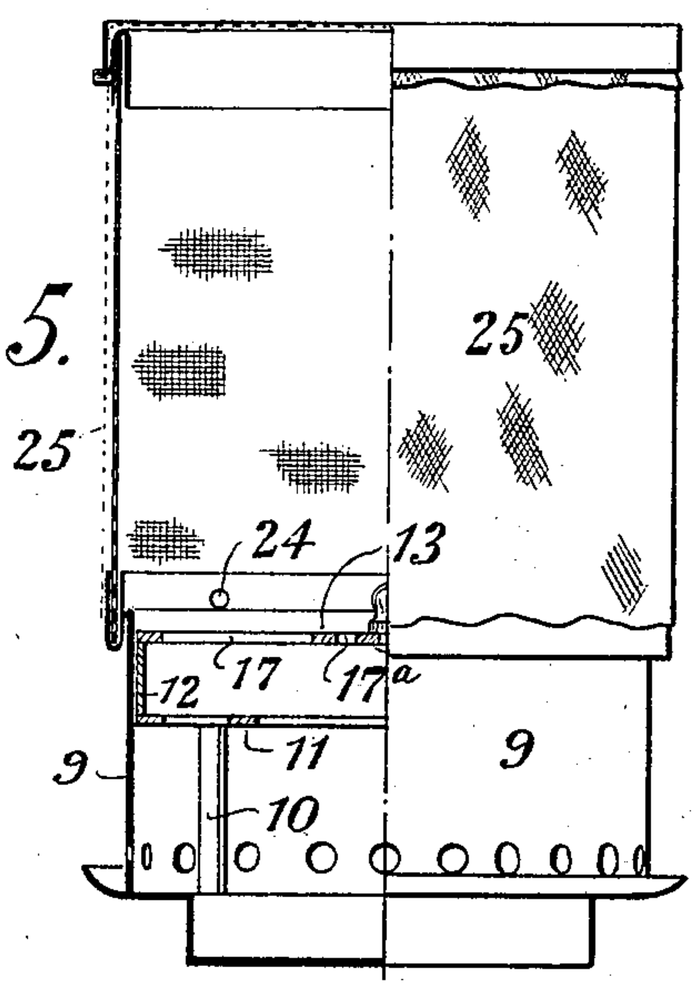
J. WHEELER.

METHOD OF AND APPARATUS FOR PRODUCING FILMS.

(Application filed June 16, 1897.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 5.



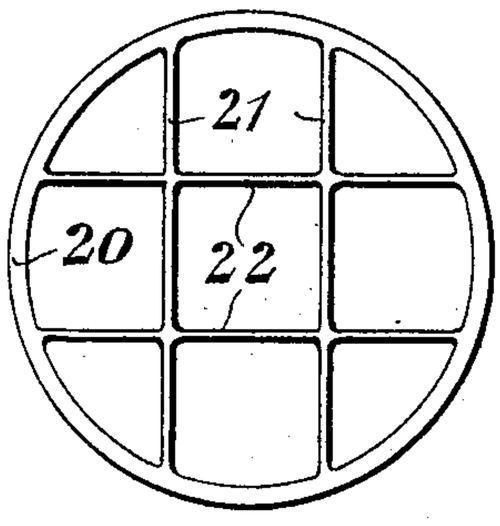


Fig. 9.

Fig. 6.

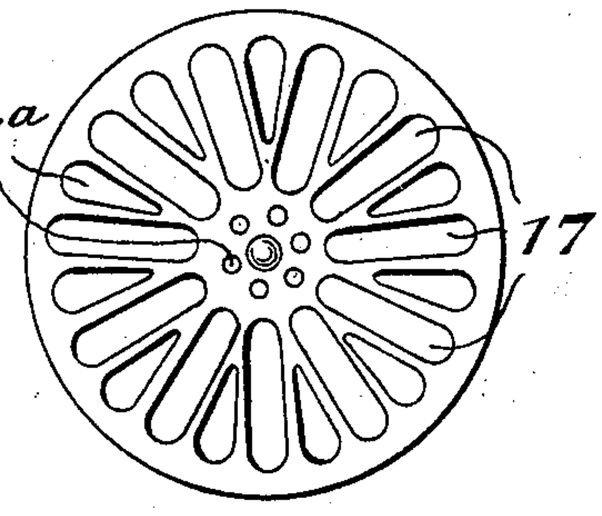
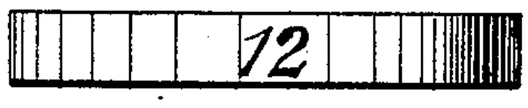


Fig. 7.



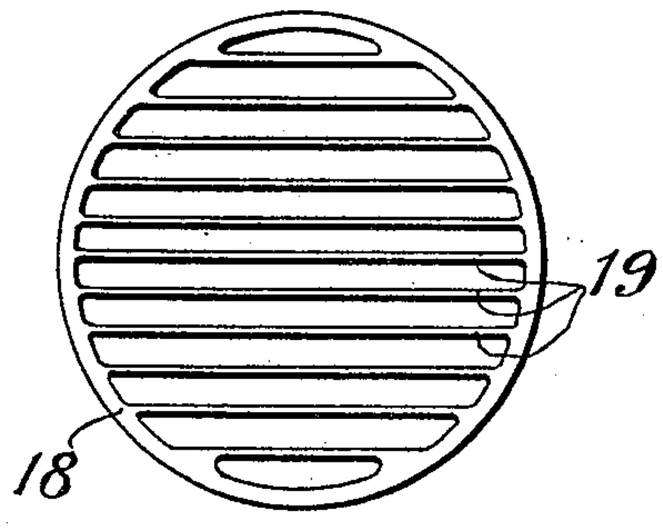
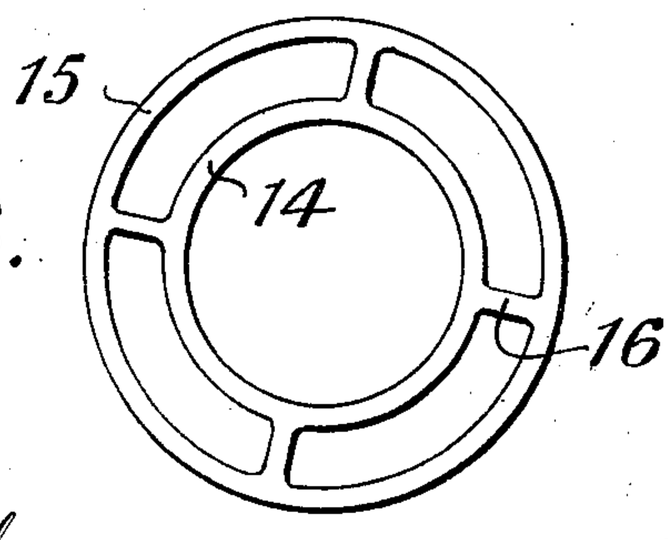


Fig. 10.

Fig. 8.



Witnesses
Geo. E. Frech,
Hubert E. Peck

Inventor
James Wheeler,
by Pattison & Nesbit, Attys

UNITED STATES PATENT OFFICE.

JAMES WHEELER, OF ILFRACOMBE, ENGLAND.

METHOD OF AND APPARATUS FOR PRODUCING FILMS.

SPECIFICATION forming part of Letters Patent No. 611,047, dated September 20, 1898.

Application filed June 16, 1897. Serial No. 641,041. (No model.) Patented in Belgium October 21, 1897, No. 131,391, and in France January 24, 1898, No. 274,328.

To all whom it may concern:

Be it known that I, JAMES WHEELER, a subject of the Queen of Great Britain and Ireland, residing at Ilfracombe, in the county of Devon, England, have invented a Method of and Apparatus for Producing Films, of which the following is a specification, and for which patents have been granted in France, No. 274,328, dated January 24, 1898, and in Belgium, No. 131,391, dated October 21, 1897.

This invention relates to the production of various articles of films containing betulin or betulin anhydrid. According thereto the articles on which films are to be produced are exposed in a closed chamber to fumes produced by burning without flame a combustible material comprising or containing the epidermis or outer rind of birch bark to an amount bearing a suitable proportion to the area of the chamber. According to the conditions under which the combustible material is burned there is produced (*a*) an opaque film that is pervious to hydrofluoric acid, so that when produced on suitable glass and subjected to the action of that acid it will enable the said acid to act upon the glass in such a manner as to impart to it a finely-pitted translucent surface, such as to render it highly suitable for use as focusing-glass or other purposes requiring a maximum amount of highly-diffused light, or (*b*) a transparent film that offers great resistance to hydrofluoric acid and also to dampness and the attack of insects or fungoid growths. The opaque and pervious film I consider to consist wholly or chiefly of pyrobetulin and the transparent of pyrobetulin anhydrid—that is to say, respectively of betulin and betulin anhydrid produced by burning and consequent dry distillation instead of by the action of a solvent, such as boiling alcohol, which has hitherto been the means employed for obtaining betulin.

In carrying my invention into practical effect I may employ the combustible material in the form of small blocks or tablets made by compressing together a mixture comprising finely-ground epidermis of birch bark, preferably that of white birch or *Betula alba*, and an oxygen-carrier, such as nitrate of potassium. The percentage of nitrate of potassium in the material may vary. For the production of opaque or transparent films for etching purposes there may be, for example, about eight per cent. of nitrate of potassium, and when intended for producing transparent films for protecting articles from damp, insect attack, &c., the percentage of nitrate of potassium may be from one to four. When less than two per cent. of nitrate of potassium is used, the mixture should be dried for a considerable time both before and after compression. In order to produce an opaque film, the tablets are arranged so as to give an air-space around each, whereas to produce a transparent film the tablets are placed close together, whereby a slower combustion will be attained than with the former arrangement. The result of the respective arrangements is that whereas in the one case pyrobetulin is obtained by the burning away of the cortical investment of the betulin of the bark, in the other case this pyrobetulin is converted into its anhydrid by the more prolonged heating and slower evolution of the fumes. The fumes are preferably filtered before being deposited, and in producing opaque films it is desirable to agitate the fumes given off in such a manner as to insure uniform deposition.

Figures 1 and 2 of the accompanying drawings are sectional views, taken at right angles to each other, of an apparatus suitable for filming various articles according to this invention. Fig. 3 is a partial plan representing a support for a lamp. Fig. 4 is a detail view showing in elevation a portion of a support for the agitating apparatus. Fig. 5 shows the lamp half in vertical section and half in elevation. Figs. 6, 7, and 8 are respectively a plan of a charge-plate, an elevation of an annular distance-piece, and a plan of a floor-plate used in producing opaque films; and Figs. 9 and 10 are respectively plans of a charge-plate and a floor-plate used in producing transparent films. Figs. 5 to 10, inclusive, are drawn to a larger scale than the other figures.

The apparatus shown comprises a filming-chamber 1 of sheet-zinc, in which the articles to be filmed are placed and which has in its top an opening 2, preferably of circular shape,

through which it communicates with an upper compartment 3, formed by a conical cover 4, that fits upon the top of the chamber 1, forming therewith around the opening 2 an air-tight joint by means of an india-rubber ring 5 and a flange 6 or other suitable means.

The bottom of the chamber 1 may be closed in a sufficiently air-tight manner by placing it upon a thick cloth or a pile of compressible paper. At the center of the opening 2 there is supported from the top of the chamber 1, by means of bars 7, (see Fig. 3,) soldered or otherwise secured thereto, a suitable stand 8 for a lamp in which to burn the tablets. This lamp may, as shown, comprise a cylindrical cup 9, (see Fig. 5,) perforated, as shown, at its lower part to admit air and adapted in its upper part to support by means of brackets 10 a floor-plate 11, on which is placed a ring or distance-piece 12, (see also Fig. 7,) which supports a charge-plate 13, in which the tablets are arranged with their lower edges resting more or less on the floor-plate 11. To produce opaque films, the floor-plate may advantageously consist, as shown in Fig. 8, of two concentric rings 14 and 15 of metal, connected by radial pieces 16 of metal, and the charge-plate 13 may, as shown in Fig. 6, be a plate of metal having a number of radial openings 17 made through it for the due retention within them of the tablets with an air-space around each. (17^a are air-holes.) The edges of the tablets will then rest more or less on the ring 14. For producing transparent films the floor-plate may advantageously consist, as shown in Fig. 10, of a metal ring 18, having opposite sides connected together by a number of parallel bars 19, and the charge-plate may consist, as shown in Fig. 9, of a similar ring 20, having two intersecting sets of bars 21 and 22, respectively, that connect opposite sides, but are placed at a comparatively great distance apart, and between which the tablets are arranged in close contact transversely to the bars 19 of the floor-plate. The lamp is provided with a chimney 23 of wire-gauze, which is adapted to be supported, by means of pins 24, on the upper end of the cup 9 and to project upward therefrom, and which is surrounded by and covered with filtering material 25, such as muslin. Instead of being supported by pins 24, resting on the upper end of the cup 9, the chimney 23 may rest upon and within an upwardly outwardly-extending flange secured to and a little below the upper edge of the cup 9. Besides acting as a support to the chimney this collar will serve to prevent air from entering the chimney between its wall and the cup 9 to an injurious degree.

Within the conical cover 4, which has a domed top 26, there is arranged a metal cylinder 27, supported by a cross-bar 28, which engages in slots 29 in the cylinder 27 and is secured at its ends to a conical ring 30, removably connected to the cover 4 by bayonet-joints, consisting of pins 31, projecting from the cover 4, and slots 32 (see Fig. 4) in the ring 30. Within the cylinder 27 there is mounted a suitable apparatus—such, for example, as a vertical egg-whisk 33 for agitating the internal atmosphere—this apparatus having a crank-handle 34 or other suitable operating means outside the cover 4 and the metal cylinder 27 being provided below the agitating apparatus with a conical guide or deflector 35.

In using apparatus constructed as described, the articles to be filmed having been placed in the filming-chamber 1 (care being taken that the articles do not overlap one another or have nothing above them in the chamber, for the fumes descend after the manner of dew) and the tablets having been suitably arranged in the lamp, the latter are ignited simultaneously by means of a jet of gas caused to play upon their upper surfaces, and any flame produced having been immediately extinguished the chimney 23 is placed upon the cup 9 and the lamp put upon its stand 8. The conical cover 4 is then placed in position and the agitating apparatus 33 put into motion. The fumes on being formed rise upward through the cylinder 27 and are deflected by the guide 35 toward the center of the agitating apparatus 33, through which they pass to the top 26 of the cover 4, which deflects them downward and causes them to descend between the cover 4 and the metal cylinder 27 into the filming-chamber 1 with the result that having been thus intimately mixed together and with the air within the cover 4 they form uniform films upon the articles in the filming-chamber.

The annular recess formed by and between the cylinder 27 and the external surface of the deflector 35 serves to catch carbonaceous matter which collects upon the agitating apparatus 33 and, especially if the latter is not occasionally cleaned, is thrown from it to the sides of the cylinder in very thin flakes, which if allowed to fall upon the film leave corresponding marks upon it when finished.

The lamp and its charge when arranged for producing transparent films should, especially in cold weather, be preparatorily heated as much as is consistent with its proper handling in order more completely to prevent at the outset the evolution of low-temperature fumes adapted to produce opaque films. In the case of a filming-chamber of very large area it may be necessary to provide a fan which may be arranged to revolve in a circle slightly larger than the opening 2 and be slowly revolved by a motor, which would also work the agitating apparatus when producing opaque films; also, further, to facilitate the working a hook or ring may be fitted at each corner and connected with a common rope or chain passing over an overhead pulley for raising the chamber to allow of the removal of the filmed material therefrom. Furthermore, the conical cover may be made in two parts, forming an air-tight joint with

each other by means of flanges, the lower part supporting the stand for the lamp and having one or more internal annular grooved depressions or channels adapted to prevent condensed moisture from running down and falling upon the films and the upper part carrying the agitating apparatus 33 and the cylinder 27.

For producing an opaque film on glass I have obtained satisfactory results with an apparatus, as above described, in which the filming-chamber had a length of twenty-two inches, a breadth of sixteen inches, and a depth of eight inches, while the opening in its top was nine inches in diameter, the height of the cover twelve inches, and the diameter of the cup of the lamp two and one-fourth inches, this being adapted for circular tablets of about five-eighths of an inch in diameter. I have for this purpose and with this apparatus employed tablets weighing fifty grains—*i. e.*, in the ratio of twenty grains to each superficial foot of the area of the filming-chamber. With this apparatus I have found it suitable to operate the agitating apparatus for fifteen minutes and then to allow a further fifteen minutes for the due subsidence of the fumes. I have then removed the plates of glass from the chamber and exposed them in the open air, or preferably in a drying-chamber, to mature the films for not less than three days. In producing a transparent film on glass or metal and when filming other material it is unnecessary to employ the agitating apparatus, which, together with the cylinder 27, is, before doing this, preferably removed.

For producing transparent films on glass or metal for etching purposes, suitable charges weigh from forty to sixty grains to the square foot of the area of the filming-chamber. For filming-chambers of larger area than that of which the dimensions have been given, while the proportions of the charges for transparent films should remain the same, that for opaque films should be reduced. Thus for a chamber of an area of nine square feet a suitable charge is one of two drams. Opaque films should not be thicker than necessary, for the thicker they are of course the longer must be the exposure to the action of the etching fluid, and even with the longer exposure the result is less satisfactory than with films of proper thickness. A safe rule to follow as regards glass (and as the same thickness of film is correct for metals a trial slip of glass may be filmed along with metal articles) is that on removing an opaque film on glass from the filming-chamber immediately after the film has been deposited a one-inch jet of gas should be seen clearly outlined through the filmed plate when the plate is held at a distance of three feet from the jet.

In filming a tube or like article it may advantageously be mounted on a core and rotated about a horizontal axis while the deposit is being formed. Films may be produced on powders in this manner. If a powder be lightly sifted over the floor of the filming-chamber and a film produced upon it, as hereinbefore described, an intimate mixture of the same (whether consisting of pyrobetulin or of pyrobetulin anhydrid) with the powder can be easily effected immediately after the deposition of the film.

For reducing the epidermis of birch bark to a sufficiently fine powder to produce the combustible material or tablets I first pass it through a disintegrator until it is reduced to a finely-shredded condition. I then dry it by exposing it to the air freely and to a temperature of 120° Fahrenheit during three days, and I then pass it repeatedly under heavy stone-edge runners until sufficiently fine to pass through a sieve having sixty holes to the linear inch.

Transparent films formed from a mixture containing about two per cent. of nitrate of potassium and produced in the manner described may be employed for various purposes in addition to those hereinbefore referred to. For example, it has been found that lint having such a film deposited upon it according to this invention acts very beneficially as a preventive to the formation of pus when applied to wounds. Plasters, bandages, paraffined paper, boric-acid powder, and wound-dressing materials generally other than lint may of course be similarly treated with a like result. By so filming leather or fabrics, either simply or alternately with the application of oil or fatty matter, the appearance, durability, and resistance to damp or mildew are materially enhanced. Corks likewise may advantageously be filmed to render them capable of withstanding the action of acidulous or other corroding substances. Again, two-per-cent. films produced according to this invention on paper impart to it a surface admirably adapted for receiving impressions of engravings, &c., and in order to vary the natural india-tint of the film when used for this purpose an addition of from five to ten per cent. of asphaltum, dragon's blood, or other suitable sublimable material may be made in the composition of the tablets, the quantity of nitrate of potassium being proportionately increased, if necessary, adequately to effect their proper combustion. By filming (with two-per-cent. films) finished photographs having mat or dull surfaces or prints according to this invention fine effects of softness and heightening of shadows can be produced. The tin amalgam or other silvering of mirrors, moreover, may have transparent films formed from a mixture containing eight per cent. of nitrate of potassium with the addition of a suitable amount of a sublimable material adapted to render the films harder, such as ten per cent. of copal gum or kauri gum, and deposited upon the silvering in accordance with this invention to protect it from cracking and becoming "fogged" by contact with a damp wall. The weight of charge for these various purposes is dependent upon the degree of antiseptic protection or color re-

quired. Charges of from ten to sixty grains per square foot of the area of the filming-chamber may, however, sufficiently indicate the range. It is, moreover, obvious that the translucent surface produced on glass or the mat or dull surface produced on "metal" by means of an opaque film made according to this invention may not only be plain, but may be of any desired lettering or design, and this lettering or design may be either clear on an opaque or mat ground or opaque or mat on a clear ground. To obtain a clear lettering or design on an opaque or mat ground the lettering or design may be traced or worked direct upon the glass or metal after opaque filming by using as a stop-out the anhydrid colored as described in the next succeeding sentence, or in the case of glass by removing such parts of the film as are necessary to represent the lettering or design, in effecting which removal a certain portion of the film is left below the removed parts, and the pressure employed by destroying its porosity renders this portion capable of resisting the action of the acid for the requisite period of exposure, or the lettering or design may be first drawn or stenciled on, transferred to, or photographically deposited upon the glass or metal in suitable "resist" (the best material for use with stencils or for transfers being betulin anhydrid produced in bulk in a manner similar to that hereinbefore described for two per cent. transparent films and suitably colored by admixture with ivory-black or Japan varnish ground up with linseed oil) and an opaque film be subsequently deposited, as hereinbefore described. After this the back of the plate is protected with Brunswick black or other suitable resist and the plate is passed (care being taken to avoid cross-currents) evenly into the etching agent, which in the case of glass may be the ordinary fuming aqueous hydrofluoric acid of commerce, and from which, after the requisite number of seconds' exposure, it is transferred to a bath adapted promptly to arrest the action of the acid. In the case of glass this bath may be a strong solution of commercial carbonate of soda—*i. e.*, "washing-soda"—and in the case of metal it may be a whiting bath. The removal of the resist by suitable solvents and a subsequent scrubbing in soap and water with a stiff brush complete the process. To obtain an opaque or mat design or lettering on a clear or bright ground, one or more transparent films of the full capacity of the charge-plate, according to the resisting power required, is or are deposited on one surface of the glass or metal plate and the lettering or design traced or worked through the film or films, so as to expose corresponding portions of the glass, (to facilitate the working a slight opaque film may advantageously be deposited over the transparent film or films,) or an opaque film is first deposited upon the surface of the glass or metal and allowed to mature. Then a fern or other natural object or a stencil having the ground portion removed is placed evenly upon the opaque film and a transparent film is produced over the whole, after which the fern or other object or stencil is removed. The process is completed in each case by etching to the required depth in the manner above described. By carrying the etching to a sufficient depth into glass or metal a matrix may be formed for obtaining a gelatin or other relief from which a printing-surface may be made by any of the ordinary methods, or a photographic negative suitable for the production of a printing-surface may be obtained by photographing white etching produced by means of a transparent film upon ruby or orange flashed glass.

After a pattern has been produced on glass by etching, as just described, suitable enamel colors may be worked into the design and fired.

To determine with accuracy the requisite number of seconds of exposure to the action of the etching-acid for an opaque film or of minutes for a transparent film on glass, a trial strip of the same glass and filming is graduated and subjected to the acid for successively-increased exposures corresponding to the graduations, and the results obtained determine the proper exposures. The fitness of any given sample of glass, more particularly for use with opaque films, is determined in like manner. It is important to take care that the glass employed be suitable—kinds yielding double fluorides are unsuitable—and the glass should be so cleaned and polished that the breath will condense upon it in an even film, free from all irregular markings. It is also important that the opaque film should be properly matured, the measure of the opacity that it yields to the glass being proportional to its maturity, and that the action of the acid, which in this case must be strong—*e. g.*, the fuming aqueous hydrofluoric acid of commerce—upon the opaque film be promptly arrested, after due exposure, by plunging the article into a solution of the carbonate of soda of commerce—*i. e.*, washing-soda.

It appears advisable for etching purposes to employ the transparent film within a few hours after its formation, as within a day or two an opacity begins to appear. On the other hand, the longer the opaque film is kept the better it becomes.

For etching metal articles after filming them according to this invention the etching fluid employed must of course be such as to form a soluble compound with the metal to be treated, and the liquid used to neutralize the etching agent must be alkaline or acid in accordance therewith.

If for producing on a smooth non-absorbent surface a transparent film for etching purposes instead of burning, as hereinbefore stated, a mixture containing eight per cent. of nitrate of potassium there be burned a mix-

ture containing a low proportion, such as one or two per cent., of nitrate of potassium, there will be produced on such a surface a film that presents an appearance of reticulation, and to an extent dependent upon this appearance is readily pervious to hydrofluoric acid, so that after maturing for two or three days in a dry atmosphere it will under the action of a weak solution of that acid, such as the fuming aqueous hydrofluoric acid of commerce mixed with not less than fifty per cent. of water, impart to the surface of ordinary glass, if it has been produced thereupon, a like appearance of reticulation, which while offering no increased resistance to the passage of light is yet sufficiently opaque for all purposes for which obscurity to vision alone is required. Flashed glass treated in this way gives rise to brilliant effects of scintillation of light which render it well suited for use as "cathedral" glass. For producing reticulated films for etching purposes on glass or metal a suitable charge for the apparatus of which the dimensions are hereinbefore given weighs forty grains to the square foot of the area of the filming-chamber. For chambers of larger area the charge should be so regulated that after the contraction of the film, causing the appearance of reticulation, there would be no further deposition. When a reticulated film has been properly deposited upon a plate of glass and matured, the glint of the glass is visible through the pervious portions of the film, whereas if there be further deposition after contraction this will not be the case. The grain of reticulated films produced in this way varies with the temperature of the air in the apparatus in which the filming is performed. For instance, the grain of a film produced in an unwarmed chamber would be finer if formed in very cold weather than if formed in hot summer weather. The grain may also be made finer by reducing the charge below that of forty grains per square foot, hereinbefore mentioned. To insure uniformity in the size of the grain of a reticuluted film all that is necessary is to equalize the temperature within the filming-chamber by some suitable means. In the case of the apparatus of which the dimensions are hereinbefore given hot bricks placed in close contact with the two ends of the chamber are adequate for the purpose. Chambers of larger area may each either be provided with a jacket, between which and the chamber warmed air will be caused to pass, or have a lining of asbestos to prevent radiation of heat.

What I claim is—

1. Producing films containing pyrobetulin or pyrobetulin anhydrid on articles by compressing together into small blocks or tablets a mixture comprising or containing finely-ground epidermis or outer rind of birch-bark and an oxygen-carrier such as nitrate of potassium, and exposing the said articles in a closed chamber to fumes produced by burning, without flame, a quantity of the said blocks or tablets bearing a suitable proportion to the area of the said chamber, substantially as hereinbefore described.

2. Producing films containing pyrobetulin or pyrobetulin anhydrid on articles by compressing together into small blocks or tablets a mixture comprising or containing finely-ground epidermis or outer rind of birch-bark and an oxygen-carrier such as nitrate of potassium, exposing the said articles in a closed chamber to fumes produced by burning, without flame, a quantity of the said blocks or tablets bearing a suitable proportion to the area of the said chamber, and agitating the said fumes so as to mix them together and with the air of the said chamber, substantially as hereinbefore described.

3. Producing films containing pyrobetulin or pyrobetulin anhydrid on articles by compressing together into small blocks or tablets a mixture comprising or containing finely-ground epidermis or outer rind of birch-bark and an oxygen-carrier such as nitrate of potassium, exposing the said articles in a closed chamber to fumes produced by burning, without flame, a quantity of the said blocks or tablets bearing a suitable proportion to the area of the said chamber, and filtering the said fumes before allowing them to form films on the articles treated, substantially as described.

4. Producing on articles films of pyrobetulin pervious to the action of an etching agent so that articles so filmed will, under the action of such an agent, be given a finely-pitted surface, the said films being produced by compressing together a mixture comprising or containing finely-ground epidermis or outer rind of birch-bark and an oxygen-carrier such as nitrate of potassium, exposing the articles in a closed chamber to fumes produced by burning, without flame, a quantity of the said compressed mixture in the form of small blocks or tablets bearing a suitable proportion to the area of the said chamber and so arranged as to have an abundant supply of air, and agitating the said fumes so as to mix them together and with the air of the said chamber, substantially as hereinbefore described.

5. Apparatus for producing films on articles comprising a lower compartment for containing the articles to be filmed, an upper compartment communicating through an opening with the said lower compartment, a lamp supported within the said upper compartment, and a hollow cylinder extending upward from the said lamp to within a short distance from the top of said chamber, substantially as described and shown.

6. Apparatus for producing films on articles comprising a lower compartment for containing the articles to be filmed, an upper compartment communicating through an opening with the said lower compartment, a lamp supported within the said upper compartment, a hollow cylinder extending up-

ward from the said lamp to within a short distance from the top of the chamber, agitating apparatus arranged within the said cylinder, and means for operating the said agitating apparatus from outside the said upper compartment, substantially as described and shown.

7. Apparatus for producing films on articles comprising a closed chamber having a conical cover, a lamp situated centrally as regards the said cover, and a hollow cylinder extending upward from the said lamp to within a short distance from the said cover, substantially as hereinbefore described.

8. Apparatus for producing films on articles comprising a closed chamber having a conical cover, a lamp situated centrally as regards the said cover, a hollow cylinder extending upward from the said lamp to within a short distance from the top of the said cover, an agitating apparatus above the said lamp, means for operating the said agitating apparatus from outside the said chamber, and a guide or deflector for directing into the said agitating apparatus fumes rising up from the said lamp, substantially as hereinbefore described.

9. Apparatus for producing films on articles comprising a closed chamber, a lamp therein adapted to burn combustible material without flame, and means for filtering the fumes produced by the partial combustion of the material as they are given off, substantially as hereinbefore described.

10. Apparatus for producing films on articles comprising a closed chamber, a lamp adapted to burn combustible filming material without flame, means for filtering the fumes produced by the partial combustion of the said material as they are given off, and means for effecting the uniform deposition of a film upon the articles to be filmed, substantially as hereinbefore described.

11. Apparatus for producing films on articles comprising a closed chamber, a lamp adapted to burn combustible filming material without flame, means for filtering the fumes produced by the partial combustion of the said material as they are given off, means for agitating the fumes after filtering, and means for effecting the uniform distribution of a film upon the articles to be filmed, substantially as hereinbefore described.

12. For producing films on articles, a lamp comprising a receptacle to receive combustible filming material and a chimney having walls and a cover of material adapted to filter fumes produced by the partial combustion of the said filming material substantially as hereinbefore described.

13. For producing films on articles, a lamp comprising a cup perforated in its lower part and provided in its upper part with means for supporting combustible filming material, and a chimney having walls and a cover of material adapted to filter fumes produced by the partial combustion of the said filming material, substantially as hereinbefore described.

14. For producing films on articles, a lamp comprising a cup perforated in its lower part and provided in its upper part with means for supporting combustible filming material in such a manner as to allow it an abundant supply of air, and a chimney having walls and a cover of material adapted to filter fumes produced by the partial combustion of the said filming material, substantially as hereinbefore described.

15. For producing films on articles, a lamp comprising a cup having its lower part perforated, means in the upper part of said cup adapted to support tablets of combustible filming material with an air-space around each tablet, and a chimney having walls and a cover of material adapted to filter fumes produced by the partial combustion of the said filming material, substantially as hereinbefore described.

16. For producing films on articles, a lamp comprising a receptacle to receive combustible filming material and comprising an open-work floor-plate adapted to support the lower edges of the tablets, a charge-plate having radial openings each adapted to receive a tablet, and a distance-piece between the said floor-plate and the said charge-plate, and a chimney having walls and a cover of material adapted to filter fumes produced by the partial combustion of the said filming material, substantially as hereinbefore described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES WHEELER.

Witnesses:
HERBERT KIDMAN,
HAROLD DISMOND.