(No Model.)

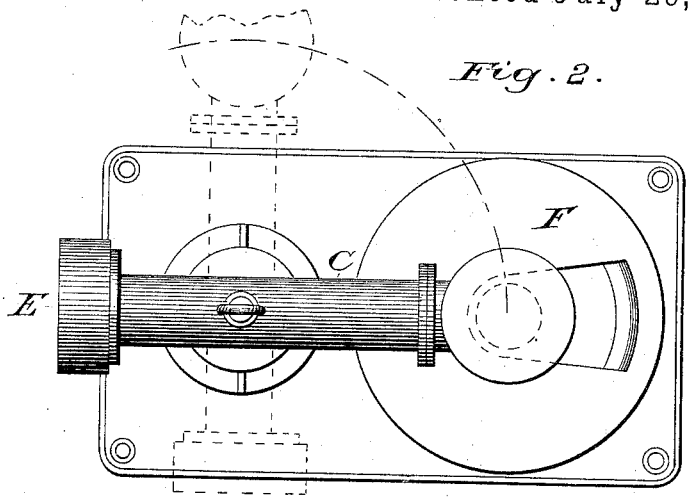
2 Sheets—Sheet 1.

A. DAVY.

APPARATUS FOR MAKING STEEL BY THE BESSEMER PROCESS.

No. 302,712. Patented July 29, 1884.

Fig. 2.



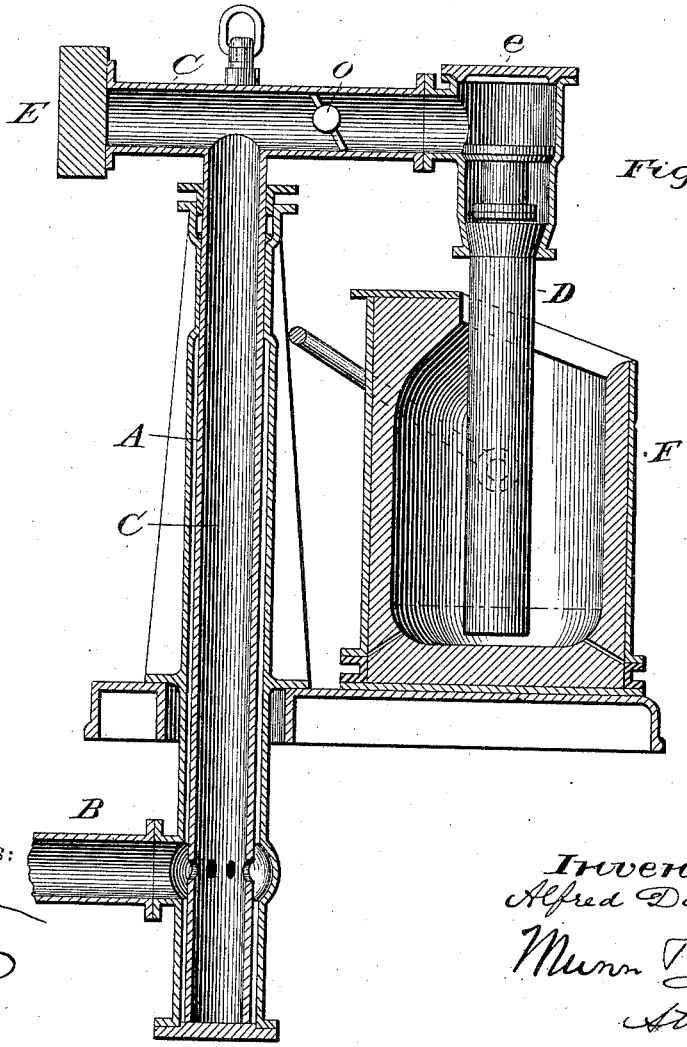


Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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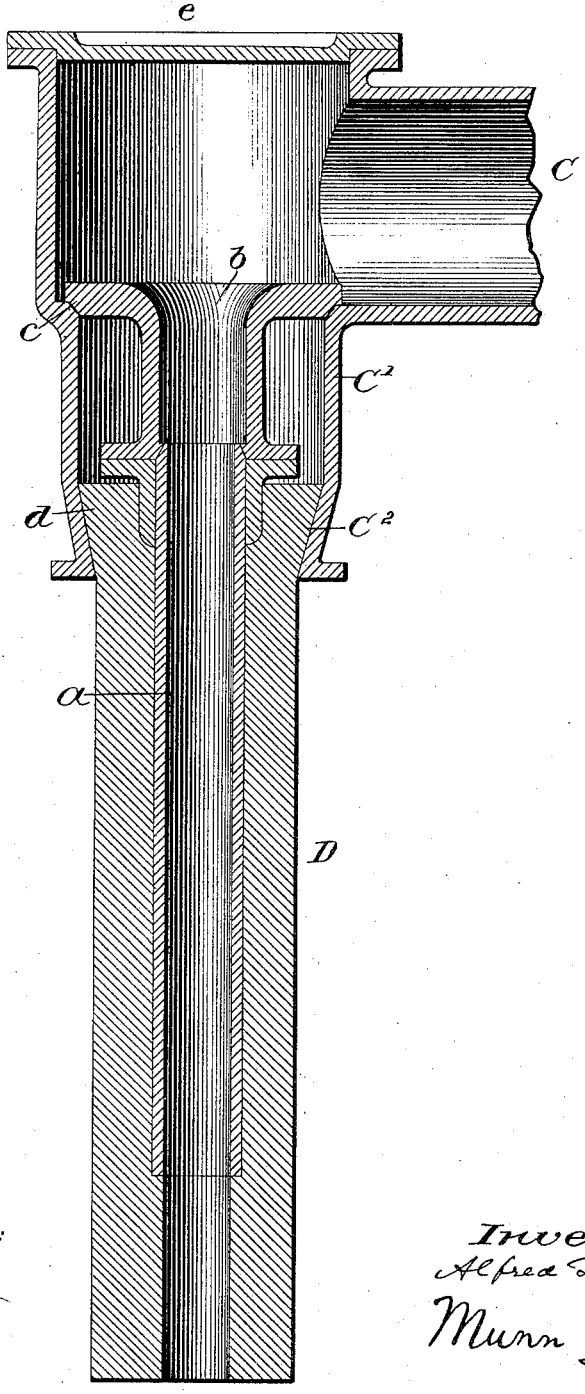
Fig. 1ª.



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UNITED STATES PATENT OFFICE.

ALFRED DAVY, OF SHEFFIELD, COUNTY OF YORK, ENGLAND.

APPARATUS FOR MAKING STEEL BY THE BESSEMER PROCESS.

SPECIFICATION forming part of Letters Patent No. 302,712, dated July 29, 1884.

Application filed December 10, 1883. (No model.) Patented in England May 19, 1883, No. 2,514, and in France November 15, 1883, No. 158,575.

To all whom it may concern:

Be it known that I, ALFRED DAVY, a subject of the Queen of Great Britain, residing at Sheffield, in the county of York, England, have invented certain new and useful Improvements in Apparatus for Making Steel by the Bessemer Process, (for which I have received Letters Patent in Great Britain, No. 2,514, dated May 19, 1883,) of which the following is a specification.

The object of this invention is to enable cast-iron founders and others to make steel and steel castings without the costly plant now in use for producing the same. By means of this invention cast-iron may be tapped out of a cupola or furnace into a portable vessel, and there be decarbonized by blowing air through the metal and converted into steel as in the Bessemer process. The costly plant of fixed or tipping converters and steel-producing furnaces heretofore used may thus be dispensed with, and steel may be produced at a very little greater cost than cast-iron in any ordinary iron-foundry provided with a comparatively-inexpensive blowing apparatus of sufficient capacity to blow through and decarbonize the quantity of metal intended to be dealt with.

The invention consists, essentially, in the employment, in combination with a portable vessel, (which may either be an ordinary foundry-ladle or other portable vessel unprovided with any special means of conveying air into it,) of stand-pipes constructed and adapted to discharge the air into the metal beneath the surface thereof by a pipe or pipes dipping into the metal from above. To this end I provide, in any position convenient for the purpose, a stand-pipe, in connection with the air-main from the blowing apparatus. In this stand-pipe may be fitted to slide telescopically another pipe, to which is attached a downwardly-turned dip-pipe, terminating in nozzles or tuyeres for immersion in the metal, for discharging the air beneath the surface thereof. This telescopic sliding pipe is partially counterbalanced, and a valve is provided in the air-main to cut off or regulate the supply and another in the sliding telescopic pipe. By means of these valves the pressure of air may be made to raise the telescopic dip-pipe to allow of placing the ladle or vessel in position beneath it, after which, by releasing the pressure, the dip-pipe may be lowered by its own weight into its proper position for blowing. The air may then be blown through the dip-pipe and be discharged at suitable nozzles, tuyeres, or other orifices at the extremity of the pipe beneath the surface of the metal, the air finding its way up through the body of the metal, as in an ordinary Bessemer converter. Portable vessels specially designed for this purpose are deeper than ordinary ladles used for iron-foundry purposes, and are of such shape or form as either to allow the heat and flames or sparks to pass out vertically when blowing, or to direct the same into a flue or stack. If an ordinary foundry-ladle be used, it must be so much larger than if it were required for the same weight of cast-iron in an iron-foundry as to allow for the ebullition of the metal and admit of a thick lining of ganister or fire-brick or refractory material, instead of the ordinary comparatively thin sand or ganister lining of a foundry-ladle, which would not stand the heat and blowing. If bricks of a refractory material be used for lining an ordinary ladle for this purpose, they may be continued above the top thereof in such form as to divert the flame and sparks, if found desirable; or this lining may terminate at the top of the ladle, and the latter may during the process of blowing be placed under a fixed hood leading into a flue. This hood would be composed of or lined with fire-brick or other refractory material. If such a hood is not used, a portable cover lined with the same material, or one attached to the sliding dip-pipe of the blowing apparatus, may be made to answer the same purpose.

The portable vessels or ordinary foundry-ladles which I propose to use may be made so that the metal after it is blown may be poured from the top of the vessel, as in an ordinary foundry-ladle; or they may be provided with a pouring-nozzle and stopper to run the metal from the bottom of the vessel, as in the ladles into which the metal is poured from the converter in the ordinary Bessemer process. These portable vessels are moved from the cupola, or wherever the cast-iron is first tapped or

run into them, by any ordinary hydraulic, steam, or hand crane; or they may be mounted on a carriage and run into position for blowing.

In the drawings, Figure 1 represents in sectional elevation, and Fig. 2 in plan, a stand-pipe provided with a telescopically-sliding and laterally-swiveling dip-pipe, which is raised to allow of the portable vessel being placed in position, and is lowered therein for blowing.

The same letters of reference indicate similar parts in both the figures.

Referring to Figs. 1 and 2, A is the stand-pipe, erected upon a suitable foundation and connected with pipe B, leading from the air-main supplied with air from the blowing engine or apparatus, a suitable valve (not shown) being provided in pipe B for regulating the supply of air to the stand-pipe.

C is a T-shaped pipe, the leg of which slides telescopically through a stuffing-box at the top of the stand-pipe A. To one branch of the T-pipe is attached the dip or tuyere pipe D, the other branch being closed and a counter-weight, E, attached thereto to balance the dip-pipe and admit of the sliding pipe turning freely on its vertical axis. The whole of this movable portion is partially counterbalanced by weights attached to a wire rope or chain, which is connected by a swivel to the T-head of the sliding pipe and passes over a suitable pulley above, or in other convenient ways; or the sliding pipe may be attached to a piston-rod passing through a gland in the bottom of the stand-pipe, and the balance-weights may be connected to said piston and work in a pit beneath the floor. *o* is a valve in the T-head between the pipes C and D. By closing this valve and admitting air to the sliding pipe the pressure of air may be made to raise the dip-pipe sufficiently to enable it to be brought over the vessel, after which, by releasing the pressure, it may be lowered therein into position for blowing.

Fig. 1[a] is a vertical section of the dip-pipe on a larger scale, showing details of construction.

a is a wrought-iron pipe secured to *b* by a flange, as shown.

b is a flanged casting fitting loosely in a coned seat at *c*.

D is a ganister or fire-clay tube, which may either be made in one length, as shown, or in two or more lengths secured by transverse cotters shorter than the outside diameter of pipe D, and sealed in with ganister to protect them. The upper end of the tube D, or of the upper section thereof, as the case may be, is enlarged in the form of a cone, *d*, which is received in a corresponding socket, C, at the lower end of a chute branch pipe, C′, leading down from the T-pipe C, and is bedded therein with plastic ganister. The whole dip-pipe may be removed bodily at an opening above, closed by a cover, *e*, for renewal, when required. The pipe D here shown has an open mouth at bottom of the full size of the bore; but the lower end for, say, twelve inches of its length may be solid and perforated with a number of smaller holes, all running out of the one pipe, for insuring a more uniform distribution of air through the metal.

Instead of constructing the dip-pipe with a wrought-iron lining, as above described, it might be molded solid of ganister or fire-clay, with a number of longitudinal passages through it, and with a flange at top above the coned part to rest on a corresponding seat in the socket on pipe C.

F is the portable vessel in which the conversion is effected. It is here shown as of special construction, being partially closed in at top, a sufficient opening (of the form shown in Fig. 2) only being left for the dip or tuyere pipe to pass through, and for the flames, &c., to escape freely during the process of blowing, the form of the upper part of the vessel and the position of the opening being such as to direct the flames, &c., away from the upper part of the dip-pipe. The body of the vessel is constructed of an iron shell lined with ganister or other refractory material, and the bottom is made separate to admit of its being renewed, when required, without disturbing the lining of the upper part, this refractory bottom being held in a flanged hoop or casing, which is bolted to flanges on the shell of the upper part, as shown.

I am aware that a blast-pipe has been mounted to slide in a stand-pipe, and provided with a hydraulic ram to raise and lower said blast-pipe; also, that it is old to line converters with refractory material; also, that dip-pipes have been formed of refractory material, with a metal interior tube; and I do not claim any such constructions, broadly, as of my invention.

Having described the nature of the said invention, and the manner of performing the same, I declare that what I claim is—

1. In a blast apparatus, the combination, with a telescopic pipe having a projecting arm and dip-pipe, of a valve located in the sliding pipe, substantially as and for the purpose set forth.

2. The combination of the stand-pipe A and blast-connection B with the T-shaped pipe C, the leg of which slides in the stand-pipe, and to the branch of which is attached a suitable dip-pipe, and a valve, *o*, in said branch between the dip-pipe and leg, substantially as set forth.

ALFRED DAVY.

Witnesses:

C. B. WEBSTER,
United States Consul.

T. T. HIBBERT,
His clerk.