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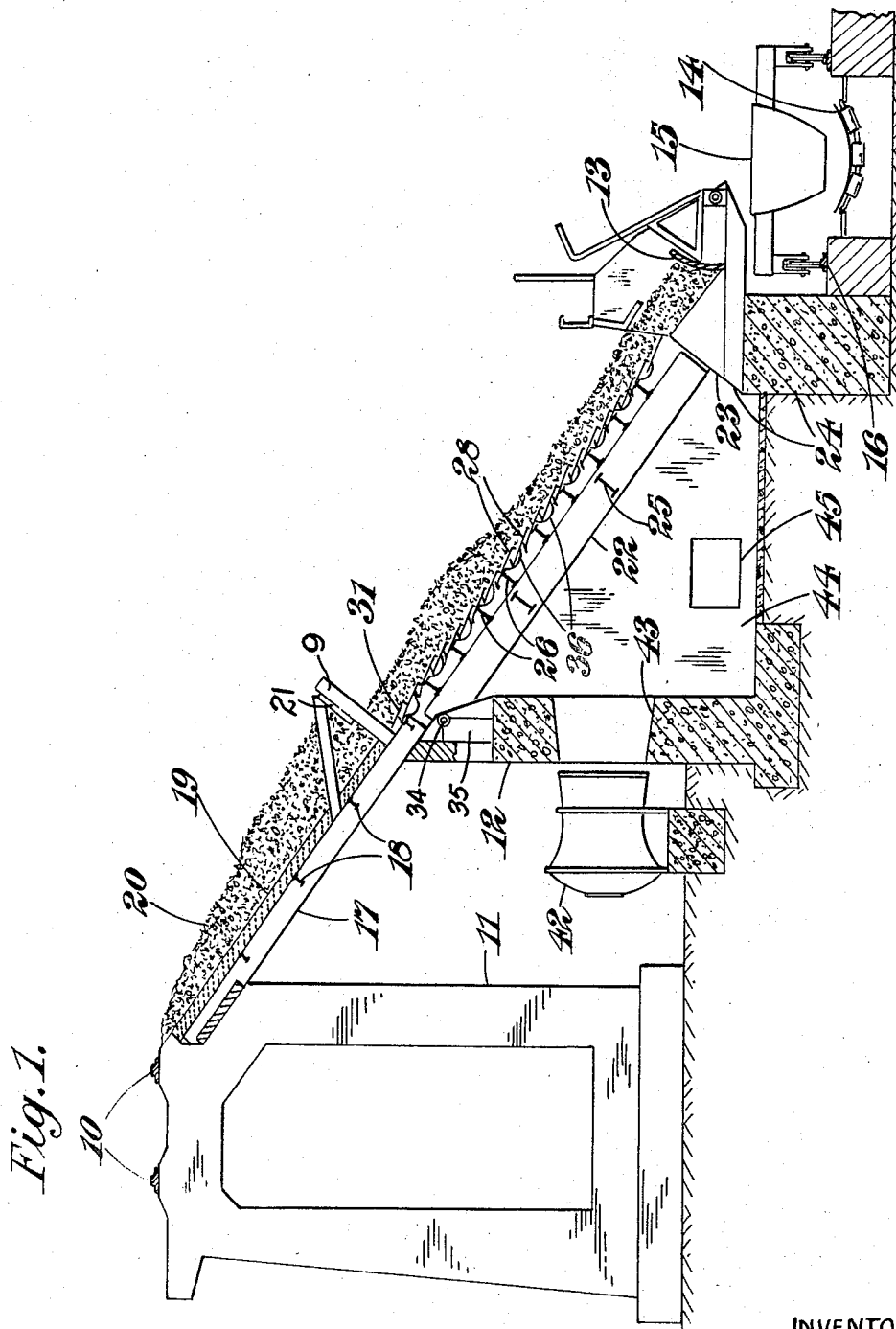
W. C. E. BELL ET AL

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COOLING BENCHES

Filed Aug. 8, 1955

3 Sheets-Sheet 1



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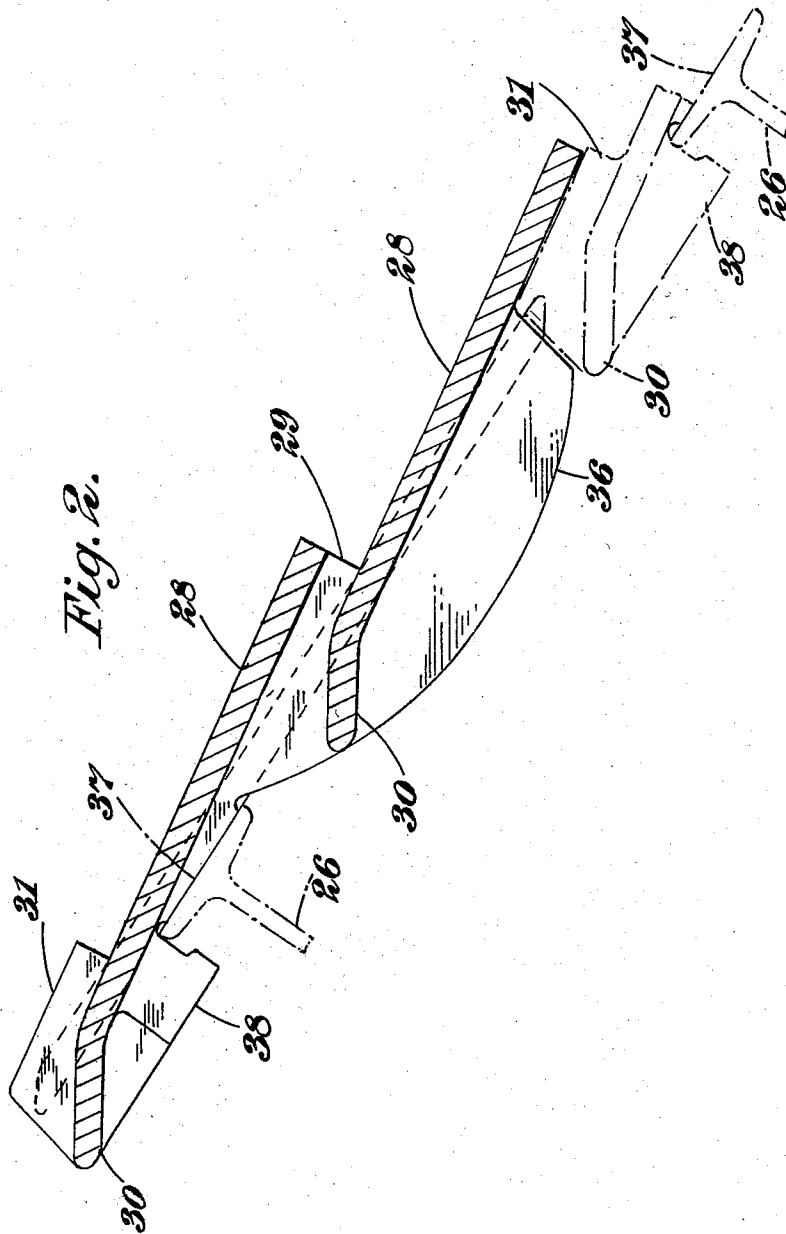
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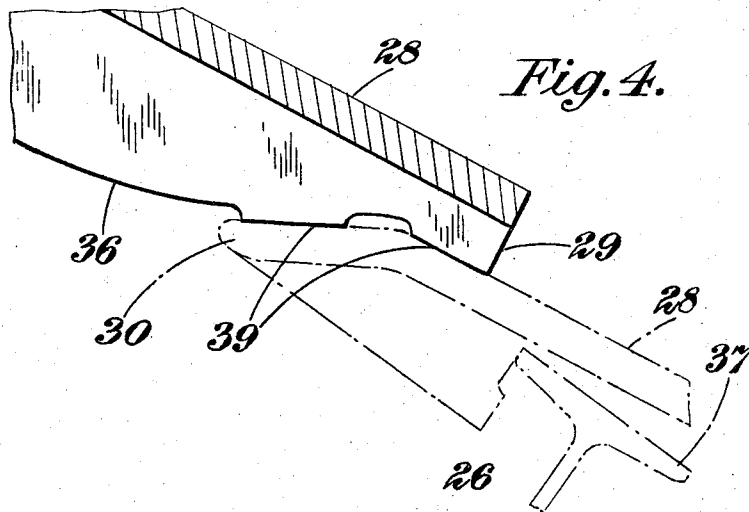
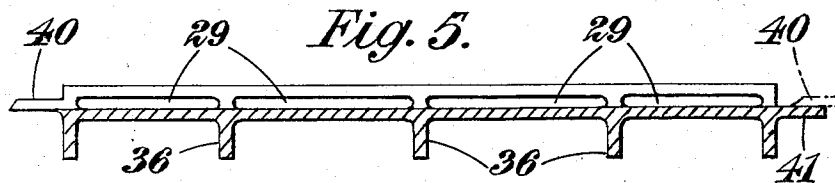
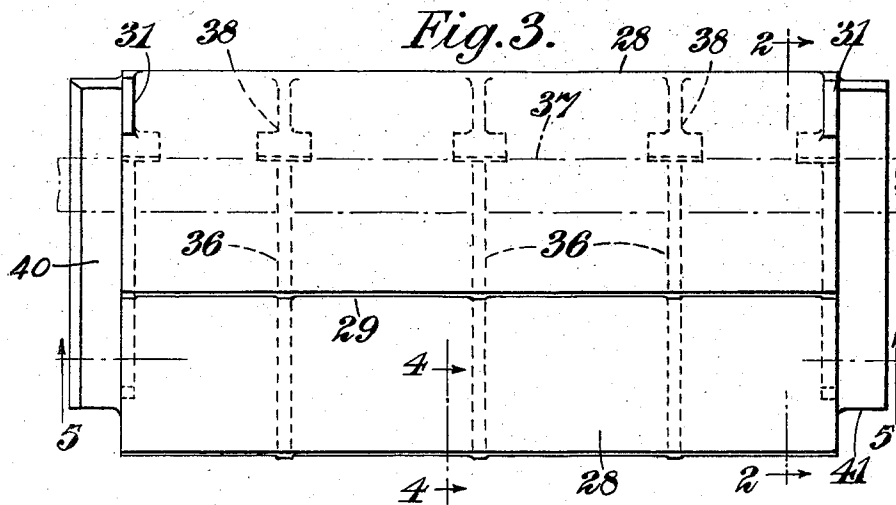
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COOLING BENCHES

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9 Claims. (Cl. 266—21)

This invention relates to cooling benches, particularly for cooling hot sintered material such as sintered ore preparatory to its loading onto an endless belt conveyor or other means of transport for despatch to storage or for further processing, e.g. in a smelting furnace.

The getting of ores and materials and the later preparation of the same preparatory to reduction or other metallurgical processes, involves the production, in many cases, of large quantities of fines, i.e. materials of small size, which, although containing valuable reduceable contents would, owing to their small size, cause erratic and unsatisfactory working of any furnace into which they might be charged. Additionally, such fines are known to exist in their natural state.

To enable such materials to be used, it has, particularly in the smelting of iron, become usual after incorporation of a suitable fuel, e.g. pulverised coke, to sinter the mixture by igniting the fuel in the mass and thereafter sustaining the combustion by drawing air through the same until the materials have been fritted together, or, as it is termed, sintered into loosely-bound vitrified masses which, on discharge from the sintering pans or pallets, break up into lumps of say 8" cube downwards and up to as much as 50% in the form of vitreous smalls of $\frac{5}{16}$ " downwards. These smalls are in due course returned to mix with new material and re-sintered.

The freshly sintered material is discharged from the sinter machines at temperatures of around 600° C. or more, which is too hot for convenient handling.

Attempts have been made to cool the sinter by exposing it to the atmosphere on slowly rotating roundabouts of upwards of 40 ft. in diameter in the hope that the sinter would cool sufficiently in one revolution to allow of a fraction being constantly discharged. This arrangement has not proved wholly satisfactory and the percolation of air through the mass is limited due to the depth of material to be dealt with in this design. It is known to spray the sintered material with water so as to accelerate the cooling, but this is undesirable from the metallurgical point of view due to the fact that it has a tendency to increase the amount of fines.

It is also known to discharge freshly made sinter onto benches inclined to the horizontal, on which the material is held by gates at the bottom of the incline and is left to cool. Finally, the material is drawn off by opening the gates along the lower edges of the bench onto a feeder serving a conveyor belt. This system, although prodigal of space, is satisfactory but for the fact that when the sinter is tipped onto the bench the dust and smaller particles become the lower fraction of the bed as it lies on the bench, and this cools at a very slow rate.

Any attempt to accelerate the cooling by the provision of water jets or sprays produces the objectionable effect already mentioned.

According to this invention, a cooling bench of the fixed inclined type is characterised in that air passages are so formed in the bench as not to become clogged with the material being cooled, and in that means are

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provided for inducing a flow of cooling gas (e.g. air), through said passages and through the layer of material resting on the bench.

In one arrangement according to the invention, the flow of air through the passages may be induced either by natural draught or by means for generating a supply of low pressure air beneath the bench.

The bench may be arranged to form a roof extending either wholly or partially over one or more chambers to which natural draught or low pressure air is supplied, the portion of the bench not overlying such chambers being arranged for natural cooling either with or without air passages of the aforesaid nature.

For example, a number of closed chambers may be arranged side by side along the length of the bench.

The chambers may be open to natural draught or independently supplied with low pressure air, so that different parts of the bench may be cooled at different rates, and may underlay the whole width of the bench or partially. In the latter case the portion not so underlaid may be arranged as stated earlier.

The bench may comprise a number of metal panels arranged side by side and end to end, each comprising overlapping and spaced louvres or flats so as to provide the aforesaid passages which extend downwardly in an inclined manner.

The panels may be so constructed that adjacent edges thereof may overlap one another.

The panels may be of integral construction, for example, they may be formed from cast iron.

The panels may be supported by an underlying recticulated structure which permits the passage of air. The panels may be loosely located on the said structure so as to permit them to expand when heated, and the recticulated structure itself is so constructed as to allow of free expansion or contraction due to temperature changes.

One or more adjustable baffle plates may be arranged at suitable positions across and above the panels for controlling the depth of material lying on the bench.

The upper part of the bench may be provided with a continuous imperforate supporting surface and the aforesaid adjustable baffle plates be arranged at the junction between the imperforate portion of the bench and that portion provided with said passages.

The following is a more detailed description of one form of cooling bench for sintered ore according to the invention reference being made to the accompanying diagrammatic drawings:

Figure 1 is a vertical section through the bench;

Figure 2 is a vertical section through one of the slotted panels;

Figure 3 is a plan view of a panel;

Figure 4 is a section through the lower edge of the panel on the line 4—4 of Figure 3;

Figure 5 is a section through the panel on the line 5—5 of Figure 3.

Supporting the top of the bench there is a structure 11 along which extends a track 10. Cars which have received a charge of hot sintered ore are traversed along this track and are discharge laterally over the upper edge of an appropriate section of the bench. The upper portion 19 of the bench extends downwardly from the supporting structure 11 and across a wall 12 disposed intermediate of the width of the bench. The bench terminates at its lower end opposite a number of discharge gates 13 which are arranged above an endless belt conveyor 14. The conveyor transports the cooled sintered ore away to a disposal location. A travelling feeder 15 is mounted on rails 16 above the conveyor and an operator can travel on this feeder and control the various discharge gates as the feeder moves past them.

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The upper part of the bench is supported by a number of I-section beams 17 which are secured to and extend downwardly from the supporting structure 11 which beams terminate at and are supported by the top of the said intermediate wall 12. The beams 17 are cross-braced by a number of subsidiary I-section members 18. These beams 17 and cross members 18 support an imperforate brick lining 19 on which the hot sintered ore 20 is initially discharged. Alternatively this portion of the bench may be provided with a louvred surface for the passage of cooling air by natural draught which surface may be constructed in a similar manner to the lower portion of the bench about to be described.

A number of adjustable upright baffle plates 21 are mounted on a super structure 9 at the lower end of the part of the bench supported by the beams 17 and cross members 18 in such a manner that the baffles can be moved towards and away from this part of the bench and thus control the depth of sinter overlying the lower portion of the bench.

Further I-section beams 22 are pin jointed at 34 at their upper ends to brackets 35 on the intermediate wall which beams extend downwardly in an inclined manner and have their lower ends freely supported by a bracket 23 on the base 24 thereby enabling the beams to expand and contract with variations of temperature. These I-section beams 32 are also cross braced by I-section members 25. A further set of horizontal extending I-section beams 26 rest on the upper flanges of the main I-section beams 22 and are loosely clipped thereto so that there may be a limited endwise movement. A grid like structure is thus formed which is arranged to support a number of cast iron panels.

The cast iron panels (see Figures 2 to 5) are so constructed that when appropriately laid on the upper flanges of the beams 26 they form an inclined surface made of a series of overlapping shelves 28 the lower edge of each of which shelves is spaced above the upper edge of an adjacent shelf thereby providing slots 29 extending across the bench through which slots issue low pressure air or naturally induced cooling air. The size of the panel is purely arbitrary.

In Figures 2 to 5 the panel is shown as comprising two overlapping shelves 28 which provide a slot 29 between them. The lower edge of the lower shelf of one panel is arranged to overlie the upper edge of the upper shelf of another panel and in order to provide the required slot between these edges the bosses 31 are cast at intervals along the top edge of each panel on which the lower edges of the next panel rest. These bosses are of such a height that a slot is formed of the same dimensions as the slot 29 in the main body of the panel. The upper edges 30 of all the shelves are set at a different angle to the horizontal than the shelf itself so that in conjunction with the under surface of the overlapping shelf above, an airway is provided converging towards the outlet of the slot 29.

On the underside of each panel there are cast stiffening ribs 36 extending from the top to the bottom thereof and formed so as to provide seating faces 37 which rest on the upper flange on one of the beams 26 and also so formed to provide a lug 38 for engaging an edge of said flange thus preventing downward displacement of the panel.

As will be seen from Figure 4 the lower ends of the ribs 36 are so shaped at 39 as to engage the inclined portion 40 of the shelf of the lower panel.

The sides of the panel are provided with extension pieces 40 and 41 arranged at different levels so that they may overlap the extensions of adjacent panels as shown in Figure 5.

The means for supplying the cooling air may comprise electric motor driven fans 42 which are supported opposite that face of the intermediate wall 12 nearer the

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supporting structure 11. The wall 12 may be provided with suitable openings 43 through which the cooling air may be delivered. The intermediate wall 12 is also provided with forwardly extending partitions 44 of brick or other material which extend up to the base 24 supporting the aforesaid brackets 23 thus dividing the space beneath the surface of the cooling bench into a number of cooling chambers. Each partition is provided with an opening normally closed by a hatch 45 but which can be opened to allow two or more of the chambers to be placed in parallel or in series. Each fan may be independently controlled. Alternatively, cooling air may be supplied from another source to a common main with branches serving each chamber and with or without independent air controls for each branch; or a natural draught may be employed to provide a flow of air up through the bed. This natural draught may be generated by the heat of the sintered ore in which case the fans may be omitted or may not be driven, the cold air in the case of the chambers, being drawn in through the fan openings and then rising to the roof of the chambers and up through the panels.

We claim:

1. A cooling bench comprising a supporting structure, an inclined platform supported by said structure and affording a substantially continuous sloping surface along the downward length of the platform on which surface the material to be cooled is disposed, which platform is made up from a number of similar, interengaging plate members spaced in a sloping position on said structure and fixed against downward sliding movement thereon, each plate partly overlapping the next adjacent plate below it, said plates affording passages of similar length formed between overlapping, spaced and downwardly inclined portions of the plates, which passages have their inlet ends opening to the underside of the platform and spaced apart along the downward length of the platform and having their outlet ends opening to and spaced apart along the downward length of said surface each at a lower level than its inlet end, a plurality of adjustable baffle plates positioned adjacent the first of said plate members to extend upwardly from the platform to control the movement of material onto the first of said plate members, at least one closed compartment beneath said platform and means associated with said compartment for forcing cooling air through said passages.

2. A cooling bench according to claim 1 wherein the upper part of the platform is imperforate and wherein said closed compartment is disposed beneath said plates.

3. A cooling bench according to claim 1 wherein a number of closed compartments are arranged side by side beneath the plates and across the width of said inclined platform with which compartments are associated said means for forcing air upwardly through the passages afforded by said plates.

4. A cooling bench according to claim 1 wherein the means for forcing air upwardly through the passages comprise a motor driven fan arranged opposite an opening in the wall of the closed compartment.

5. A cooling bench according to claim 1 wherein a number of closed compartments are arranged side by side beneath the plates across the width of said inclined platform and which closed compartments are separated by dividing walls having openings and associated removable hatches and with which compartments are associated said means for forcing air upwardly through said passages.

6. A cooling bench according to claim 1 wherein the upper part of the inclined platform is imperforate and said closed compartment is disposed beneath said plates, and wherein a track way is provided at the upper end of the imperforate part of the platform extending across the width thereof and wherein a travelling conveyor is arranged to extend across the lower end of the platform.

7. A cooling bench comprising a closed compartment the upper wall of which is formed as an inclined reticu-

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lated framework having spaced horizontal cross members at different levels, a plurality of similar metal plates affording sloping passages between them for the flow of cooling air, said plates covering said framework and loosely resting on said cross members so as to be capable of expanding when heated each of which plates is inclined, a plurality of adjustable baffle plates arranged to extend upwardly from the outer face of said framework adjacent the first of said metal plates to control the movement of material onto the first of said metal plates, a plurality of discharge gates positioned adjacent the bottom of said platform to control the discharge of material from said plates and means associated with said compartment for forcing air upwardly through said passages.

8. A cooling bench according to claim 7 wherein the upper end of said reticulated framework is provided with a pivotal connection for securing it to a wall of said

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compartment and the lower end of which compartment rests loosely on a supporting member at the lower end of the compartment.

9. A cooling bench according to claim 7 wherein said inclined plates are arranged with their adjacent edges overlapping.

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