No. 674,992. Patented May 28, 1901.

H. S. WOOLLEY.

FURNACE.

(Application filed Feb. 6, 1901.)

(No Model.) 2 Sheets—Sheet 1

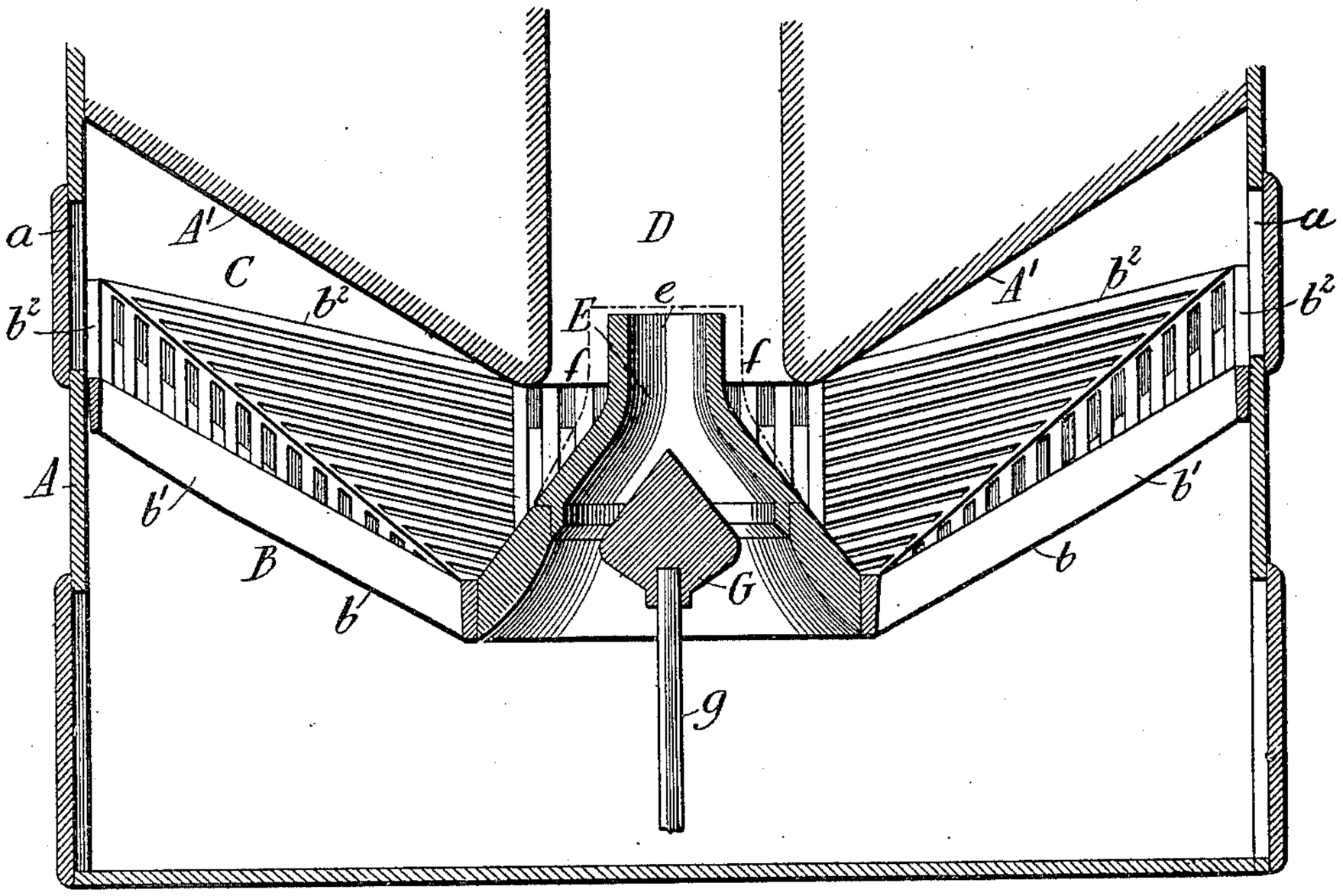

Fig. 1.

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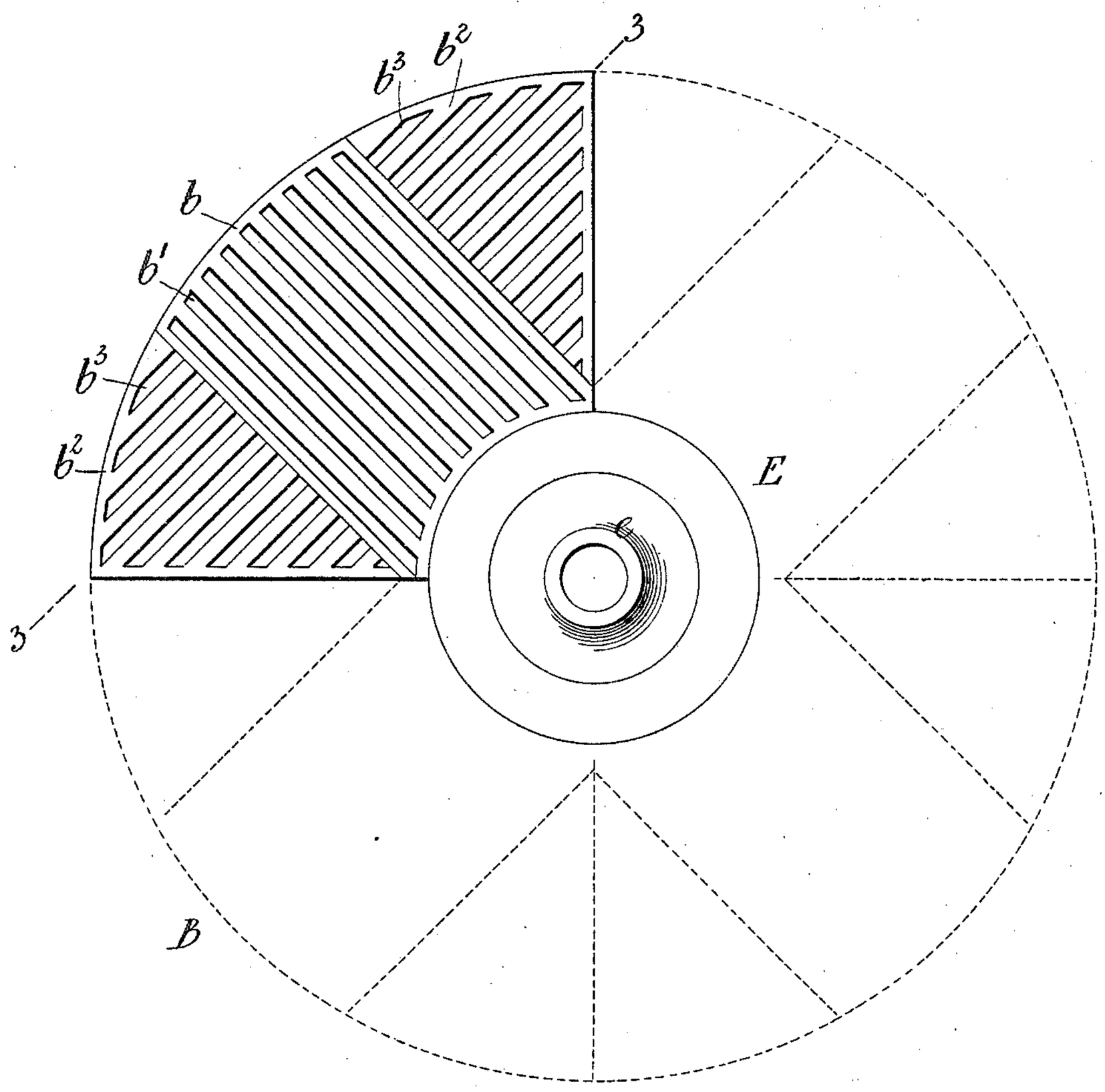

Fig. 2.

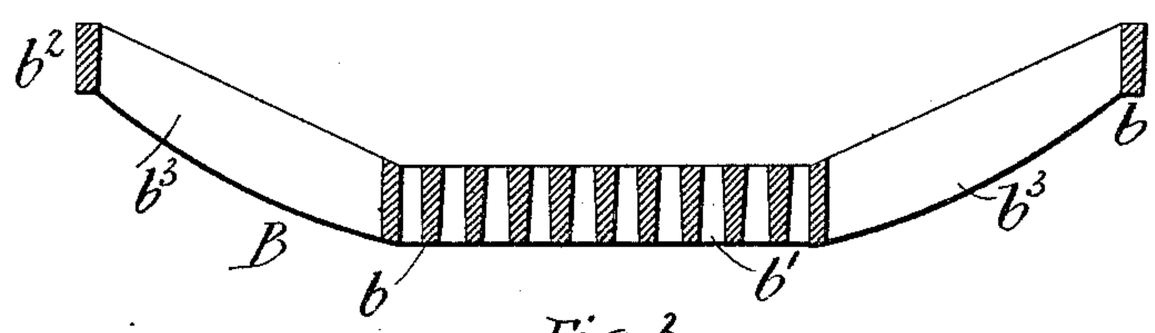

Fig. 3.

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FURNACE.

SPECIFICATION forming part of Letters Patent No. 674,992, dated May 28, 1901.

Application filed February 6, 1901. Serial No. 46,226. (No model.)

To all whom it may concern:

Be it known that I, HYRUM S. WOOLLEY, a citizen of the United States, residing at Paris, in the county of Bear Lake and State of Idaho, have invented certain new and useful Improvements in Furnaces; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a new and improved furnace capable of general utilization, but especially designed for use in connection with steam-boilers, inasmuch as the operation of the furnace is attended with the generation and concentration of a comparatively high degree of heat, though it will be understood that the heat obtained may readily be diverted, diffused, or radiated, dependent upon the desired utilization.

An object of the invention is the maximum combustion of fuel and the consequent consumption of smoke and economy in operation.

Another object of the invention is the simplification of furnace structures, whereby is obtained economy in construction and nonliability to disorder.

A further object of the invention is the production of a furnace requiring for its maintenance the minimum of labor and time and which is durable, the grate and other perishable parts being subjected only to such a degree of heat as will not effect their destruction.

Generally speaking, the invention consists of what is here conveniently termed a "primary combustion-chamber," into which the fuel is introduced and in which it is converted into combustible gases, a secondary combustion-chamber receiving these gases and in which complete combustion of these is effected, an imperforate air-feeding conduit extending from below the secondary combustion-chamber to within the same, forming with the walls thereof a restricted passage, through which the unconsumed products of combustion or gases are compelled to pass, and a grate for the primary combustion-chamber, adapted to direct the fuel against the conduit to heat the latter.

The details of the preferred construction of furnace embodying the invention are fully set forth in the following description, in connection with which attention is called to the accompanying drawings.

In the drawings, Figure 1 is a vertical sectional view of a furnace embodying the invention. Fig. 2 is a plan view of the preferred construction of grate. Fig. 3 is a sectional view taken on line 3 3 of Fig. 2.

Referring to the said drawings by letter, A denotes an outer casing, in the bottom of which is the ash chamber or pit.

B is the grate, forming the bottom of the primary combustion-chamber C.

D is the secondary combustion-chamber, located above and preferably centrally to the primary combustion-chamber, and E is the air-conduit, which extends upwardly through the primary combustion-chamber into the secondary combustion-chamber, producing a restricted passage *f* between the two chambers.

The furnace is shown as being circular in horizontal section; but other forms may be employed, and the illustration is not, therefore, to be regarded as a limitation. The grate shown consists of segmental sections, each comprising a central portion *b*, having longitudinally-disposed slots *b'* and sloping from the stoking-opening *a* in the furnace casing or wall toward the grate-center, and portions b^2 b^2, extending from the sides of the central portion upwardly at an angle and having transverse slots b^3, the side portions being oppositely inclined and forming with the central portion a grate-section of trough shape, whereby the fuel, which may be manually or mechanically fed, gravitates toward the center of the grate. Centrally to the grate and extending some distance above the fuel-level is the air-conduit E, which is in the form, preferably, of a hollow cone and is without perforations. The outer surface of the cone forms with the sloping grate an annular trough for the fuel. In its passage through the fuel the oxygen of the air combines with the excess of carbon, forming carbon monoxid, (CO.)

The crown A' of the furnace slopes from the casing or wall A to the chamber D, the

angle of inclination approximating that of the grate portions *b*. The upper or delivery end *e* of the cone, which is preferably cylindrical in form, as shown, extends into the chamber D and produces between its outer side and the wall of said chamber the annular restricted passage *f*. The object of this restriction is to cause the temperature of the gases to rise to a point where the uncombined oxygen and carbonic acid (CO_2) of the gases will attack the carbon of the smoke, forming carbon monoxid, (CO.) The area of the passage into the combustion-chamber D may be varied, according to requirements, by means of any suitable contrivance—as, for instance, substituting cones of different size or degree of taper—the cone to this end being made sectional, as shown. Variations in the area of said passage *f* may also be effected by constructing the cone to be vertically adjustable.

Air is delivered to the chamber D through the cone, and to control such delivery there is employed a valve G, preferably of conical form and adjustable by means of a stem *g*, which may be vertically moved to vary the area of the air-passage.

In practice the gases resulting from the partial combustion in the primary combustion-chamber are concentrated at the restricted passage *f*, which is the only exit, being deflected to this central point by the sloping crown of the furnace and the conical form of the air-conduit, and said products entering by said passage into the combustion-chamber are met by and are intimately mingled with the heated air delivered through the cone, thus producing the proper conditions for complete combustion of said products. In addition to the very high degree of heat produced in the secondary combustion-chamber, which heat is remote from the perishable parts of the furnace, the smoke is consumed, together with any sparks or unconsumed carbon, and thus not only is complete combustion of the fuel practically effected, with the consequent large saving in the cost of operating the furnace, but at the same time the smoke nuisance is entirely abated, while the steaming capacity of boilers is largely increased by reason of the absence of deposits on the boiler sheets and flues. The grate by reason of its sloping form operates to direct the incandescent fuel against the conduit to highly heat it throughout, and the air passing through the conduit is thus raised to a very high degree of temperature before entering the secondary combustion-chamber, with the result that previous to its admixture with the products of combustion the air is heated to such a degree as will insure the ready combustion of its oxygen with the combustible elements furnished by the primary combustion-chamber.

It has been found in practice that the delivery of the highly-heated air within the secondary combustion-chamber produces a very violent agitation of the air and gases and insures the admixture of the elements to the proper extent to produce complete combustion. The volume of air admitted through the cone or conduit is determined by the amount of combustible gas furnished by the primary combustion-chamber.

Various changes in construction may be resorted to without departing from the spirit of the invention.

I claim as my invention—

1. In a furnace, the combination of a primary combustion-chamber, a secondary combustion-chamber, an imperforate air-feeding conduit extending from below the secondary combustion-chamber to within the same and forming with the walls thereof a restricted passage, and a grate for the primary combustion-chamber adapted to direct the incandescent fuel against the imperforate air-feeding conduit.

2. In a furnace, the combination of a primary combustion-chamber, a secondary combustion-chamber situated above and centrally of the primary combustion-chamber, a grate for the primary combustion-chamber sloping toward the center thereof, and an imperforate air-feeding conduit extending from the center of the grate to within the secondary combustion-chamber and forming with the walls of said chamber a restricted passage.

3. In a furnace, the combination of a primary combustion-chamber, a secondary combustion-chamber situated above and centrally of the primary combustion-chamber, an imperforate conical air-feeding conduit extending from below the secondary combustion-chamber to within the same and forming with the walls thereof a restricted passage, and a grate for the primary combustion-chamber adapted to direct the incandescent fuel against the imperforate conical air-feeding conduit.

4. In a furnace, the combination of a primary combustion-chamber, a secondary combustion-chamber, an imperforate air-feeding conduit extending from below the secondary combustion-chamber to within the same and forming with the walls thereof a restricted passage, a grate for the primary combustion-chamber adapted to direct the fuel against the imperforate air-feeding conduit, and means for controlling the delivery of air through said conduit.

5. In a furnace, the combination of a primary combustion-chamber, a secondary combustion-chamber, an imperforate conical air-feeding conduit extending from below the secondary combustion-chamber to within the same and forming with the walls thereof a restricted passage, said conduit being of sectional construction whereby the upper section may be removed and other sections of different diameter substituted to vary the area of the restricted passage, and a sloping grate for the primary combustion-chamber.

6. In a furnace, the combination of an upper secondary combustion-chamber, a lower

primary combustion-chamber having a crown sloping to the secondary combustion-chamber, an imperforate conical air-feeding conduit extending from below to within the secondary combustion-chamber and forming with the walls thereof a restricted passage, and a grate for the primary combustion-chamber sloping to the air-feeding conduit.

7. In a furnace, the combination of a primary combustion-chamber, a secondary combustion-chamber situated above and centrally of the primary combustion-chamber, an air-feeding conduit extending vertically through the primary combustion-chamber and into the secondary combustion-chamber, and a grate for the primary combustion-chamber sloping toward the air-feeding conduit and formed of segments each having transversely-sloping portions flanking a longitudinally-sloping portion.

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

HYRUM S. WOOLLEY.

Witnesses:

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W. T. NORTON.