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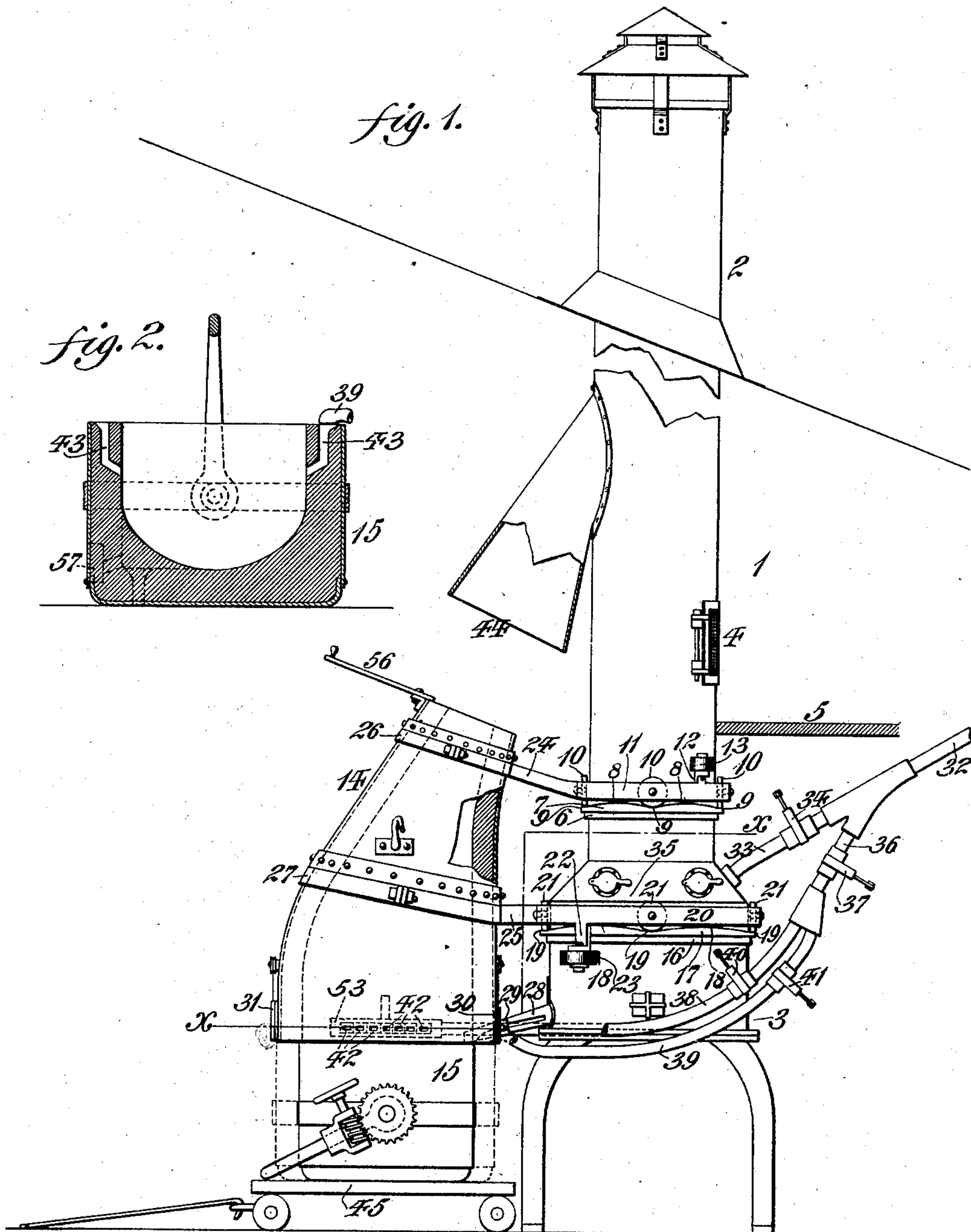
Patented Apr. 29, 1902.

E. C. WILLS.
APPARATUS FOR MAKING STEEL, &c.

(Application filed Oct. 16, 1900.)

(No Model.)

2 Sheets—Sheet 1.



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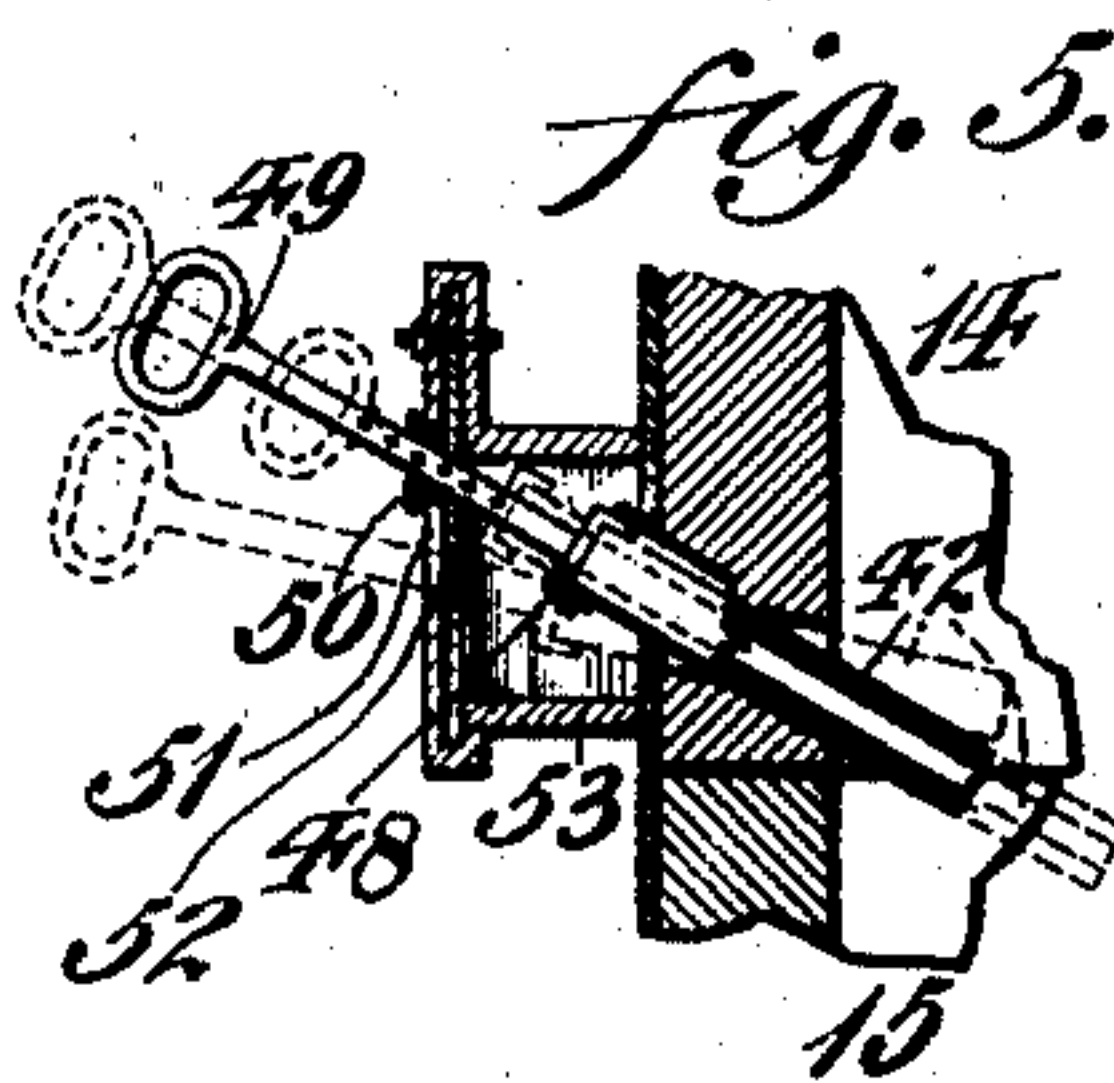
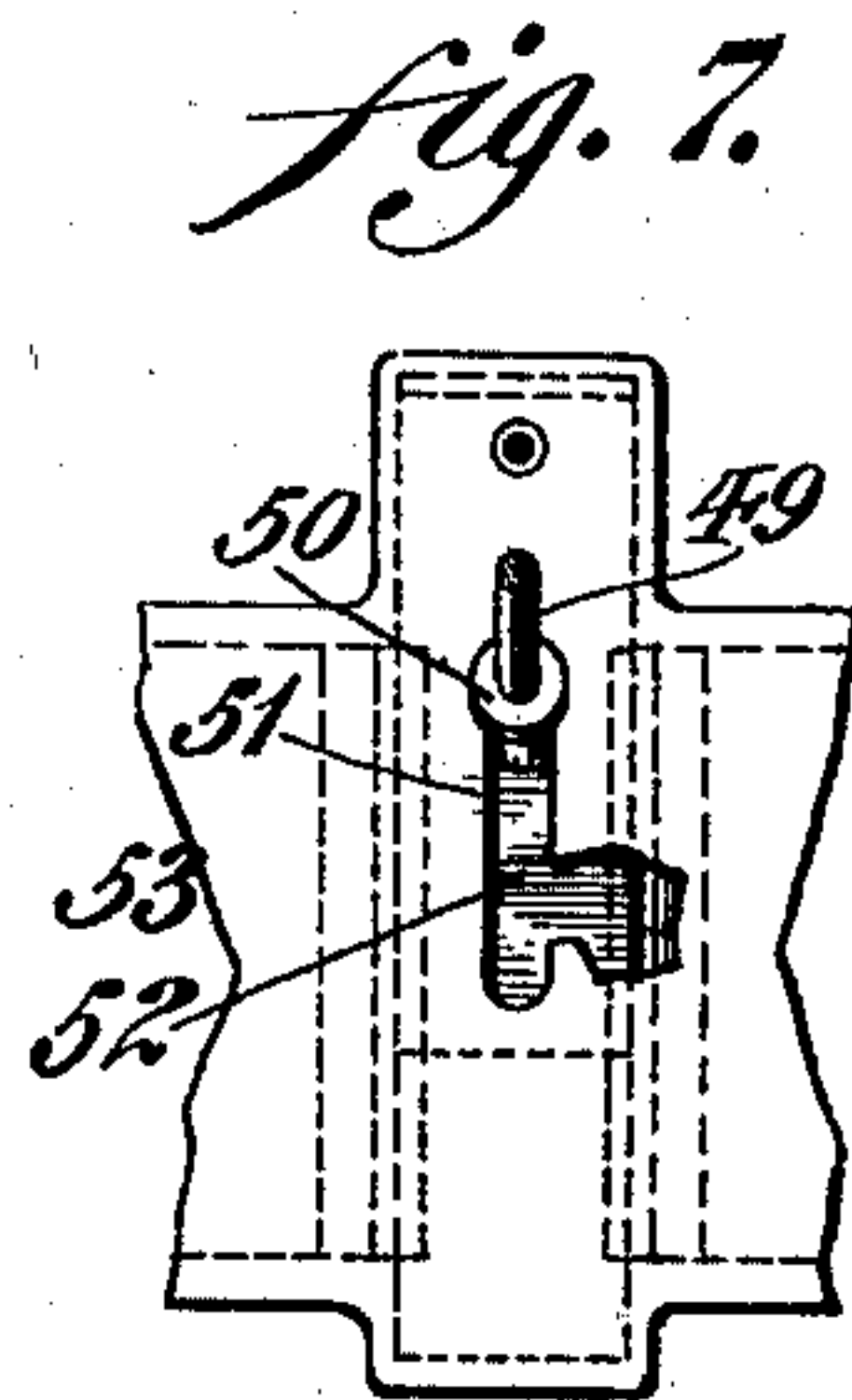
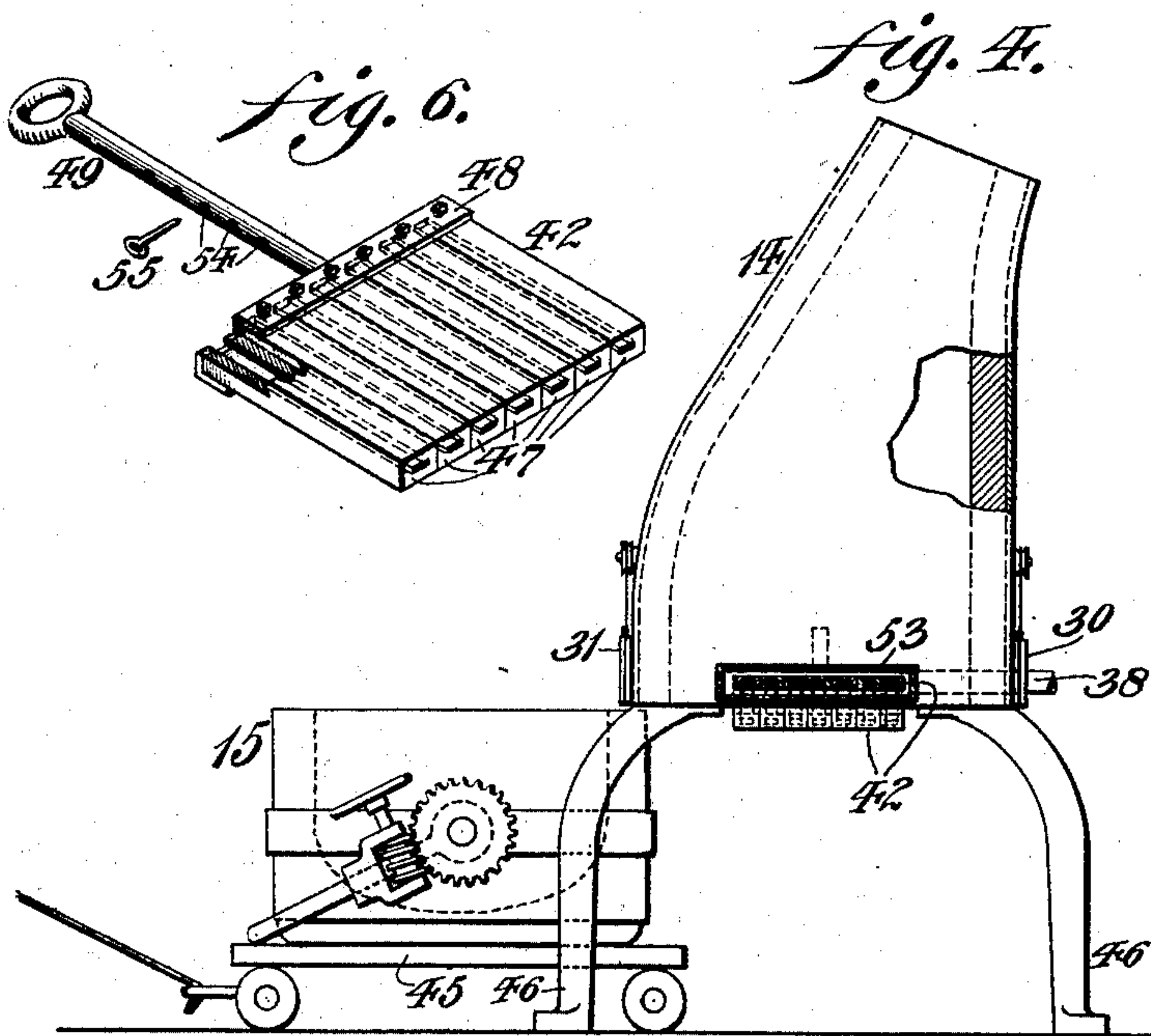
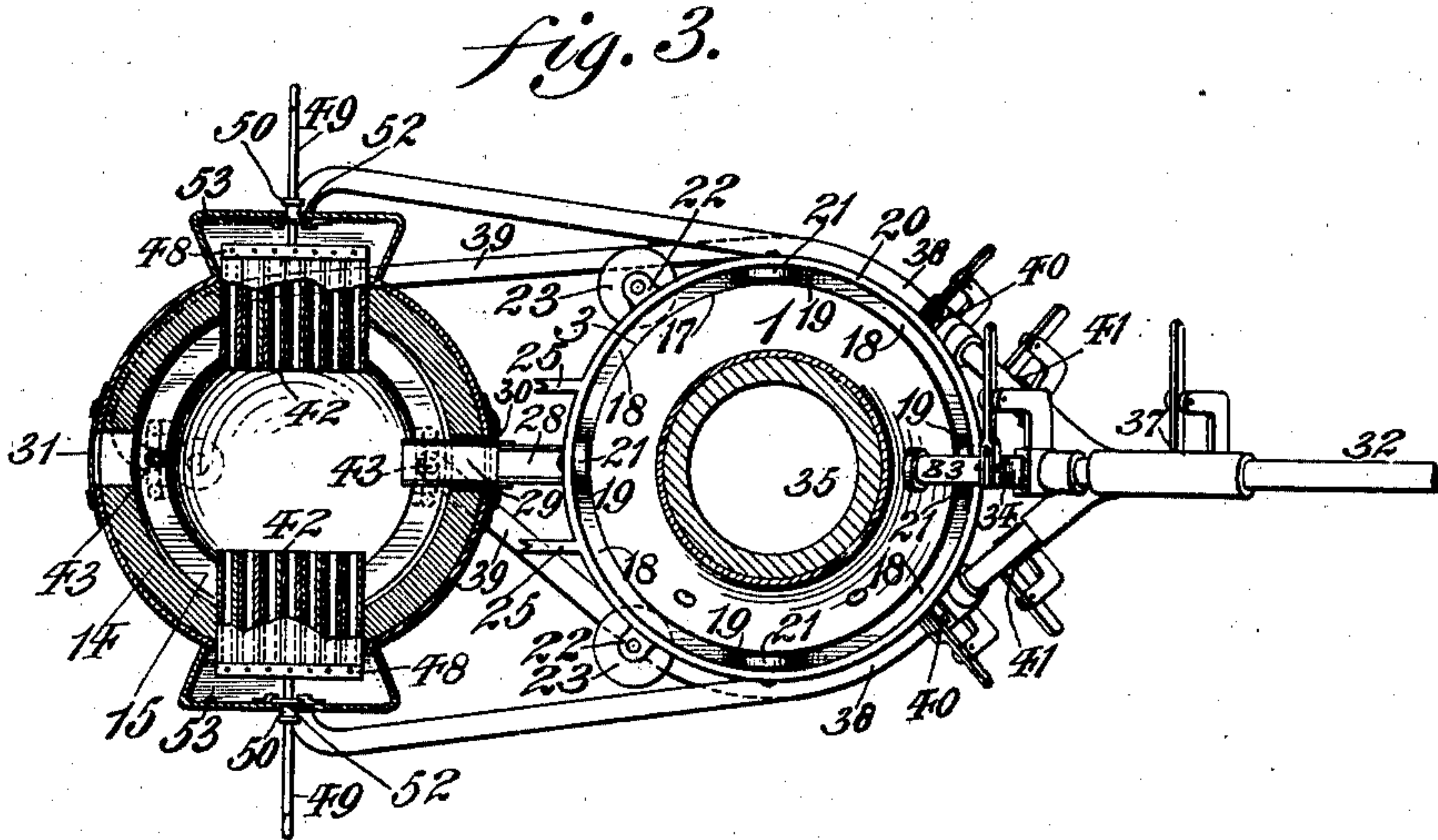
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MAKING STEEL, &c.

SPECIFICATION forming part of Letters Patent No. 698,610, dated April 29, 1902.

Application filed October 16, 1900. Serial No. 33,295. (No model.)

To all whom it may concern:

Be it known that I, EDWIN C. WILLS, a citizen of the United States, residing at Peru, in the county of Miami, State of Indiana, have invented a new and useful Improvement in Apparatus for Making Steel and other Metals, which improvement is fully set forth in the following specification.

My invention consists of an improved construction of an apparatus for making steel, wherein I employ in addition to a cupola of the usual construction an auxiliary apparatus consisting of a dome-section and a ladle-section, each being provided with twyers to which an air-blast (or blasts) is conducted from a suitable source.

It also consists, broadly, in the novel combination of a cupola and stack of the usual construction with my novel dome-section and ladle-section and means whereby the gases from the dome-section are conducted to said stack.

It also consists of the novel construction of adjustable twyers for the dome-section.

It also consists of a novel construction of ladle-section provided with twyers for the introduction of air into the metal, said twyers being capable of being utilized in pouring the metal from said ladle.

It also consists of my novel combination of a dome-section and a ladle-section adapted to coact with each other.

It further consists of novel details of construction, all as will be hereinafter fully set forth, and particularly pointed out in the claims.

Figure 1 represents a side elevation of an apparatus for making steel embodying my invention. Fig. 2 represents a vertical sectional view of a ladle-section employed, the same being shown in detached position. Fig. 3 represents a horizontal sectional view of the apparatus seen in Fig. 1, the section being taken on line *x x*, Fig. 1. Fig. 4 represents a side elevation of a dome-section, showing the same supported upon legs and the ladle-section movable with respect thereto. Fig. 5 represents, on an enlarged scale, a vertical sectional view showing a portion of the side walls of the dome-section and the adjustable twyer therefor. Fig. 6 represents, on an enlarged

scale, a perspective view of the adjustable twyers for the dome-section in detached position. Fig. 7 represents a front elevation of Fig. 5.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates a cupola having the stack 2, base 3, charging-door 4, and platform 5, all of the above parts being of the usual construction, and therefore requiring no further description.

6 designates a stationary support or ring surrounding a suitable portion of the cupola or stack and having a track 7 on the upper portion thereof, said track being provided with the raised portions 8 and the depressions 9, upon which the rollers 10 travel, said rollers being suitably journaled in the yoke 11, which loosely encircles or surrounds the cupola.

12 designates arms projecting from the yoke 11 and provided with rollers 13, which are preferably four in number and contact with the cupola or stack, although it will be apparent that more or less rollers may be employed, if desired, the function of said rollers being to preserve the alinement of the dome-section with respect to the ladle-section 15, as will be hereinafter explained.

16 designates a ring or support surrounding the lower portion of the cupola and provided on its upper portion with the track 17, which has the elevations 18 and the depressions 19, which are located in substantially the same relative position as the elevations and depressions of the upper track, already described.

20 designates a yoke surrounding the lower portion of the cupola, said yoke having journaled thereon the rollers 21, which travel on the track 17.

22 designates arms projecting from the lower yoke 20 and provided with the rollers 23, which latter assist the rollers 13 in preserving the proper position of the dome-section with respect to the ladle-section, as is evident. The yokes 11 and 20 are provided with the extensions 24 and 25, which engage suitable portions of the dome-section 14, said extensions having secured thereto the straps or bands 26 and 27, respectively, which sur-

round said dome-section and are capable of being disconnected from the extensions 24 and 25, so that said dome-section can be readily removed, if desired, for the purposes of inspection or repairs, it being apparent that by the employment of the connections above described the dome-section can be readily swiveled to an existing cupola or furnace. The lower portion of the cupola is provided with the spout 28, which has the telescopic section 29, which leads to the ladle-section 15, said spout readily entering said ladle-section when the door 30 of the dome-section is raised. The dome-section is also provided with the door 31, it being apparent that the doors of the dome-section can be utilized to introduce the metal into the ladle-section and also to skim the slag, as well as to make tests, as may be desired, without changing the position of the apparatus.

32 designates the main blast-pipe, which is provided with the branch 33, having therein the gate 34, said branch 33 leading to the wind-box 35 of the cupola.

36 designates a branch leading from the main blast-pipe 32 and provided with the gate 37, from which branch leads the branches 38 and 39, which are provided with the gates 40 and 41, respectively, said branches 38 leading to the twyers 42 of the dome-section 14, while the branches 39 lead to the twyers 43 of the ladle-section 15, it being understood that the blast-pipes 38 in the present instance extend to each side of said dome-section and that the blast-pipes 39 extend to each of the twyers 3 of the ladle-section, as is best seen in Fig. 3. The twyers 42, located in the lower portion of the dome-section, are preferably movable or adjustable, as will be clearly understood from Figs. 5 and 6, whereby I am enabled to direct the blast into or on top of the metal in the ladle-section at any desired angle, it being apparent that the gases or vapors pass through the dome-section 14 to the cupola-stack 2 through the smoke-hood 44, which is angularly located with respect to the cupola-stack, as will be understood from Fig. 1.

45 designates a car or truck upon which the ladle-section 15 may be supported, whereby said ladle-section can be removed when desired, although it will be apparent that other means may be provided for supporting the ladle-section according to requirements. It will also be apparent that, if desired, I may support the dome-section or dome 14 upon the legs 46 or other suitable supporting devices, as seen in Fig. 4, and that the ladle-section 14 or dome-section 15 can be moved into or from the relative position seen in Fig. 1 by any suitable or convenient appliances, such as are familiar to those skilled in this art.

In practice I construct the adjustable twyers 42 substantially as seen in Fig. 6, said twyers being composed of a plurality of fire-bricks 47, arranged side by side and held in

juxtaposition by any suitable means, as 48, the latter having the handle 49 attached thereto, which passes through a suitable stuffing-box 50, which is movable in the opening 51, which is provided with the slide 52, which is suitably guided on the wind-box 53. The handle 49 is provided with the openings 54, which are adapted to be engaged by the pin 55, whereby said handle and twyers can be adjusted to the desired position.

The operation is as follows: I first charge the cupola through the charging-door 4 with suitable fuel and metals. The gate 37 being closed, the gate 34 is opened and the blast from the main pipe 32 is conducted into the wind-box 35. When the metal is melted, it is tapped out through the door 30 into the ladle-section 15 by means of the spout composed of the telescopic sections 28 and 29, after which the section 29 of the spout is removed from the ladle-section and the doors 30 and 31 are closed. The gate 37 is now opened and the gate 34 closed and a blast directed through the pipes 38 and 39 to the twyers 42 of the dome-section and also to the twyers 43 of the ladle-section. The introduction of the air-blast is continued until the process is carried out to the desired extent and the gases and vapors generated in the ladle and dome sections pass upwardly through said dome-section into the smoke-hood 44 and are conducted thence to the cupola-stack 2. After the metal in the ladle-section has been properly treated to the desired extent the dome-section is moved to one side, after which the ladle-section 15 is readily accessible and can be poured by any suitable means.

It will be apparent to those skilled in the art that by my invention various advantages over the usual forms of the apparatus employed are obtained, since the metal in the ladle-section 15 reaches a cleaner and hotter condition than can be attained when the metal is poured directly from the furnace into a ladle of lower temperature, as the custom now generally practiced, since when the metal is poured into the ladle having a lower temperature than the metal a slag is formed; but in my invention, where the ladle and the metal therein are heated to substantially the same temperature, I am enabled to skim the refuse or slag from the top of the metal in said ladle-section through the door 31, and since by my invention an even temperature is attained I can get the desired result in a more effective manner than has heretofore been possible.

By the employment of a detached dome-section, which is swiveled to the cupola in the manner described, it will be seen that said dome-section can be readily swung to one side, so as to render the ladle-section readily accessible, and since the major portion of the refuse of the metal in the ladle-section becomes separated from said metal and attached to the inner portion of the dome-section it

can be readily removed therefrom, since said dome-section is readily accessible at all times.

If desired, the dome-section can be removed and iron or other metal cast in the cupola, as desired, without extra expense. My apparatus is compact and direct, requiring shop-space which is generally not utilized to any advantage, and my entire apparatus can be readily attached to or disconnected from existing furnaces, as will be apparent.

It will be understood that all joints between the dome and ladle sections are made up with fire-clay, asbestos, or other suitable material.

It will be apparent that changes may be made by those skilled in the art which will come within the scope of my invention, and I do not therefore desire to be limited in every instance to the exact construction herein shown and described.

By introducing gas or oil in conjunction with air or steam in said twyers of the dome and ladle sections I am able to melt metals of low melting-points—such as brass, bronze, &c.—as will be evident.

It will be apparent that the dome-section and the ladle-section can be operated independently of the cupola, if desired.

In some instances I prefer to employ the damper 56, which can be turned to close the exit from the dome-section 14, and thereby retain the heat therein.

In Fig. 2 I have shown the upper or front wall of the ladle seen therein as provided with a breast 57, whereby when a series or battery of furnaces are used the metal can be withdrawn through said breast 57 into one large ladle, if desired.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a dome-section, a ladle-section independent thereof and adapted to coact therewith, and twyers in the ladle-section which twyers pass downwardly from a point in the upper surface of the ladle-section through the walls of the said section and then turn and pass in a downward direction through the inner walls of the section whereby the blasts of air issuing from said twyers are directed upon the surface to be occupied by the metal and toward the center thereof.

2. The combination of a dome-section, a ladle-section independent thereof and adapted to coact therewith, twyers in said dome-section and ladle-section, the twyers of said ladle-section extending downwardly from the upper edges thereof, through the walls of the said section and then turning and passing in a downward direction through the inner walls of the section and having their lower ends converging inwardly, whereby the blasts from the said twyers are directed upon the surface to be occupied by the metal and toward the center thereof, and blast-pipes leading to said twyers.

3. The combination of a cupola, a dome-section swiveled thereto, a ladle-section adapted to coact with said dome-section, and means for conducting metal from said cupola to said ladle-section.

4. As an improved article of manufacture, a ladle-section having therein twyers which pass downwardly from a point in the upper surface of the ladle-section through the walls thereof and then turn and pass downwardly through the inner walls whereby the blasts of air will be directed upon the surface to be occupied by the metal and toward the center thereof.

5. As an improved article of manufacture, a ladle-section having twyers in the walls thereof, projecting downwardly from the top of said section through the walls of the said section and then turning and passing in a downward direction through the inner walls of the section and converging inwardly and being adapted to conduct air into the interior of said section, upon the surface above the space to be occupied by the metal and toward the center thereof.

6. The combination of a cupola, a dome-section swiveled thereto, and a ladle-section arranged to coact with said dome-section.

7. The combination of a cupola, tracks thereon, a dome-section, supporting devices for the latter, adapted to travel on said tracks, and a ladle-section arranged to coact with the said dome-section.

8. The combination of a cupola, a stack therefor, a smoke-hood connecting with said stack and depending therefrom, a dome-section located below said smoke-hood and rotatably mounted on the cupola and adapted to discharge thereinto, and a ladle-section arranged to coact with said dome-section.

9. The combination of a dome-section, a wind-box located at the lower portion thereof, an adjustably-mounted twyer mounted in said section and wind-box, said twyer being movable at its outer end from its lower end as a center, a ladle-section having twyers therein, and means for conducting a blast to said twyers.

10. The combination of a cupola, a dome-section rotatably mounted thereon, and a ladle-section arranged to coact therewith.

11. The combination of a cupola, a dome-section movably mounted thereon, a ladle-section arranged to coact therewith and twyers for said ladle-section and dome-section.

12. The combination of a cupola, a dome-section movably mounted thereon, a ladle-section arranged to coact therewith, twyers for said ladle-section, and a series of adjustable twyers for said dome-section.

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