

D. C. DANIELS.
 METHOD OF UTILIZING THE HEAT OF METAL PRODUCTS.
 APPLICATION FILED APR. 22, 1909.

1,000,328.

Patented Aug. 8, 1911.

3 SHEETS—SHEET 1.

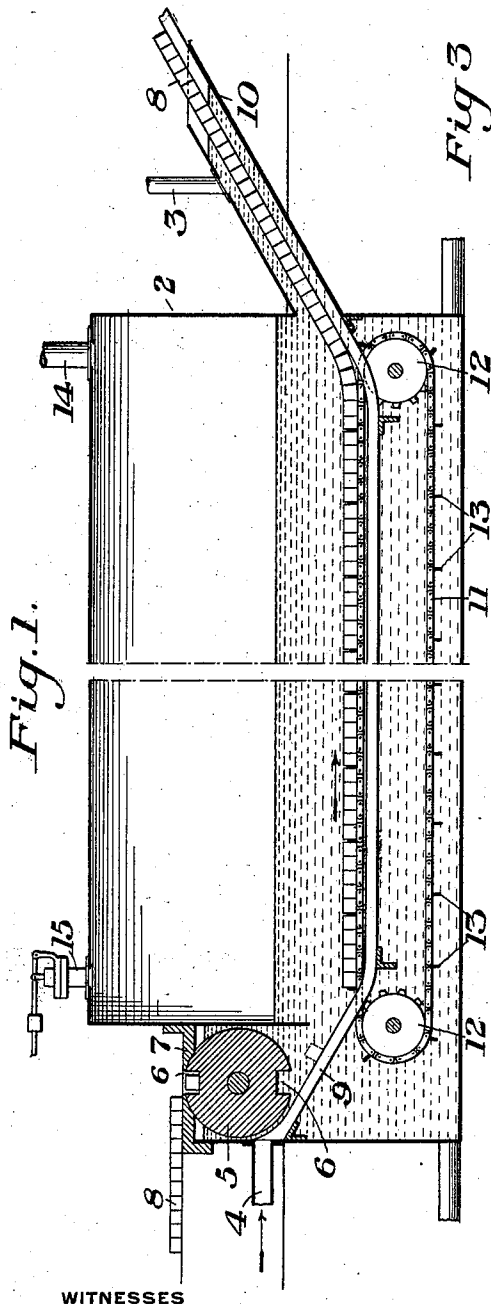


Fig. 1.

Fig. 3

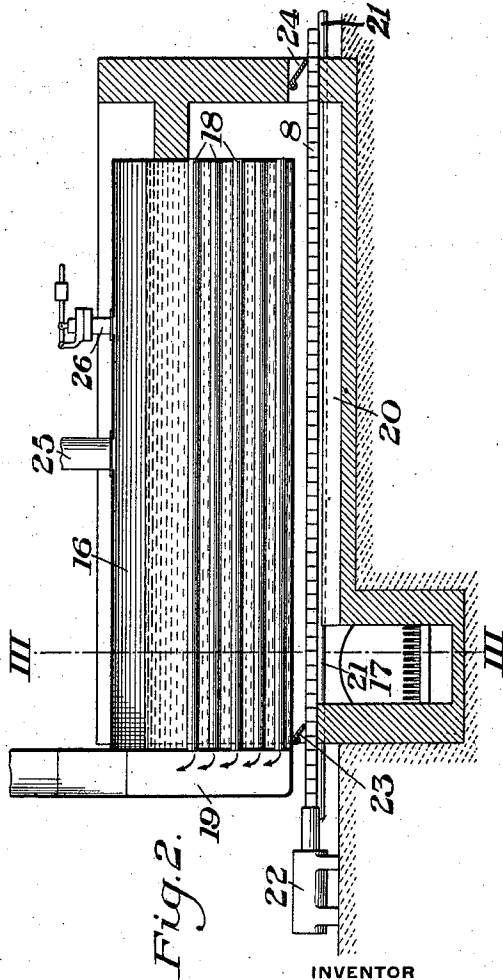
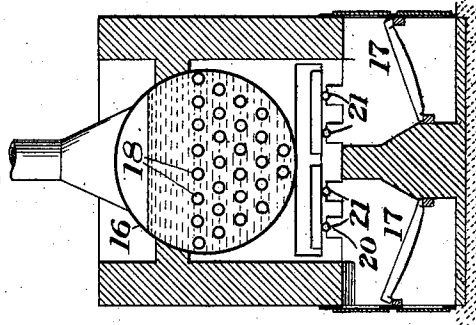


Fig. 2.

WITNESSES

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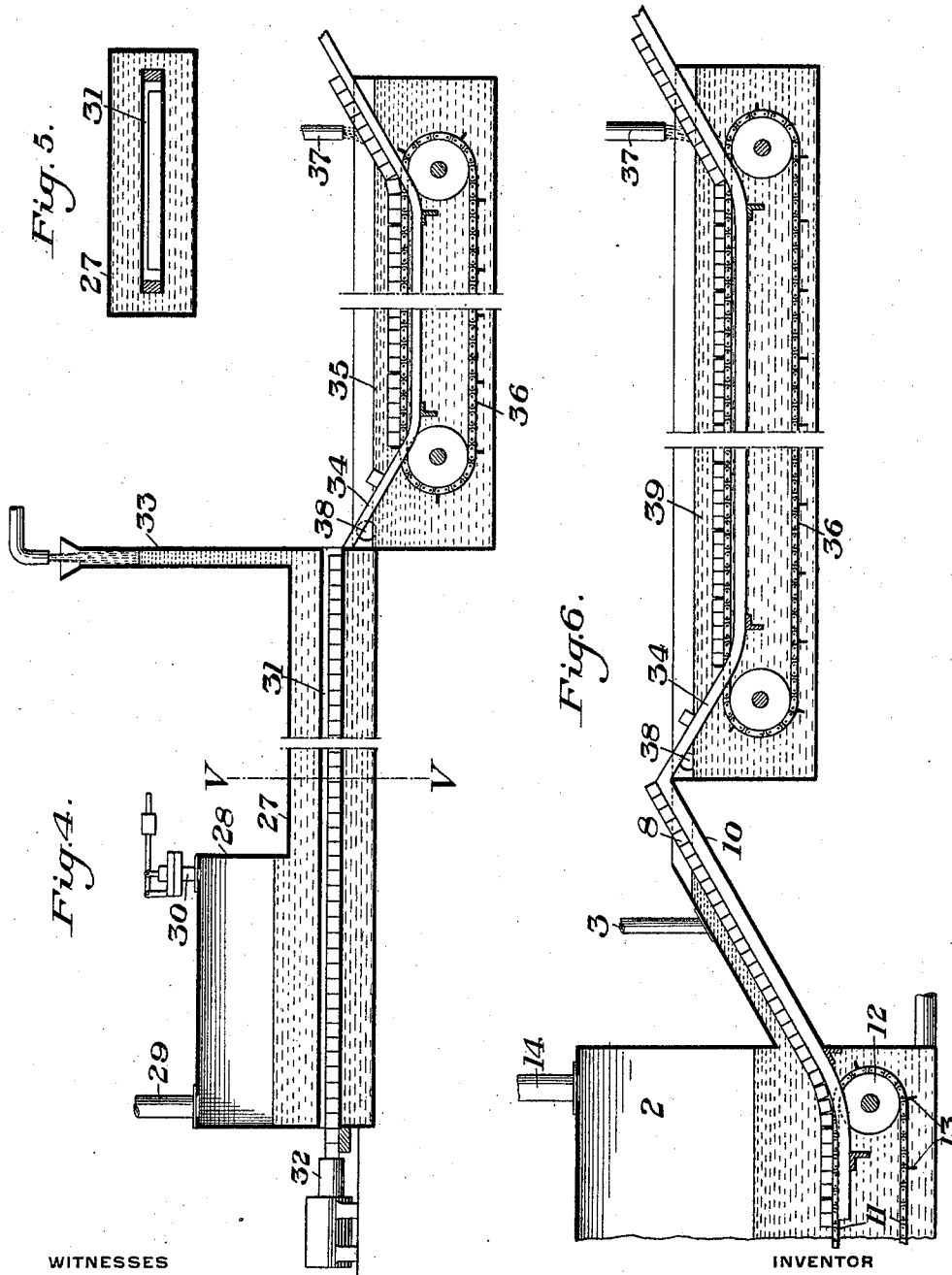
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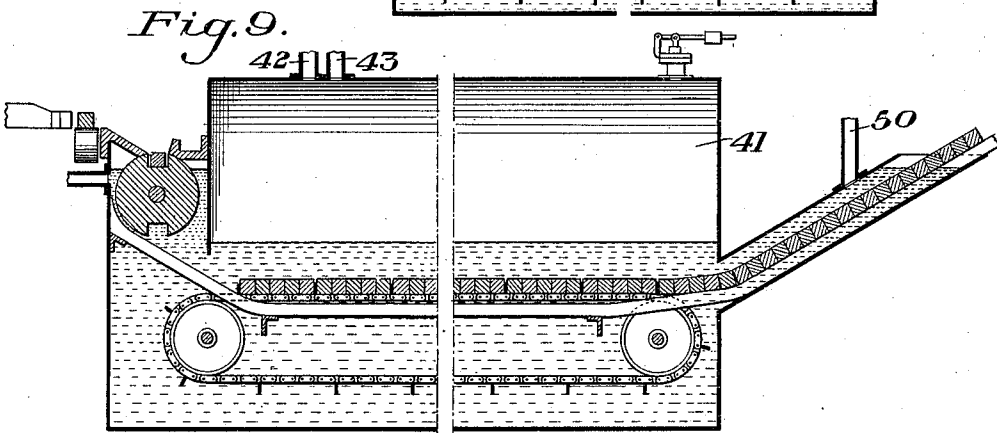
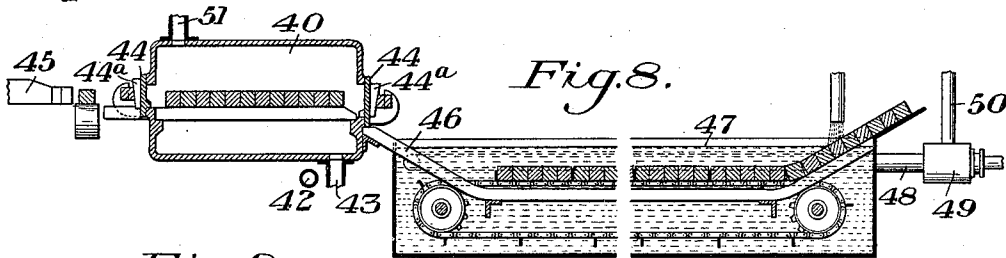
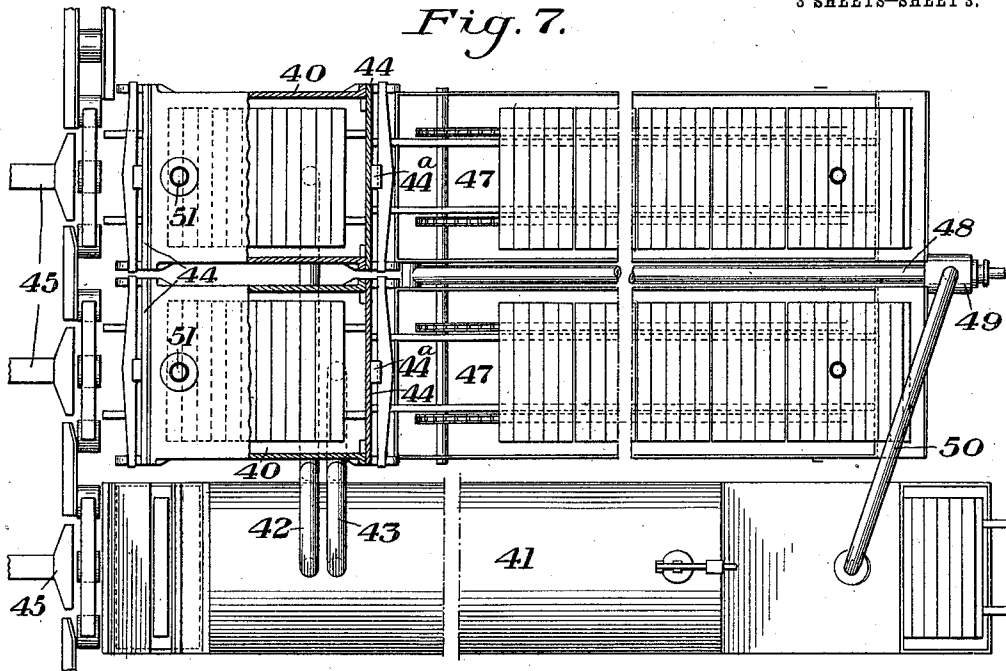
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3 SHEETS—SHEET 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

DWIGHT C. DANIELS, OF WORCESTER, MASSACHUSETTS.

METHOD OF UTILIZING THE HEAT OF METAL PRODUCTS.

1,000,328.

Specification of Letters Patent. Patented Aug. 8, 1911.

Application filed April 22, 1909. Serial No. 491,519.

To all whom it may concern:

Be it known that I, DWIGHT C. DANIELS, of Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Method of Utilizing the Heat of Metal Products, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional side elevation, showing one form of apparatus for carrying out my invention; Fig. 2 is a similar view, showing another form of apparatus for the purpose; Fig. 3 is a cross section on the line III—III of Fig. 2; Fig. 4 is a sectional side elevation showing another form of steam generator and water heater; Fig. 5 is a cross section on the line V—V of Fig. 4; Fig. 6 is a view showing the feed-out portion of Fig. 1, with a water heater forming a part thereof; Fig. 7 is a plan view partly in section, showing another form of the invention; Fig. 8 is a longitudinal section of the feed water and superheater portion of Fig. 7; and Fig. 9 is a longitudinal section of the boiler portion thereof.

Heretofore when hot metal has been worked, as in rolling, forging, etc., the product, whether at an intermediate stage or in final form, has been allowed to cool in the open air previous to further heating and working, or previous to use.

My invention is designed to utilize the heat of such articles for useful purposes, such as generating steam, heating feed water, etc.

To that end, the invention consists in feeding the heated products through a heating apparatus and absorbing at least a part of the heat therefrom by fluids, such as water, either by direct contact of the fluid with the articles, or indirectly as by conduction, convection and radiation.

In Fig. 1 of the drawings, I show one form of apparatus for carrying out my invention, designed for the generation of low pressure steam for driving low pressure steam turbines. In this form the water, which is brought into direct contact with the articles, is fed into a closed tank or boiler 2, which is shown as having two pipes 3 and 4 for feeding in the water. One of these pipes is located at the inlet end for the heated products and the other at or near the outlet. One or more pipes may be used for

feeding in the water at any desirable point or points. One end of the boiler or generator is offset and contains a circular drum 5, having pockets 6, 6, this drum having a shaft which extends through suitable stuffing boxes (not shown) in the sides of the generator. The pockets are arranged to register with a slot in the top plate 7 of a length corresponding to the heated articles, which, in this case, are hot billets, a row of which are shown at 8. These billets are pushed over a bed to the plate 7 and dropped, one after another, in the pockets, of which there may be any desirable number. The drum rotates in the water, which is at a higher level in the offset portion than in the boiler proper, owing to the low pressure. As soon as the billet is dropped into the pocket, the drum is quickly turned to drop the billet on inclined tracks 9, which extend downwardly, thence horizontally through the water, and thence upwardly and outwardly through an exit spout or channel 10. The billets slide down the incline 9, by gravity, and join the row of billets within the generator, this row being fed along by sprocket chains 11, carried over sprocket wheels 12, 12, within the generator, these sprocket wheels preferably having shafts extending through the sides and being driven through any suitable connections. The chains are preferably provided with projections or bars 13, to assist in carrying along the heated billets. The generator is provided with a steam outlet 14, and is also preferably provided with a pipe 15, having a relief valve, which will lift when the pressure rises above a predetermined limit. The length of the apparatus, the speed of the conveyer and the position of the inlet pipe for cold water are preferably so arranged that the billets, when they are carried out of the water, have the same or nearly the same temperature as the water. If the temperature of the hot billets is, for example, 1600° and they are taken out of a temperature of say 100°, the difference of 1500° represents the sensible heat of the billets which is taken up by the water.

In Figs. 2 and 3, I show a different form of apparatus for utilizing the heat of the heated billets or products. In this form, 16 represents an ordinary flue or fire tube boiler, beneath one end of which may be provided the grate furnaces 17, which are fed from the sides. The products of combustion rising from the fuel flow along the

lower portion of the boiler until they reach the other end, where they flow through the tubular flues 18 to the stack outlet 19. Below the boiler and between it and the grates are a series of longitudinally extending horizontal piers 20, which may be provided with water-cooled pipe supports 21, for the billets, which are shown as arranged in two rows. The row of hot billets is pushed in by a pusher device 22, at the stack flue end of the boiler, entering through openings having swinging doors or closures 23. They feed out at the opposite end of the setting through similar openings having similar swinging closures 24. The hot gases of combustion are preferably just sufficient to act as a conveyer of heat from the billets to the water and also to keep the billets in a neutral atmosphere and protect them from the air. Any gas which will serve these purposes may be employed, as, for example, the gas from a gas producer, in which no special conditions for firing would be necessary.

In the operation of the boiler the row or rows of billets supplied at the front end is fed through substantially continuously, and the water is heated both by radiation and by conduction from the gases passing over the billets and flowing through the tubes. The steam, which is preferably at two or three pounds pressure, may be led over to the turbines through the pipe 25, and I also preferably provide a pipe 26, having a relief valve set to open at certain pressure. Instead of generating steam, either form of apparatus may be used to simply heat feed water passing to a steam boiler, or for any other purpose.

In Figs. 4 and 5, I show another form of boiler and heater in which the water in the boiler is not brought into direct contact with the water and the billets feeding out of the boiler are utilized to heat the water which may afterward be supplied to the boiler. In these drawings, 27 is the boiler having an upward extension 28, acting as a steam reservoir and provided with a steam outlet 29, and a pipe 30, which is preferably provided with a relief valve. A rectangular inclosing channel 31, extends through the boiler from one end to the other open at both ends, and the pusher 32 operates to shove the line of hot billets through this channel, as before described. The water is preferably fed in through a pipe 33 at or near that end of the boiler from which the billets are fed out. In this case, the water below the billets is heated by conduction through the bottom plate of the channel or duct, while the water above is heated by radiation through the metal wall. This gives a very effective way of heating the water without allowing contact between it and the billets. Moreover, the water circulates in the opposite direction to that of

the billets making it possible for the billets to leave the vessel at a minimum temperature, and consequently, give off a maximum amount of heat to the water. After leaving the boiler, the billets slide down an incline 34, into a tank of water 35, and are moved along the continued supports through and out of the water by conveyers 36. 37 represents the water supplied to the tank, and 38 the outlet, which is at the feeding-in end for the billets. The billets, which still contain considerable heat, will thus heat the water which may then be taken to the boiler or to any other point of use.

In Fig. 6, I show the boiler of Fig. 1, provided with a water heater connected to the exit spout or channel 10, the water-heating receptacle 39 and its contained apparatus for conveying the warm billets therethrough being substantially the same in the form of Fig. 4.

In Figs. 7, 8 and 9, I show my invention as applied to the heating of feed water, generation of steam and superheating of steam. In this case, 40 are superheating passages to which the steam is led from the boiler 41, through pipes 42 and 43. These superheaters are provided with suitable covers or doors 44, at each end, which may be held by keys or wedges 44^a, as shown, so that they may be easily taken off or put in place. The superheaters are used alternately, one being employed while the other is being charged and closed. The billets may be pushed in by the hydraulic pushers 45, as before. The line of billets fed out from the superheater on to inclined guides 46, which lead into feed water heaters 47, operate in the same manner as those in previous figures. The heated feed water is led through pipe 48 to pump 49, whence it passes through pipe 50 to the feed water end of the boiler 41. This boiler is substantially the same as shown in the previous figures. The steam may be taken out of the superheaters through pipe 51, which may lead the steam to a low pressure turbine. Relief valves may be employed, as in the previous forms. After the billets in a superheater have heated the steam therein, the chamber is opened and the billets pushed out into a tank corresponding thereto, where the water is heated by the remaining heat.

The advantages of my invention result from saving the very considerable amount of heat of metal which is in intermediate form of reduction, as in billets, blooms, etc., or in final rolled, forged or worked form. Many other forms of apparatus may be devised for carrying out my invention, and the heat may be absorbed from the hot articles by gases, air, etc., instead of by water or liquid, although I prefer the latter form.

I claim:

1. The method of producing steam, which consists in forming a body of water in a

closed chamber, and passing hot worked metal products successively into the said body of water at one point through the body of water in direct contact therewith, and
5 removing said metal products in a cooler condition at another point.

2. The method of producing steam, which consists in forming a body of water in a closed chamber having a sealed inlet at one
10 point and a sealed outlet at another point, and passing hot worked metal products successively into said body of water through the sealed inlet and through the body of water in direct contact therewith, and re-
15 moving said metal products in a cooler condition through said outlet.

3. The method of utilizing hot worked metal products, consisting in feeding them through a steam receiver and thereby im-
20 parting heat to the steam and reducing the temperature of the products, and afterward feeding the partially cooled products to a water heater to impart a higher degree of
25 heat to the water therein and further reduce the temperature of the products.

4. The method of utilizing hot worked metal products, which consists in first sub-
jecting a steam generator to the heat, of said

products, while they are in a highly heated condition, to produce steam and reduce the
30 temperature of the products, and afterward subjecting a water heater to the heat from the partially cooled products to heat said water and further reduce the temperature of
35 the products.

5. The method of utilizing hot worked metal products, which consists in passing
the same while in a highly heated condition through a body of water in a closed steam
40 generator chamber to produce steam and reduce the temperature of the products, after-
ward passing the partially cooled metal products through and in direct contact with a
45 body of water in the water heater to heat such water, and further reduce the tempera-
ture of the products, and transferring the water to the steam generator to be trans-
formed into steam by the succeeding highly
heated metal products.

In testimony whereof, I have hereunto set
50 my hand.

DWIGHT C. DANIELS.

Witnesses:

WM. A. BACON,
GEO. SIEURIN.