(No Model.)

M. W. GRISWOLD.

MANUFACTURE OF WINDOW GLASS.

No. 410,546. Patented Sept. 3, 1889.

Fig. 1.

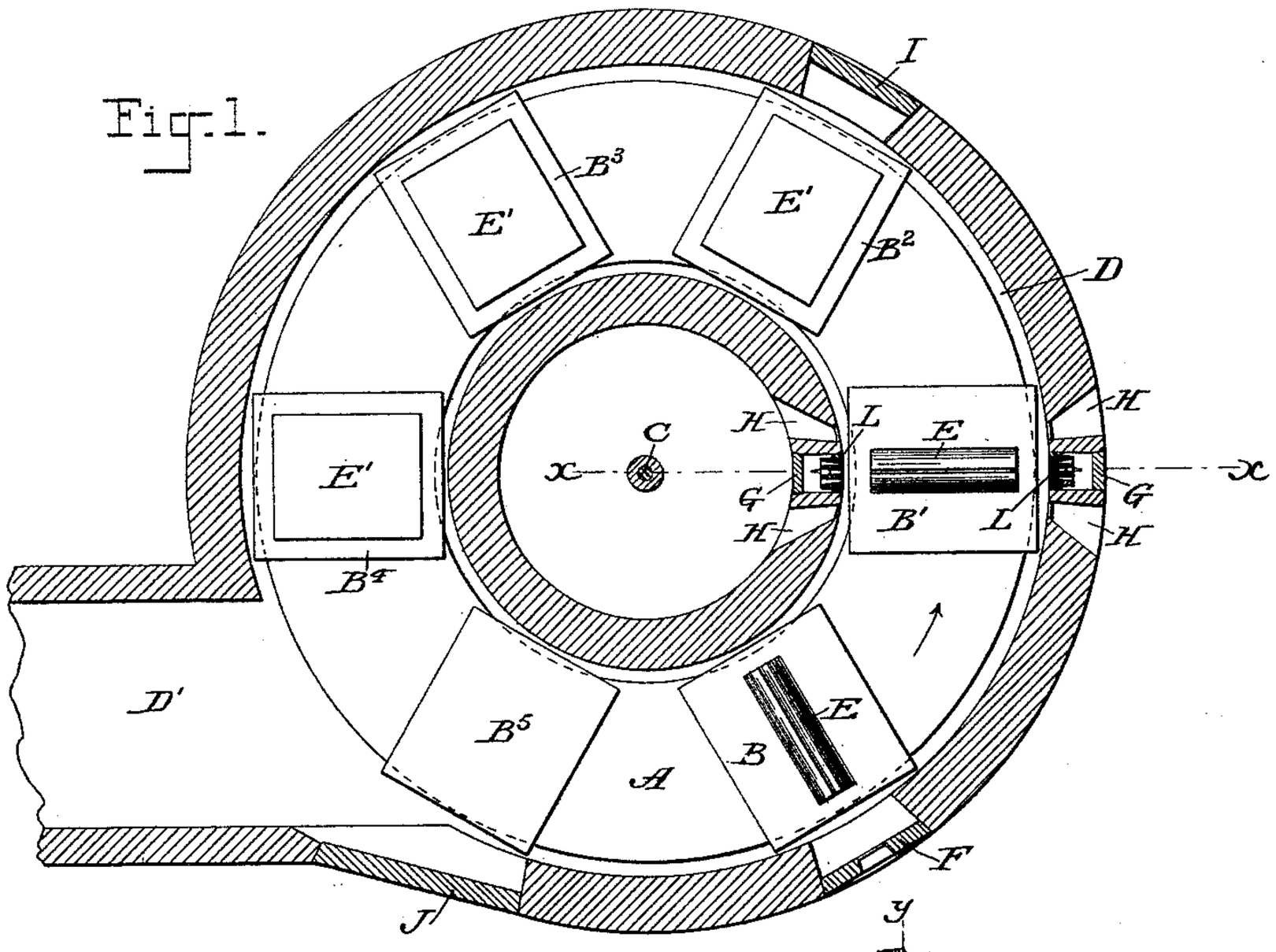


Fig. 2.

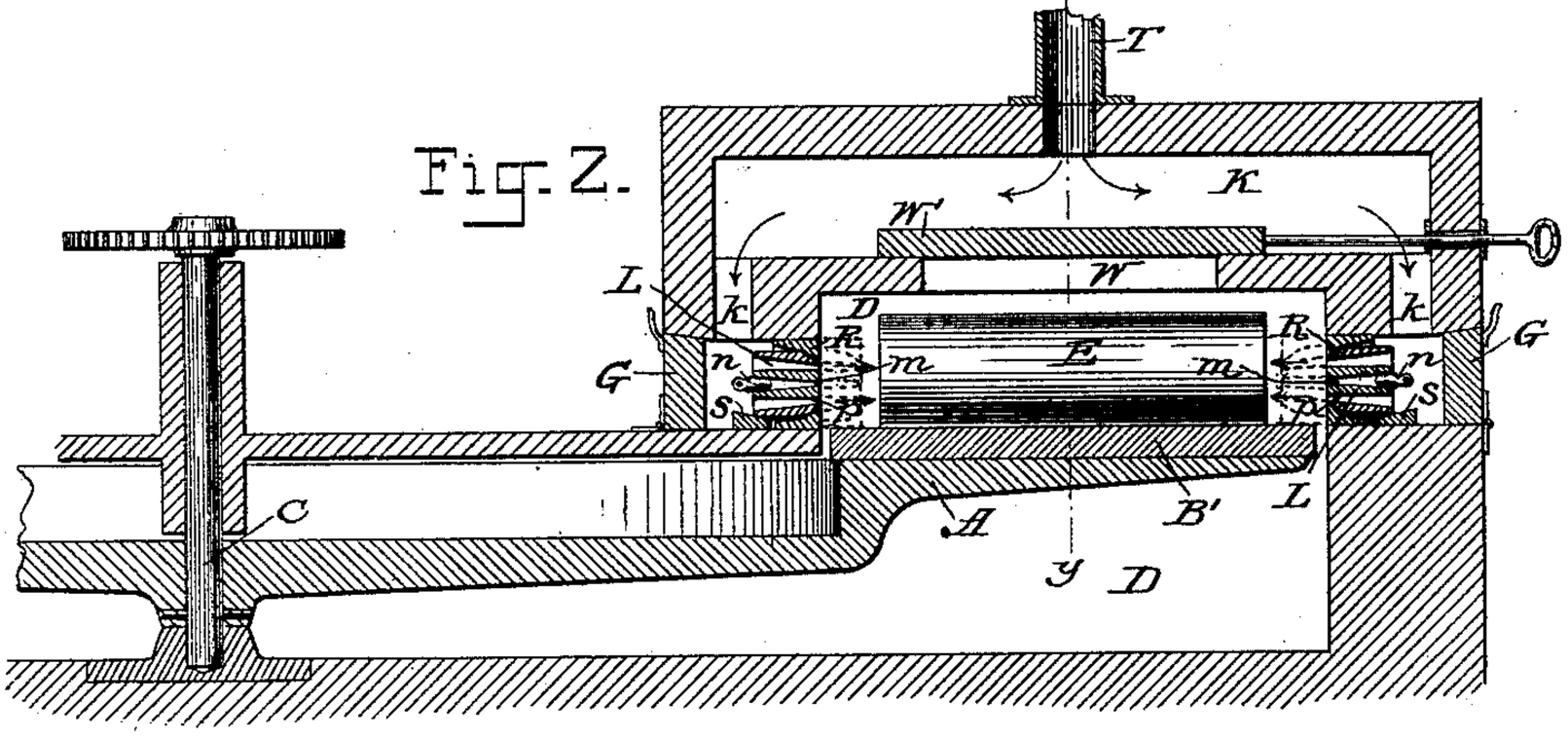


Fig. 3.

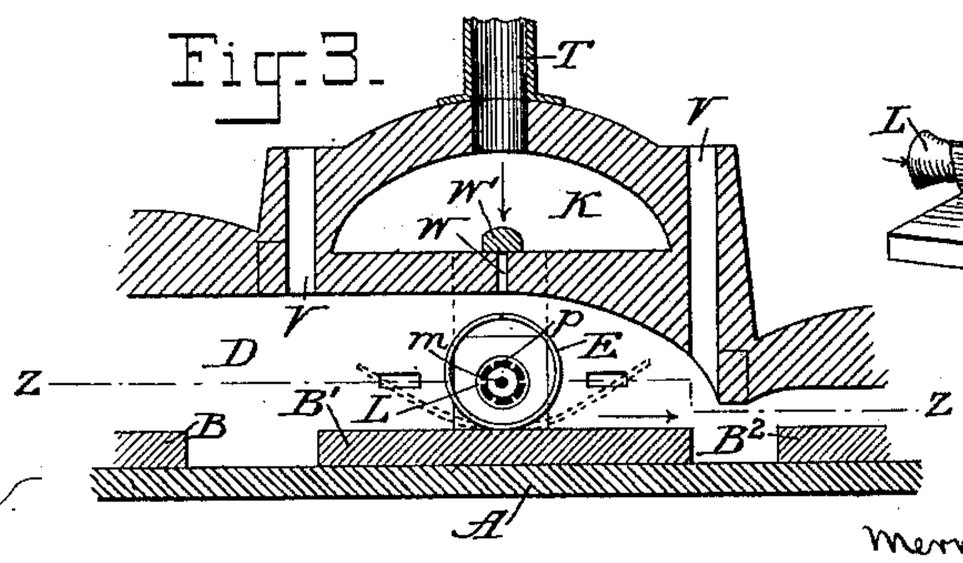
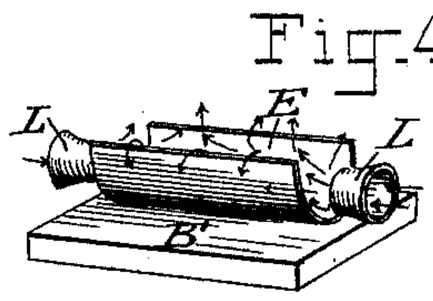


Fig. 4.



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MANUFACTURE OF WINDOW-GLASS.

SPECIFICATION forming part of Letters Patent No. 410,546, dated September 3, 1889.

Application filed January 26, 1889. Serial No. 297,702. (No model.)

To all whom it may concern:

Be it known that I, MERRITT W. GRISWOLD, of Ridgewood, in the county of Bergen and State of New Jersey, have invented a new and useful Improvement in the Manufacture of Window-Glass; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to an improved process for producing window or sheet glass by the flattening of glass cylinders, and has for its object to obtain with greater ease, rapidity, and economy a better quality of glass than by the methods heretofore employed.

It consists in spreading open the divided glass cylinders as they become ductile in the furnace by means of a blast of hot air, steam, or gas directed within the cylinder to produce an expansion thereof and an unfolding of its divided edges, as is hereinafter more fully described and explained.

In the accompanying drawings, which illustrate an apparatus which may be employed in the process, Figure 1 is a sectional plan view of a furnace of customary form adapted to the flattening of glass cylinders, and of a portion of the annealing-leer which extends therefrom in line *z z* of Fig. 3. Fig. 2 is a vertical radial section, on an enlarged scale, in line *x x* of Fig. 1; Fig. 3, a transverse section in line *y y* of Fig. 2; and Fig. 4 is a detached view in perspective illustrating the ductile cylinder of glass in process of being opened out and flattened by the pneumatic pressure exerted upon its inner face.

Similar letters indicate like parts in all of the figures.

A is the wheel or annular flattening-table, carrying a series of radially-disposed flattening-stones B B′ B², and mounted upon and secured to a vertical spindle C to revolve within a suitable circular furnace or oven D, having an annealing-leer D′ extending therefrom, the whole being constructed and arranged substantially in the manner well known to the art.

F is the receiving-door; G G, the doors through which access is had to the apparatus for expanding and flattening the glass; H H, sight-holes provided on each side of said doors; I, the finishing-door, and J the door for the leer.

K (see Fig. 2) represents a hot-air or gas chamber formed transversely over the furnace or oven D above the doors G G, and which is made to communicate with said furnace or oven through passages *k k*, formed in the walls thereof immediately within each door G, the opening of each of said passages *k* into the furnace D being made to correspond in size and to register with the outer doorway. Within each of said openings a tuyere L, of any suitable refractory material, is fitted for the purpose of controlling and directing the flow of air, steam, or gas from the chamber K into the ends of the cylinder brought within range thereof. Each tuyere is formed with a central opening *m*, adapted to be closed by a plug *n*, and with a concentric annular opening *p*, and is rounded at its front end to fit with a close joint into a counterpart circular seat R, which will permit of a limited rotary movement of the tuyere, whereby it may be inclined in any direction, so as to permit thereby the direction or inclination of the jets of air or gas issuing therefrom to be changed more or less, as may be required. This may be accomplished by means of a wedge-piece S, introduced under the rear end of the tuyere, as shown in Fig. 2. Each tuyere may also be moved to and from the table A, so as to admit of adjustment with reference to the length of the glass cylinder to be brought between them, as shown by dotted lines in Fig. 2.

The chamber K is connected by means of a pipe T with a hot-blast stove or furnace, an air-compressor, or a steam or gas generator of any suitable character, (not shown in the drawings, and which need not herein be described,) it being understood that the air, steam, or gas is preferably heated to a working temperature by any suitable means before being admitted to the tuyeres L L, and is supplied thereto under sufficient pressure to produce a strong blast or jet when issuing from said tuyere into the furnace.

A narrow longitudinal slit or opening W is formed between the upper chamber K and

the furnace to register with the slit in the glass cylinder E, brought and held in range of the tuyeres L L upon the revolving table A. This narrow extended opening is controlled by a suitable valve W′, which permits it to be wholly closed.

V V represent vents formed through the top of the furnace on each side of the tuyeres, so as to allow of an escape of the inflowing jets and allow of the expansion of the glass cylinder under the action of said jets.

In the operation of the apparatus a longitudinally-slitted cylinder of glass E is inserted into the furnace or oven D through the door at F and placed radially with the longitudinal slit therein uppermost, upon the proximate flattening-stone B. The wheel or table A is then turned to bring the cylinder into line opposite the tuyeres L L, which are preferably so adjusted as that the mouth of each shall be brought close to the proximate end of the cylinder. Ordinarily the cylinder, after being properly heated in the customary manner, is spread open at this point by means of tools or mechanical appliances which force apart the divided edges of the cylinder and bear them down flat upon the stone. In this method of flattening the glass the outside of the cylinder, being the hottest because more immediately exposed to the direct heat in the furnace, and consequently more mobile and yielding than the inner surface, is apt to become ridged or corrugated or lumpy, and in a measure, therefore, imperfect, as it is compressed in the process of flattening out its convexity.

By my process the divided cylinder is prevented from falling or lapping down and is gently and evenly spread open until it flattens down upon the stone by forcing into it through the tuyeres L L strong blasts or currents of air, gas, or superheated steam preferably at a temperature which renders the inner concave surface softer and more yielding than the outer convex surface, and said inner surface being extended as it is straightened out will be thereby drawn out into a perfectly true, even, and beautifully smooth surface, while the under surface will retain its original perfect condition and be improved by the condensation of its particles. Thus the glass is truly and evenly flattened with great rapidity and with a resultant finish superior to that produced by the ordinary methods. As occasion may require an auxiliary current of air or gas may be introduced through the extended slit W, directly over the open seam in the cylinder E as the latter begins to open, so as to facilitate its expansion under the influence of the jets from the tuyeres. The glass plate thus produced by the opening and flattening of the cylinders E under a pressure of air or gas is carried forward by the intermittent revolution of the wheel or table A to a point opposite the door I, where it is smoothed down by the customary appliances and it is finally brought opposite the end of the annealing-leer D′, into which it is delivered, as usual, to be tempered and finished in the customary manner, which it is not necessary to describe.

It is evident that the expanding jets, blasts, or currents of air, gas, or superheated steam may be introduced to the open ends of a slitted cylinder E in a suitable oven or furnace by means of tuyeres or nozzles of various descriptions with or without immediate connection with a hot-air chamber K, as described, and that inflammable and inflamed gases may be employed under pressure instead of air, gases, or steam heated wholly by external appliances.

While it is preferable to employ in the process, as described, blasts of air, gases, or steam heated to a temperature which will render the glass ductile and cause its inner surface to be softer than the outer surface, I contemplate, where the cylinders are already heated in the furnace to a proper temperature to render them sufficiently ductile, opening and flattening them by jets or blasts of cold air or gases.

I claim as my invention—

1. The within-described process of flattening divided glass cylinders, which consists in subjecting them when ductile to a blast of air, gas, or steam introduced into the cylinder, substantially in the manner specified.

2. The within-described process of flattening divided glass cylinders, which consists in subjecting them to a sufficient degree of heat to make them plastic and then submitting them to a blast of air or gas forced into the cylinder under a pressure sufficient to produce a separation or divergence of the opposite sides of the ductile cylinder.

3. The process of softening the inner concave surface of a divided glass cylinder, which consists in heating the same by means of a blast of air, gas, or dry steam applied directly thereto with power sufficient to produce a separation and divergence of the opposite sides of the ductile cylinder, substantially in the manner and for the purpose herein set forth.

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

MERRITT W. GRISWOLD.

Witnesses:

A. N. JESBERA,

E. M. WATSON.