R. R. WILEY & W. S. HOUGH, Jr.

METHOD OF MAKING GLASS LETTERS.

APPLICATION FILED AUG. 16, 1913.

1,146,910.

Patented July 20, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

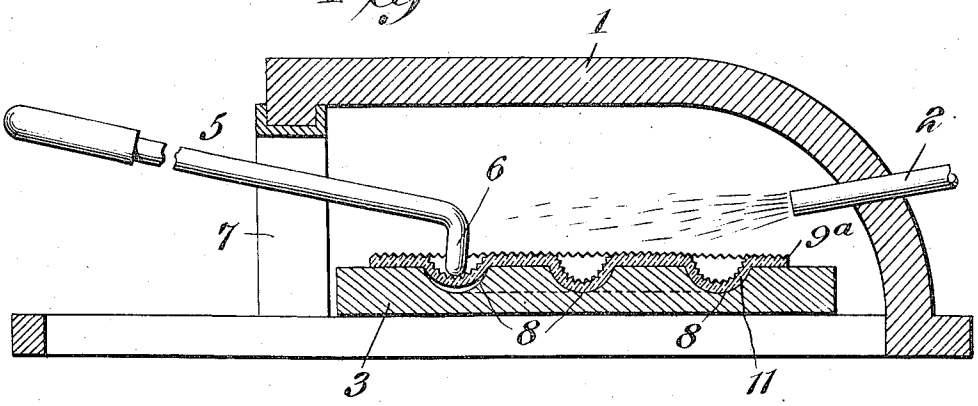


Fig. 2.

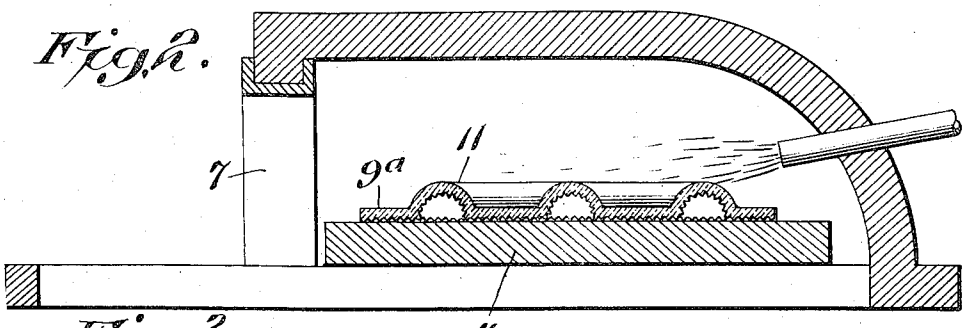


Fig. 3.

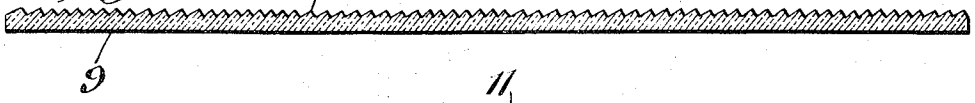
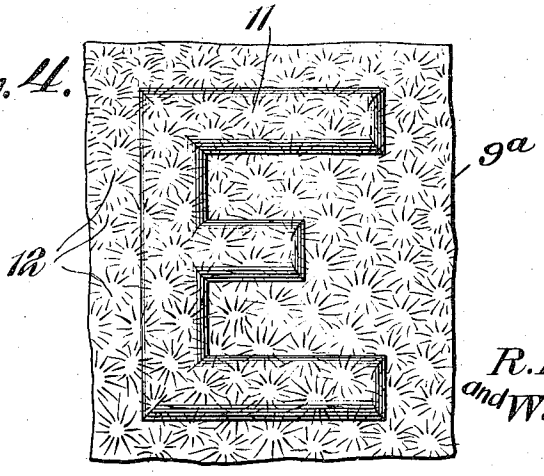


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

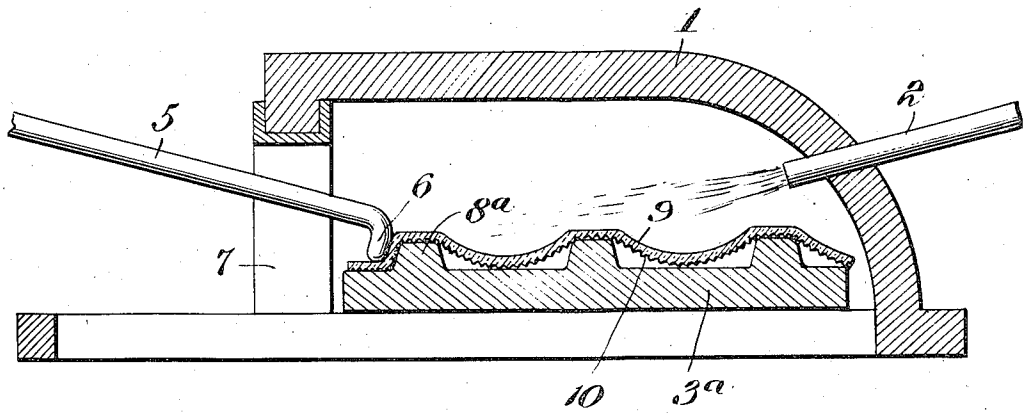


Fig. 6.

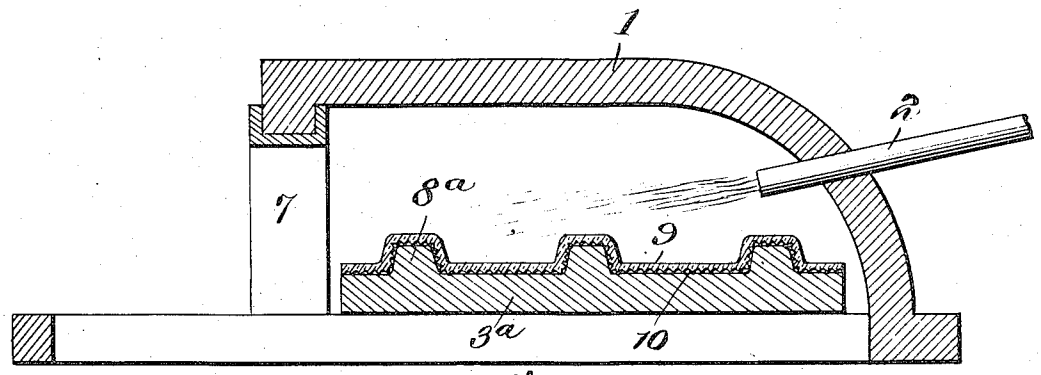
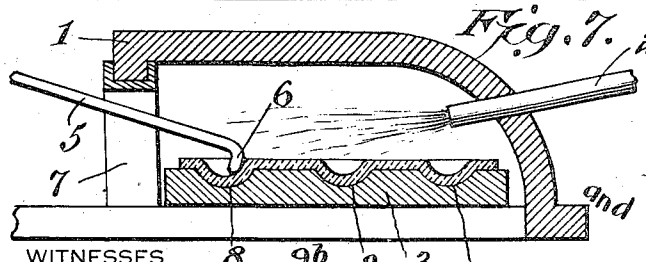


Fig. 7.



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METHOD OF MAKING GLASS LETTERS.

1,146,910. Specification of Letters Patent. Patented July 20, 1915.

Application filed August 16, 1913. Serial No. 785,187.

To all whom it may concern:

Be it known that we, ROY R. WILEY and WILLIAM S. HOUGH, Jr., citizens of the United States, residing, respectively, at Buffalo and St. Catherines, in the county of Erie and Province of Ontario, respectively, and State of New York and Dominion of Canada, respectively, have invented a new and useful Method of Making Glass Letters, of which the following is a specification.

This invention has reference to improvements in the method of making glass letters and its object is to produce glass letters especially adapted for signs intended to be illuminated at night from a source of light at the rear of the sign and to be made brilliant in daylight by light reflected from the letters.

The present invention is adapted for the production of other sign characters than letters, but for convenience of description the characters produced will be designated letters, with the understanding that the term employed is to be interpreted broadly enough to include any sign character whether it be a letter of the alphabet or a numeral or some other character imitative or fanciful.

Glass sign letters have been used for many years and relief letters of glass have also been used for many years. Such sign characters have long been employed for signs of the type known as illuminated signs where a light giving element or elements are placed behind the letters for making the sign visible at night, but prior to the present invention such signs had inherent defects which greatly marred the artistic effect of the sign, and, moreover, the daylight effect was either very poor, or where the attempt was made to obtain a daylight effect such effect was only imperfectly obtained.

In accordance with the present invention there is first provided a sheet of glass of substantially even thickness throughout and usually one surface is formed into a great number of prisms having their angles such that light coming from the plane side of the glass will strike the surfaces of the prisms and when the rays of light are at the proper angles they will be almost totally reflected back through the plane side of the glass, thus imparting to the eye of the beholder the impression of brilliant illumination. When, however, there is a source of light on one side of the glass sheet and the observer is on the other side, such source of light is not seen as a localized source of light, but the light is broken up by the many prisms and reaches the eye of the observer from various directions giving the impression of an illumination from a large light area.

Street signs are designed to be viewed from a considerable distance and, therefore, are made large, and in most instances are considerably elevated, so that under the ordinary conditions of use different observers will view the signs from different angles and in most instances are below the level of the sign, wherefore the letter is made in relief and when made from a sheet of glass the strokes of the letters are hollow and of approximately even thickness throughout, although rounded outwardly or toward the observer. The result of this is that the light is transmitted at greatly increased angles with respect to the source of light, so that an observer standing almost in the plane of the letter will still see the strokes brilliantly illuminated as though the source of light was inside the strokes, when as a matter of fact the source of light is located several inches back of the letter.

Any structure of glass which will admit of the illuminating results may be employed, the present invention having to do with the formation of the glass sheet into a hollow letter in relief, this being accomplished in a manner to be described.

The invention will be best understood from a consideration of the following detailed description, taken in connection with the accompanying drawings forming a part of this specification, with the further understanding that the structure employed may be variously modified and the procedure described may also be variously modified, so long as such modifications mark no departure from the salient features of the invention.

In the drawings:—Figure 1 is a vertical section of a heating furnace, more or less schematically illustrated, and showing one step of the method. Fig. 2 is a similar view showing another step of the method. Fig. 3 is a section of a form of glass sheet which may be employed in the method, as such sheet appears before treatment. Fig. 4 is a front view of a glass sheet such as shown in Fig. 3 after having been subjected to treatment in accordance with the method of the

present invention. Figs. 5 and 6 are views similar to Fig. 1, but showing another manner of practising the invention. Fig. 7 is a view showing the application of the invention to smooth glass.

In the drawings there is shown a furnace 1, the showing being more or less schematic and without attempt at showing any particular proportions, and this furnace is supplied with means indicated by the pipe 2 for directing a burning fuel into the furnace in a manner to produce a desired degree of heat.

In order to carry out the method of the present invention there is provided a plate 3 and another plate 4, and also a tool 5 having an extremity 6 bent at an angle to the length of the tool and this tool is sufficiently long to permit a workman to introduce it through an opening 7 in the furnace, through which opening the plates 3 and 4 are also introduced, the workman being sufficiently remote from the opening 7 to prevent injury from the escape of heat from the furnace.

The plate 3 which may be an iron plate of appropriate dimensions, has produced in one surface sunken portions in the form of grooves 8 delineating a letter or whatever character it is desired shall be reproduced in glass. In practice the desired letter or other character may be formed in pattern in relief, and then against this pattern the iron plate is cast and this casting may be sufficiently smooth to permit its use without expending any particular labor upon it. The plate 4 is a plain plate and is free from grooves.

In carrying out the process the plate 4 is introduced into the furnace so as to be heated, and the plate 3 is also introduced into the furnace so as to be heated. The plate of glass indicated at 9 is inserted in the furnace for short intervals and withdrawn until the plate is of a uniform temperature throughout and sufficiently heated so that it can be placed on plate 3 without cracking. At the same time the sheet 9 is not sufficiently heated to spontaneously collapse and the operator thereupon, while the plate 3 and sheet 9 are within the furnace, manipulates the tool 5 in a manner to cause the end 6 to press upon the glass sheet immediately over the grooves 8, the sheet at this time having the prismatic surface indicated at 10 uppermost. The glass sheet being in a softened condition yields to the pressure applied by the tool end 6 and is forced into the grooves 8 until seated therein, but at no time does the glass become sufficiently soft to cause obliteration or flattening of the prisms 10, although the glass will yield to a force applied by the tool 5, the operator being able to follow the outlines of the letter accurately, and produce a sufficiently faithful copy of the die. The forcing of the softened but still quite resistant glass into the grooves causes a partial distortion of the glass sheet 9 so that it is no longer flat, but is more or less wrinkled. This is remedied by the operator flattening the wrinkled portions from time to time with his tool. The operator now withdraws the plate or die 3 with the treated glass sheet thereon and at the same time withdraws the plate 4 and then by the use of a suitable tool the formed glass sheet is lifted from the die 3 and reversed upon the plate 4, so that the formed letter is now uppermost and the plate 4 is reintroduced into the furnace for a short time sufficient for the heating of the glass sheet to cause it to flatten down upon the plate 4 but without sensible effect upon the relief portions agreeable to the grooves 8. The plate 4 is now again withdrawn from the furnace and with the letter thereon is placed in an annealing oven where it remains a sufficient length of time, say twenty-four hours, more or less, when it is ready for use. The glass sheet with the letter in relief is indicated at 9^a in Fig. 4, the letter itself being shown at 11.

The prisms in the particular form shown in Fig. 4 are indicated at 12 as arranged in groups where the individual prisms of each group radiate from a common center, and this arrangement has been successfully employed in actual practice, giving a distribution of light in connection with reflecting and toning-down means producing an evenness of illumination by night that gives to the observer the impression that back of the letter is a source of illumination as large as the letter itself, it being understood that all that part of the glass sheet not occupied by the letter is covered by opaque material, so that the letter alone is visible.

In the practice of the invention it is a matter of but a few moments' time to produce the letter complete and ready for the annealing oven, and without harmful distortion of the prismatic surface whether the letter be of the character indicated in Fig. 4 or of some other character, and the glass sheet after having the letter produced therein is in shape for being mounted in the sign structure without further treatment, those portions of the glass plate about the letter serving as means for fastening it in the sign structure.

In forcing the softened glass sheet into the grooves delineating the letter the tool 5 is moved in various directions as needed to press upon the glass to make it conform to the grooves, and while comparatively large portions of the glass sheet where over the grooves, and, therefore, unsupported, will yield quite readily to the action of the tool 5, the prismatic ridges are more resistant to distortion and hence do not sensibly change

their shape under the action of the tool, this being due to the fact that the active end of the tool is blunt and of less extent than the width of the groove, and hence may locally stretch or form the glass for a considerable distance from the point of application of the tool by transmission through the glass rather than the force being all expended at the point of contact only, which latter effect would result in the marked distortion, if not the obliteration of the prisms.

The heat employed is not sufficient or is not continued for a sufficient time to cause any material spontaneous flow of the glass, but only to soften it so as to yield without fracture to a force tending to cause the glass to conform to the grooves by progressive applications of the force or pressure or an application of the pressure in such manner as to permit the glass to yield without disturbance of any configuration of the glass. So far as the manner of causing the glass sheet to conform to the grooves is concerned, this might be applied to glass smooth on both sides or with the prismatic surface on that side which in the finished letter is the outside surface.

In the foregoing description reference has been had only to the formation of the sign characters in sunken molds. The characters on the mold, however, may be in relief, so that the glass sheet is in the main forced down upon the body portion of the mold plate, but the sign character itself as formed in the glass sheet is in relief as before. The prisms, however, may be on the face of the plate remote from the forming or working tool, thus relieving them from the action of the tool. Still if it be so desired the prismatic surface may be on the outside face of the glass, or the sign character may be formed of a glass sheet plain on both faces.

A mold adapted to the formation of relief sign characters of glass prismatic on one face, but with the prisms out of the path of the forming tool, is shown in Figs. 5 and 6, where there is indicated a plate 3^a having raised portions 8^a defining the sign character and a glass sheet 9 having a prismatic surface 10 when placed upon the plate 3^a with the raised sign character 8^a, and when appropriately softened by heat may be worked by the tool 5 having an angle end 6, while the mold plate and glass sheet are within the furnace 1 and maintained hot by the flame of burning fuel issuing from the pipe 2.

In Fig. 5 the softened glass sheet is indicated as lying upon the plate 3^a and being molded about the raised portions or ribs 8^a defining the sign character, while in Fig. 6 the completion of the operation of molding the glass sheet is indicated. It will be noticed that the forming tool 5 does not come in contact with the prismatic face of the glass sheet and so there is no tendency to distort the prisms. Still, this tendency is not marked, so that it is possible to mold the sign character with the prisms outermost, although usually it is preferred to have the prisms on the rear face of the sign character.

In either form of mold there is a surface capable of sustaining the glass sheet and there are portions sunken below such surface and such sunken portions are either in the form of a groove or grooves delineating the sign character or they form the margins or borders of and so delineate the sign character. It is into such sunken portions that the glass sheet is forced by an appropriate tool to produce a relief sign character, and in either case the sign character is produced by forcibly depressing parts of a glass sheet to cause the formation of the sign character in relief upon such glass sheet. Moreover, in either case while the glass sheet may be plain on both faces, it may also, and preferably is, prismatic on one face, and while the prismatic face may be that presented outwardly or inwardly in the finished sign character, the prismatic surface is preferably the inner or rear face of the sign character.

While the prismatic glass gives highly satisfactory results in the formation of relief sign characters, other types of glass free from prisms, or having substantially smooth surfaces and of a trunslucent nature, such as opal glass or the like, may be employed in the practice of the invention.

In Fig. 7 there is shown a sheet 9^b of smooth glass being subjected to the action of the forming tool 5, whereby relief strokes of the character are made. It will be understood of course that the structure of Fig. 5 may be employed instead of the particular structure shown in Fig. 7 when smooth glass is used, and it will be further understood that the subsequent treatment with the smooth glass is the same as with the prismatic glass.

What is claimed is:—

1. The method of producing glass sign characters for illuminated signs in which the character strokes are in relief, consisting in providing a sheet of glass of substantially even thickness throughout, heating the glass sheet to soften it while maintaining the temperature at a point less than that producing fusion or surface flow of the glass, and while the glass sheet so softened is supported upon a die having a sustaining surface for the sheet and portions sunken below such surface, whereby the die delineates a sign character, and also while the glass is maintained in such softened condition by the continued application of the heat, applying pressure to the softened glass where overlying the sunken portions of the die with the pressure exerted in directions both longitudinally and laterally of the

lengths of the character strokes so as to force the softened glass into the sunken portions of the die.

2. The method of producing relief glass sign characters for illuminated signs, which consists in providing a sheet of glass of substantially even thickness throughout, placing such sheet upon a die having a supporting surface for the glass sheet, and portions sunken below such surface whereby the die delineates a sign character, heating the glass sheet to soften it and locally and progressively applying pressure to the glass sheet both laterally and longitudinally of the sunken portions until the glass sheet has been depressed into the sunken portions throughout the area defined thereby.

3. The method of making glass letters, which consists in providing a sheet of substantially even thickness throughout with one face prismatic, heating the glass sheet to soften it while lying upon a die with the letter delineated by sunken portions and the glass sheet having the prismatic surface uppermost, and applying pressure to the softened glass sheet where overlying the sunken portions to force the glass thereinto, the heating being continued during the pressing operation.

4. The method of forming glass letters which consists in providing a sheet of glass of substantially even thickness throughout, heating the glass sheet to a temperature regulated to cause the glass to soften without spontaneously flowing, then while the glass sheet is supported upon a die with the character delineated therein by high and sunken portions, applying pressure to the glass where overlying the sunken portions to there force the glass into such sunken portions and continuing the pressure progressively both laterally and longitudinally of the sunken portions until the glass has been forced to the bottom thereof, then inverting the glass sheet upon a flat surface and submitting it as a whole to a softening temperature less than a temperature producing spontaneous flowing of the glass, whereby unevenness of those portions of the glass sheet other than the character strokes, which unevenness is due to the molding of the sheet into the sunken portions, is obliterated.

5. The method of producing glass characters for signs which consists in providing a sheet of substantially even thickness throughout, heating the glass sheet to a temperature regulated to cause the glass to soften without spontaneously flowing, and then while the glass sheet is supported upon a die with the character delineated therein by high and sunken portions, applying pressure to the glass where overlying the sunken portions to there force the glass into such sunken portions and continuing the pressure progressively both laterally and longitudinally of each sunken portion until the glass has been forced to the bottom thereof.

6. The method of producing glass characters which consists in providing a sheet of glass of substantially equal thickness throughout and of greater area than the character to be produced, and also having one surface covered with prisms, heating the glass sheet to a temperature regulated to cause the glass to soften without spontaneously flowing, and while the glass sheet is supported upon a die having the character delineated therein by high and sunken portions, and with the glass sheet having the prismatic surface uppermost, applying pressure to circumscribed areas of the prismatic surface of the glass where overlying the sunken portions and shifting the point of application of pressure from place to place both laterally and longitudinally of the sunken portions until the glass sheet where overlying the sunken portions has been forced to the bottom thereof.

7. The method of producing glass characters, which consists in providing a sheet of glass of substantially equal thickness throughout and of greater area than the character to be produced and also having one surface covered with prisms, heating the glass sheet to a temperature regulated to cause the glass to soften without spontaneously flowing, and while the glass sheet is supported upon a die having the character delineated therein by high and sunken portions and with the glass sheet having the prismatic surface uppermost, applying pressure to circumscribed areas of the prismatic surface of the glass where overlying the sunken portions and shifting the point of application of pressure from place to place both laterally and longitudinally of the sunken portions until the glass sheet where overlying said sunken portions has been forced to the bottom thereof, the softening temperature being maintained throughout the pressing operation by the continued application of heat to the glass sheet.

8. The method of producing glass letters or character, which constists in providing a sheet of glass of substantially even thickness throughout with one surface covered with prisms, and said glass sheet being of greater area than the letter to be produced, heating the glass sheet to a temperature to soften the sheet without causing the glass to spontaneously flow, and, while the softened glass sheet is supported with the prismatic surface uppermost upon a die having the letter or character delineated therein by high and sunken portions, applying pressure to circumscribed areas of the prismatic surface where overlying the sunken portions and shifting the point of application of pressure from place to place both laterally and longitudinally of the sunken portions

over that portion of the glass overlying said sunken portions until the glass sheet is there forced to the bottom thereof, then removing the glass sheet with the relief letter or character formed therein from the die and inverting the sheet upon a plane plate, and heating the inverted glass sheet to cause the spontaneous elimination of irregularities therein produced by the molding of the character.

9. The method of producing hollow glass letters in relief, which consists in placing a glass sheet upon a die in covering relation to sunken portions in one face of the die delineating the letter to be produced, the margins of said letter including an area less than that of the glass sheet when the letter in relief has been produced therein, maintaining the glass sheet while on the die in a softened condition at a temperature less than that causing spontaneous flowing of the glass, and while the glass sheet is so softened, forcing those portions overlying the sunken portions of the die thereinto by the pressure applied locally and progressively to the said portions of the glass sheet overlying the sunken portions of the die, the area of applied pressure being so much less than either the length or width of a sunken portion as to require displacement of such area of pressure both laterally and longitudinally of the sunken portion to completely seat the glass sheet therein.

10. The method of producing hollow glass letters in relief, which consists in placing a glass sheet of greater area than the letter to be produced and having one face prismatic upon a die in covering relation to a sunken portion or portions produced in one face of the die and delineating the letter to be produced, maintaining the glass sheet while on the die in a softened condition by the continued application of heat at a temperature less than that causing the spontaneous flow of the glass, and forcing the softened glass into the groove or grooves of the die by pressure applied locally and progressively to the glass over said sunken portion by a tool having a single blunt active end with its terminal face of less extent than either the interior length or width of the sunken portion to permit movements of the tool both laterally and longitudinally of said sunken portion.

In testimony, that we claim the foregoing as our own, we have hereto affixed our signatures in the presence of two witnesses.

ROY R. WILEY.
WILLIAM S. HOUGH, JR.

Witnesses:
A. R. WHITE,
A. J. CROFTS.