

No. 804,080.

PATENTED NOV. 7, 1905.

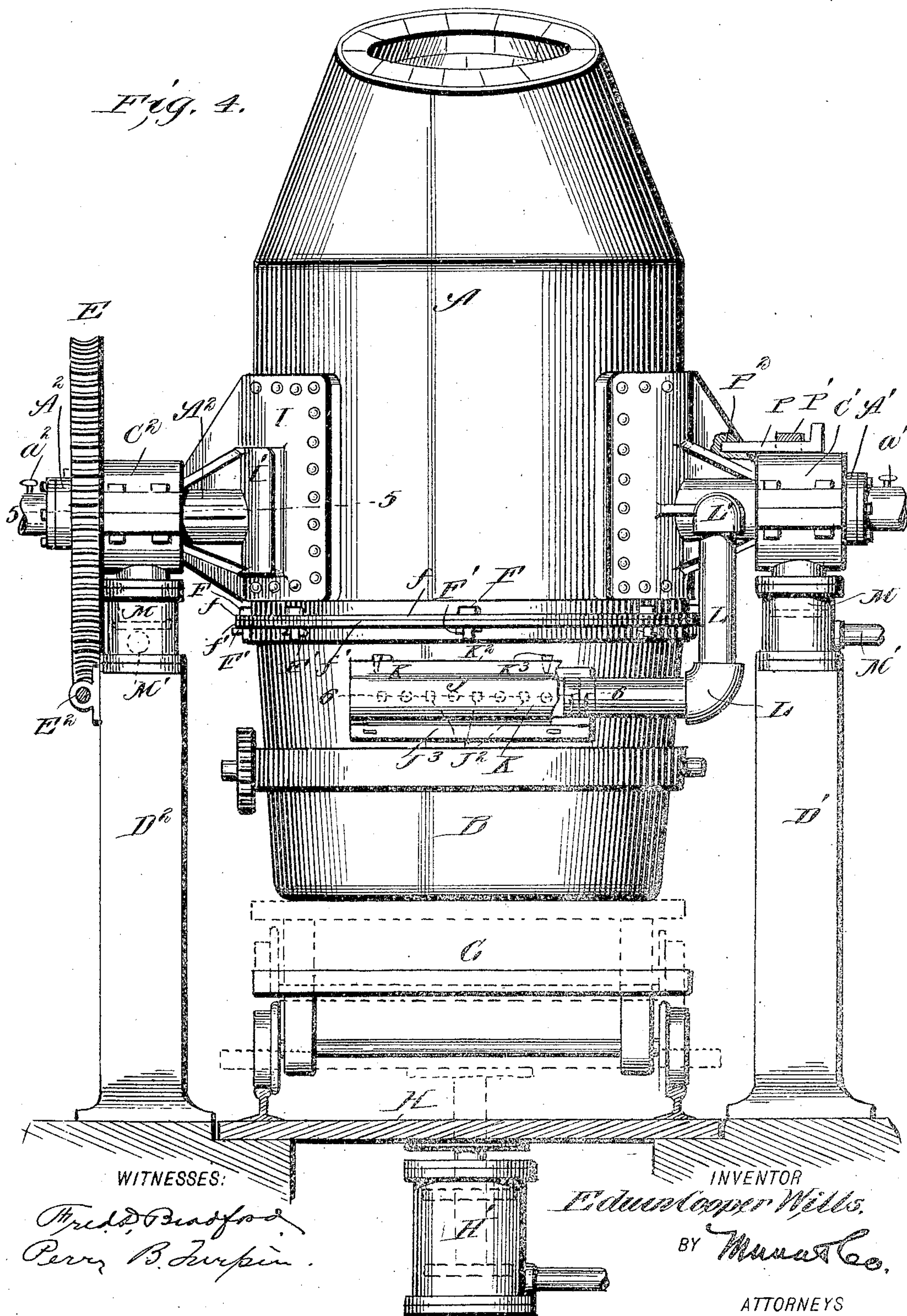
E. C. WILLS.

APPARATUS FOR MAKING STEEL AND OTHER METALS.

APPLICATION FILED OCT. 31, 1903. RENEWED APR. 14, 1905.

3 SHEETS—SHEET 2.

Fig. 4.



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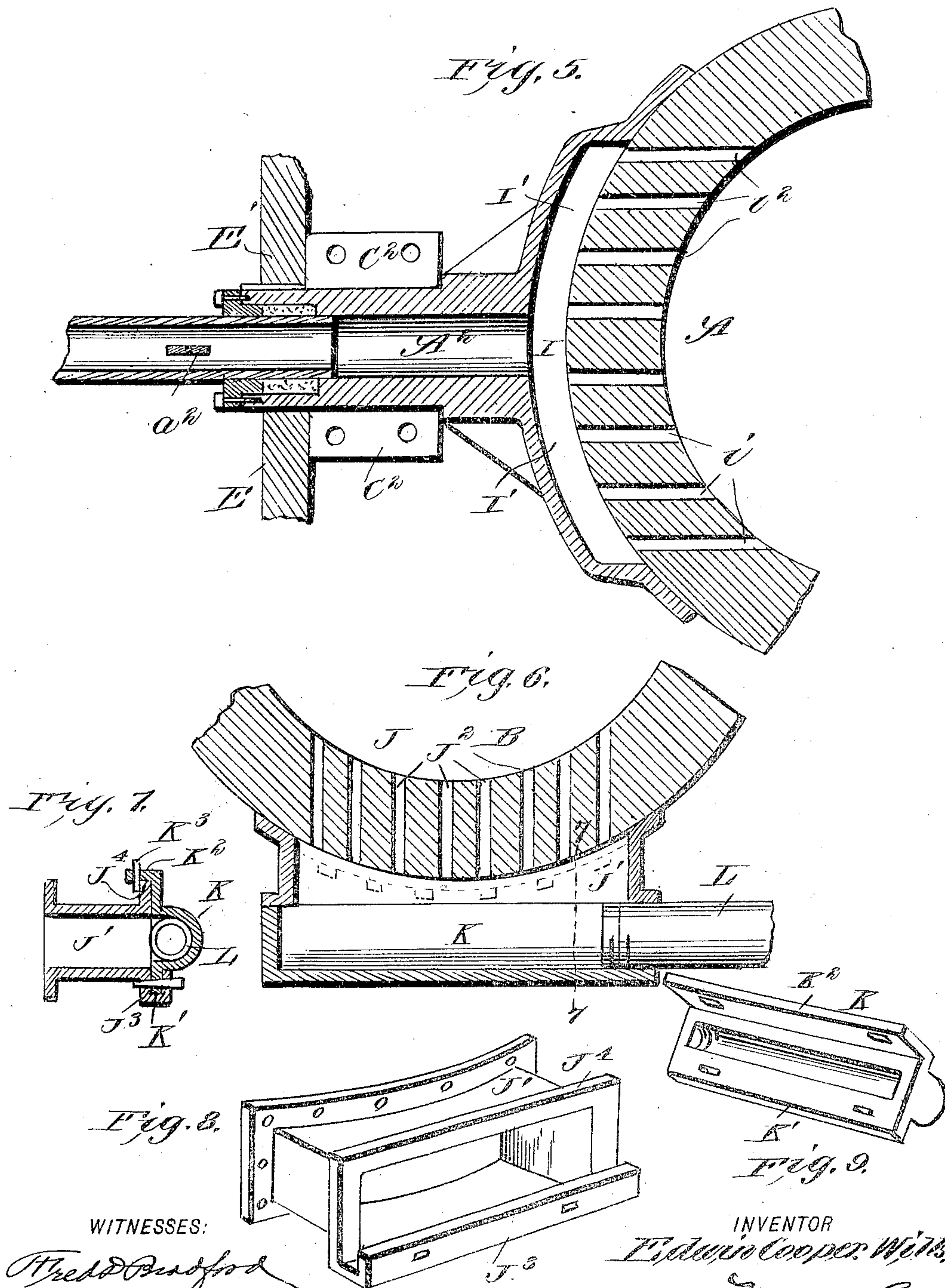
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WITNESSES:

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APPARATUS FOR MAKING STEEL AND OTHER METALS.

No. 804,080.

Specification of Letters Patent.

Patented Nov. 7, 1905.

Application filed October 31, 1903. Renewed April 14, 1905. Serial No. 255,656.

To all whom it may concern:

Be it known that I, EDWIN COOPER WILLS, a citizen of the United States, residing at Trenton, in the county of Mercer and State of New Jersey, have made certain new and useful Improvements in Apparatus for Making Steel and other Metals, of which the following is a specification.

My invention is an improvement in apparatus for use in the manufacture of steel and the like, and relates particularly to the construction of the converter and the means for operating the several parts thereof and for admitting air and the like in the use of the apparatus; and the invention consists in certain novel constructions and combinations of parts, as will be hereinafter described and claimed.

In the drawings, Figure 1 is a side elevation of an apparatus embodying my invention, the lower section of the converter being shown in full lines connected with the dome-section and in dotted lines adjusted out of the way and dotted lines being employed to illustrate the tilting of the converter to an approximately horizontal position. Fig. 2 is a cross-section on about line 2 2 of Fig. 1. Fig. 3 is a detail vertical section illustrating the means for connecting the dome-section with the ladle-section. Fig. 4 is an end elevation of the converter. Fig. 5 is a detail horizontal section on about line 5 5 of Fig. 4, illustrating the twyer of the dome-section and the hollow trunnion for supplying air thereto. Fig. 6 is a detail horizontal section on about line 6 6 of Fig. 4, illustrating the twyer of the ladle-section and the means for supplying air thereto. Fig. 7 is a detail cross-section on about line 7 7 of Fig. 6. Fig. 8 is a detail perspective view of the wind-box of the ladle-twyer. Fig. 9 is a detail perspective view of the inner side of the coupling-head for connection with said wind-box, and Fig. 10 illustrates in detail the cinder-notch and the means for closing the same.

By my invention I seek to provide a converter having an upper or dome section and a lower or ladle section and means for detachably connecting the dome-section with the ladle-section, the dome-section being supported on trunnions, so it can be readily turned to or beyond the horizontal position shown in Fig. 1 or to any position between the same and the upright position shown in full lines in the same figure, and twyers being provided on the dome-section and the ladle-section, so that air may be introduced to either the ladle or dome

section, or to both, as may be desired, and so the converter may be tilted to discharge the metal from the nose of the dome-section or the ladle-section may be detached from the dome-section and moved to any desired point and the metal discharged directly from such ladle-section, as will be more fully described hereinafter.

In the construction shown the apparatus includes the converter having the dome-section A and the ladle-section B.

The dome-section A is provided with trunnions A' and A², suitably secured to the dome A and made hollow for the introduction of air. The trunnion A' affords a passage for the air to the twyer of the ladle-section, while the trunnion A² supplies the air to the twyer of the dome-section, and valve devices a' and a² may be provided to control the passage of air through the trunnions, and thereby control the air supplied to the twyers of the dome and ladle sections in the use of the invention, as will be more fully described hereinafter. The hollow trunnions A' and A² are journaled in bearings C' and C², supported on stands D' and D², and one of the trunnions is provided with a worm-wheel E', meshed by a worm E², so the dome-section can be tilted to different positions, as will be understood from Figs. 1 and 4 of the drawings.

The ladle-section B is preferably in the form of an ordinary foundry-ladle, and means are provided for detachably connecting such ladle-section B with the dome-section A. This may preferably be effected by means of the pins F passing through flanges f and f', respectively, on the dome-section A and the ladle-section B at the meeting ends of said parts and receiving keys F', as best shown in Figs. 1, 3, and 4, to firmly unite the dome and ladle sections, as shown in Figs. 1 and 4, when desired. At the same time this construction permits the ready disconnection of the ladle-section, so the latter may move to the position shown in dotted lines at the right in Fig. 1 whenever desired.

The ladle-section B may be mounted on the car G, which may run on the track-platform H, directly below the dome-section A, and means are provided for lifting the platform H and the car G bodily, so the ladle-section may be raised to the position shown in Fig. 4, where it can be readily connected with the dome-section, and in order to lift the platform H and the car and ladle-section thereon I may employ a cylinder H', having a piston to op-

erate the platform H and arranged for operation by any suitable fluid-pressure supplied from any desired source.

From the foregoing description it will be seen I provide a converter having its dome-section and ladle-section separately formed, the dome-section being mounted to turn, and means being provided for detachably connecting the dome-section with the ladle-section, so that the ladle-section can be readily connected with the dome and the converter tilted to the dotted-line position shown in Fig. 1 for charging the converter, or, if desired, for discharging the metal from the nose of the converter or after the converting process has been performed the ladle may be detached from the dome-section and lowered from the position shown in Fig. 4 by a proper operation of the car and platform and then run off to any desired point and the metal be discharged directly from the ladle. This is important, as in some instances it is desirable to discharge the metal from the nose of the dome-section, while in other instances it may be desired to discharge the metal directly from the ladle, and by the construction described I am able to secure these results in the use of the same apparatus. At the same time I am able to employ the same dome-section with a number of ladle-sections, applying the ladle-sections successively in connection with the dome-section and connecting them thereto and then manipulating the converter to secure the desired results.

The dome-section has a twyer I at one side, having a wind-box I', to which air is discharged through the hollow trunnion A² and provided with the numerous twyer-openings i², discharging to the interior of the dome-section. By this construction it will be noticed air may be supplied to the dome whenever desired. The ladle-section is provided with a twyer J near its upper end, having the wind-box J' and the numerous twyer-openings J². The wind-box J' is adapted for connection with the coupling-head K, which latter is secured to the pipe connection L, leading to the hollow trunnion A', through which air is supplied to the twyer of the ladle-section. As shown, the wind-box J' is open at its outer end, is provided at such end with an upturned flange J³ at its lower edge and with an upwardly-projecting flange J⁴ at its upper edge, and the coupling-head K is in the form of a plate adapted to close the outer end of the wind-box, arranged at its lower edge K' to fit in the hooked flange J³ at the base of the wind-box J' and provided at its upper edge with an inwardly-projecting wing K², overlapping the upwardly-projecting flange J⁴ of the wind-box and receiving the keys K³, by which the coupling-head may be secured to the wind-box J' when the parts are applied, as will be understood from Figs. 1, 4, and 7 of the drawings. The pipe connection L is

secured at one end L' in connection with the hollow trunnion A', preferably by threading it therein, and its other end is connected with one end of the coupling-head K, preferably by threading it therein, as will be understood from Figs. 4 and 9, so that when the parts are applied as shown in Fig. 4 and it is desired to disconnect the coupling-head from the wind-box J' it is only necessary to raise the coupling-head out of engagement with the wind-box by swinging the pipe connection on its joint L', and when the parts have been disconnected the coupling-head may be permitted to swing down, the pipe connection turning at L', as will be understood from Fig. 4 of the drawings.

It may be desirable in some instances to raise and lower the dome-section. This may be conveniently accomplished by interposing cylinders and pistons, as shown at M, between the stands D and D' and the bearings for the hollow trunnions, fluid-pressure being supplied through pipes M' in order to raise the dome-section and to permit the same to lower, as will be understood from Fig. 4 of the drawings.

As best shown in Fig. 10, I provide a cinder-notch N in the upper edge of the ladle, through which cinders and slag may discharge, or additions may be made to the bath and through which the contents of the ladle may be discharged when it is desired to discharge directly from the ladle. This notch may be closed in operation by a plug O, of fire-brick or other suitable material, which may be luted when applied with fire-clay or the like, and will be held by the cover-plate P, which interlocks with headed bolts Q on the ladle and may slip readily into and out of interlocking connection with said bolts in the use of the invention, as will be understood from Fig. 10 of the drawings.

The worm E² and worm-wheel E' constitute gearing by which the dome-section of the converter may be tilted. In order to secure the dome-section in any desired adjustment, I prefer to provide a lock in the form of a bolt P, sliding at P' on the bearing in the trunnion A' and engaging at P² with the dome-section of the converter in order to secure the same in any desired adjustment, as will be understood from Fig. 4 of the drawings.

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

1. An apparatus substantially as described, comprising the converter having a dome-section provided with hollow trunnions and a twyer receiving air from one of said trunnions, bearings for the hollow trunnions, stands forming supports for said bearings, adjusting devices between the bearings and stands, the ladle-section, means for detachably securing the ladle-section to the lower end of the dome-section, means for raising

and lowering the ladle-section, said section being provided with a twyer having a wind-box, the coupling-head fitted for detachable connection with the wind-box, and a pipe connection between said coupling-head and the trunnion of the dome-section opposite that supplying air to the twyer of said dome-section.

2. The combination of the dome-section having hollow trunnions and a twyer receiving air from one of said trunnions, the ladle-section having a twyer receiving air from the opposite trunnion of the dome-section, and means for detachably connecting the ladle-section with the dome-section and means for raising and lowering the dome-section and the ladle-section.

3. The combination with the dome-section having a twyer and the ladle-section having a twyer, and means for detachably connecting said dome and ladle sections and means whereby said sections may be raised and lowered, of the hollow trunnions for the dome-section, one of said trunnions delivering air to the twyer of the dome-section, and means whereby air may be delivered from the opposite trunnion to the twyer of the ladle-section.

4. A converter having a dome-section provided with trunnions, a ladle-section, means for detachably connecting the ladle-section with the dome-section, means for raising and lowering the ladle-section, bearings for the trunnions of the dome-section, and means for raising and lowering said bearings.

5. A converter having a dome-section provided with a twyer and with hollow trunnions, one of which supplies air to the twyer of the dome-section, the ladle-section having a twyer receiving air from the opposite trunnion of the dome-section, means for detachably connecting the ladle-section with the dome-section, means for raising and lowering the ladle-section, bearings for the trunnions of the dome-section, and means for raising and lowering said bearings.

6. The combination with the converter having a dome-section provided with a twyer and with hollow trunnions one of which discharges air to the twyer of said dome-section, bearings for the trunnions of the dome-section, means for raising and lowering said bearings, gearing connected with one of the trunnions for tilting the dome-section, the ladle-section having a twyer provided with a wind-box, a pipe connection provided at one end with a coupling-head for connection with the wind-box of the twyer of the ladle-section and connected at its other end with the hollow trun-

nion of the dome-section opposite the trunnion of the dome-section which supplies air to the twyer of the dome-section and means for raising and lowering the ladle-section.

7. The combination in a converter with the dome-section and the ladle-section and means for detachably connecting the ladle-section with the dome-section, the hollow trunnions on the dome-section, bearings for said trunnions, means whereby air may be delivered from one of said trunnions to the dome-section and from the other trunnion to the ladle-section, gearing whereby the dome-section may be tilted and a lock for said dome-section substantially as set forth.

8. The combination substantially as described of the dome-section, hollow trunnions whereby the dome-section may be tilted means for raising and lowering the dome-section, the ladle-section having a cinder-notch, means whereby said notch may be closed, means for raising and lowering the ladle-section means for detachably connecting the ladle-section with the dome-section and means for supplying air to the dome and ladle sections from the opposite hollow trunnions substantially as set forth.

9. An apparatus substantially as described comprising a dome-section suitably supported whereby it may be tilted means for raising and lowering the dome-section a ladle-section detachably connected at its upper end with the lower end of the dome-section whereby metal may be poured from the nose of the dome-section or the ladle-section may be detached from the dome-section and metal poured directly therefrom and means for raising and lowering the ladle-section substantially as set forth.

10. The combination with the ladle having a twyer and a wind-box open at its outer end and provided at such end with an upturned flange at its lower edge and an upwardly-projecting flange at its upper edge and the coupling-head having a plate adapted to close the outer end of the wind-box and fitting at its lower edge in the upturned hooked flange at the base of said wind-box and provided at its upper edge with an inwardly-projecting wing overlapping the upwardly-projecting flange of the wind-box and provided with means for securing it to the wind-box and a pipe connection for discharging air to said coupling-head.

EDWIN COOPER WILLS.

Witnesses:

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