Nov. 22, 1932. C. D. AINSWORTH 1,888,419

PROCESS FOR TREATING CELLULOSIC MATERIAL

Filed Aug. 14, 1923

Fig. 1.

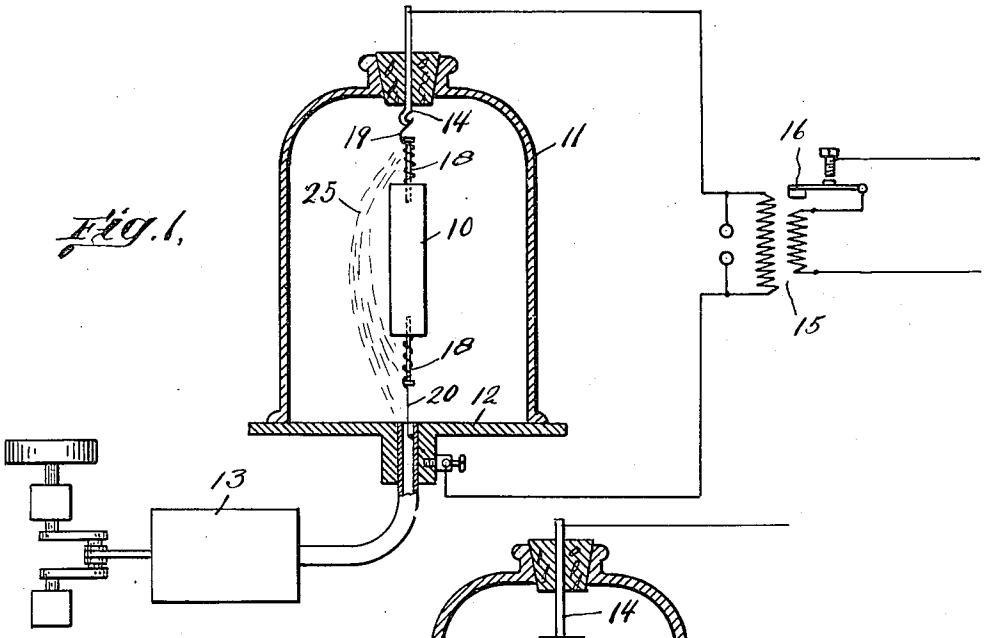


Fig. 2.

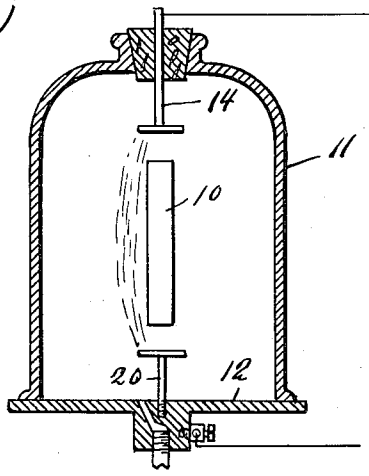
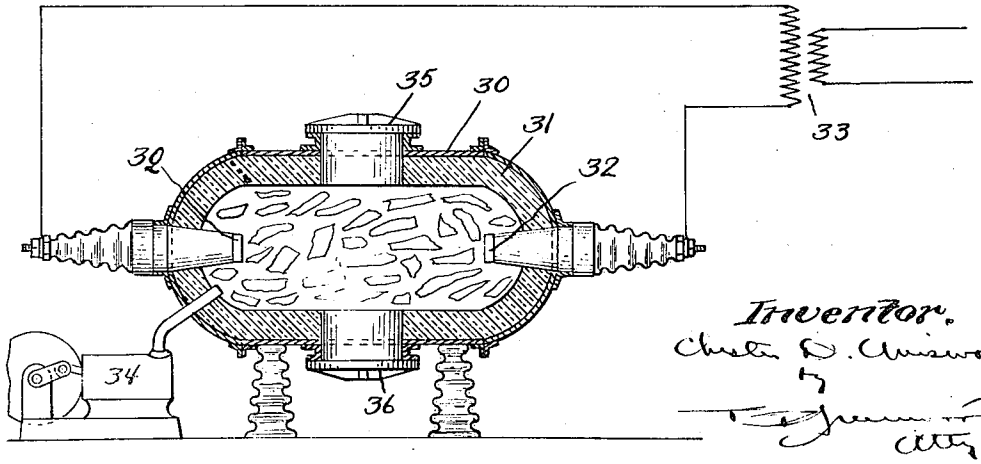


Fig. 3.



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UNITED STATES PATENT OFFICE

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PROCESS FOR TREATING CELLULOSIC MATERIAL

Application filed August 14, 1923. Serial No. 657,441.

This invention relates to and has for its object a novel process for the removal of the gums, as the resins and sugars and the like from a material containing them, as a fibrous cellulosic material, as wood and the like, and, particularly, without destroying the structure or formation of the material.

The invention is particularly concerned with, although not limited to, a process of treatment of wood for violins and other musical or acoustic instruments, or the instruments themselves, or finished parts therefor, by which the wood is caused to become more resonant and the tonal qualities thereof are enhanced.

A wood which enters into the construction of a violin, for instance, for excellence of tone, is required to vibrate easily over the entire note range of the instrument and to respond purely and with practically uniform intensity to notes of uniform intensity over the entire note range. In addition to response to the fundamental tone, it should be capable of vibrating in pleasing overtones whereby to produce the characteristic violin tone. Ordinarily the more numerous the harmonious overtones to which the wood will respond, the better is the violin considered.

The ease with which the wood of a violin may respond to the string vibrations, and the number and harmoniousness of the overtones, other things being equal, depends upon the amount of loading of the wood with its natural resins or sugars. The resins and sugars act to damp the vibration of the wood, whereby it may respond only with difficulty to the vibration of the string, and cause the wood to vibrate unequally in localized portions thereof, thereby to set up displeasing overtones. Resins and sugars are necessarily present in wood and the difference between a good and a poor violin, otherwise having uniform characteristics, may be measured by the gum content of the wood entering into the construction of the violin, the good violin having a smaller gum content of its wood than the poor violin, or a more uniform distribution of gum.

An object of this invention is an improved process of treating a material, as wood or other cellulosic material to de-gum it, or to remove a substantial portion of the resin or sugar or other undesirable content therein, without destroying the structure of the material and, also, without altering the configuration or appearance of the material in any harmful manner.

A further object is a process of treating wood for a violin or other acoustical instrument to improve the tonal qualities of the instrument in which the wood is incorporated.

A further object is a process of treating the complete instruments, or finished parts therefor, to improve the tonal qualities thereof, without altering the configuration or appearance of the instrument, or parts, in any harmful manner.

A yet further object is generally to improve the processes for de-gumming cellulosic material.

In brief, my improved process consists in subjecting the cellulosic material, for the degumming thereof, as the removal of resins or sugars therefrom, to the action of an electric field of a suitable nature, and for a suitable period of time, and preferably at the same time subjecting the material to a reduced ambient gaseous pressure. Preferably the electric field is adapted to be such as to produce an ionic discharge, or an arc stream, in the vicinity of the cellulosic material and in a vacuum of a few millimeters pressure, in which vacuum the cellulosic material is contained.

Fig. 1 is a diagrammatic illustration of the apparatus for carrying out my process.

Fig. 2 is a modified arrangement of Fig. 1.

Fig. 3 is a further modification, and illustrating an apparatus especially adapted for the treatment of wood for the manufacture of paper pulp.

In carrying out my process, as one adaptation thereof, I may enclose the wood piece 10 to be treated, which piece here shown may be the base bar of a violin, for instance, in a closed receptacle as the bell jar 11, which jar may rest upon the plate 12 of an air pump 13. Said air pump is adapted to exhaust said bell jar to a suitably low pressure, as a Crookes

vacuum, say about .02 mm., for instance, although the precise degree of exhaustion does not appear to be material except as it appears to govern the time of the process. It appears that, with a given amount of electrical power, the lower the pressure, the shorter is the time required to carry out the process, especially when the pressure is not carried below that point at which the potential required to pass a given current through the gas becomes greater. The converse also apparently holds true. For a large amount of electrical power, the vacuum may be less than for a lesser amount of electrical power, to carry out the process to the same degree in the same time. Preferably, however, the vacuum is adapted to be such as to lower the oxygen content of the air in the receptacle, or bell jar, to such a degree that the wood undergoing treatment will not be oxidized by the action of the electrical field. If the atmosphere in the receptacle is inert, that is, does not contain a gas capable of acting on the wood in any harmful manner, the pressure within the receptacle may be materially different than with an atmosphere having an oxygen content.

The bell jar 11 may be provided with a terminal 14 which extends into the bell jar and said terminal is adapted to be connected with a source of high potential, as the secondary winding of a transformer or induction coil 15. Said secondary winding may be connected with a second terminal of said bell jar and said second terminal may comprise the plate 12 of the vacuum pump, as shown. The two terminals are adapted to be spaced apart a suitable distance and the wood piece 10 is adapted to be disposed between or in the vicinity of said terminals in position to be acted on by the electric field set up between said terminals. As here shown, the transformer or induction coil 15 is provided with an interrupter 16 in its primary circuit and said primary circuit may be connected to a suitable source of alternating current. Said interrupter 16 may be synchronized with the frequency of the alternating current whereby to produce a predominating direct potential at the secondary terminals. My process may be carried out satisfactorily with either an alternating potential or a direct potential and for commercial purposes, an alternating potential is preferable. When an alternating potential is to be used, the coil 15 may be replaced by a high potential transformer of any desirable type. The precise potential at which my process is carried out will vary with the spacing of the discharge terminals 14 and 12 and the degree of vacuum existing between said terminals but the potential should preferably be sufficient to cause an appreciable ionic current flow or arc stream or discharge between said terminals.

The wood piece 10 to be treated is placed in position to be acted upon by the electric field set up between said terminals and preferably, said wood piece 10 is disposed between said terminals. Said wood piece 10 may be free from actual connection with the terminals as illustrated in Fig. 2, wherein it is supported in position by suitable means, not shown, or it may be electrically connected with said terminals and also supported thereby, as indicated in Fig. 1, but the showing in Fig. 1 appears preferable. As shown in Fig. 1 supporting-members 18 are attached to the wood piece, either by being driven into the opposite ends of the wood piece, as shown, or otherwise attached thereto. A conductor 19 may be connected with the upper supporting member and also with the upper terminal 14, whereby to support the wood piece from, and electrically connect it with, said terminal. A second conductor 20 may be connected with the lower supporting member and be in contact with, or in proximity to the lower terminal 12.

In carrying out my process, in the preferred manner, a high potential is applied to the terminals 14 and 12 and the receptacle 11 is evacuated by the pump 13. The degree of evacuation may be variable and may depend upon the amount of electrical power available and upon the electric potential. Preferably an ionic discharge or arc stream should take place between the electrodes or terminals of the receptacle, and the degree of evacuation is adapted to be such as to permit such discharge. So long as a discharge takes place, the character thereof, as governed by the degree of evacuation, does not appear to be highly important. Under a certain vacuum the discharge may be confined to a more or less broad band or arc stream between the electrodes, or the supporting-members 18, and at one side of the wood piece 10, as illustrated at 25, Fig. 1. At a higher vacuum, the discharge stream may completely enclose and surround the wood piece 10 and the discharge stream may show the characteristic potential bands of an electric discharge in a high vacuum.

As the wood piece 10 undergoes treatment it will be noted that the surface of the wood usually assumes a brighter appearance and finally shines and glistens when a beam of light is thrown on it. Sap or resin pockets, which might be contained in the wood below the surface and invisible prior to the treatment, are caused to stain the wood at the surface as the resin or sugar therein is driven to the surface and dispelled; and the pocket, which might initially have been full of resin or sugar, is emptied as the process continues. The grain of the wood becomes more pronounced. The resin or sugar in the wood appears to be propelled to the surface of the wood and finally dispelled from the surface

in minute particles and is or may be deposited on the walls of the receptacle and the electrodes. At intervals microscopic nodules or stalactites of resin or sugar, which may be composed of small resin or sugar particles coherently united under the heat of the reaction although the wood piece may not rise in temperature more than a few degrees, appear on the surface and appear to be inclined toward the arc stream or the terminals, depending upon the location of the nodules, and are or may be finally disintegrated and disappear. The completion of the reaction is indicated, to the practiced observer, when the surface of the wood takes on a shining and satiny appearance. Different woods may have different appearances when the process is practically completed, which appearances are readily recognized with practice. The diminution or cessation of formation of gum nodules and discharge of gum particles is also an indication of the practical completion of the process, although more difficultly observable.

The time of the process varies with the dimensions and character of the wood piece, a hard wood usually requiring a longer treatment than a soft wood. Ordinarily, for small pieces of wood, such as the tops of violins, the process is practically complete at the end of half an hour with say one hundred watts of electrical energy at say, seven thousand volts. It may be found desirable to operate the vacuum pump at intervals, to maintain the vacuum during the treatment.

The treated wood, when suitably supported and struck, to cause it to vibrate, gives off a predominant note which usually is distinctly higher than its predominant note prior to the treatment. The tone persists for a much greater period of time and has more overtones, and more harmonious overtones, than the untreated piece; all of which are readily recognized by an experienced observer.

The action of the process appears to set up a force which acts on the gum particles which are finely distributed through the wood, to drive them to the surface and dispel them from the surface throughout the receptacle, where they will be deposited on the walls of the receptacle and the electrodes. The deposit appears to be greatest in the vicinity of the more positive electrode.

While I have described my invention mainly in connection with an improved wood for violins and other acoustic instruments; it may be equally applicable to other uses and materials. In Fig. 3, for instance, I have illustrated an apparatus adapted for treating a cellulosic material, such as wood chips, for the removal of the gums, to prepare the wood chips for paper making.

The receptacle 30 may be made of steel, for instance, and have an insulating lining 31 therein. Insulated electrodes 32 may extend into the receptacle and be connected with a suitable source of electrical power, as the high tension transformer 33. The receptacle may be evacuated to a suitable degree by the vacuum pump 34. Wood chips, or other suitable material, may be introduced into the receptacle through the upper manhole 35 and packed between the electrodes, and the treated material may be removed through the lower manhole 36. As thus arranged the arc stream will be through the material.

With the above process, the structure or form of the wood piece is not altered in any manner.

I claim:

1. The method of removing gum from cellulosic material which consists in subjecting the cellulosic material to the influence of an electrostatic field having such high potential and under such condition as to act on and dispel gum from the material without destroying the latter.

2. The method of removing gum from cellulosic material which consists in subjecting the cellulosic material to the influence of a reduced gaseous pressure and an electrostatic field having such high potential as to act on and dispel gum from the material.

3. The method of treating cellulosic material to extract the gum therein which consists in subjecting the material to the influence of a high potential electrostatic field and an ionic discharge, under conditions to extract the gum without destroying the cellulosic material.

4. The method of treating cellulosic material to extract the gum therein which consists in subjecting the material to the combined influence of a vacuum and a high potential electro-static field and an ionic discharge in the vacuum.

5. The method of treating wood to increase the resonant quality thereof which consists in subjecting the wood for a substantial period of time to the influence of a high potential electrostatic field under such condition as to prevent destruction of the wood.

6. The method of treating wood to increase the resonant quality thereof which consists in subjecting the wood for a substantial period of time to the influence of a reduced gaseous pressure and a high potential electrostatic field.

7. The method of treating wood which comprises establishing about the wood a high potential arc stream in a substantially inert atmosphere.

8. The method of treating wood which comprises establishing about the wood a high potential arc stream in an atmosphere of reduced gaseous pressure.

9. The method of treating wood which comprises establishing about the wood be-

tween spaced electrodes a potential sufficiently high to produce an arc stream in a vacuum, and maintaining said potential until the gum is dispelled from the wood.

10. The method of treating wood which comprises establishing between spaced electrodes and about the wood a high potential arc stream in an inert atmosphere.

11. The method of treating wood which comprises placing wood in an inert atmosphere between spaced electrodes, establishing a high potential arc stream between said electrodes, and maintaining said arc stream until the gum is dispelled from the wood.

12. The method of removing normally solid mobile dielectric particles from fibrous material containing them which consists in subjecting said material to the influence of an electrostatic field having such high potential and under such conditions as to dispel said mobile particles from said material without destroying the latter.

13. The method of removing normally solid mobile dielectric particles from fibrous material containing them which consists in subjecting said material to the combined influence of a vacuum and a high potential electrostatic field and an ionic discharge in the vacuum.

In testimony whereof, I have signed my name to this specification.

CHESTER D. AINSWORTH.