May 26, 1936. K. A. LINDNER 2,041,844

APPARATUS FOR SEPARATING METALS AND METAL ALLOYS

Filed March 10, 1934 3 Sheets-Sheet 1

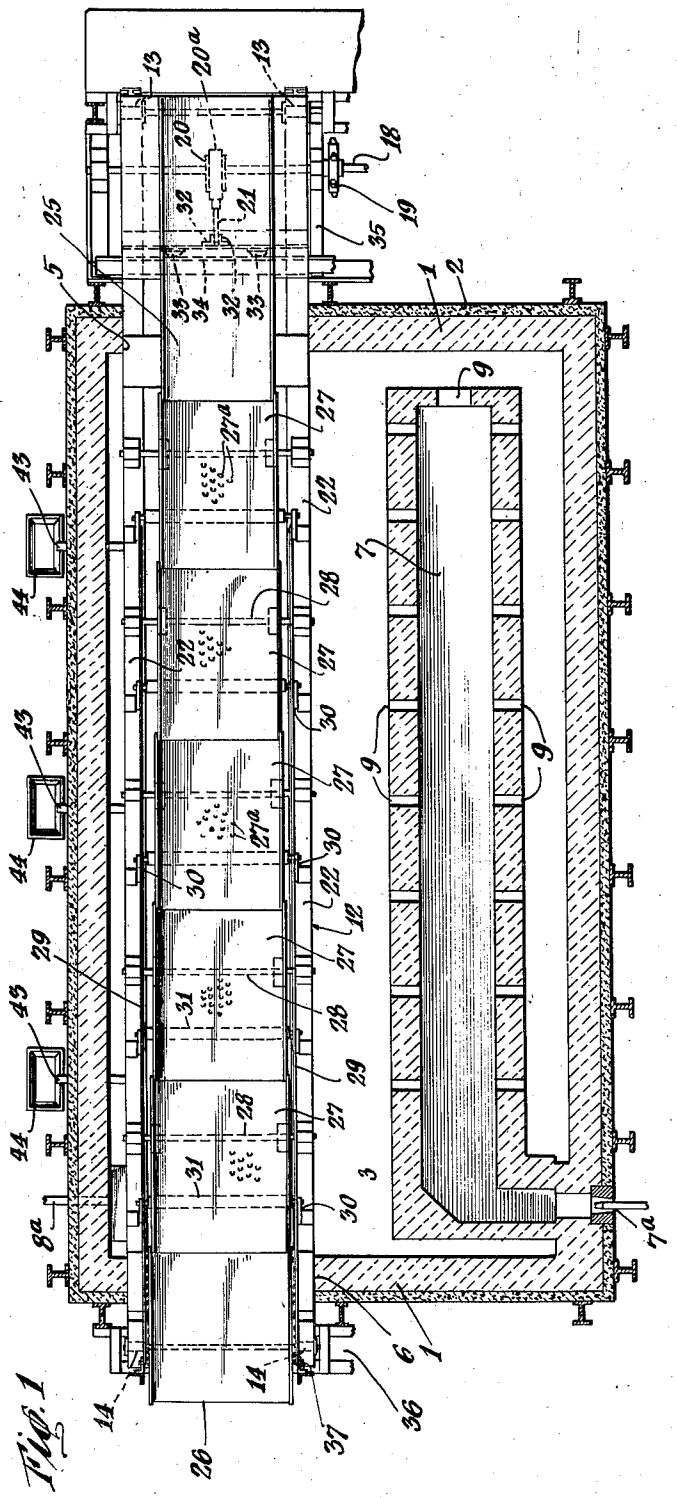


Fig. 1

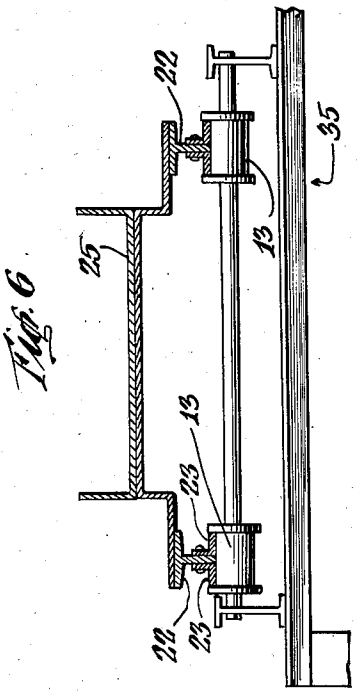


Fig. 6

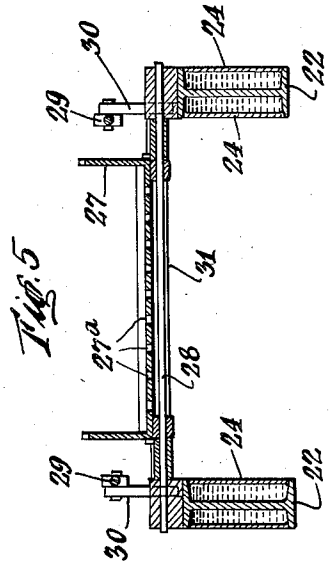


Fig. 5

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APPARATUS FOR SEPARATING METALS AND METAL ALLOYS

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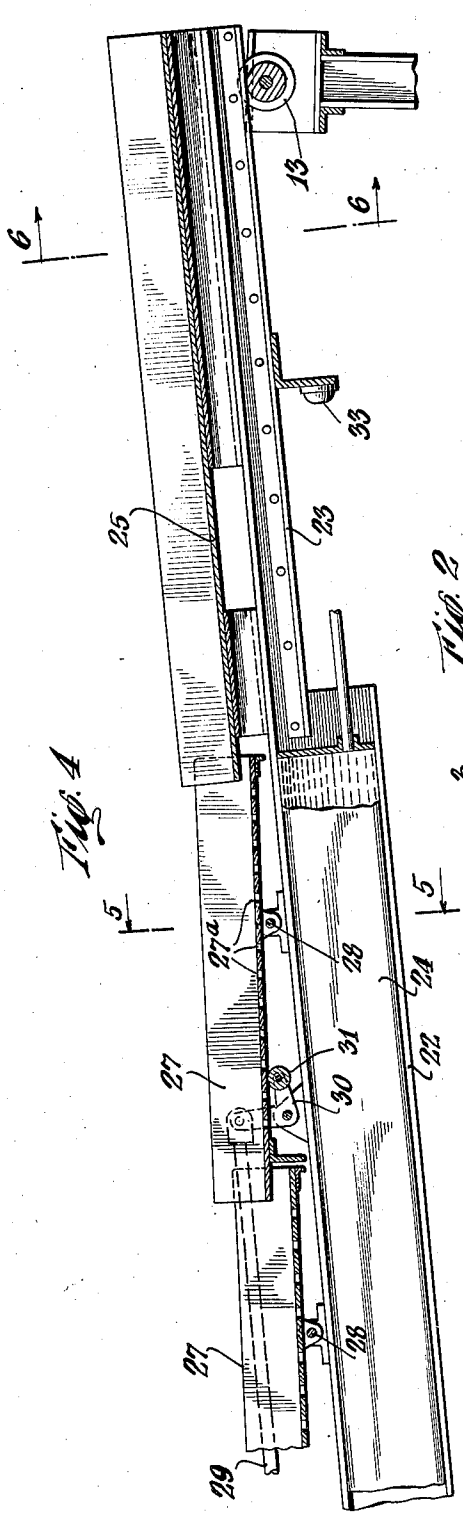


Fig. 1

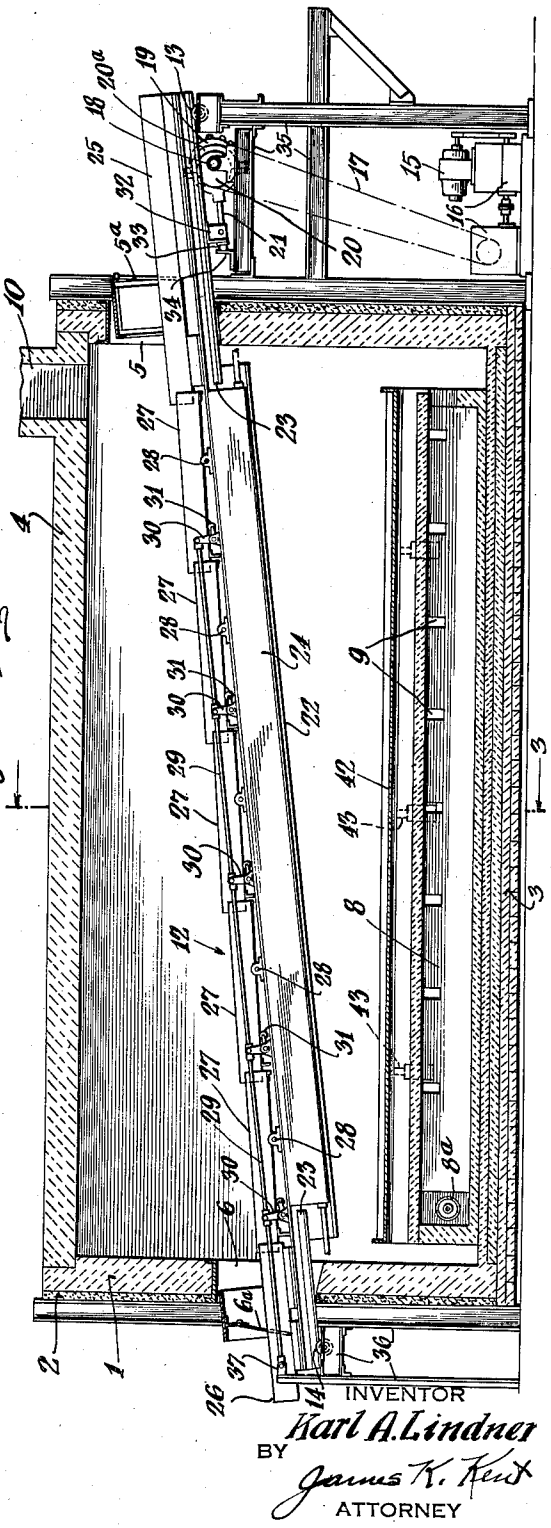


Fig. 2

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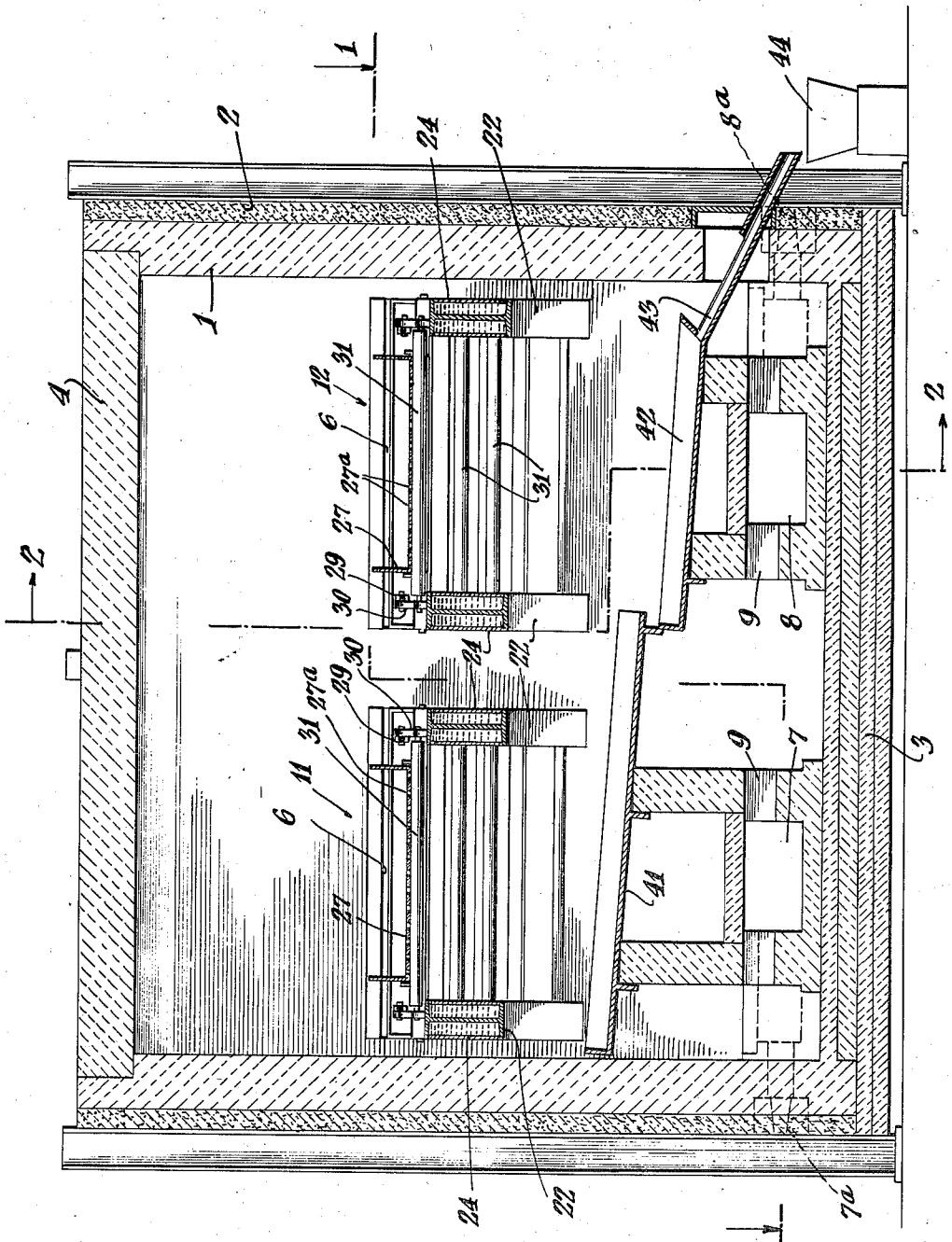


Fig. 3

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2,041,844

APPARATUS FOR SEPARATING METALS AND METAL ALLOYS

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5 Claims. (Cl. 266—33)

This invention relates to apparatus for separating and recovering metal values.

The invention is particularly directed to structure and methods suitable for the continuous separation of lower melting metals and alloys from higher melting materials. Apparatus constructed according to the invention may accordingly be adapted to the reclamation of tin, lead, solder and other low melting coatings or binders from associated higher melting metals and alloys in scrap materials. It may be utilized, for example, for effecting the recovery of solder from scrapped radiators of internal combustion engines or the removal of lead coverings from wire cables and the like. The furnace may be arranged to heat the materials under controlled conditions to melt the low melting metals and alloys without excessive oxidation or the formation of dross.

In accordance with the invention, a continuous process sweating furnace is preferably provided with a sloping chute or hearth made up of a plurality of hearth pans, associated driving mechanism being arranged to cause motion or agitation of the hearth pans in a predetermined manner. This mechanism may preferably impart to the hearth pans a longitudinal reciprocating motion together with a jarring or thumping action to work the material being treated through the heated furnace and simultaneously dislodge and separate the low melting metals and alloys from the higher melting materials. Devices may likewise be provided, if desired, to impart an individual rocking or bouncing action to each hearth pan.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a sectional plan view of a furnace and associated apparatus taken on the line 1—1 of Fig. 3;

Fig. 2 is a sectional elevation taken on the line 2—2 of Fig. 3;

Fig. 3 is an end section taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged sectional elevation of part of the hearth structure;

Fig. 5 is an end section of the hearth structure taken on the line 5—5 of Fig. 4; and

Fig. 6 is an end section taken on the line 6—6 of Fig. 4.

Like reference characters denote like parts in the several figures of the drawings.

Referring now more particularly to the drawings, the furnace is constructed to effect an efficient utilization of heat due to control of the rate of heating, the method of circulating the hot furnace gases and the insulated character of the furnace walls. The walls may be of fire brick 1, which is covered on the outside with a heat insulating material such as magnesia brick or cement 2. The floor 3 may be built up of several layers of brick. The roof 4 may be formed of successive layers of fire brick, magnesia and insulating cement.

One end-wall of the furnace is provided with a pair of feed or intake openings 5 and the opposite end with a pair of discharge openings 6 at a lower level than the feed openings. A pair of hearth structures 11 and 12, placed side by side, extend between the intake and discharge openings and serve to convey the materials to be treated through the furnace. The feed and discharge openings are provided with swinging inlet and outlet doors 5a and 6a respectively. These doors are hinged along the upper edges of the openings whereby material passing down the hearth will temporarily raise them while entering or leaving the furnace but the openings will be closed the remainder of the time.

Extending lengthwise of the furnace chamber are two combustion chambers 7 and 8 resting on the floor thereof. These are equipped with suitable burners 7a and 8a, respectively, which are adapted to burn oil, gas, pulverized coal or the like. The chambers may, however, be constructed to burn other forms of fuel if desired. The burners are preferably located at the ends of the combustion chambers nearest the discharge end of the furnace. Several vents or openings 9 are distributed along the side walls of the combustion chambers to permit the hot combustion gases to escape into the furnace chamber. A stack 10 rises from the roof 4 of the furnace near the feed end for carrying away the used combustion gases. Standard automatic control devices are preferably associated with the furnace to regulate the combustion to maintain the required degree of heat and to regulate the chemical composition of

the combustion gases to prevent oxidation and dross formation.

As hearths 11 and 12 are identical in construction, hearth 12, only, will be described in detail. This hearth comprises a pair of I-beams 22 with the lower flanges cut away at the feed and discharge ends to provide narrower portions which extend through the feed and discharge openings. Angle irons 23 are clamped to the web portions of the beams where they are cut away to strengthen the projecting ends thereof. The ends of the beams projecting from the furnace at the feed and discharge ends rest on rollers 13 and 14, respectively, which are journalled on supporting frames 35 and 36, respectively, outside the furnace. I-beams 22 are provided with suitable water jackets 24 through which cooling water may be circulated for cooling these beams.

Mounted at the upper end of the hearth structure is a channel shaped feeder pan 25 extending through the feed or input opening 5 and mounted at the lower end is a channel shaped discharge pan 26 extending through the discharge opening 6. A plurality of channel shaped hearth pans 27, having bottom perforations 27*a*, are individually mounted to rock on rocker shaft mountings 28 extending between I-beams 22. The pans 27 are mounted in cascade and are so disposed with relation to each other as to provide a substantial drop between successive pans. The feed and discharge pans, and the perforated hearth pans thereby form a channel or chute sloping downwardly from the feed to the discharge opening of the furnace.

Steel framework 35 outside the furnace at the feed end supports a driving mechanism comprising motor 15, speed reducers 16, drive chain 17, drive shaft 18 carrying a sprocket wheel 19 and an eccentric sheave 20. A reciprocating connecting rod 21 is journalled to sheave 20 by strap 20*a* and is connected at its other end by means of a crank pin to a connecting bracket 32 secured to the hearth frame structure. Also attached to the connecting bracket 32 are rubber bumpers 33 adapted to strike a bumper plate 34 attached to the supporting framework 35.

Means for rocking the hearth pans 27 on their rocker shaft mountings 28 are provided and comprise a pair of rods 29 attached to supporting framework 36 at the discharge end of the furnace and extending up through the furnace along the sides of the hearth pans. Near the lower end of each of said pans are a pair of bell crank levers 30 connected to rods 29 and mounted to rotate in mountings secured to I-beams 22. Each pair of bell crank levers carries a roller 31 which passes under the lower end of its respective hearth pan whereby rotation of the bell crank lever will lift the lower end if its respective pan a small amount to cause the pan to rock a small distance on its rocker mounting 28.

Collecting pans 41 and 42 for receiving the molten metals and alloys are suitably positioned below hearth structures 11 and 12 and are supported by piers or extensions on combustion chambers 7 and 8, respectively. These pans slope toward one side of the furnace whereby any solder collected in pan 41 will drain into pan 42. The molten metals will be drained therefrom by suitable spouts 43 mounted at intervals along the lower edge of pan 42 and feeding into suitable collecting receptacles 44 outside the furnace.

In the operation of the furnace, the burners 7*a* and 8*a* in the combustion chambers 7 and 8 are started, the hot combustion gases leaving the combustion chambers through vents 9 and circulating around the collecting pans 41 and 42 and the hearth structures 11 and 12 and finally leaving the furnace through stack 10. The driving motor 15 is started whereby the drive shaft 18 is caused to rotate imparting a reciprocating motion to connecting rod 21 by means of the eccentric 20. A similar motion is imparted to another connecting rod associated with hearth 11. This motion is transmitted to the hearth structures 11 and 12 causing them to vibrate or reciprocate longitudinally throughout their length. At each rotation of the drive shaft, rubber bumpers 33 strike bumper plate 34 at the end of the downward stroke of the hearths giving a sudden impact to the hearths when they are in their lowermost position. As the hearth structures are drawn to their highest position by connecting rods 21, the bell crank levers 30 are rotated slightly by bell crank rods 29 causing rollers 31 to lift the lower ends of the hearth pans slightly. On the return stroke these pans are suddenly dropped by the bell crank mechanism giving a vertical jarring or bouncing action in addition to the previously described lateral motion and impacts.

Material to be treated, such as scrap internal combustion engine radiators, is placed on feeder pan 25 and moves into the furnaces as a result of the jarring action imparted by the driving mechanism. The material is heated by the combustion gases within the furnace and upon reaching the hearth pans 27 receives the particular shaking, bouncing and jarring action provided by the novel driving arrangement. This action effectively dislodges the solder or any other low melting metals and alloys which have been fused by the heat of the furnace and causes these molten metals and alloys to fall through the perforations 27*a* in the hearth pans and onto the solder collecting pans 41 and 42. At the same time the jarring action works the material down the hearth to the discharge end of the furnace.

The molten solder and low melting metals falling on collecting pans 41 and 42 are drained through discharge spout 43 and collected in collecting receptacles 44 outside the furnace.

Thus, by this invention a continuous and substantially complete separation and recovery of the low melting materials and alloys is obtained. The low melting materials are collected in a suitable form for reuse and the higher melting materials are continuously removed from the furnace after the separation.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In an apparatus for separating lower melting metals and alloys from higher melting metals and alloys, a furnace, heating means associated therewith, an intake opening and a discharge opening in said furnace, a plurality of perforated hearth trays individually mounted on a common hearth structure forming a chute sloping downwardly from said intake to said discharge opening to receive and convey said metals and alloys through said furnace, means for imparting both longitudinal reciprocating and rocking motion to said hearth trays comprising a drive shaft, an eccentric thereon, link means between said eccentric and

said trays and a bumper associated with said link means.

2. In a sweating furnace for removing lower melting materials from higher melting materials, a chute comprising a series of hearth pans mounted in cascade and disposed relatively to each other to provide a substantial drop between successive pans, means for imparting longitudinal reciprocatory motion to said hearth pans, and means for imparting rocking motion thereto.

3. A sweating furnace comprising hearth supporting beams extending through the heating chamber thereof, oscillatory mountings for said beams, a sloping hearth comprising a plurality of pans in cascade, said pans being mounted on individual rocker arms carried by said beams, means secured to a stationary frame and connecting said pans enabling the latter to be rocked when said beams are moved longitudinally and means for imparting reciprocatory, longitudinal movement to said beams.

4. Apparatus for separating lower melting metals and alloys from associated higher melting materials which comprises a heating chamber, reciprocable means for conveying the said materials through the said chamber, mechanism for driving said reciprocable means, the said means including a sloping hearth comprising a plurality of individual hearth pans disposed so that each of the pans is adapted to receive materials directly from the preceding pan, the discharge end of one pan being spaced above the intake end of the adjacent pan so that the material will fall from one pan to the next as the material passes along the pans thereby being subjected to shocks as the material passes along the hearth pans, supporting beams for the pans, mechanism mounted on the beams for individually rocking the respective pans for jarring the said materials as they pass along the pans, the said mechanism including rocker shafts extending between the beams and carrying the respective pans, bell cranks for the respective pans, the said bell cranks being rotatably connected at their elbows with the said beams, one arm of the said bell cranks engaging the bottom of the respective pans, a rod extending along the pans and connected to the other arm of the bell cranks, a supporting frame at the discharge end of the furnace, and means connecting the rods to the frame, whereby upon actuation of the drive mechanism, a rocking movement is imparted to the bell cranks for rocking each of the said pans on its rocker shaft.

5. A sweating furnace comprising the combination with a heating chamber for receiving articles to be sweated, of hearth-supporting beams extending through the heating chamber in the direction of travel of articles to be sweated, a plurality of hearth pans supported on the beams and arranged so that the articles to be sweated drop from one hearth pan to the next in line, cooling jackets mounted on the beams and extending substantially the length thereof, roller mountings for the beams positioned beneath the beams and enabling the beams, together with the cooling jackets and pans, to be longitudinally oscillated, mechanism secured to the beams for longitudinally reciprocating the same, together with the pans, in the direction of travel of the articles for feeding articles to be sweated from one hearth pan to another through the heating chamber and a resilient bumper adapted to impart sharp impacts to the hearth when same is in its lower operating position.

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