J. E. DUNN.

VACUUM CASTING APPARATUS.

APPLICATION FILED AUG. 20, 1915.

1,186,558.

Patented June 13, 1916.

2 SHEETS—SHEET 1.

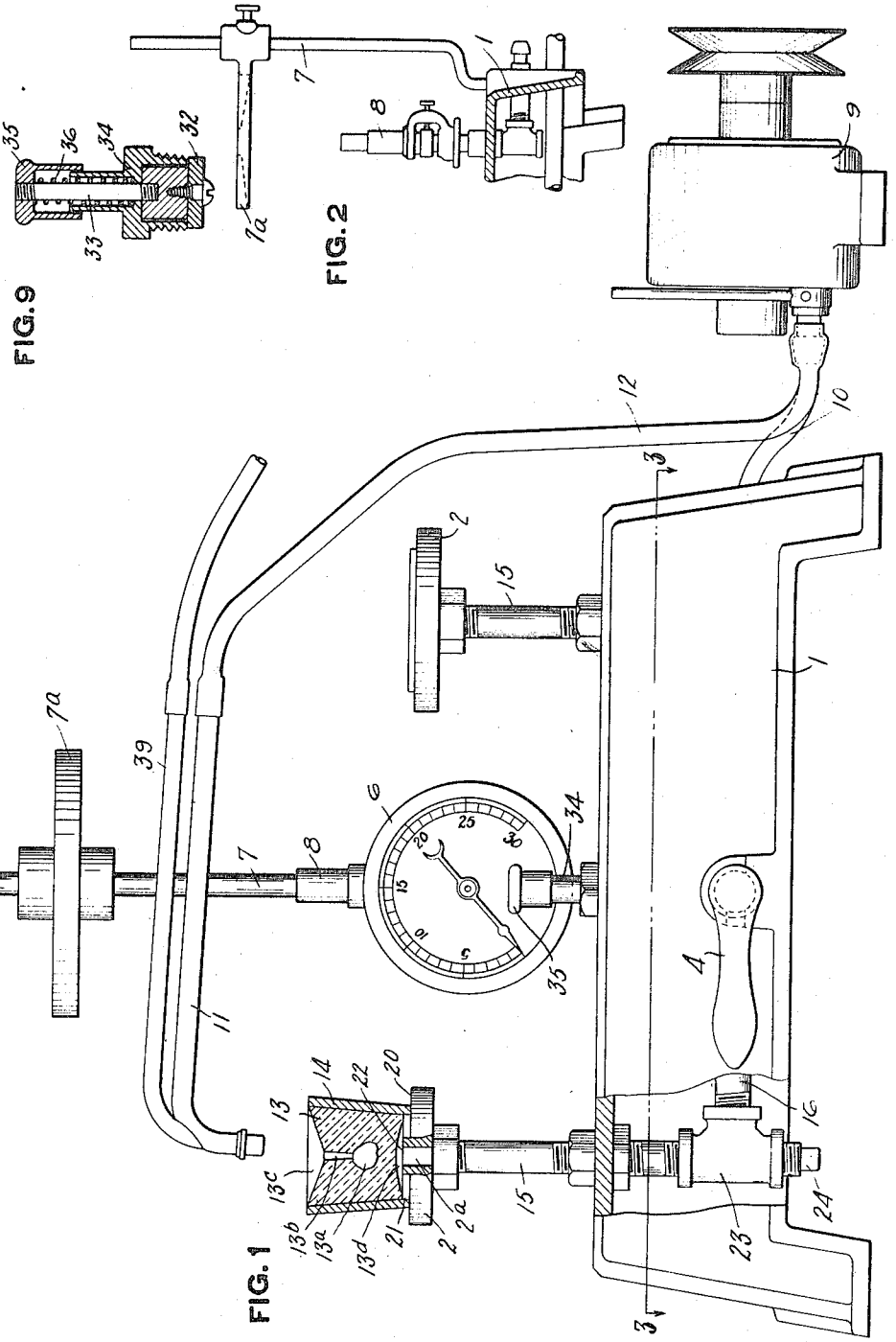


FIG. 1




FIG. 2




FIG. 9

WITNESSES

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2 SHEETS—SHEET 2.

FIG. 3

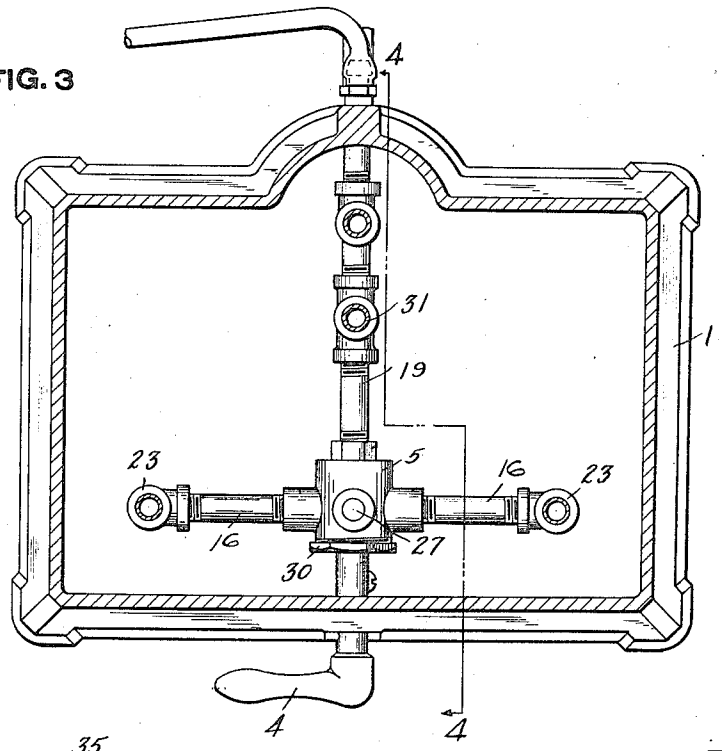



FIG. 4

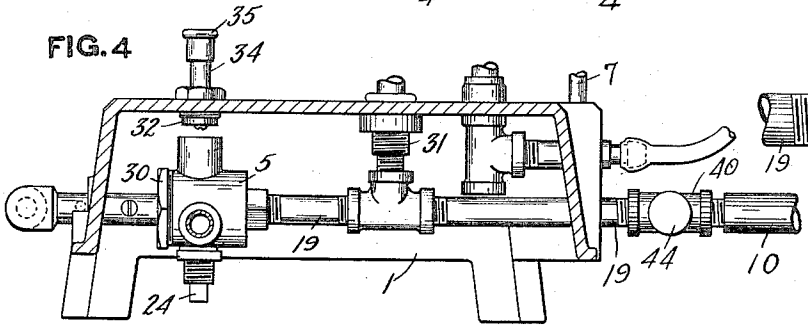
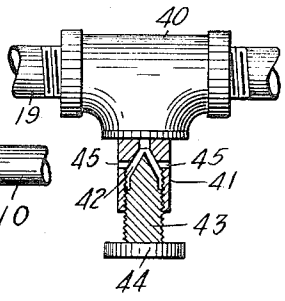



FIG. 8



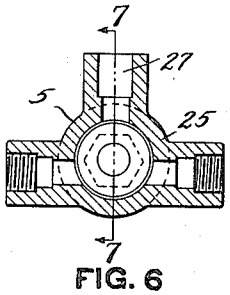




FIG. 6

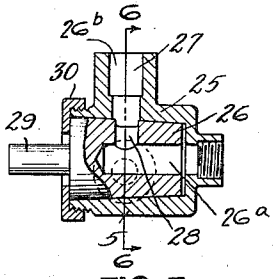



FIG. 7

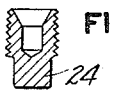



FIG. 5

WITNESSES

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# UNITED STATES PATENT OFFICE.

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## VACUUM CASTING APPARATUS.

1,186,558. Specification of Letters Patent. Patented June 13, 1916.

Application filed August 20, 1915. Serial No. 46,503.

*To all whom it may concern:*

Be it known that I, JAMES E. DUNN, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Vacuum Casting Apparatus, of which the following is a specification.

This invention relates to vacuum casting apparatus for producing dental inlays.

The object of the invention is to provide improved apparatus for casting an accurate dental inlay which completely fills the molding cavity and does not have imperfections which might produce a leaky filling.

A further object of the invention is to provide apparatus of this kind which is of simple construction and can be readily manipulated during the casting operation, which enables molds of various sizes to be used with the same machine, which is so arranged as to enable the operator at any time to know the degree of vacuum produced in the machine and to be imposed upon the investment, and which enables the degree of vacuum to be adjusted to the most efficient point.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

The invention comprises the vacuum casting apparatus hereinafter described and claimed.

In the drawings, Figure 1 is a front elevation of one form of apparatus embodying the invention, parts being broken away and the mold flask being shown in section; Fig. 2 is a detail sectional elevation of the rear portion of the apparatus, and showing the heating burner; Fig. 3 is a sectional plan view on the line 3—3, Fig. 1; Fig. 4 is a sectional elevation through the base, on the line 4—4, Fig. 3; Fig. 5 is a detail view of a safety plug; Fig. 6 is a cross sectional view of the valve, the section being taken on the line 6—6, Fig. 7; Fig. 7 is a longitudinal section of said valve on the line 7—7, Fig. 6; Fig. 8 is a detail sectional view of a vacuum regulating valve; and Fig. 9 is a detail sectional elevation of another valve.

The apparatus illustrated in the drawings comprises a suitable supporting base or foundation 1 carrying the stationary part of the apparatus, and which may rest upon a table or other support. On said base are mounted two casting tables 2 located at opposite sides of the machine, and preferably of different sizes in order to receive different casting molds. Each casting table is in the form of a metal disk having an upwardly extending circular projection 22 with a flat upper surface and providing an annular vertical shoulder 21 and an annular plane surface 20 to receive the molding flask 14, in which is located the mold body or investment 13 containing the cavity $13^a$ to produce the inlay. This investment 13 is made in the usual manner and is provided with a gate $13^b$ communicating with a cavity or depression $13^c$ in its upper end to receive the metal to be melted for filling the cavity and producing the inlay.

The tables 2 are threaded upon the upper ends of pipes 15 and are provided with central openings $2^a$ communicating with the passages in the pipes 15 for imposing suction or vacuum upon the lower surface of the porous investment for causing the molten metal to be drawn into and completely fill the cavity $13^a$. Preferably, the investment 13 is formed with a shallow cavity $13^d$ in its bottom so that the vacuum is effective over a large area of the investment and is not concentrated at the central axis thereof directly beneath the cavity $13^a$, while the investment and flask have a three point bearing upon the plane surface 20, the shoulder 21 and the projection 22 so as to produce an effective seal.

The two vertical pipes 15 communicate with horizontal pipes 16 connected to opposite sides of a three-way valve 5 shown in detail in Figs. 6 and 7. Said valve has a casing 25 in which is a cavity to receive a conical plug 26 held therein by a screw cap 30 and having a stem 29 to which is connected an operating handle 4 lying on the outside of the base 1. The plug 26 has a longitudinal bore $26^a$ open at one end and communicating through the casing with a pipe 19, and a port 28 through its side wall which is adapted in the three several positions of the valve to communicate with either of two passages in the casing 25 leading to the pipes 16 and casting tables 2, or with an air inlet passage 27 in the upper portion of the valve casing, which communicates with the atmosphere. Above the valve casing is located a valve device having an operating member on the upper portion of the base 1, and by means of which the inlet passage 27 in the valve casing may be closed,

so as to actuate the gage and register the vacuum thereon. In the form shown, this valve comprises a casing 34 screwed into an opening in the base 1 directly above the valve inlet 27 and in the bore of which is a vertically movable stem 33 provided at its lower end with a valve member 32 and at its upper end with an operating button 35. The valve is normally held in the position shown in Fig. 9, in which position the passage 27 is open to atmosphere, by a compression spring 36, so that the button 35 must be pressed downwardly whenever it is desired to close the inlet passage 27 independently of valve 5.

Pipe 19 communicates through a vertical pipe 31, with a suitable vacuum gage 6, which is preferably of a type to indicate the vacuum in inches of mercury, or some other suitable units. Pipe 19 also extends out through the rear wall of the base 1 and communicates with suitable devices for regulating the vacuum to be produced. As illustrated, said pipe communicates with a T 40, one branch of which has screwed therein a casing 41 provided with a cavity 42 to receive a needle valve 43 threaded into said casing and provided with a head 44. Casing 41 is also provided with one or more lateral ports or openings 45. By adjusting the valve member 43 by its head 44 the passage through the regulating valve may be opened more or less to admit air to the pipe 19. The other branch of the T 40 communicates with a flexible conduit, such as the rubber tube 10, leading to the suction end of a vacuum producing machine, such as the rotary pump 9 provided with an operating pulley which may be coupled by a belt or other device to an electric motor or other operating mechanism, (not shown). The discharge end of said pump communicates through a rubber tube or other flexible conduit 12 with a suitable blow-pipe 11 having a connection 39 communicating with a source of fuel supply. At the back of the base 1 is located an upright stationary standard 7 provided with an adjustable bracket $7^a$ to receive the investment in baking or burning the same, and below said bracket is located a suitable burner, such as the Bunsen burner 8, having the usual regulating devices and communicating with a gas supply.

In operation, the tooth cavity is filled with a brittle wax, to which is connected a thin metal stem for producing the gate $13^b$. The wax impression is surrounded with suitable investment material to form the investment 13, which is properly shaped to provide the cavities $13^c$ and $13^d$. The flask 14 with the investment therein is then placed on the bracket $7^a$ over the burner 8 and is heated to burn or vaporize the wax and produce the cavity $13^a$. The investment in its flask is then placed on one of the tables 2 in the manner shown in Fig. 1, and the gate forming pin is removed.

The operating motor is started to drive the pump 9 and produce a suction effect in the pipe 10 and a pressure effect in the pipe 12. The valve 5 is in its middle or neutral position, so that the port 28 in said valve communicates with the passage 27 leading to atmosphere. Consequently, the suction end of the pump is open through a large passage to the atmosphere and a full supply of air is delivered by said pump to the blow pipe 11. The gold to form the inlay is placed in the cavity $13^c$, the supply of gas through the pipe 12 is turned on, and the blow pipe flame is directed upon said gold to melt the same. This gold is drawn into the cavity by the suction of the pump 9, which is applied to the investment by turning the operating handle 4 so as to connect the pump through the valve 5 with the proper casting table 2. The suction is applied at a time when the gold is in a completely molten condition, so that it will flow freely and smoothly into the cavity under the influence of the suction. In practice, however, it is found that too great a vacuum applied to the investment may produce an imperfect inlay, by causing the gold to flow so rapidly that it chokes the gate $13^b$ and prevents escape from the cavity $13^a$ of all the air therein, so that bubbles may be produced in the inlay. Consequently, the operator should know what degree of vacuum is being produced by the pump before the vacuum is applied to the investment. This is ascertained by pressing down the button 35 to close the valve member 32 against its seat on the upper end of the casing 25 and thus shut off the supply of air through the pipes 19 and 15 leading to the suction end of the pump. The vacuum produced by the pump then becomes effective upon the gage 6, the pointer of which indicates the vacuum in inches of mercury. If the vacuum is too high the regulating valve is opened by turning its head 44 so as to admit a supplemental air supply to the pipe 10 communicating with the pump. The greater the supplemental air supply through this regulating valve, the less effective is the vacuum upon the gage 6. The regulating valve is adjusted so that the most effective vacuum is produced by the pump. This regulating valve can be located anywhere between the casting tables 2 and the suction side of the pump. The operator now releases the valve head 35 so that the valve 5 is again open through the passage 27 to atmosphere. As soon as the gold is fully melted, the operating handle 4 is turned in the proper direction to connect the particular casting table in use to the pump, to thereby apply the vacuum to the investment. This vacuum

causes the gold to flow into the cavity, which it fills completely, and there solidifies. During adjustment of the regulating valve and while casting, the blow pipe receives its supply of air from the regulating valve and through the pores of the investment so that the molten metal has no opportunity to cool or solidify until it reaches the cavity 13ª.

In some cases the investment has a flaw or is weaker than usual, so that it breaks during the casting operation, which allows the molten gold to flow down through the investment and into the pipe 15. This gold is caught by a suitable trap, shown as a hollow plug 24 screwed into the bottom of a T connection 23 between the pipes 15 and 16. This plug can be removed at intervals for recovering the gold.

The apparatus described is of simple construction and can be readily operated in a most efficient manner. It enables a proper degree of vacuum to be applied to the investment and thereby produces a very accurate and perfect inlay.

What I claim is:—

1. Vacuum casting apparatus, comprising a casting table, a source of vacuum therefor, a vacuum indicating gage communicating with said source, a valve for controlling communication between said table and source, and a valve controlling communication between said source and the atmosphere.

2. Vacuum casting apparatus, comprising a casting table, a source of vacuum therefor, a vacuum indicating gage communicating with said source, a valve for interchangeably connecting said source to said table or an air inlet, and a valve for closing said air inlet.

3. Vacuum casting apparatus, comprising a plurality of casting tables, a source of vacuum therefor, a vacuum indicating gage communicating with said source, a valve for interchangeably connecting said source to any of said tables or an air inlet, and a valve controlling communication between said source and the atmosphere.

4. Vacuum casting apparatus, comprising a plurality of casting tables, a source of vacuum therefor, and a single valve arranged to establish communication between any one of said tables and said source of vacuum, or to connect said source of vacuum to the atmosphere.

5. Vacuum casting apparatus, comprising a plurality of casting tables, a source of vacuum therefor, a gage communicating with said source of vacuum, means for establishing communication between said tables and the source of vacuum, an air inlet for said source of vacuum, and means for closing said inlet to actuate said gage.

6. Vacuum casting apparatus, comprising a plurality of casting tables, a source of vacuum therefor, an air inlet for said source of vacuum, a single valve arranged to connect the source of vacuum to said air inlet or to either of said casting tables, and a vacuum gage connected to said source.

7. Vacuum casting apparatus, comprising a plurality of casting tables, a source of vacuum therefor, an air inlet for said source of vacuum, a valve arranged to connect the source of vacuum to said air inlet or to either of said casting tables, and independent means for closing said inlet.

8. Vacuum casting apparatus, comprising a casting table, a source of vacuum therefor, an air inlet for said source, means for establishing communication between said source and either said table or said inlet, and a valve between said table and source of vacuum and controlling an air supply for said source independent of said air inlet and table.

9. Vacuum casting apparatus, comprising a casting table, a source of vacuum therefor, an air inlet for said source, means for closing said air inlet, and means independent of said air inlet and table for supplying additional air to said source.

10. Vacuum casting apparatus, comprising a casting table, a source of vacuum therefor, a gage connected to said source, an air inlet to said source, means for closing said inlet to actuate the gage, and means for supplying additional air to said source.

11. Vacuum casting apparatus, comprising a casting table, a source of vacuum connected thereto, an air inlet for said source, means for closing said inlet, and an adjustable valve for controlling a supplemental air supply independent of said air inlet and table to said source.

12. Vacuum casting apparatus, comprising a casting table, a source of vacuum therefor, a gage connected to said source, an air inlet to said source, means for closing said inlet to actuate the gage, and an adjustable valve for controlling a supplemental air supply to said source.

13. Vacuum casting apparatus, comprising a casting table having an annular plane surface and an upwardly extending projection forming a shoulder, a molding flask resting upon said surface and surrounding said projection and abutting said shoulder and an investment of porous material in said flask having an exposed bottom cavity above said projection.

In testimony whereof, I have hereunto set my hand.

JAMES E. DUNN.

Witnesses:
ELBERT L. HYDE,
SUE B. FRITZ.