

CLASS EXERCISE I

AN OBVIOUSNESS TRIAL

For this class exercise, we'll conduct a "mini-trial" on the obviousness of an invention. You'll be assigned one of three roles to play: either the patentee, the challenger, or the decision-makers (judge/jury).

Your instructions are as follows:

1. For the invention, I've provided a partial description of the case, the patent itself, and the most relevant prior art. Other prior art is found in the background information.
2. During the first 30 minutes of class, you'll be given the opportunity to meet as a group and plan your strategy.
3. The patentee and challenger groups will each make a 10 minute presentation regarding the obviousness / nonobviousness of the asserted invention. Each side will have 5 minutes of rebuttal time. The decision-makers will be allowed (and, indeed, expected) to ask questions. At the end of the allowed time, the decision-makers will then meet for 5 minutes, and then have 3 minutes to explain their decision, in terms of the analytic tools for obviousness we've discussed.
4. Each group can decide how best to present its case. More than one group member must speak. Most groups divide up the arguments.

You'll want to consider the following:

- a. What factual findings must a court make to analyze obviousness?
- b. Who has the burden of proof?
- c. How important are the "objective indicia"? How do you establish them?

ASSIGNED ROLES

Patentee (arguing for nonobviousness)

Group 1

Challenger (arguing for obviousness)

Group 2

Decision-makers (the judge and jury)

Group 3

CLASS EXERCISE 1



The following documents provide the relevant materials for this case:

1. US Patent No. 1,687,510 issued to Pipkin (the invention)
2. US Patent No. 1,240,398 issued to Wood (prior art)
3. A narrative description of the Pipkin '510 patent, describing other prior art, and other facts of the case.

***The question is whether the
Pipkin '510 invention is
obvious under 35 U.S.C. § 103.***

UNITED STATES PATENT OFFICE.

MARVIN PIPKIN, OF CLEVELAND HEIGHTS, OHIO, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC-LAMP BULB.

Application filed June 29, 1925. Serial No. 40,152

My invention relates to bulbs for electric lamps and more particularly to frosted bulbs for such lamps. This application is a continuation in part of my application Serial No. 690,672, filed February 4, 1924.

An important feature of my invention is an improved method of frosting bulbs and other thin glassware on the inside. Inside frosting has advantages over outside frosting. This is particularly true in the case of illuminating glassware since better diffusion with lower absorption of light is obtained. Another advantage of the inside frosting, which applies generally, is that the outer surface of the article is left smooth and, therefore, does not collect dirt easily and may be easily cleaned. There are other instances where inside frosting is desirable to improve the appearance or to perform other functions in the operation of the device. The preferred method of frosting is by removal of material, that is, by etching, rather than by application of coatings. However, as heretofore produced, bulbs and similarly thin articles thus frosted on the inside have been fragile to such a degree as to occasion prohibitive breakage. Bulbs ordinarily used for incandescent lamps are between 10 and 90 mils in thickness, averaging between 15 and 70 mils, and apparently, the application of the inside frost by etching has weakened them so that they have been very easily broken. The object of my invention is to produce an inside frosted glass bulb which will be much stronger than those heretofore produced.

The prior art makes no distinction between the methods of inside and outside frosting. The frosting on the outside has been accomplished by sand blasting or by the use of a chemical frosting medium. Frosting by etching is to be distinguished from the etching without frosting as the former produces a fine grained rough surface which appears more or less white while such etching without frosting produces a surface which is substantially colorless. The unfrosted etched glass is not sufficiently diffusing for lamp bulbs. The preferred method of frosting is by the use of a chemical medium. For lime glasses the presence of an ammonium compound in addition to the hydrofluoric acid seems to be necessary. The effect is improved by the addition of finely divided inert materials such as barium sulphate. In some cases

the presence of sodium salts such as sodium sulphate is of advantage. Dextrin or flour may also be added in order to cause better adherence of the mixture to the glass surface. The degree of frosting depends upon three factors; first, the strength of the frosting mixture as indicated by the percentage of hydrofluoric acid present; second, the temperature of the mixture; and third, the time during which the bulb is exposed to the frosting mixture. Ordinarily the stronger the mixture, the higher the temperature, and up to a certain point, the longer the time, the greater the degree of frosting. When the inside surface of a lamp bulb is subjected to these frosting mixtures to the extent necessary to produce a practical frost, that is, one which will produce the proper light diffusion, the article becomes extremely fragile. I have found, however, that if the bulb is given a further treatment, which I term a strengthening treatment, in which it is subjected to an etching or frosting treatment of lower degree than that to which it was first subjected, it becomes quite strong. Indeed, it may be made practically as strong as the original clear glass bulb. The use of a weaker etching medium for the treating step is preferable to lessening the time or temperature. An etching solution becomes weaker with use and so, good results may be sometimes secured by using, for the strengthening treatment, the used frosting solution.

In the drawing, Fig. 1 is a diagram showing the effect of inside frosting on the strength of a bulb; Fig. 2 is a diagram showing the results of the strengthening treatment comprised by my invention; Fig. 3 is a diagram showing the effect of the strengthening treatment on the strength, the light absorption and the diffusion of the bulb; Fig. 4 is a diagram showing the variation of the various sizes of lamps in maximum brightness; Fig. 5 is a diagram showing the variation in absorption; Fig. 6 is an elevation of a bulb strength tester; Fig. 7 is a plan and Fig. 8 is an elevation partly in section of an apparatus for applying the frosting and strengthening treatments.

In Fig. 1 the ordinates represent the strength of the bulb as determined by the ivory ball tester hereinafter described. The abscissas represent the time in minutes during which the inside of the bulb is subjected

to the frosting mixture. There are two curves. In obtaining curve No. 1, the following frosting mixture was used:

	Per cent.
5 Ammonium biffuoride-----	36
Dextrin (powder)-----	10
Barium sulphate-----	28
Sodium bi-sulphate-----	5
Water -----	21

10 This mixture contained 11.9% hydrofluoric acid. The temperature was 20° centigrade. For test No. 2 the above mixture was diluted with water and the mixture used was constituted as follows:

	Per cent.
15 Ammonium bi-fluoride-----	25
Dextrin -----	6.9
Barium sulphate-----	19.32
Sodium bi-sulphate -----	3.45
20 Water -----	45.33

The temperature was 20° centigrade. The frosting mixture contained 8.34% hydrofluoric acid. In test No. 1 and test No. 2 a fresh solution was used in each bulb frosted. In both cases the mixture was poured into dry bulbs and allowed to remain for the time specified. In test No. 1 five sets of bulbs were tested, each set containing five bulbs. The tests were made at zero, one minute, five minutes, ten minutes and twenty minutes. The average showed an initial strength of 44.8; 9.8 after one minute; 2.6 after five minutes; 2.2 at ten minutes and about the same at twenty minutes. The bulbs which were frosted for one minute did not have enough frosting to make them practical for use. In test No. 2 a similar number of bulbs were tested and the average was 44.8 at zero; 42.2 at five minutes; 13.8 at ten minutes; 4.2 at twenty minutes and 2.6 at twenty-five minutes. The bulbs frosted for five minutes were almost like clear bulbs. Those for ten minutes had just a slight haze but were unsuitable for use in lamps.

15 A bulb having a strength less than 7, which is about 16% that of the clear bulb, would be too fragile for handling commercially. In practice it is aimed to keep the strength above 20 or about 45% that of the clear bulb. It is apparent therefore from the above test results that when the frost was sufficient to produce practical diffusion, the bulb was prohibitively weak.

Fig. 2 shows the effect of the strengthening treatment comprised by my invention. The frosting mixture used had an acidity of 11.8% hydrofluoric acid and the temperature was 50° centigrade. The mixture was sprayed over the inside of the bulb for five seconds, and after five seconds it was sprayed again and this continued for the period of the test. The time is indicated in seconds and represents the time during which the frosting mixture was in contact with the bulb. The clear bulbs were washed out with water at

about 45° centigrade just before being sprayed. The curve marked "Frosting" was derived from five sets of bulbs of five bulbs each. The average showed a strength of 44.8 at zero; 11 at 10 seconds; 4.2 at twenty seconds; 3 at thirty seconds, and so on as indicated in the full line curve. The bulbs frosted for ten seconds had only a slight haze and were unsuited for practical use. Those frosted for twenty seconds were not uniform. Those at thirty seconds were better, and from then on the bulbs were suitable.

In Fig. 2 the broken line curve marked "Treating" was derived from the results of tests in which five sets of bulbs of five each were used. The bulbs treated had been frosted and showed an average strength of 3.2 on the ivory ball tester. The mixture used contained 7.44% hydrofluoric acid, 40% barium sulphate and 2% dextrin. The procedure followed was the same as followed in the case of the frosting, i. e. the mixture was sprayed over the interior surface of the bulb. The curve shows that the initial strength was 3.2; that after thirty seconds treatment the strength was 39.6; and that after this time the strength rose to substantially the same as that of the clear bulb. It has been found in practice that thirty seconds under these conditions is a desirable period and the curve shows that during this time the strength increased from 3.2 to 39.6, or 11.37%.

In order to obtain comparative information regarding the effect of exterior and interior frosting, tests were conducted in which a uniform selection of lime glass bulbs was made. These were divided into two portions. One portion was frosted inside and the other on the outside. Of the portion which was frosted on the inside some were given the strengthening treatment and some were not, and the amount of the strengthening treatment was varied. The strength tests were obtained from samples and lamps were made from the remaining bulbs. The lamps were the ordinary tungsten 115 volt, 40 watt lamps of the vacuum type and made according to standard practice. Photometric tests were then made of the lamps so as to determine the maximum brightness in candles per square centimeter which indicates the amount of diffusion. The absorption by the bulb was also determined, the loss in lumens being expressed in percentage. The results showed the average for the clear bulbs to be strength 44.8; absorption 0; and maximum brightness 201.8. Lamps frosted on the outside showed strength 44.8; absorption 5.13; and maximum brightness 5.36. Lamps frosted on the outside for a longer time showed strength 44.8; absorption 3.96; and maximum brightness 5.4. Lamps frosted on the inside but which were not given the strengthening treatment showed strength 6.8; absorption 2.25; 130

and maximum brightness 3.02. Lamps frosted on the inside and given the strengthening treatment comprised by my invention for ten seconds showed strength 30.4; absorption 1.22; and maximum brightness 4.5. Those treated for twenty seconds showed strength 42; absorption 1.27; and maximum brightness 5.6. Those treated for forty seconds showed strength 44.8; absorption 1.07; and maximum brightness 5.92. These results indicate that the inside frosted lamps have greater diffusion and lower absorption than the outside frosted lamps. They also indicate that by the strengthening treatment the strength is brought up so that the lamp can be practically handled, and that while the maximum brightness is increased, or in other words, the diffusion is reduced, still the absorption is lessened. Moreover, the diffusion is substantially as good as that of the outside frosted lamps.

Fig. 3 is a diagram showing the effect of treating. Curve 1 shows the strength, curve 2, the absorption and curve 3 the maximum brightness. The treating solution had an acidity of 5.2% hydrofluoric acid and the temperature was 55° centigrade. These curves indicate that treating enormously increases the strength of the bulb. It increases the maximum brightness somewhat but not to an objectionable extent and at the same time this is compensated for to a certain extent by the lowering of the absorption. The curve shows that, after a treatment of ten seconds, the strength had been increased from 6.8 to 30.4, while the brightness had been increased from 3 to 4.5, and on the other hand the absorption had been lowered from 2.25 to 1.22.

The tests upon which the curves shown in Fig. 4 are based were made to show the relation between the maximum brightness of the inside frosted bulb lamp and the corresponding clear bulb lamp for the various wattages. The curve shows the following values:

Wattage	Maximum brightness (clear)	Maximum brightness (inside frosted)	Per cent
15	176	2.33	1.3
25	261	4.1	1.6
40	259	5.2	2.0
60	596	9.2	1.55
100	632	12.3	2.0
100 (daylight)	269	6.4	2.4
200	807	19.9	2.6
500	925	39.0	4.2

These tests indicate that for ordinary incandescent lamps, the average maximum brightness for inside frosted lamps, frosted according to my invention, is below 4.5% of that of the clear bulb lamp of the same wattage. Heretofore bulbs inside frosted so that the maximum brightness of the frosted lamp was below fifty per cent of that of the clear bulb lamp had a strength below 16% of that of the clear bulb.

The full line curve in Fig. 5 shows the output in lumens of the clear bulb lamp and the dotted line shows the same for a lamp having a bulb inside frosted by my invention. The small percentage loss in lumens caused by the inside frost will be apparent.

In obtaining the curves of Figs. 1, 2 and 3, the measurement of strength of bulb was made by means of the ivory ball tester shown in Fig. 6. This device consists of a spring clamped holder 10 adapted to receive and hold securely a bulb 11. The holder and bulb are suspended as by means of a chain 12 so as to allow them to swing. The blow is applied by means of an ivory ball 13 which is mounted on a rod 14 pivotally suspended at 15 to the frame 16. The force of the blow delivered by the ivory ball depends upon the length of the arc through which it swings. It strikes the bulb through a circular passage in the block 16' into which the bulging portion of the bulb extends. A gauge is provided consisting of an arcuate scale 17 suitably graded and supported from the frame 16 by a suitable bracket 18. A slidable marker 19 provides a guide for the starting of the pendulum swing of the ivory ball in each case.

In Figs. 7 and 8 are shown an apparatus which I have devised for the application of the inside frosting and treating. This apparatus comprises a suitable reservoir 20 surrounded by a water jacket 21 having inlet and outlet pipes 22—23. Water may be circulated through the water jacket at a suitable temperature to maintain the frost mixture contained in the reservoir 20 at the desired temperature. The frosting mixture is forced up through the pipe 24 to the bulb 25 by air pressure applied through the pipe 26. A suitable holder 27 is provided which serves to support the bulb. The surplus frosting mixture returns to the reservoir through the funnel 28 and pipe 29. Fresh solution may also be added through the same means. Conveniently mounted on the same frame 30 as the frosting apparatus is the washing means consisting of the water pipe 31 which projects up above the frame so that the bulb 25 may be placed thereover, said bulb being supported in the holder 32. After the bulb has been frosted it is washed by this means and the overflow goes into a reservoir 33. On the same frame is also mounted the apparatus for giving the bulbs the strengthening treatment hereinbefore referred to. This apparatus, as shown, is a duplicate of the apparatus used for the first frosting. As hereinbefore stated, it is preferred to use a weaker solution in the strengthening mixture reservoir 34 from that used in the frosting mixture reservoir 20.

As set forth in my application Serial No. 690,672, filed February 4, 1924, and hereinbefore referred to, the probable explanation of the fact that the bulbs made according to my

R. W. WOOD.
METHOD OF MAKING LIGHT DIFFUSING SCREENS.
APPLICATION FILED MAY 29, 1913.

1,240,398.

Patented Sept. 18, 1917.

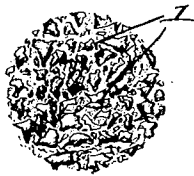


Fig. 1.

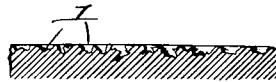


Fig. 2.

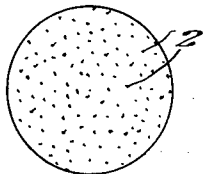


Fig. 3.



Fig. 4.

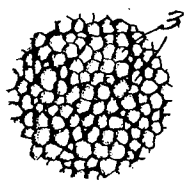


Fig. 5.



Fig. 6.

Witnesses

E. G. Marshall
M. P. Imire

Inventor

R. W. Wood,

By

John N. Hock
his Attorney

UNITED STATES PATENT OFFICE.

ROBERT W. WOOD, OF BALTIMORE, MARYLAND.

METHOD OF MAKING LIGHT-DIFFUSING SCREENS.

1,240,398.

Specification of Letters Patent.

Patented Sept. 18, 1917.

Application filed May 29, 1913. Serial No. 770,872.

To all whom it may concern:

Be it known that I, ROBERT W. WOOD, a citizen of the United States, residing at Baltimore city and State of Maryland, have invented certain new and useful Improvements in Methods of Making Light-Diffusing Screens, of which the following is a specification.

An ordinary ground glass screen, while diffusing the transmitted light very perfectly, transmits only from 60% to 70% of the total light which falls upon it, reflecting back a large proportion of the light. This results from the circumstance that the surface of the glass is cut into irregular crevices, pits and grooves of considerable depth, the pits reflecting the light at a large angle of incidence, often in a to-and-fro manner, either returning it toward the source, or scattering it laterally within the glass plate.

This unfavorable action I have overcome by treating the surface of the glass by a process which gives it a structure of considerable regularity, the surface being covered with very minute smooth depressions similar to concave lenses. These lenses are not necessarily regular in outline, but are contiguous; that is, they run together along their edges, the whole forming a cellular structure when viewed under the microscope, totally different in appearance from the surface of glass plates ground or etched by the usual methods. These microscopical lenses, which cover the surface, diffuse the light in a very perfect manner and transmit practically all of the light, the loss due to reflection from the steep sides of irregularly formed pits being absent in this case.

Referring to the accompanying drawing:

Figure 1, represents in top plan the surface of an ordinary ground glass plate, as viewed under a microscope;

Fig. 2, an enlarged cross-section of the same;

Fig. 3, a top plan view of the surface of a glass plate as viewed under a microscope, and pitted by an air blast as in the first step of the process herein described;

Fig. 4, an enlarged cross-section thereof;

Fig. 5, a top plan view as seen under a microscope, of a glass plate after the pits have been treated according to my process to form concave lenses, and

Fig. 6, an enlarged cross-section thereof.

One embodiment of my method of making such screens is as follows: A blast of air

charged with a fine dust of flour emery or carborundum is caused to play over the surface of the glass, for a few seconds. The effect is to produce a very slight cloudiness of the surface, which is scarcely noticeable. Each grain of dust has, however, produced a microscopical dent in the surface by chipping out a minute fragment of glass. The surface is now flowed with hydrofluoric acid, which enlarges and smooths out the pits made by the emery dust grains into the minute concave lenses previously alluded to.

When the acid has done its work, the plate is washed to remove the acid. The time the acid has to stay on the plate may be readily determined by experiment, and after one has become accustomed to the process, the appearance of the glass itself will show when the acid has done its work.

In the accompanying drawings, 1 indicates the crevices formed in the surface of ordinary ground glass; 2, the microscopic dents or pits made by the emery dust grains according to the method herein described, and 3, the minute concave lenses formed by enlarging and smoothing the pits 2, as herein described.

The diffusing power of a plate prepared in this way is fully equal to that of the usual ground glass, while the intensity of the transmitted light is very nearly double that transmitted by such ground glass.

When placed before a dark back-ground, and illuminated, my glass appears very nearly as black as ordinary untreated glass, in contrast to the milky white appearance of ordinary ground glass. This makes it of great value as a focusing screen for cameras. The image formed by the lens upon a glass screen prepared in this way, is by actual measurement double the brilliancy of the image seen on ordinary ground glass, and as the cellular surface reflects little or no light, the use of the black focusing cloth can be dispensed with even out of doors in full sunlight. It is of especial value in the case of cameras of the Graflex type, which suffer somewhat from insufficient brilliancy of the image on the focusing screen.

Such a screen is also useful for rendering the bulbs of incandescent lamps diffusing without at the same time causing the very marked loss in the efficiency of the lamp, which results from frosting the bulbs in the usual manner.

It should be understood that the emery

blast operation to which I subject the glass does not produce a surface similar to the ordinary ground glass surface; in my case the pits are separated from each other much
 5 more than in the case of ground glass, as will be readily seen from a comparison of Figs. 1 and 3.

The average diameters of the concave lenses which form the cellular surface can
 10 be varied by modifying the treatment of the surface previous to the action of the acid. By employing a less strong blast of air and allowing it to act for a longer time the micro-
 15 scopic pits are smaller and more numerous, which results in the production of a cellular structure of finer grain, and a wider angle of diffusion. By controlling in this way the size of the lenses and the depth to
 20 which they are excavated, it is possible to vary the angle through which the light is diffused, small angles being better suited to certain purposes than large angles, for example, in the case of window glass in which
 25 it is desired that most of the light passes through without excessive lateral diffusion, and here I may remark, when this glass is used in windows it has very much more the appearance of ordinary clear window glass than has the usual ground glass; that is to
 30 say, it reflects considerably less light and, therefore, does not present the white or frosty appearance to anything like the extent of the usual ground glass.

While my invention is particularly well
 35 adapted to the specific uses herein mentioned, it may have a variety of other applications which it is hardly worth while to here enumerate.

40 It should also be understood that the specific method set forth herein may be modi-

fied without departing from the scope of what I claim.

What I claim is:

1. The method of making a light diffusing screen, which consists in forming in a
 45 glass surface a multiplicity of minute pits separated by a plane surface relatively wide as compared with the depth of the pits, then enlarging these pits into contiguous concave
 50 depressions, whereby each such depression forms a surface of a concave lens.

2. The method of making a light diffusing screen, which consists in forming in a glass surface by mechanical abrasion a multiplicity of irregular pits separated by a plane
 55 surface relatively wide as compared with the depth of the pits, and then smoothing out and enlarging these pits into contiguous concave depressions by the application of
 60 acid to the pitted surface of said glass, and then removing the acid therefrom, each of said depressions forming the surface of a concave lens.

3. The method of making a light diffusing screen, which consists in applying a blast of
 65 abrasive material to a glass surface and thereby forming in said surface a multiplicity of pits separated by a plane surface relatively wide as compared with the depth
 70 of the pits, flowing the pitted surface of said glass with hydrofluoric acid and thereby enlarging said pits into contiguous smooth concave depressions, and then removing the acid from said glass.

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT W. WOOD.

Witnesses:

ADRIAN GRAPE,
 CHAS. A. NICHOLSON.

Background to the Pipkin Invention

The Pipkin patent ('510) relates to a frosted glass bulb for electric lamps. The single claim-at-issue is:

1. A glass electric lamp bulb

having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb,

said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than twenty per cent of that of the clear bulb.

Many years prior to the Pipkin patent, efforts had been made to reduce the glare produced by the brilliant filament of an incandescent lamp having a clear bulb. The most common method of reducing the glare was to frost the outside surface with an acid frosting solution. While bulbs so treated reduced the glare, the rough outside surface collected dirt and was difficult to clean, with the result that the light output was further reduced. Twenty-five years before Pipkin, Kennedy (patent No. 733,972 issued July 21, 1903) had showed an inside frosted bulb. But a difficulty appeared. When the outside surface of a bulb was frosted the strength of the bulb was not materially affected. When the inside surface, however, was frosted, the strength of the bulb was substantially reduced, making it unfit for practical use. Pipkin recited these facts in his specifications and stated, 'The object of my invention is to produce an inside frosted glass bulb which will be much stronger than those heretofore produced.' He went on to state that the preferred method of frosting was by use of a chemical medium which, when applied so as to produce the proper light diffusion, made the bulb extremely fragile. And he added: 'I have found, however, that if the bulb is given a further treatment, which I term a strengthening treatment, in which it is subjected to an etching or frosting treatment of lower degree than that to which it was first subjected, it becomes quite strong. Indeed, it may be made practically as strong as the original clear glass bulb.' He gave as the probable explanation the fact that the first treatment produced sharp, angular crevices or pits in the glass, while the second or strengthening treatment ate away additional glass and rounded out the angular crevices into

saucer-shaped pits.¹ The fact that the bulb was strengthened when additional glass was dissolved was referred to by the court below as 'Pipkin's paradox'. The patent contains charts showing the relative extent to which the strength of the bulb is weakened by the first frosting treatment and its strength restored by the second treatment. The patent also shows that while the bulb of the patent materially reduced the glare obtained in a clear bulb, the lighting efficiency of the two is substantially the same for any given wattage.

As the first claim of the patent indicates, the characteristic feature of the patented bulb is the fact that the interior surface is 'characterized by the presence of rounded as distinguished from sharp angular crevices.' It is that feature which is responsible for the bulb's strength. Now, an electric bulb frosted on the inside was old in the art. Kennedy had disclosed such a product twenty-five years earlier. Moreover, it had long been known in the art that successive acid treatments of glass rounded out the sharp angular crevices produced by the first etching. That was shown in particularity by Reinitzer² in 1887 and by Tillotson³ in 1917. And it was shown in Sprechaal of 1907 (a German trade paper) that if hollow glass was subjected to a second etching, the surface would have a silk-like appearance, the finish being called satin etching or silk mat.⁴ It is true that these prior publications were concerned with frosting for the purpose of obtaining a decorative finish in glass ware or desired optical effects in focusing screens for cameras and the like. But Sprechaal in 1912 specifically described the application of successive etchings to electric bulbs. And that publication recommended, as Pipkin did years later, that a weaker or diluted etching solution be used for the second etching. Moreover, Wood (patent No. 1,240,398 issued September 18, 1917) observed that successive acid treatments of glass rounded out the sharp angular crevices produced by the first etching, and he applied that idea to electric bulbs as well as to other glass articles. His patent covered the making of light-diffusing screens. He noted that if glass was etched once, the surface was cut into irregular

¹ One of the experts, when asked for the explanation of this phenomenon testified: 'Because in the instance where we have sharp angular crevices on the inside surface and the bulb is subjected to impact on its outer surface, the inner surface tends to be extended and therefore it is put into tension and the sharp angular crevices are the starting point for cracks, whereas in the case where the crevice has been rounded out the impact against a bulb having on its inner surface this type of frosting, is such that the testing effort is spread over a very much larger area and the bulb is almost as strong as it was before frosting.'

² Die Glashutte of 1887, Contributions to the Knowledge of Glass Etching.

³ Journal of Industrial and Engineering Chemistry, October 1917.

⁴ It was largely on the basis of this prior disclosure that the British patent was held invalid. See British Thomson-Houston Co., Ltd. v. Tungstalite, Ltd., supra note 1, pp. 288, 289.

crevices, pits and grooves with the result that only a portion of the light was transmitted. But if after the first etching (which he accomplished by a blast of air charged with a fine dust of flour emery or carborundum) the surface was flowed with acid, the crevices and pits were enlarged and smoothed out into minute concave lenses. These microscopical lenses diffused the light perfectly and transmitted practically all of it. He noted that his process was especially valuable in the case of certain types of cameras. But he added, 'Such a screen is also useful for rendering the bulbs of incandescent lamps diffusing without at the same time causing the very marked loss in the efficiency of the lamp, which results from frosting the bulbs in the usual manner.' Wood, to be sure, did not describe frosting the inside of the bulb. Kennedy, however, had shown that. Moreover, prior to Wood it was well known in the art, as we have noted, that successive acid treatments of glass produced a surface characterized by the presence of rounded as distinguished from sharp angular crevices or pits. If there was novelty in applying that process to electric bulbs, Wood achieved it. At least since Kennedy, it was known that inside frosted electric bulbs were preferable to outside-frosted bulbs.

Wood, of course, was concerned only with light diffusion and transmission with of screens, secondarily of electric bulbs. Neither he nor any other before Pipkin appears to have given any indication that the second treatment resulted in any strengthening of the glass. But strengthening was inherent in the method he proposed. And it appears that an electric bulb, which had been frosted inside pursuant to his method, would have inevitably obtained the rounded pits and hence the attendant strength characteristic of the Pipkin bulb.

invention have a higher strength than those inside frosted by simple application of the frosting treatment which has heretofore been applied to the outside, is that in the latter case the surface of the glass is covered by a multitude of depressions or pits having sharply defined angles while the depressions or pits where my invention is employed are more or less rounded.

10 What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angu-

lar crevices to such an extent that the strength to resist breakage by impact is greater than twenty per cent of that of the clear bulb.

2. A glass electric lamp bulb having its interior surface frosted by etching so that the maximum brightness of an ordinary incandescent lamp comprising such a bulb will be less than twenty-five per cent of that of said lamp with a clear bulb, said interior bulb surface being characterized by the presence of rounded as distinguished from sharp angular crevices to such an extent that the strength to resist breakage by impact is greater than forty-five per cent of that of the clear bulb.

In witness whereof, I have hereunto set my hand this 28th day of June, 1925.

MARVIN PIPKIN.

Oct. 16, 1928.

1,687,510

M. PIPKIN

ELECTRIC LAMP BULB

Filed June 29, 1925

2 Sheets-Sheet 1

Fig. 1

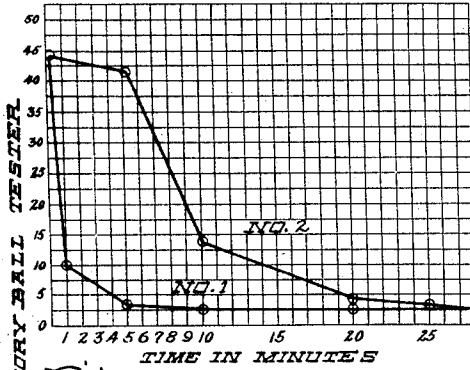


Fig. 2

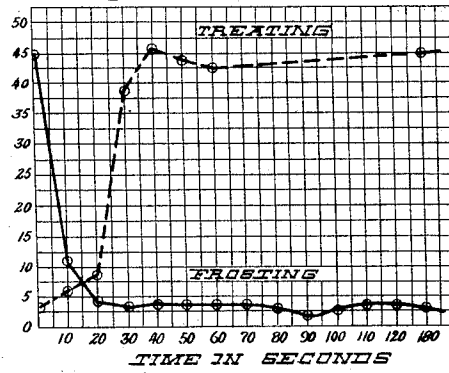


Fig. 3

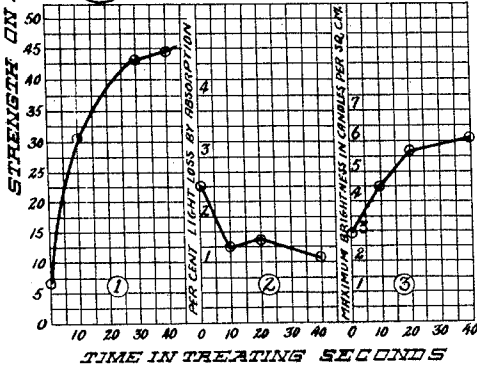


Fig. 4

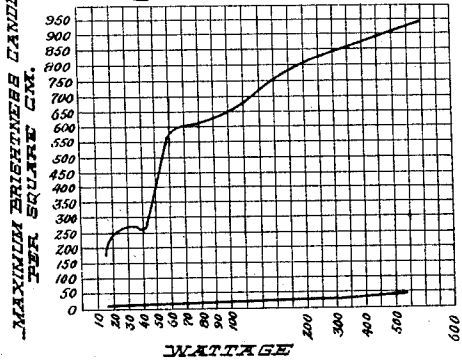


Fig. 6

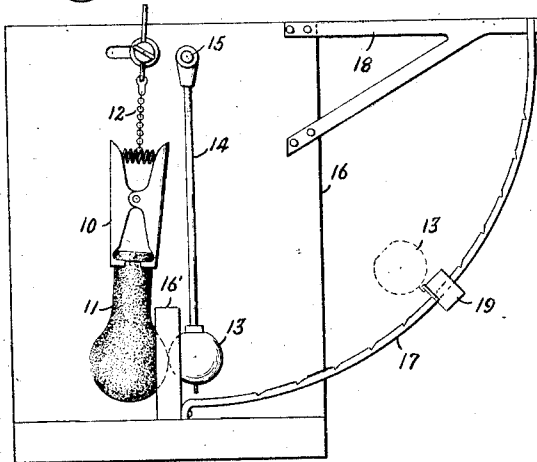
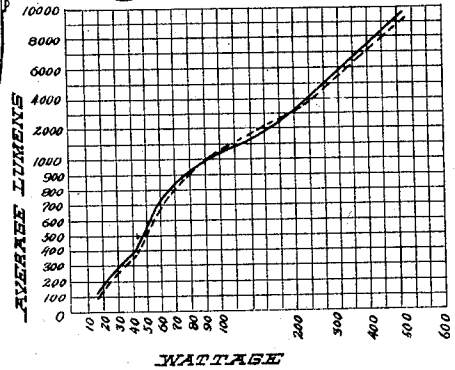


Fig. 5



INVENTOR:
 MARVIN PIPKIN,
 BY *Alexander S. Lunt*
 HIS ATTORNEY.

Oct. 16, 1928.

1,687,510

M. PIPKIN

ELECTRIC LAMP BULB

Filed June 29, 1925

2 Sheets-Sheet 2

FIG. 7

