SIEMENS *et al. v.* CHAMBERS & MCKEE GLASS CO.

(Circuit Court, W. D. Pennsylvania. August 11, 1892.)

1. PATENTS FOR INVENTIONS—EXTENT OF CLAIMS—GLASS-MELTING TANKS.
Letters patent No. 261,054, issued July 11, 1882, to C. W. Siemens, as assignee of Frederick Siemens, cover "a tank for the continuous melting of glass, having gas and air ports, and of the depth herein described, for the purpose of forming, below the upper fluid portion of the metal, a layer of metal in a semifluid or partially solid condition, as and for the purposes described." In his specifications the applicant states that "in the fusion of window or other white glass there is a continuous descending and ascending movement of the particles throughout the mass, as is proved by the wearing away of the bottoms of shallow tanks. The advantage to be obtained from increasing the depth of the tanks will be the formation of a layer of chilled glass at the bottom, at which point the movement of particles ceases, whereby the bottom blocks will be protected from wear, the presence of stone in the glass avoided, and a larger proportion of first-quality glass be produced." *Held*, that the increased depth of the tank was only for the purposes here specified, and did not, and was not intended to, provide for the alleged discovery of the so-called "vertical fining" of the glass.

2. SAME—NOVELTY—PRIOR ART.
The fluid layer and its function, as well as the ascending and descending motion of the particles, were known in the prior state of the art, as shown in the Granger patent, (1872,) No. 80,623; the Leuffgen patent, (1870,) No. 103,208; and the following foreign patents to C. W. Siemens: English, (1868,) No. 1,172; French, (1876,) No. 110,125; Italian, (1877.)

3. SAME—ANTICIPATION.
The patent was anticipated by the Belgian patent of 1877 to C. W. Siemens, which not only showed a tank exceeding 18 inches in depth, but met every other requirement of the claim and specifications.

4. SAME—INFRINGEMENT—BURDEN OF PROOF.
The burden is on complainants to prove that defendant's furnaces perform the functions covered by the patent, and it is insufficient to show that theoretically they should do so, or merely to meet defendant's proofs as to the actual fact.

In Equity. Suit for infringement of patent. Bill dismissed.
Kerr & Curtis and *George H. Christy*, for complainants.
James I. Kay and *Francis T. Chambers*, for defendants.
Before BUFFINGTON, District Judge, and ACHESON, Circuit Judge.

BUFFINGTON, District Judge. This suit is brought by George H. Benjamin, in the name of Frederick Siemens, of Dresden, Germany, and Alexander Siemens and others, executors and trustees of Sir William Siemens, late of Westminster, England, against the Chambers & McKee Glass Company, of Jeannette. It is for an alleged infringement of patent right in defendants' using what are known as "deep-tank" furnaces. The questions to be passed upon are of grave importance, involving, as they do, the right to use for continuous glass melting any tank of a depth of more than 18 inches. In view of its far-reaching results, the case deserves, and has had at the hands of the court, a patient hearing of the able and interesting arguments, and a laborious examination of the testimony and questions raised. A brief *resume* of glass melting will lead to a more intelligent understanding of the controversy. Formerly glass was melted in pots about 39 inches deep. They were expensive to construct, and subject to frequent breakages, caused by the variations in temperature between the melting and working processes. They were charged with batch or materials for making glass, placed in furnaces and

subjected to great heat, the batch renewed as the melting went on, until they were filled with molten glass, when they were allowed to cool, and the glass grew stiff enough to work. This intermittent process resulted in great loss of time, fuel, and material. There are four processes in glass making—*First*, melting; *second*, clarifying or fining; *third*, planing; and, *fourth*, working out. The tending of inventive minds for the last 30 years to overcome these difficulties has been towards tank furnaces. By means of them pots have been dispensed with and a continuous method of working reached, the batch being constantly fed at one end and worked out at the other. In large measure they have revolutionized the glass business. These tanks hold great beds of glass; some of them are 120 feet long by 20 feet wide, and of varying depths, from 2 to 6 feet. Large bricks or blocks, placed at some distance apart, and between which the molten glass can run, form their bottoms. They are placed on pillars or arches, thus forming a cave, through which a cool circulation of air passes, and the molten glass is thus chilled and prevented from escaping through the crevices between the blocks. By means of an energetic circulation through this cave, what is called a "chilled layer" may be formed on the upper side of the blocks, which preserves the bricks from the heat of the mass, and the cutting action of the glass in its movement or flux. In this progress the Siemens brothers bear a distinguished part. They first applied the regenerative gas furnace to glass melting, and the cave principle was their work. These important features, and many others, were the results of their inventive genius, were all patented, and presumably they have derived from them the financial returns which their importance demanded. These steps were all prior to 1879. On November 22, 1879, there was granted to C. W. Siemens an English patent, No. 4,763. Based on this patent, an American patent, No. 261,-054, dated July 11, 1882, was granted to Charles William Siemens, assignee of Frederick Siemens, for a glass-melting furnace. It is important to note what was asked for and what granted. The claims were:

First. "A regenerative gas furnace having a tank of sufficient depth for the purposes described." *Secondly.* "The process of melting glass in a regenerative tank furnace, which consists in forming below the upper fluid portion of the metal a layer of metal in a semifluid or partially solid condition, as and for the purpose described."

The claim for the process of melting was not allowed. A substituted claim for a tank was allowed, as follows:

"A tank for the continuous melting of glass, having gas and air ports, and of the depth herein described, for the purpose of forming below the upper fluid portion of the metal a layer of metal in a semifluid or partially solid condition, as and for the purposes described."

The examiners in chief, on appeal in this patent, say:

"The applicant states that, 'by increasing the depth of the tank to a sufficient degree while maintaining an active circulation of air beneath, the metal under treatment is maintained quite fluid to a depth of about eighteen inches,' leaving it to be inferred that the tank should be considerably deeper than this, but just how much is not stated. This vagueness is the defect of the whole application, for the first claim turns on 'the depth herein described' for its

distinctiveness, and might be regarded as specific, were the instructions and disclosures specific. * * * We believe that an improvement lies somewhere in what applicant has done, but we do not find it so clearly and distinctively disclosed as to be 'distinguished from what was old,' as the statute requires prior to patentability. It is possible that the first claim can be made good by more specific instructions in the specifications. The second claim would seem, with our present light, to be merely for the employment of these somewhat deeper tanks in the old way,—a matter not involving any novelty of process."

We are of opinion that the elements lacking in the original claims were not supplied by the substituted one, and that it is also open to the same objections. Assuming, however, for the present, the validity of the patent, we turn to the alleged infringement for which this suit is brought. The argument of complainants' counsel is that up to that time continuous tanks had been a failure, and that the Messrs. Siemens then discovered and gave to the world in the patent in suit the principle of "vertical fining," which has turned failure into success. It is a curious fact that the claim of this patent, which is alleged to have revolutionized the glass business, is not being pushed by the Messrs. Siemens, although they are of ample means to do so, but is enforced for his own benefit by Mr. Benjamin, who has acquired their rights. The contention of Mr. Benjamin, who is also the principal witness and expert for complainants, is that, from the time Messrs. Siemens turned their attention to glass melting until 1879, they acted on the theory that the fining of glass took place on the surface. That the object had been to subject the glass to the heat bath at the surface. To that end they made the tanks broad and shallow, say from a foot to 18 inches deep. That about 1879 they found this was wrong; that the fining or reactions of the particles took place in the descent from the higher to the lower levels, and not at the surface. This new discovery he calls "vertical fining," and says that it was then for the first time learned that depth was a function, and a necessary one, in perfect fining, and that to fine perfectly (in continuous working) a deep tank must be used. That in deep tanks a depth of 18 inches of fluid glass could be had in which this "vertical fining" would take place. That below this the movement of the particles ceased, and there was then formed on the bottom blocks of the tank a layer of glass in a semifluid or partially solid condition, which served as a covering to protect the bottom from the moving of the glass and the detaching of portions of the blocks by which glass was spoiled in shallower tanks. That this discovery of "vertical fining" made the continuous tank a success by turning it into a deep tank, and using depth as a function in fining.

The claim allowed is for "a tank for the continuous melting of glass, having gas and air ports of the depth described," viz., over 18 inches, "for the purpose of forming below the upper fluid portion of the metal a layer of metal in a semifluid or partially solid condition, as and for the purposes described." This is not a primary patent. Even so far as the Messrs. Siemens are concerned, it is the last of some 17 patents on continuous glass-melting furnaces, and it merely purports to consist in certain modifications in the details of the construction of such furnaces, and

novel methods of working the same. The semifluid layer was not new in 1879 in tank furnaces. In fact, this is admitted by Mr. Benjamin, who says:

"One of the most radical improvements made in the tank furnace was the substitution by Charles William Siemens of a cooling cave for the air channels under the bottom of the tank, whereby the ventilation was greatly improved. By the use of this improvement, and by the effective cooling of the sides of the tanks, they succeeded in forming a lining of glass upon the sides and bottom, which protected the tank against the injurious action of the heat and glass-ma ing materials."

It will be noted that the function of the semifluid layer was well understood to be a protection against the injurious action of the glass-making materials as well as against the heat. How generally the semifluid layer was recognized as a fact, how its functions of protecting the bottom and sides of the tank from the two dangerous elements, viz., heat and the cutting action of the glass upon them, and that it was recognized not as "an immobile or quiescent fluid," but as chilled enough to stand against the side as well as on the bottom of the tank, will be seen by examining Niles Granger's patent, (1872,) No. 80,623; C. W. Siemens' English patent, (1868,) No. 1,172; Leuffgen's American patent, (1870,) No. 103,208; C. W. Siemens' French patent, (1876,) No. 110,125, (in this a fluid layer of six inches is shown;) C. W. Siemens' Italian patent, (1877;) and the Glass Maker's Hand Book, (complainants' exhibit.) In fining glass, Mr. Benjamin assumes there are two theories,—surface fining, which, he says, was the accepted theory before 1879; the other, vertical fining, which he states was first disclosed by the patent in suit. The differences between them he states as follows:

"Assuming that prior to the date of complainants' patent it was believed that glass fined on the surface, became planed glass, and sank. Under this theory the depth of the tank is unimportant, because all the chemical actions take place on the surface. On the other hand, to carry out the theory of the vertical fining of the glass, the question of the depth of the tank is all important, because such a depth must be given to the tank as will permit the fining to take place in a vertical direction, without the fluid metal being brought into contact with the bottom blocks."

The facts and allegations thus stated fairly represent the complainants' contention in this case. They contend that prior to 1879 surface fining (*i. e.*, that glass fined on the surface became planed glass, and sank) was the accepted theory; that by the patent "vertical fining" was set forth, viz., "that such a depth *must* be given to the tank as will permit the fining to take place in a vertical direction;" in other words, that depth is a necessary function in fining. In both these propositions we are satisfied there is error. The accepted theory in 1879 was not that the glass was wholly fined on the surface, nor does the patent of 1879 set forth the theory of vertical fining, as now claimed by Mr. Benjamin, viz., that depth is a necessary function in fining.

The truth lies in neither extreme. The gravital action of the particles, that the fined glass sought the lowest zones, that there were ascending and descending currents of glass in different stages of fining, were

facts well known before the patent in suit. Indeed, it was upon these facts that the whole system of continuous tanks was based, as is shown by complainants' exhibit, in which Prof. Stillman, in discussing, in 1884, before the American Institute of Mining Engineers, the Siemens patents, including the one in suit, says:

"The fundamental idea upon which all the Siemens glass patents are based is found in the cardinal fact, before overlooked, or not availed of, that, in the melting or fining of glass, there is an important difference of density in the product in the successive stages of the process, the fine glass being denser and falling by gravity to the bottom of the pot, while the less refined glass floats on the surface of the denser glass, bearing with it the 'scum' or 'stone,' so called,—imperfectly melted material and impurities fatal to the beauty and homogeneity of the finished product. The Siemens brothers, with characteristic sagacity, have seized on this fact, and have developed out of it an entirely new system of glass furnace and glass manufacture, as described in their patents."

In the Italian patent of C. W. Siemens (1877) this vertical movement of the glass and the fining during those movements is clearly shown:

"The composition melts gradually in the compartment, A, under the influence of the heat developed at the surface of the bath. Then, in proportion as the glass melts and is refined, it gains the bottom of the tank. * * * As the heating takes place by the reverberation of the heat upon the surface of the bath, while the bottom is energetically cooled in a constant manner, when a molecule of glass is refined at the surface of the bath, and has consequently acquired a greater density, it gains the bottom of the tank, and is replaced at the surface by a molecule of greater density. There results from these vertical movements, combined with the general advance movement of the glass from the charging door to the gathering ports, a 'pugging,' so to speak, of the glass mass, which imparts to it homogeneousness and augments its fineness and its quality."

What this "pugging" which "results from these vertical movements," "which imparts to the glass homogeneousness and augments its fineness and its quality," is, unless it is vertical fining under the name of "pugging," we cannot understand. Unless it is this, then some process other than the four accepted ones of melting, fining, planing, and gathering has been overlooked in glass making. The same phenomena, and the uses made thereof, are also shown in C. W. and Frederick Siemens' patent, (1872,) No. 127,800, and C. W. Siemens' English patent, (1872,) No. 2,152. It will be observed if depth is a necessary function in fining, and fining necessarily takes place below the surface, that the patent in suit admits it was then known that fining occurred elsewhere than at the surface, for it says:

"Glass-melting tanks have hitherto been constructed under the belief that the fining operation of the material takes place *mostly* at the surface."

A fair construction of this statement is that it was also known that part of the fining operation was not at the surface, and that it was recognized as a continuous operation, a "pugging," so to speak, as Mr. Siemens had four years before stated in his Italian patent. In the patent in suit Mr. Siemens does not claim depth as a necessary function in fining, as the theory of Mr. Benjamin now is. He admits that the

fining *may* take place horizontally, so to speak, and that the reactions *actually did take place* "in the upper portion of the currents traveling towards the working holes." In the deep tank he says it has been found not only possible, but advantageous, to reduce the extent of surface heat, for the reason that "in this case" (that is, in deep tanks) "the reactions occur during their descent;" virtually admitting that if depth were not given that the reactions would take place "in the upper portions of the current traveling towards the working holes." A fair construction of this patent shows that, as Mr. Siemens then understood the art, fining could take place both at the surface and underneath it, both in the horizontal and the vertical movement of the particles. We are also of opinion that his object in providing the semifluid layer had no connection with the vertical fining of the glass, but with the gravital action of the particles. Thus he speaks, page 2, line 33, of patent, of "the reactions of the particles." So, also, in line 48. These manifestly refer to the fining process; but at line 56 he begins a new paragraph, and turns to what complainant says is a different thing, (namely, gravital action,) and to a new subject, (namely, white as distinguished from dark glass,) and says:

"In the fusion of window or other white glass there is a continuous descending and ascending movement of the particles (complainants' gravital action) throughout the mass, as is proved by the wearing away of the bottoms of shallow tanks. The advantage to be obtained from increasing the depth of the tanks will be the formation of a layer of chilled glass on the bottom, at which point the movement of particles (gravital action) ceases, whereby the bottom blocks will be protected from wear, the presence of stone in the glass avoided, and a larger proportion of first quality of glass be produced."

From this it will be seen that the semifluid layer was to be where "the movement of the particles ceases," (*i. e.*, gravital action,) and had no reference to the reactions of the particles, (*i. e.*, vertical fining,) and that the semifluid layer was—*First*, for the protection of the bottom blocks from wear; *secondly*, the presence of stone in the glass avoided; and, *thirdly*, the production of a larger proportion of first-quality glass,—three points, all of which had been previously protected from gravital action by the fluid layer, and both gravital action and the semifluid layer are confessedly old. It seems incredible that if Mr. Siemens had in his mind, when this patent was granted, the elaborate theory of vertical fining, as now explained, he should have made but casual allusion to it; that he should make no claim that by failure to provide against it damage was done to the tank, but, on the contrary, should specially refer to the damage done by what is now called "gravital action," and claim the fluid layer as a protection or feature connected with it alone.

But, leaving for the present the examination of the semifluid layer in general, it will be seen that, even in continuous tanks of over 18 inches deep, the forming of a semifluid layer was not new in 1879. In two patents the use of a tank above that depth and a fluid layer are shown. C. W. Siemens, in 1877, took out a Belgian patent for improvements in glass-melting furnaces. The law of that country provides, (article 5:)

"The drawings shall be placed in and to a metrical scale; they must represent as nearly as possible the article to be invented by plans and sections and elevations," etc.

It will be noted that this requirement is not for a drawing to "the metric scale," as contended for by the complainants' counsel, but "to a metrical scale." This means a scale "pertaining to measurement." In other words, a scale for measuring from which the article to be invented may be reproduced in actual size by enlarging the drawing in proportion to the scale given. In pursuance of the provisions of the act, we find on the drawing the French word, "*Echelle*, 1-32," in English, "Scale, 1-32." This means the drawing is one thirty-second the size of the article invented. Applying this measurement to the plan, we find the distance from the top of the sill of the charging door to the top of the bottom blocks of the melting tank to be at least 24 inches. Applying the same scale, we find the communication between the melting and working tank to be over 4 inches above the bed of the tank, thus leaving some 4 inches for the semifluid layer, and 20 inches for the fluid glass above. This furnace meets every requirement of the patent in suit: *First*, a tank for the continuous melting of glass with gas and air ports; *second*, it is over 18 inches in depth, the requirement of the patent in suit; *third*, it provides for a cave and system of ventilation, and consequently the semifluid layer; *fourth*, it recognizes the vertical movement of the glass. It does not limit itself as to dimensions, stating "the number of ports upon which depend the dimensions of the tank may vary from three to fifteen and upwards." It is clear that a tank furnace constructed from the plan on the scale designated would perform all the functions claimed in the patent in suit, and be an infringement upon it. Such being the case, the patent in suit should not have issued five years later. That Mr. Siemens may not have fully comprehended the possibilities of the furnace which he thus patented is no answer. This is clearly within the line of *Blake* v. *San Francisco*, 113 U. S. 679, 5 Sup. Ct. Rep. 692, that—

"The application of an old process or machine to a similar or analogous subject, with no change in the manner of application and no result substantially distinct in its nature, will not sustain a patent, even if the new form of result has not been heretofore contemplated."

And of *Burt* v. *Evory*, 133 U. S. 358, 10 Sup. Ct. Rep. 394:

"But a mere carrying forward, or a new or more extended application of the original thought, a change only in form, proportion, or degree, the substitution of equivalents, doing substantially the same thing in the same way, by substantially the same means, with better results, is not such an invention as will sustain a patent."

The patent of Niles Granger, No. 80,623, (1868,) is also to be noted. It may be said this is a pot furnace, but it is a pot, or rather two pots, worked as a tank continuously, and is in substance and fact a continuous deep-tank furnace, and the patent in suit claims to cover "pots operated as tanks, which are always kept full or nearly full of metal."

Granger's device was an ordinary melting pot, 39 inches deep, used as a fining chamber. At the lower end of one side was a chamber leading to a smaller pot or working vessel. Save in its being used in a regenerative furnace, the Granger patent embodied and anticipated the functions of the patent in suit. It is, in the words of the patent in suit, "a pot, operated as a tank, which is always kept full or nearly full of metal." It makes use of the semifluid layer, by Granger called "a glaze," and also of the gravital action of the glass.

There is much learning and discussion in this case on the subject of "vertical fining." From the evidence and admitted facts, we conclude that the "vertical fining," so called, is nothing more or less than the "vertical finding" by each particle of its natural relative position by reason of its increased specific gravity, caused by the expulsion of gases from such particles by the influence of the heat. In other words, heat at the surface, aided by the storage heat in the mass itself, causes fusion. Gas is liberated as an effect of heat. Its gradual expulsion, for it is manifestly not catalytic, causes a gradual increase of specific gravity. The particle thus freed or in process of freeing itself of gas, and with increased specific gravity, will sink and sink until it finds a level of particles of specific gravity equal to its own; in other words, its natural relative position. This place may be near the bottom or near the top of the mass. In thus finding its natural relative place it has displaced some other particle of less specific gravity, and it, in its turn, is driven upwards. The less refined particles are thus driven to the surface, where, under the influence of heat, additional fusion takes place, gas is expelled, and the vertical fining again begins. When thoroughly fined and the gases driven out, not by descent but by fusion caused by heat, and it has gained its natural relative place, (*i. e.*, with other particles of thoroughly fined glass,) no other particle will displace it, for it has reached the maximum specific gravity, and it will remain quiescent until drawn towards the working end of the tank to fill the place of refined particles there withdrawn. Such seems to us, *from the evidence*, to be the process as now understood. To say otherwise is to say that descent is a necessary function in fining,—is in effect to say that heat does not refine, and that fining can only take place in deep vessels, when the fact that fining does take place in a shallow current is a fact proven by the evidence, and that it takes place in a shallow vessel is a fact admitted by the patent in suit. From the evidence, we cannot find as a fact that vertical fining, as explained by the complainants, does take place. Unless such vertical fining is a fact,—not a mere theory, but a practical, proven fact,—this patent must fail. This measure and burden of proof the complainants have failed to meet. They have given us their theory of vertical fining from the facts, but they have not proven to our satisfaction that vertical fining, as they explain it, is an actual, existing fact.

Assuming, however, that the patent in suit must be sustained, the further question arises, have the defendants infringed? The patent in suit was granted on the theory that the fluid depth of glass was about 18 inches, and that beneath this was formed a chilled layer of glass, not

a layer of "immobile or quiescent glass," as now contended. Thus, in line 64, p. 2, of patent, the applicant says:

"The advantage to be obtained from increasing the depth of these tanks will be the formation of a layer of chilled glass on the surface of the bottom."

That this was the theory at that time is also shown by the file wrapper in the case. In the argument and correspondence for the allowance of the patent Mr. Siemens' counsel (and we must assume he correctly stated the scientific views of his client, and after full consultation with him, as the granting of the patent was delayed and strenuously contested by the patent office authorities) refers to the glass "forming below the upper fluid portion of the metal layer in a partially solid condition;" and, in speaking of the depth of the old tank, says:

"It follows that the depth of such tanks could not exceed about eighteen inches, or, as is shown in the new application, the bottom would be covered with a layer of chilled metal."

These quotations are simply made to show the idea then held,—that to 18 inches the glass was fluid, and beneath that the chilled layer necessarily formed. Presumably Mr. Siemens was not then familiar with tanks of 5 or 6 feet deep, for none had been built. He was familiar with a fluid depth of limited thickness on the top, and with the energetic and active cooling by the cave below, by which the chilled layer was formed. With an immense body of molten glass in a tank of 6 feet, and the storage heat retained by it, he was not, so far as the evidence shows, familiar. Upon this theory of a fluid depth of 18 inches and the chilled layer as a necessary sequence, he sought a patent for tank and process. Use, the crucial test of theories, has proven its fallacy. The building of tank furnaces 5 and 6 feet deep, and the consequent effects of the vast storage heat therein, have proved that the chilled layer, as contemplated by Mr. Siemens in 1879, does not in fact exist in them, and that its then contemplated functions are not used in such tanks. In fact, the practical use of such tanks has shown more radical change from the accepted theory of deep tank melting in 1879 than the supposed theory at that time did from the prior state of the art. To grant a patent now upon the functions performed by a tank 6 feet deep would be to grant it for an improvement simply in degree, and would be manifestly wrong; to grant one in 1879 upon less radical changes and upon theoretical statements, some of which experience has disproved, was more so. Upon the complainants rests the burden of proof. They must show the defendants' furnaces perform the functions of theirs. It will not suffice to say that theoretically they should. It will not do to say that "glass in a state of rest," or "immobile fluid glass," corresponds to the chilled layer, which was the theory in 1879.

It now appears, by the use of deep tanks and the storage heat in the vast sea of glass, a fluid depth of 5 feet may be maintained, the gravital action of the glass does not extend that low, and consequently the energetic chilling, which was before necessary to form the chilled layer, and thus prevent the destructive effects of the gravital motion

of the glass on the bottom of the tank, is restricted to simply keeping the glass chilled between the bottom blocks, and this is the only chilling absolutely necessary. Then, too, the weight of the testimony, whatever the facts may be, is that the gravital action of the glass does not extend beyond more than about 5 inches. It will thus be seen that the function of the chilled layer, which was supposed in 1879 to form below the fluid depth of 18 inches, is not needed or used in the deep tanks of the present day. Moore, the manager of defendants' works, shows that the glass was fluid in their tanks to the bottom; that he has tested it frequently; that it has sprung leaks 6 or 8 times; that the glass has melted between the blocks; that with an iron bar he had felt the joints between the bottom blocks. The same facts are conceded to be sworn to by James A. Chambers. Gustave Somville has worked a 48-inch tank at Charleroi, a 72-inch tank at Bessèges, and a 48-inch at Cohansey, N. J., and says the glass is fluid to the bottom in them all. He has put down a bar to push back bits of iron that have fallen in the tank. That sometimes the bar catches in a joint between the bottom blocks. Lemaire, a builder of large experience, has built 12 tank furnaces of 6 feet in depth. He proves he made a hole in tank at a depth of 5 feet, and the fluid glass ran out; that twice, through accident, he saw the glass run out at 3 feet; that he has tested by a bar, and finds the glass fluid to the bottom, at a depth of 5 feet. From tests and experiments he finds the glass fluid at 5 feet. It is of importance on this question of the depth of fluidity to notice his testimony in regard to the depth of the furnaces. He says they build the furnace 6 feet deep to use the heat more. "I think above six feet the glass is no longer liquid, and we build tanks six feet deep to accumulate the heat; while it is well known that window glass transmits the heat to a depth of about six feet, and the accumulated heat remains in the glass, and we have through that economy of fuel." (A fact which was also noted by Mr. Siemens in the patent in suit: "By this construction the reduced surface of the tank exposed to flame is accompanied with additional economy of fuel, owing to the diminished surface for loss of heat by conduction.") He says the vertical movement of the glass is not more than 4 inches; that below that is a quiescent body of glass; that he has observed where they have had a body of bad glass, and have changed the batch, that they had a change in quality, and, calculating what had been worked out, he found the moving body worked out was but 5 inches thick. The Glassboro tanks are continuous deep tanks, though worked intermittently on account of the limited number of blowers employed. No. 1 was 12 inches deep in the melting compartment, and 18 in the working out, and No. 2 was 36 inches in the melting, and 24 in the working. Ferrari, the manager, says they are both fluid; that he has drilled holes through the side and once through the bottom, and both times the tank ran empty. The openings between the tanks were 5 inches square, thus showing in No. 2 a fluid depth of 31 inches; that No. 2 was made deeper simply for capacity, and that depth had no function in changing the quality of the glass. The glass was substantially of the same quality

in both, though the melting chamber of the old was 12 inches as against 36 in the new, thus showing that the fining can be as complete at 12 as at 36 inches. Substantially the same facts are proven by John P. Whitney, proprietor of the works, with the additional fact that in their tank No. 3 a boot leg is employed with openings at bottom one inch deep and the shape of a caret. This shows a clear fluid depth of 24 inches. Testimony in contradiction of some of these points has been produced by the complainants. The very most that could be argued for it is that it balances the proofs of the defendants. But this will not do. Infringement is alleged. To merely meet the proofs of the defendants is to leave the question in the balance, and that is to decide against the complainants. The burden of proof being on the complainants, we are of opinion the weight of the evidence is against them and in favor of the defendants.

Our conclusions, briefly stated, are—*First.* The fluid layer and its function in a continuously worked deep tank were known before this patent was granted. *Second.* At that time the gravital action of glass and the reactions taking place during such movements were known; and no hitherto unknown and now known movement, action, or process in the melting of glass were disclosed in the patent in suit. *Third.* That the contention of complainants that depth is a necessary function in the fining of glass is not established by the weight of the evidence. *Fourth.* That it is not shown that in defendants' tanks the functions of forming "below the upper fluid portion of the metal a layer of metal in a semi-fluid or partially solid condition," as claimed in the patent, is used. The weight of the evidence is to the contrary. *Fifth.* In view of the state of the art at the date of this patent, the claim granted was not then patentable, and the letters patent No. 261,054 are invalid. *Sixth.* That the burden of proof of infringement is on the complainants, and this they have failed to meet, and the bill must be dismissed, at their cost.

ACHESON, Circuit Judge, concurs.

BROMLEY BROS. CARPET CO. *v.* STEWART *et al.*

(Circuit Court, E. D. Pennsylvania. July 1, 1892.)

1. PATENTS FOR INVENTIONS—INVENTION—MECHANICAL ADAPTATION—LOOMS.
First claim of patent No. 418,349 to Thomas Bromley, Jr., for a power loom provided with a double shuttle box on each side thereof, mechanism for operating said boxes pick and pick, and a mechanism which stops the loom after every two picks, does not embrace patentable novelty, in view of the fact that all of the elements were old, in exactly the connection in which they were used, except the stopping mechanism, which was adapted by a perfectly obvious change from a closely analogous construction.

2. SAME.
The second claim of patent No. 418,349, to Thomas Bromley, Jr., for the combination, with a mechanism which stops the loom after every two shots of weft, of a mechanism which may be started by the foot, does not embrace patentable novelty,