No. 816,753. PATENTED APR. 3, 1906.

W. E. SNYDER.

CEMENT BURNING FURNACE.

APPLICATION FILED JULY 20, 1904.

2 SHEETS—SHEET 1.

Fig. I.

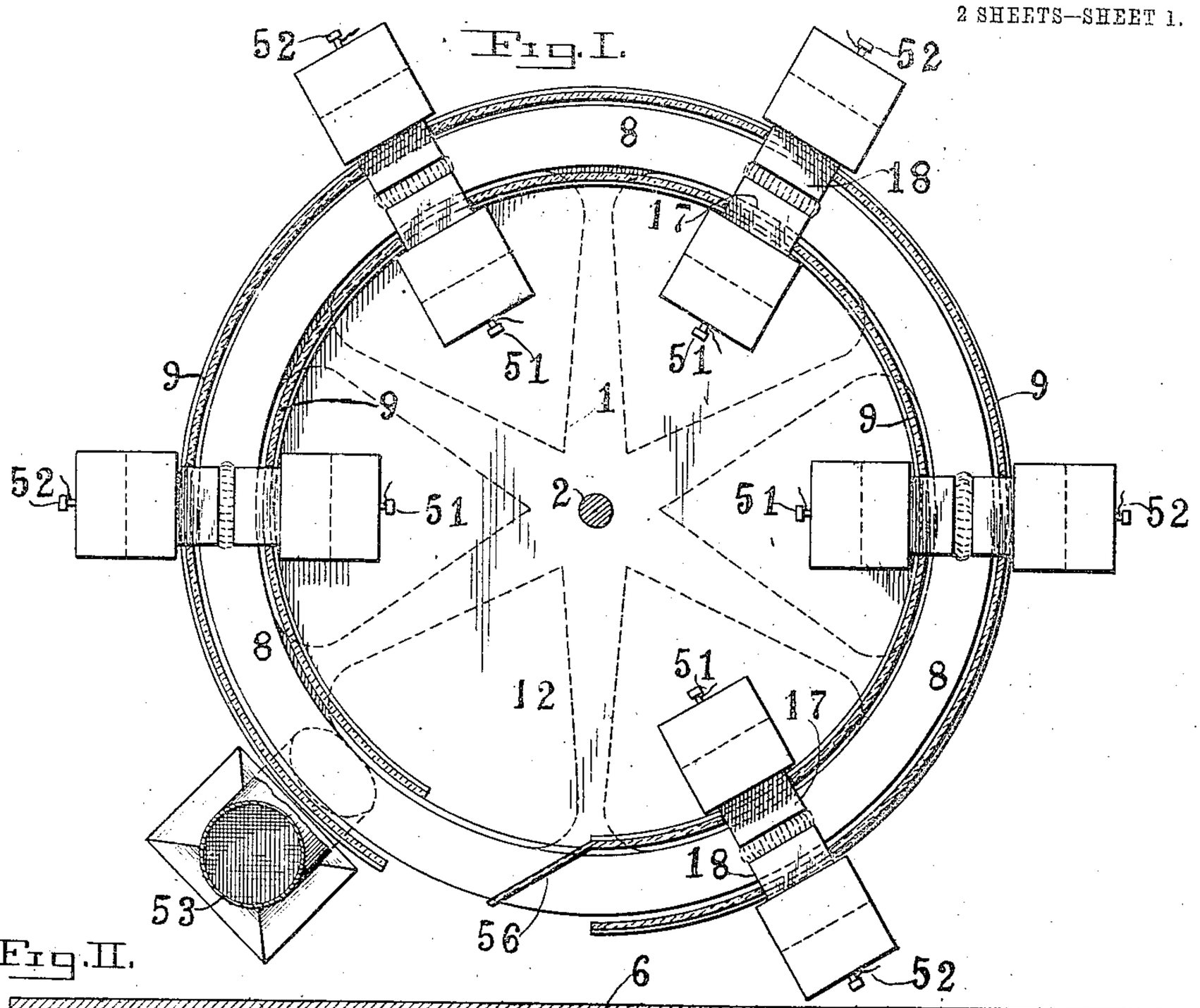
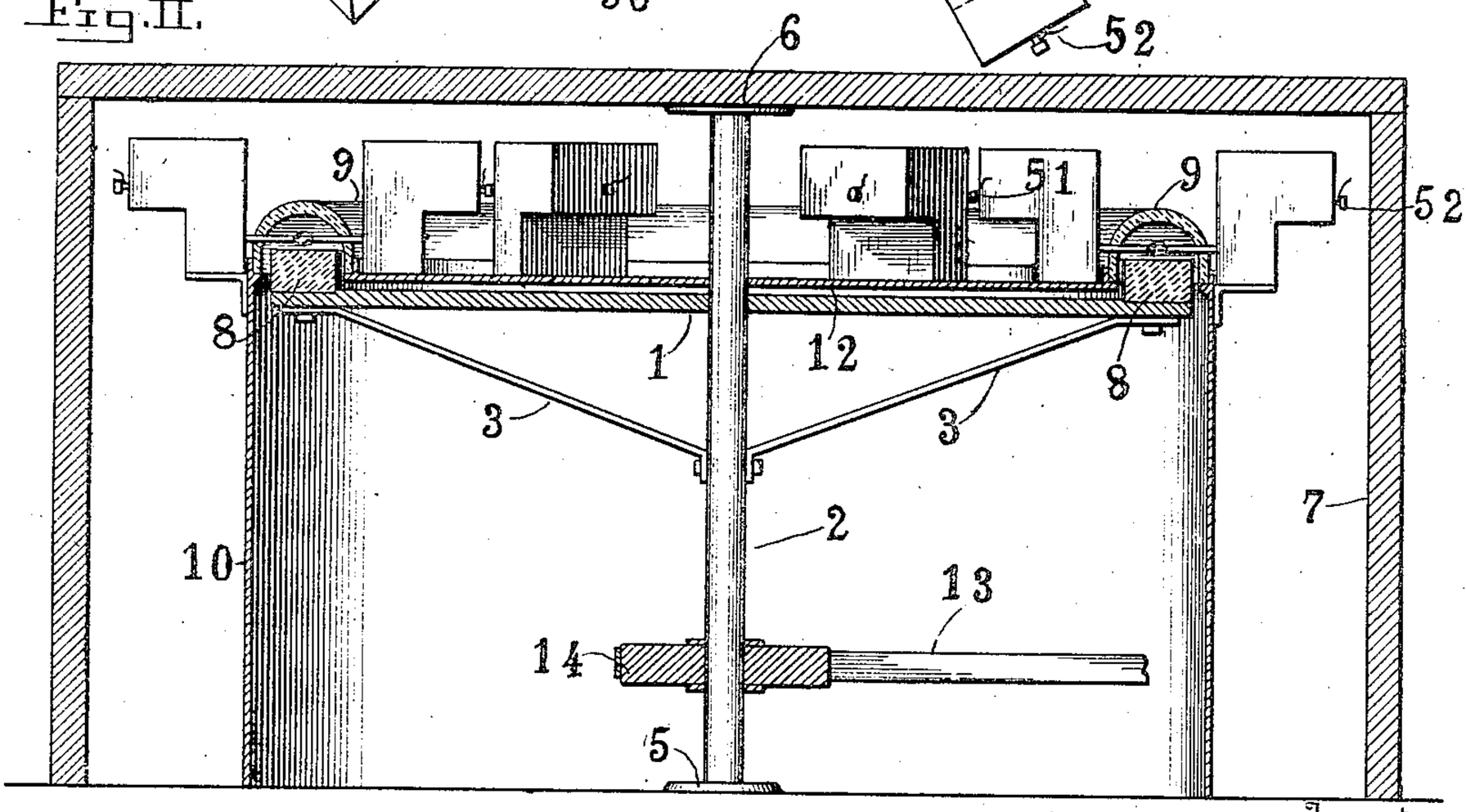



Fig. II.




Inventor:

Willoughby Elwood Snyder

Witnesses

Chas. E. Gordon

Frank J. Kent.

By Joseph A. Hopkins

Attorney.

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# CEMENT BURNING FURNACE.

APPLICATION FILED JULY 20, 1904.

2 SHEETS—SHEET 2.

Fig. III.

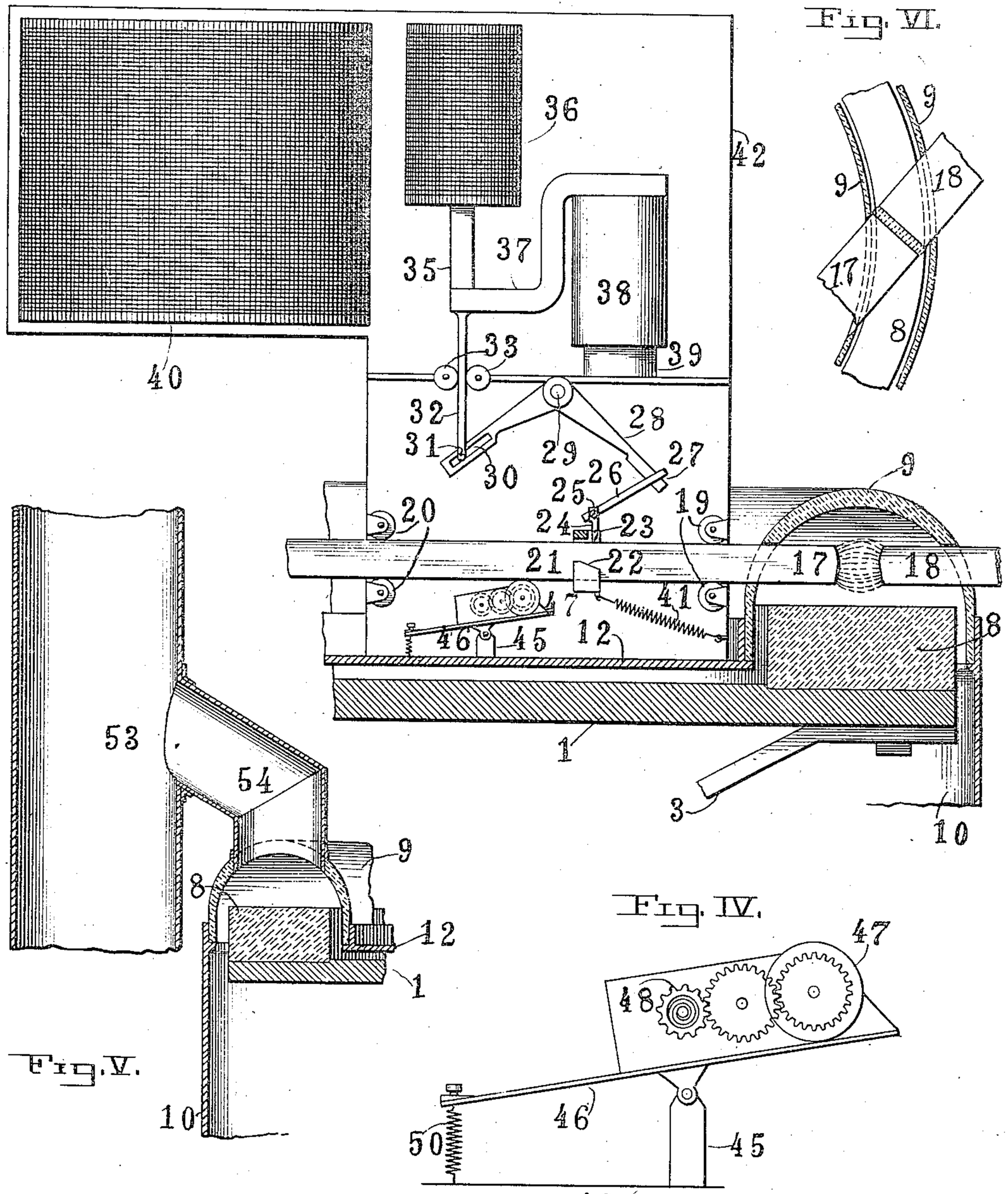


Fig. VI.




Fig. V.




Fig. IV.




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Witnesses:

Chas. E. Gordon

Frank J. Kent.

Inventor:

Willoughby Elwood Snyder

By Jasper N. Atkins

Attorney.

# UNITED STATES PATENT OFFICE.

WILLOUGHBY ELWOOD SNYDER, OF NAZARETH, PENNSYLVANIA.

## CEMENT-BURNING FURNACE.

No. 816,753. Specification of Letters Patent. Patented April 3, 1906.

Application filed July 20, 1904. Serial No. 217,317.

*To all whom it may concern:*

Be it known that I, WILLOUGHBY ELWOOD SNYDER, of Nazareth, in the county of Northampton, State of Pennsylvania, have invented certain new and useful Improvements in Cement-Burning Furnaces, of which the following is a complete specification, reference being had to the accompanying drawings.

My present invention relates to the manufacture of cement, and has for its object the production of an electric furnace for such manufacture which besides being simple and durable in structure and comparatively economical in the cost of production and operation is especially adapted to improve the quality and the uniformity of quality of the output.

The furnace herein described is also especially adapted for the practice of my process described in application, Serial No. 217,316, filed July 20, 1904.

What constitutes my invention will be specified hereinafter in detail and succinctly set forth in the appended claims.

In the accompanying drawings, Figure I is a top plan view of a preferred form of embodiment of my invention, showing its hood, shaft, and stack in horizontal section and without the inclosing shed shown in Fig. II. Fig. II is substantially a vertical central section through the complete furnace shown in Fig. I, together with its inclosing shed, some of the parts being shown in elevation. Fig. III is an enlarged side elevation, partly in section, and with the working parts of the mechanism exposed, of a portion of the furnace shown in Fig. I, showing suitable carbon feeding or adjusting mechanism. Fig. IV is a detail view, in side elevation, of the feeding mechanism of an automatic carbon-adjusting device shown in Fig. III. Fig. V is a detail sectional view illustrating a means of connection between the hood and the stack of my furnace and exemplifying suitable draft-compelling means for the practice of my invention. Fig. VI is a fragmental view intended merely to illustrate a modified arrangement of a pair of arc electrodes in relation to a traveling hearth above and in operative propinquity to which they are disposed.

Referring to the numerals on the drawings, 1 indicates a spoked wheel, which may be made of any suitable material, preferably of high, if not the highest, heat-resisting kind—such, for example, as steel—attached to a vertical shaft 2 and held in horizontal relations thereto, as by braces 3. The shaft 2 being suitably mounted, as indicated at 5 and 6, in bearings provided for it in the floor and roof, respectively, of a shed 7, which, for example, affords suitable supports for the bearings, supports, as upon a table, near its outer edge an annular hearth 8, which being of any suitable highly refractory material is covered throughout the greater part of its extent by a close-fitting hood 8, supported, as upon a casing 10, and in turn supporting above the wheel 1 a casing-cover 12. Any suitable means for imparting rotative movement to the shaft 10, by whose rotation the relative movements of the hearth 8 and hood 9 are most conveniently procured—such, for example, as a belt 13 and pulley 14—may be employed. The hood 9, like its companion member, the hearth 8, should be made of suitable refractory or heat-resisting material.

By the term "close-fitting" as definitive of the hood 9 I designate such propinquity of the inner wall of the hood to the hearth 8 as will serve to produce requisite reverberatory action of the heat of an arc located within the hood above the hearth against a charge upon the hearth.

At intervals in the hood 9 apertures in opposite sides of the hood are formed for the introduction of arc-supporting electrodes or carbons, the positive carbons being indicated by the reference-numeral 17 and the negative by the numeral 18. The angle of inclination of the axes of the carbons to the hearth 8 may be varied. For convenience of illustration they are shown as of radial disposition; but the chordal disposition of their conjoint axis (shown in Fig. VI) is preferred, because it provides, through the employment of carbons of suitable width, means to lay the arc across the entire extent of the hearth, with obvious practical advantage. Each member of the respective pairs of carbons is preferably supported between suitably-alined pairs of guide-rollers, of which two correlated pairs 19 and 20, respectively, are shown in Fig. III of the drawings. It being necessary, in order to afford means for preserving a constant arc between two electrodes, to provide automatic means of adjusting or feeding of the positive electrode, I illustrate, by way of example, suitable mechanism for that purpose in Figs. III and IV of the drawings. Upon the carbon 17 or carbon-supporting rod 21,

which is, in effect, the carbon itself, I provide a loose collar 22, within which is pivoted, as indicated at 23, an engaging pawl 24, which is pivoted, as indicated at 25, to one end of the link 26. The other end of the link 26 is loosely attached, as indicated at 27, to one arm of a bell-crank lever 28, pivotally supported, as indicated at 29, in determinate relations to the casing-cover 12. The remaining end of the bell-crank lever 28 is connected, as by a slot 30 and pin 31, to the end of a rod 32, which carries said pin. The rod 32, which preferably moves between guide-rollers 33, is preferably a coaxial extension of a solenoid core 35, loosely supported within operative relation to the helix of the solenoid or electromagnet 36.

37 indicates an arm of suitable conformation, which unites to the rod 32 and its connected core 35 an inverted cylinder 38, which, fitting over a piston 39, constitutes, in effect, a dash-pot to prevent abruptness or shock of descent of the core 35.

In order to provide for the energizing of the solenoid from the same source of energy that supplies the carbons 17 and 18, a resistance-coil 40 (shown in Fig. III) may be employed.

41 indicates a tensile spring fastened at one end to the collar 22 and at the other to the case 42 of the carbon-actuating mechanism, the office of the spring being to establish a normal relation between the collar 22 and the carbon rod 21, which carries it.

Upon a fulcrum-post 45 is pivotally mounted a gear-box 46, which carries a friction-wheel 47 and a spring-actuated drum 48, geared as desired to each other. The friction-wheel 47 being in abrasive contact with the carbon 17 or its rod 21, the driving force of the drum 48 is directed to urge the carbon 17 toward the carbon 18. The force of engagement between the wheel 47 and the carbon may be exerted and regulated, as by spring-adjusted mechanism 50. (Clearly shown in Fig. IV.) The tendency to movement of the carbon 17 under impulse of the wheel 47 is normally resisted by the collar 22 through the combined operation thereon of the spring 41 and pawl 24. If, however, the pawl relax its hold upon the carbon momentarily, the tendency asserts itself and drives or feeds the carbon until it meets with adequate resistance. It being the pull of the helix upon the core 35 which tends, through the mechanism which connects it with the pawl 24, to keep the pawl 24 in restricted engagement with the rod 21 of the carbon 17, it follows that if the power of the helix or magnet 36 be reduced the hold of the helix upon its core 35 must be relaxed, and in consequence the hold of the pawl upon the carbon must yield. As the carbon is consumed the resistance of the arc increases and the power of the helix 36 weakens. Thereupon the core 35 of the solenoid causes the engagement of the pawl 24 upon the carbon 17 or carbon rod 21 to relax and permits the automatic feeding of the carbon 17 toward the carbon 18. The effect of such automatic feed is to preserve an arc of required constancy of energy. The negative carbon 18 may be fed or adjusted as required, small movement or adjustment, on account of its very limited degree of consumption, being necessary.

51 and 52 are intended merely to indicate electric mains for the support of the arcs.

53 (compare Figs. I and V) illustrates, by way of example of draft-compelling means operatively communicating with the air-space between the hood and the hearth, a stack, whose means of communication with the hood may be an elbow 54, as shown in Fig. V. The draft-compelling means or stack 53 communicates with the charging end of the hood, as shown in Fig. I, for reasons which will hereinafter appear, the charging end of the hood being separated from its discharge end, as by an oblique transverse plate or scraper 56. (Also shown in Fig. I.)

I shall now proceed to describe the principle of my present invention, together with its mode of operation. First, I avoid actual penetration of a charge or mass of cement mixture to be treated by the arc or any part of the arc, which may prevent the manufacture of a sound cement. I employ the heat derived only by radiation, deflection, or reverberation from the arc. To that end, as shown in the drawings, I employ a hearth 8 and a hood 9, of suitable refractory material, and within the hood above the hearth I locate my arc. The arc must be located a sufficient distance above the hearth to accommodate upon the hearth a charge disposed below, but not between, the electrodes that sustain the arc, it being well understood that the heat of an arc is most intense and that the highest degree of its intensity is located directly within the current of or between the electrodes supporting the arc, where, as has has already been specified, it is, if not too intense, at least too much concentrated for its successful employment in the manufacture of cement. It is the object of my invention in part to employ such heat, free, as it is, from products of combustion deleterious to cement at its highest efficient intensity, but without its objectionable degree or manner of concentration above referred to. To that end, locating a mass of cement mixture to be treated or charged out of the line of penetration by the arc I provide for the full utilization of the available heat of the arc through the reverberatory action of the hood above the arc, which reverberatory action, along with the direct radiation from the arc, is directed, deflected, and concentrated in efficient energy against the charge upon the hearth. In order to provide for the continuous manufac-

ture of cement upon a hooded hearth of annular form, it is necessary, in view of the fact that the immediate product of calcination in the manufacture of cement is a clinker or vitrefied mass, to deposit cement mixture in separate charges upon the hearth, because when so deposited they clinker into detached portions or cakes, which may, through the continuous rotation of the hearth 8, be automatically swept therefrom one by one by the scraper 56, previously shown and described in Fig. I of the drawings. Besides, an advantage is derived over a continuous charging feed, if it were otherwise practicable, in securing to the charge that perfect homogeneity of calcination which is essential to the manufacture of a sound cement. Finally, it is advantageous to the practical application of heat over an extended charge or mass to be calcined in the manufacture of cement, but more especially in the application of successive heats to separate charges, not only to make provision for the application of an abundant supply of oxygen to the charge while it is undergoing calcination, but also with especial reference to the several stages which it undergoes between initial and complete calcination. To explain more fully, the initial application of heat to a charge of cement mixture besides expelling moisture liberates carbonic-acid gas in quantity. Consequently in order to promote combustion it is not only necessary to keep a constant supply of oxygen at the point of combustion, but also to draw off the carbonic-acid gas and other impurities or deleterious products generated by the combustion. If, therefore, suitable draft-compelling means be provided and properly applied in the manufacture, it will serve a double purpose, both of affording a fresh supply of oxygen and of removing injurious products of combustion. Consequently I provide, as by means of the stack 53, communicating with the charging end of a rotating annular hooded hearth, for the generation of a current of air in opposition to the direction of movement of the hearth—that is to say, I provide for the employment of an air-current through the successive heats from the final to the initial heat, thereby providing pure air to the final combustion and conducting it by successive stages to the point of initial combustion, whence the dense fumes generated by such initial combustion are conducted directly and without possibility of contamination of the finished product to the stack or place of discharge.

It should be clearly understood that the stack 53 is a merely representative, though preferable, means for producing, applying, and directing an air-current for the purpose specified and that in place thereof any ordinary or preferred means for accomplishing the same result may be employed.

What I claim is—

1. In a cement-burning furnace the combination with a movable hearth provided with a reverberatory hood, of a series of pairs of arc electrodes operatively disposed within the hood above the hearth, and draft-compelling means adapted to produce a current of air in opposition to the direction of movement of the hearth.

2. In a cement-burning furnace the combination with a relatively movable hearth and a reverberatory hood, of a plurality of pairs of arc electrodes operatively disposed within the hood above the hearth, and draft-compelling means adapted to supply a current of air from the last of said series of electrodes between the first series.

3. In a cement-burning furnace the combination with a rotatory hearth and reverberatory hood above the same, of a series of arc electrodes disposed within the hood above the hearth, and a stack communicating with the interior of the hood in operative propinquity to the initial electrodes.

4. In a cement-burning furnace the combination with a rotatory annular hearth, reverberatory hood, stack, and series of pairs of arc electrodes within the hood above the hearth, of a feed and discharge aperture in the hood and a scraper operatively disposed above the hearth within said aperture, substantially as specified.

5. In a cement-burning furnace the combination with a relatively movable hearth and reverberatory hood, of a pair of arc electrodes disposed obliquely within the hood across the hearth, whereby in operation they lay an arc across the entire extent of the hearth.

In testimony of all which I have hereunto subscribed my name.

WILLOUGHBY ELWOOD SNYDER

Witnesses:
THOMAS D. DANNER,
CHAS. B. BRUNNER.