

A. G. MCGREGOR.
 SKULL BREAKING APPARATUS.
 APPLICATION FILED APR. 7, 1913.

1,097,105.

Patented May 19, 1914.

5 SHEETS—SHEET 1.

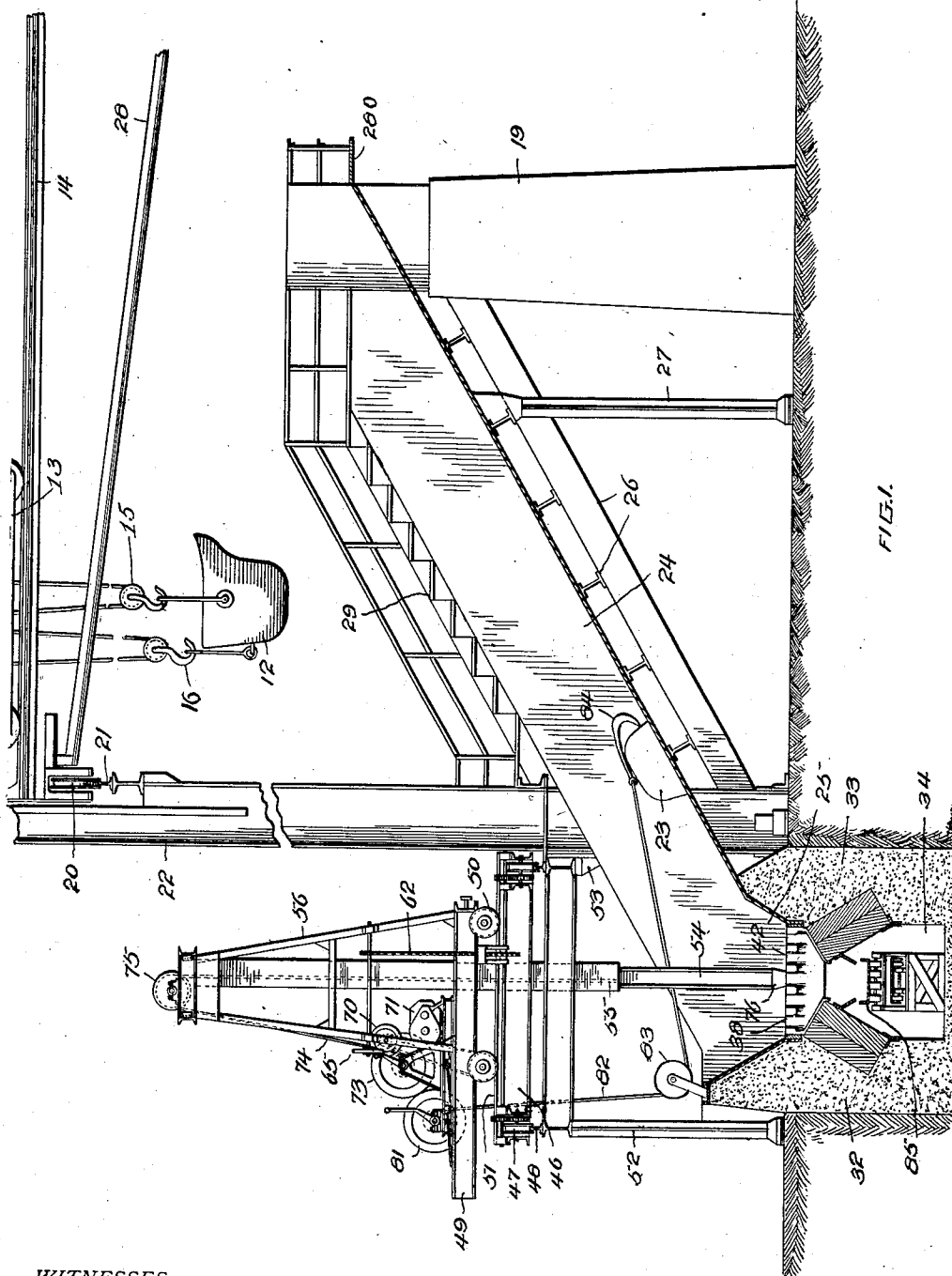


FIG. 1.

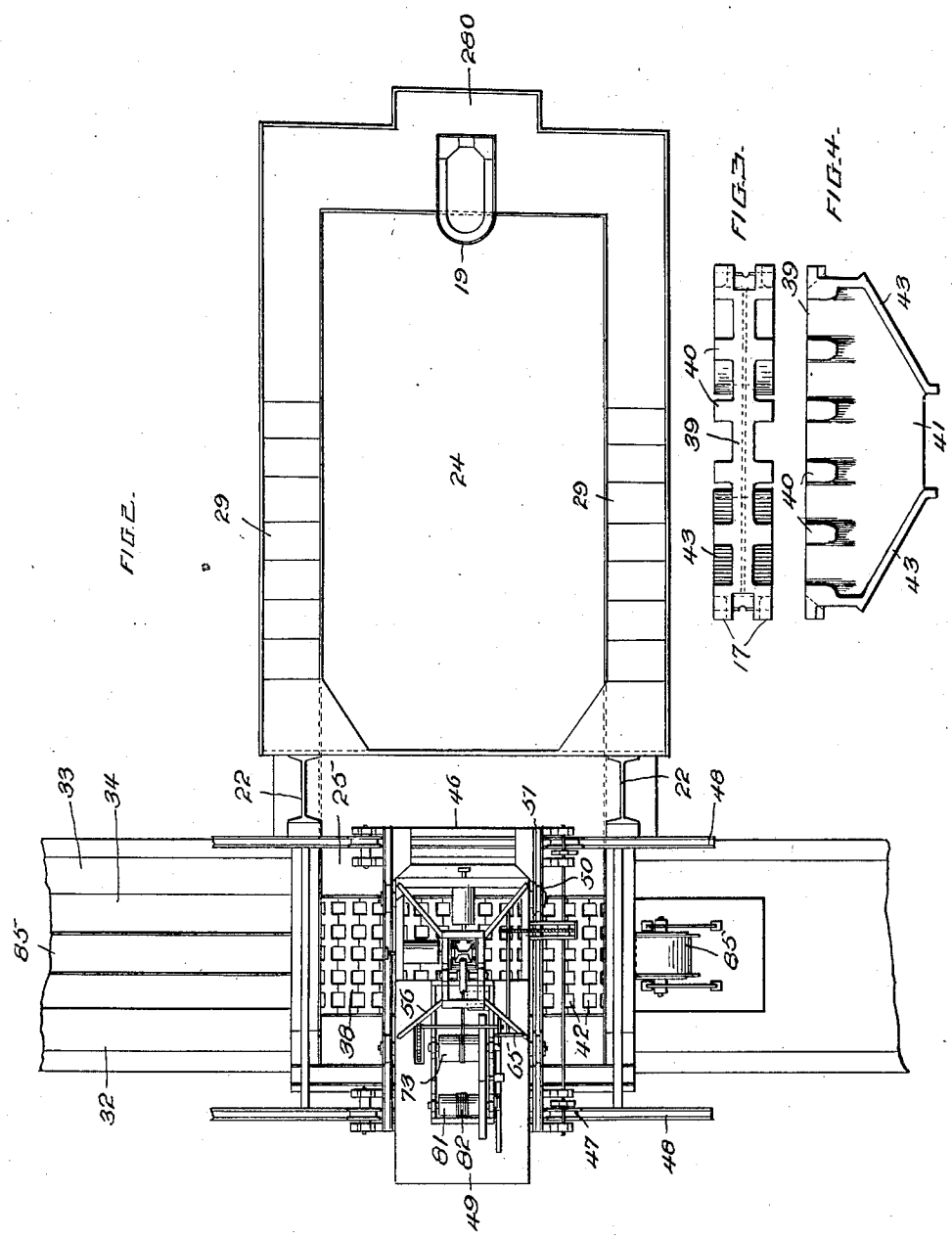
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 5 SHEETS—SHEET 2.



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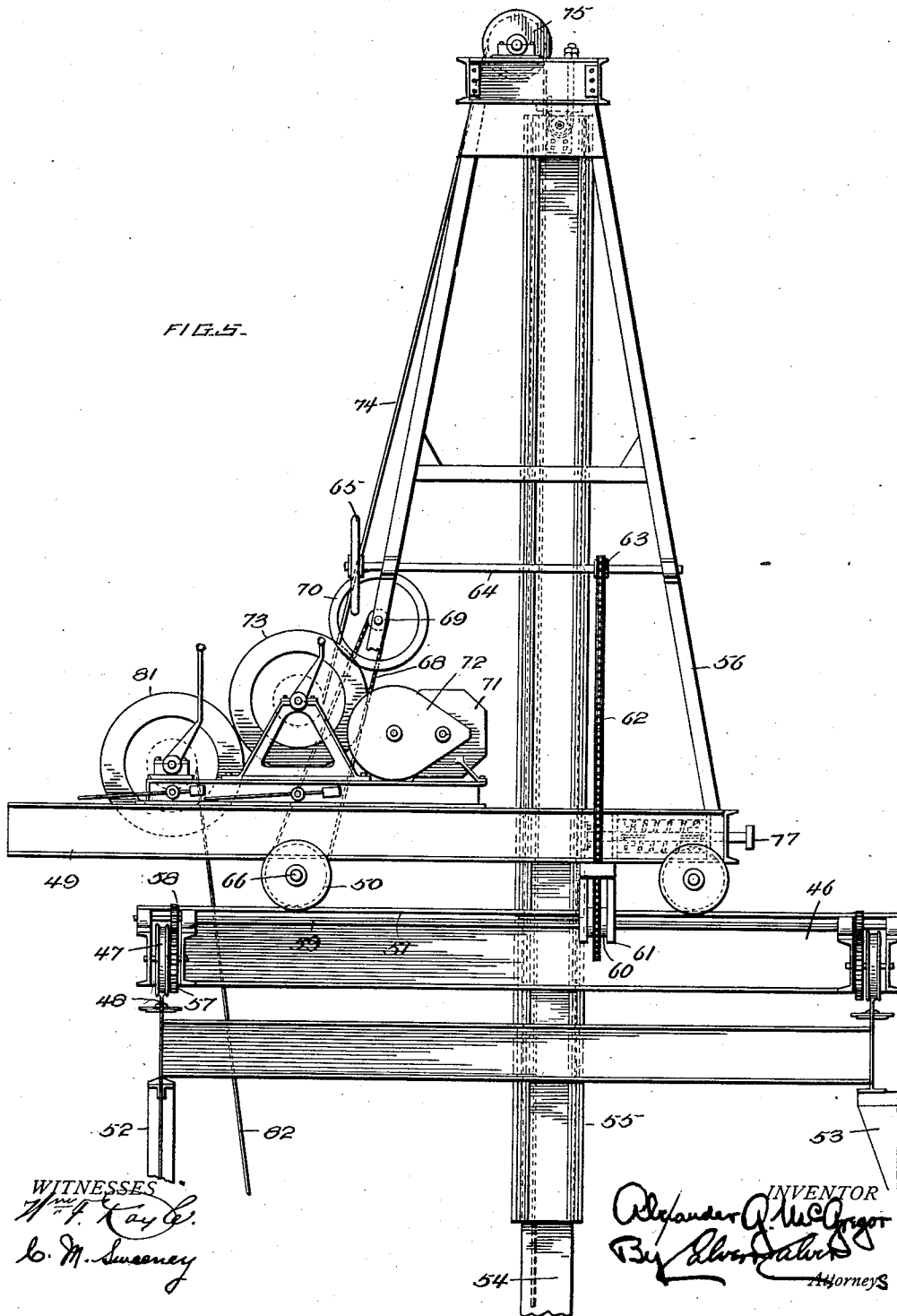
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5 SHEETS—SHEET 3.

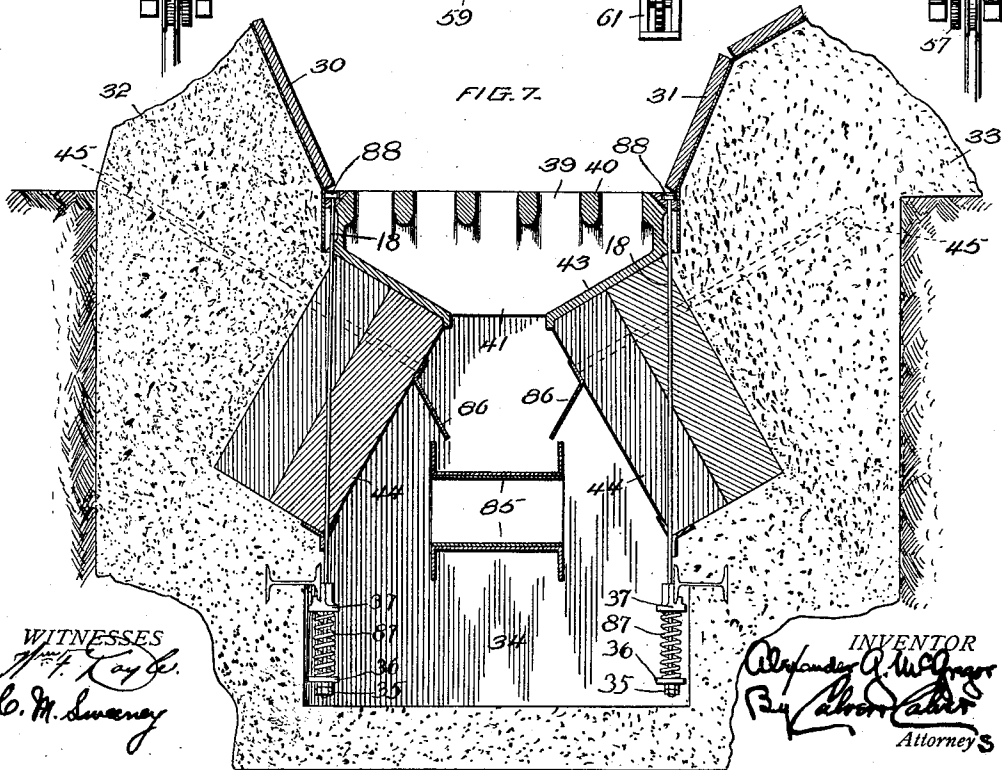
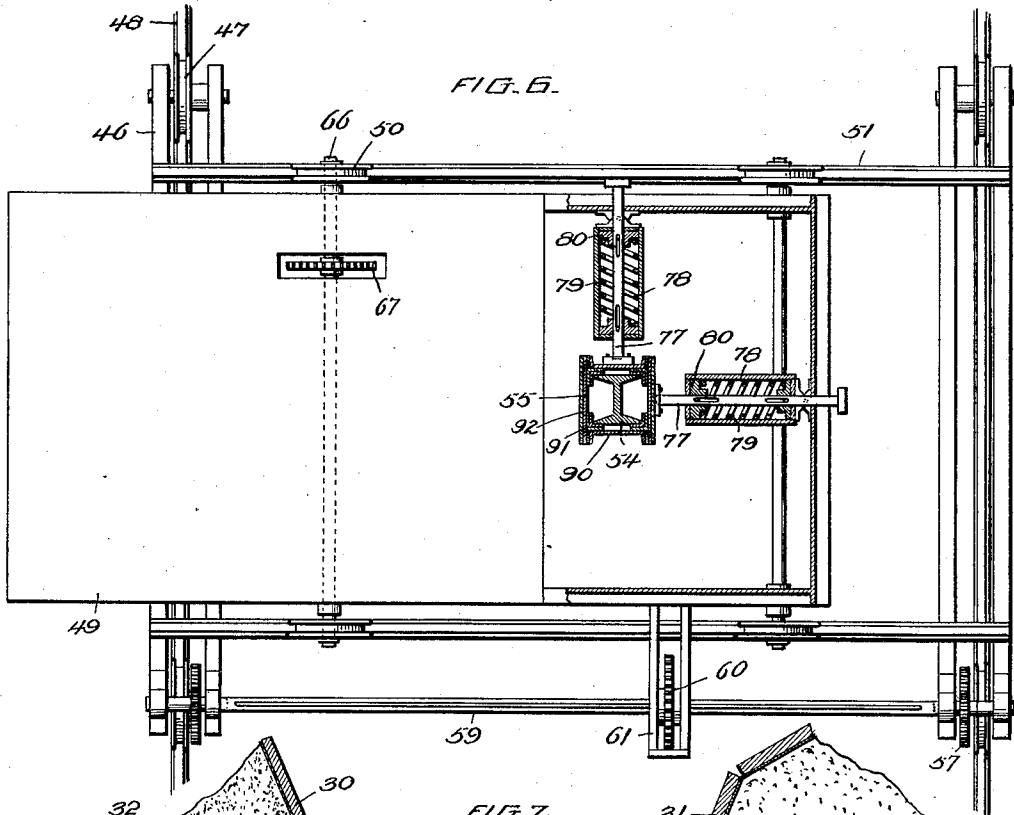


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6 SHEETS—SHEET 4.



WITNESSES
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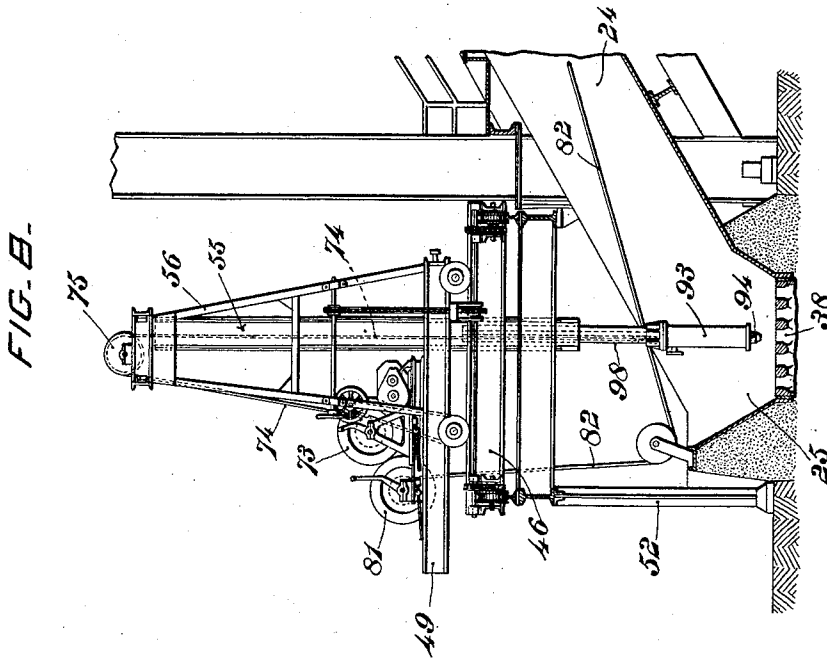
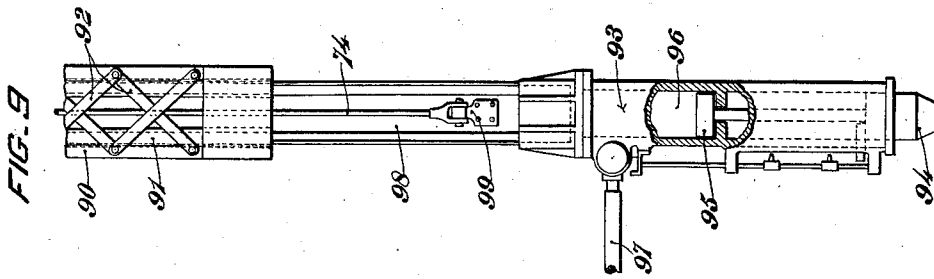
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5 SHEETS—SHEET 5.



Witnesses

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UNITED STATES PATENT OFFICE.

ALEXANDER G. MCGREGOR, OF DOUGLAS, ARIZONA.

SKULL-BREAKING APPARATUS.

1,097,105.

Specification of Letters Patent.

Patented May 19, 1914.

Application filed April 7, 1913. Serial No. 759,380.

To all whom it may concern:

Be it known that I, ALEXANDER G. MCGREGOR, a citizen of the United States, residing at Douglas, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Skull-Breaking Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

In certain metallurgical processes, for example, in the production of metallic copper from the copper matte of the blast or reverberatory furnace, it is necessary that the material operated upon be conveyed or transported, while in a molten condition, from the furnace to the converter or other apparatus for further treatment. Also the slag from the converters is transported to a slag casting machine; or it may be transported to and dumped into a blast furnace settler, or into a reverberatory furnace. For these purposes the material is usually handled in large ladles, and it is impracticable, during such transportation, to prevent the material from cooling to a certain extent, especially if the material be allowed to remain in the ladle for a considerable time. When therefore, particularly in the case of converter slag, a ladle is emptied, a crust or shell of solidified material remains adhering to the interior wall thereof, which must subsequently be jarred loose and removed. These crusts or shells, which are known in the arts as "skulls," and which are of a considerable size and thickness corresponding to the size of the ladles used and the time the molten material remains therein, are returned to a furnace for resmelting, before which, however, they must be broken up into pieces of a suitable size for introduction into the furnace. This work is ordinarily done by hand, as by men with sledge hammers, and as, in many converter plants, some one or two hundred tons of these skulls are produced in a day, this manual labor imposes a very considerable item of expense, in some converter plants as many as 100 men being employed for this purpose alone. Similar skulls are, of course, formed in other processes in which molten material is handled in ladles, which skulls must be subsequently broken up in order to be conveniently handled and disposed of.

The present invention has for its primary object to provide an apparatus by which

these skulls may be conveniently handled, rapidly broken up into fragments of suitable size, and delivered into cars, bins or elsewhere as may be desired, without the expenditure of any considerable amount of manual labor. As will be seen, however, the apparatus hereinafter described will be equally useful for other and analogous purposes, and many features thereof may be used with equal advantage in other apparatus of a similar character.

A convenient form of apparatus for carrying the invention into effect is illustrated in the accompanying drawings and will now be described in detail. It will be understood, however, that the particular construction shown and described has been chosen for illustrative purposes merely, and that the invention may be embodied in other forms within the scope of the appended claims without departing from the spirit thereof.

In said drawings: Figure 1 is a side elevation, partly in transverse vertical section, of an apparatus constructed and arranged in accordance with the invention. Fig. 2 is a plan view thereof. Fig. 3 is an enlarged plan view, and Fig. 4 a corresponding side elevation, of one of the grating bars. Fig. 5 is an enlarged side elevation of the traveling crane and hammer mechanism. Fig. 6 is an enlarged plan view of the crane carriage and trolley, showing the hammer, guide, and associated parts in horizontal section. Fig. 7 is an enlarged vertical section of the grating and associated parts. Fig. 8 is a view similar to Fig. 1 illustrating a modified form of hammer mechanism. Fig. 9 is an enlarged elevation, partly broken away, of the hammer mechanism shown in Fig. 8.

The ladles 12 (Fig. 1), after being emptied of their molten contents, are conveyed to the breaking apparatus from the converter by suitable means, preferably the usual converter plant crane comprising a wheeled trolley 13 running on an overhead track 14. The ladles are suspended from the trolley 13 and are raised and lowered therefrom, by means of a main hoist, designated as a whole by 15, and are tilted to discharge their contents by means of an auxiliary hoist, designated as a whole by 16, as will be familiar to those skilled in the art.

19 denotes an abutment, shown as a heavy concrete column, preferably protected at its

top by metal sheathing, against which the ladles may, if necessary, be swung, when lowered by the main hoist 15 and tilted by the auxiliary hoist 16, in order to dislodge the skulls therefrom. The track 14 may, as is usual in such apparatus, constitute the upper cord of a carriage or traveling bridge, the lower cord of which is designated by 28, said bridge having wheels 20 arranged to run on tracks 21 supported by columns 22.

The skulls (one of which is represented at 23 in Fig. 1) after leaving the ladles are received in the upper end of a chute or inclined bin 24 terminating at its lower end in a breaking pocket 25. The chute 24 may be supported by any suitable means. As herein shown said chute rests upon a framework 26 composed of stringers and transverse beams, said framework being supported at its upper end by the column 19 (the upper end of which projects into the upper end of said chute or bin), at its lower end by the columns 22, and at intermediate points, if necessary, by columns 27.

280 denotes a platform surrounding the upper end of the column 19 for the convenience of the operator in manipulating the ladles 12, and 29 stairways leading downward along either side of the chute 24 from the platform 280 to the hammer mechanism hereinafter described.

The breaking pocket 25 is in the form of a hopper having downwardly converging front and rear walls 30 and 31 (see Fig. 7) supported respectively by the front and rear walls 32 and 33 of the receiving pit 34, said walls 32 and 33 being preferably composed of concrete. The floor or bottom of the breaking pocket 25 comprises a grating, designated as a whole in Figs. 1 and 2 by the numeral 38, and consisting of a series of transversely arranged bars whose form is most clearly shown in Figs. 3, 4 and 7. Each of said bars is composed of a web, the upper part 39 of which has laterally extending lugs 40. The ends of the lugs 40 of adjacent bars register with and engage one another to form rectangular openings 42 as shown most clearly in Fig. 2. The lower edges of the webs are inclined and formed with downwardly converging flanges 43 which rest upon and are supported by abutment blocks 44 embedded in the receiving pit walls and secured in place therein by anchor bolts 45. The flanges 43 of adjacent grating bars engage one another and collectively constitute a hopper adapted to receive material passing through the grating and discharge the same into the receiving pit. Preferably, and as shown in Fig. 7, the ends of the grating bars are formed with bifurcated lugs 17 (Fig. 3) which receive washers 88 on the heads of hold down bolts 18. Said bolts pass downwardly through openings in the abutment blocks 44 and are provided at

their lower ends with nuts 35 and washers 36 between which and brackets 37, embedded in the receiving pit walls, are interposed compressed springs 87. By this construction the grating bars are enabled to tilt or cant a little, if necessary, when the blow is struck by the mechanism hereinafter described.

The skulls 23 are discharged from the chute 24 into the breaking pocket 25 and upon the grating 38 are broken up upon said grating by hammer mechanism which will now be described. Said hammer mechanism is carried by a traveling crane comprising a carriage or bridge 46, provided with wheels 47 arranged to run on longitudinally extending tracks 48, and a trolley 49 having wheels 50 arranged to run on transverse tracks 51 on the bridge 46. The tracks 48 are supported respectively by columns 52 and by brackets 53 projecting from the column 22. The hammer mechanism proper comprises a weight or hammer 54 mounted to reciprocate in a guide 55 carried by a frame 56 mounted on the trolley 49. In order to move the bridge 46 upon the tracks 48 and the trolley 49 upon the bridge for the purpose of bringing the hammer over any desired portion of the grating 38, the following mechanism is provided. The wheels 47 of one pair are provided with gears 57 (see particularly Figs. 5 and 6) which mesh with pinions 58 on a shaft 59 journaled in the bridge 46.

60 denotes a sprocket wheel arranged between arms 61 projecting from the trolley 49 and splined upon the shaft 59, so as to turn with said shaft and to move longitudinally thereon with the trolley 49. The sprocket 60 is connected by a chain 62 with a sprocket 63 on a shaft 64 journaled in the frame 56 and provided with a hand wheel 65. By turning the hand wheel 65 the shaft 59 and wheels 47 may be rotated, thereby moving the bridge 46 longitudinally upon the tracks 48. The axle 66 of one pair of wheels 50 has fixed thereon a sprocket wheel 67 connected by a chain 68 with a corresponding sprocket wheel on a shaft 69 journaled in the frame 56 and provided with a hand wheel 70. By turning the hand wheel 70 the wheels 50 may be rotated and the trolley 49 moved transversely on the bridge 46.

While the mechanism above described for moving the hammer mechanism over any desired portion of the grating is considered preferable, it will be obvious that, with respect to certain features of the invention, a stationary hammer mechanism might be employed.

For operating the weight or hammer 54 the following mechanism is provided. 71 denotes an electric or other motor mounted on the trolley 49 and connected by suitable gearing within a casing 72 with a winding

drum 73 upon which is wound a rope or cable 74 which passes over a sheave 75 at the top of the frame 56 and is connected at its end to the hammer 54. Suitable clutch mechanism is interposed between the drum 73 and the drum gear or motor 71 by means of which the weight 54 may be alternately raised and permitted to drop after the fashion of an ordinary pile driver, as will be familiar to those skilled in the art without further description.

The weight or hammer proper 54 preferably comprises a structural steel H section with angle bars riveted to the corners thereof to provide a suitable wearing surface and having at its lower end a suitable head 76. Additional weights may, if desired or found necessary, be secured to the hammer 54 at suitable points, preferably immediately above the head 76. The guide 55 is rectangular in cross section, being preferably composed of channels 90 having secured to their edges angle bars 91 and connected by latticed straps 92, as shown in Figs. 6 and 9, and is loosely hung at its upper end in the frame 56.

77 denotes rods arranged at right angles to one another and secured to the guide 55. The rods 77 pass through casings 78 pivoted to the side and end frame members respectively of the trolley 49. Within the casings 78 are springs 79 which engage at their opposite ends collars 80 mounted on the rods 77 and having pin and slot or other lost motion connections therewith. The arrangement of these members is such that the springs 79 act normally to center the guide 55 or hold the same in the position shown in Fig. 6, but will yield to permit said guide to swing laterally in any direction should the weight 54 strike a glancing blow upon a skull on the grating 38, thereby preventing breakage or disarrangement of the mechanism.

81 denotes a second winding drum on the trolley 49 and provided with a rope or cable 82 which passes through a snatch block 83 (see Fig. 1) mounted on the front wall 32 of the receiving pit and provided at its end with a hook 84. Preferably a series of snatch blocks 83 will be provided along the top of the front wall 32, the rope or cable 82 being engaged with any of these as may be convenient. The purpose of the winding drum 81 and the parts operated thereby is to assist in drawing the skulls down the chute 24 and into proper position upon the grating 38 should they not fall into proper position by gravity.

85 denotes a conveyer belt located in the receiving pit 34 and arranged to deliver material passing through the grating 38 into said pit to a bin or car (not shown) or to any other suitable point.

86 (see Fig. 7) denotes guide plates pro-

jecting from the abutment blocks 44 for the purpose of guiding the broken material into proper position on the conveyer 85.

The operation of the apparatus is as follows. A ladle 12 having been brought from the converter or other apparatus by means of the trolley 13 and bridge 14, the crane operator by means of the auxiliary hoist 16 will invert said ladle and swing the same sharply against the top of the column 19 if necessary, thereby dislodging the skull therefrom and causing the same to fall into the bin or chute 24. The skull may slide or roll down said chute or bin into the breaking pocket 25 and upon the grating 38, but should it fail to do so it may be drawn into proper position by means of the hook 84, rope 82, and winding drum 81, said hook being adjusted by the operator on the platform 280 or stairway 29. The hand wheels 65 and 70 are thereupon operated to bring the weight or hammer 54 directly above the skull, and the winding drum 73 operated to cause said weight to be lifted and dropped upon the skull. The operation is repeated as many times as may be necessary until the skull has been broken up into pieces small enough to pass through the openings 42 in the grating 38, the hand wheels 65 and 70 being manipulated from time to time as may be necessary in order to cause the weight to break up all parts of the material. The broken fragments passing through the grating 38 fall upon the conveyer 85 and are transported thereby to the desired point of delivery. It will be understood of course that where the apparatus is suitably located, as upon a hillside, the conveyer 85 may be omitted and the material discharged from the receiving pit 34 by gravity into a suitable chute or bin as may be desired.

Instead of the weight 54 a steam or pneumatic hammer may be employed, a suitable arrangement being shown in Figs. 8 and 9. In said figures 93 denotes, as a whole, a steam or pneumatic hammer mechanism of any well known form comprising a head 94 connected with a piston 95 operating in a cylinder 96 connected by a hose 97 with a suitable source of steam or compressed air. The hammer mechanism 93 is carried by the lower end of a slide 98 mounted for vertical movement in the guide 55 and supported by the rope or cable 74 which is attached to a bracket 99 secured to said slide. The hammer mechanism 93 may be raised and lowered by means of the drum 73 so as to engage the skull and follow the fragments thereof downwardly upon the grating as said skull is crushed.

For convenience I have herein employed the word "grating" to designate the foraminous bottom 38 of the breaking pocket 25, and have shown and described this part as composed of a series of parallel bars. It

will be obvious however that other constructions may be employed, as, for example, a single integral casting. Except therefore when otherwise limited, this term is to be taken to mean any suitable support upon which the material may be broken and having one or more openings of any suitable shape or size through which the fragments of broken material may pass.

10 Having thus described my invention, I claim:

1. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, and means for supporting said hammer mechanism adapted to move said hammer over any portion of said grating.

2. An apparatus of the character described comprising, in combination, a grating, a chute for delivering material to be broken to said grating, and hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating.

3. An apparatus of the character described comprising, in combination, an inclined chute terminating at its lower end in a breaking pocket, a grating forming the bottom of said pocket, and hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating.

4. An apparatus of the character described comprising, in combination, a grating, a chute for delivering material to be broken to said grating, means for drawing said material down said chute and upon said grating, and hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating.

5. An apparatus of the character described comprising, in combination, an inclined chute terminating at its lower end in a breaking pocket, a grating forming the bottom of said pocket, means for drawing material down said chute and upon said grating, and hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating.

6. An apparatus of the character described comprising, in combination, a grating,

ing, a chute for delivering material to be broken to said grating, a winding drum, a rope wound on said drum and extending into said chute, a hook on said rope for engaging material in said chute and drawing the same upon said grating and hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating.

7. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, and a traveling crane by which said hammer mechanism is supported.

8. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, a traveling crane by which said hammer mechanism is supported, a chute for delivering material to be broken to said grating, and means for drawing said material down said chute and upon said grating.

9. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge mounted to run on said tracks, and a trolley by which said hammer mechanism is supported mounted on said bridge and movable thereon transversely of said grating.

10. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge mounted to run on said tracks, a trolley by which said hammer mechanism is supported mounted on said bridge and movable thereon transversely of said grating, and means for moving said bridge on said tracks.

11. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the

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fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge mounted to run on said tracks, a trolley by which said hammer mechanism is supported mounted on said bridge and movable thereon transversely of said grating, and means on said trolley for moving said bridge on said tracks.

12. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge having wheels running on said tracks, a trolley by which said hammer mechanism is supported mounted on said bridge and movable thereon transversely of said grating, a shaft journaled on said bridge and geared to said wheels, a sprocket wheel splined to said shaft and movable longitudinally thereon with said trolley, an operating shaft upon said trolley, a sprocket wheel on said operating shaft, and a chain connecting said sprocket wheels.

13. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge mounted to run on said tracks, a trolley by which said hammer mechanism is supported mounted on said bridge and movable thereon transversely of said grating, and means for moving said trolley on said bridge.

14. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge mounted to run on said tracks, a trolley by which said hammer mechanism is supported mounted on said bridge and movable thereon transversely of said grating, means for moving said bridge on said tracks, and means for moving said trolley on said bridge.

15. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, tracks extending longitudinally of said grating, a bridge mounted to run on

said tracks, tracks on said bridge extending transversely of said grating, a trolley by which said hammer mechanism is supported and having wheels running on said last named tracks, an axle to which said wheels are secured, an operating shaft journaled in said trolley, and operative connections intermediate said shaft and axle.

16. An apparatus of the character described comprising, in combination, breaking mechanism, a chute communicating at its lower end with said breaking mechanism, means for conveying a ladle to the upper end of said chute, and means whereby a skull may be dislodged from said ladle and delivered into said chute.

17. An apparatus of the character described comprising, in combination, a grating, a chute communicating at its lower end with said grating, means for conveying a ladle to the upper end of said chute, means whereby a skull may be dislodged from said ladle and delivered into said chute, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, and means for supporting said hammer mechanism adapted to move said hammer over any portion of said grating.

18. An apparatus of the character described comprising, in combination, breaking mechanism, a chute communicating at its lower end with said breaking mechanism, a trolley movable toward and from the upper end of said chute and having means for supporting a ladle, and means whereby a skull may be dislodged from said ladle and delivered into said chute.

19. An apparatus of the character described comprising, in combination, breaking means, a chute communicating at the lower end with said breaking means, a trolley movable toward and from the upper end of said chute and having means for supporting a ladle, a movable bridge provided with a track upon which said trolley runs, and means whereby a skull may be dislodged from said ladle and delivered into said chute.

20. An apparatus of the character described comprising, in combination, breaking mechanism, a chute communicating at its lower end with said breaking mechanism, means for conveying a ladle to the upper end of said chute, and an abutment at the upper end of said chute against which said ladle may be swung to dislodge a skull therefrom and deliver the same into said chute.

21. An apparatus of the character described comprising, in combination, breaking mechanism, a chute communicating at its lower end with said breaking mechanism, means for conveying a ladle to the upper end of said chute, and a column for sup-

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porting said chute and extending into the upper end thereof to form an abutment against which said ladle may be swung to dislodge a skull therefrom and deliver the same into said chute.

22. An apparatus of the character described comprising, in combination, a receiving pit, a grating above said pit, a conveyer in said pit, a hammer above said grating, and means for operating said hammer whereby material on said grating will be struck and broken by said hammer and the fragments thereof will pass through said grating to said conveyer.

23. An apparatus of the character described comprising, in combination, a receiving pit, a conveyer in said pit, a grating above said pit, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, and means for supporting said hammer mechanism adapted to move said hammer over any portion of said grating.

24. An apparatus of the character described, comprising, in combination, a receiving pit, a conveyer in said pit, a grating above said pit, a chute communicating at its lower end with said grating, means for conveying a ladle to the upper end of said chute, means whereby a skull may be dislodged from said ladle and delivered into said chute, a hammer above said grating, and means for operating said hammer whereby a skull on said grating will be struck and broken by said hammer and the fragments thereof will pass through said grating to said conveyer.

25. An apparatus of the character described comprising, in combination, a receiving pit, a conveyer in said pit, a grating above said pit, a chute communicating at its lower end with said grating, means for conveying a ladle to the upper end of said chute, means whereby a skull may be dislodged from said ladle and delivered into said chute, hammer mechanism above said grating including a hammer and means for operating said hammer whereby a skull on said grating will be struck and broken by said hammer and the fragments thereof will pass through said grating to said conveyer, and means for supporting said hammer mechanism adapted to move said hammer over any portion of said grating.

26. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, a laterally yielding guide for said hammer, and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating.

27. An apparatus of the character de-

scribed comprising, in combination, a grating, a hammer above said grating, a laterally yielding guide for said hammer, means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, and means for supporting said guide adapted to move the same to bring said hammer over any portion of said grating.

28. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, a guide for said hammer, a pair of laterally yielding positioning devices for said guide arranged at right angles to each other, and means for operating said hammer.

29. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, a guide for said hammer, means for operating said hammer, and a pair of laterally yielding positioning devices for said guide arranged at right angles to each other and each comprising a rod secured to said guide, a pivoted casing through which said rod extends, a spring in said casing, and means connecting said spring and rod for yieldingly resisting longitudinal movement of said rod in either direction.

30. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, said grating comprising a series of transversely arranged bars having laterally projecting lugs and the lugs on adjacent bars registering with and engaging one another.

31. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, said grating comprising a series of transversely arranged bars and each of said bars comprising an upright web having at its upper edge laterally projecting lugs registering with and engaging the lugs on the next adjacent bar.

32. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, said grating comprising a series of transversely arranged bars, each of said bars comprising an upright web having at its upper edge laterally projecting lugs registering with and engaging the lugs on the next adjacent bar, each of said webs

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being provided at its lower side with inclined downwardly converging flanges, and the flanges of adjacent bars being in engagement with one another to form a hopper for receiving the material passing through said grating.

33. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, and yielding means for holding said grating in position.

34. An apparatus of the character described comprising, in combination, a grating, hammer mechanism above said grating including a hammer and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating, means for supporting said hammer mechanism adapted to move said hammer over any portion of said grating, and yielding means for holding said grating in position.

35. An apparatus of the character described comprising, in combination, a grating, a hammer above said grating, a laterally yielding guide for said hammer, means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass

through said grating, and yielding means for holding said grating in position. 35

36. An apparatus of the character described comprising, in combination, a receiving pit having upright walls, a grating above said pit composed of parallel bars having at their ends bifurcated lugs, means on said walls for supporting said bars, bolts provided with means for engaging said lugs, springs on said bolts, brackets on said walls engaged by said springs, a hammer above said grating, and means for operating said hammer whereby material on said grating will be struck and broken and the fragments thereof will pass through said grating. 40 45

37. An apparatus of the character described comprising, in combination, a breaking floor, hammer mechanism above said floor including a hammer, a guide for said hammer, and means for operating said hammer whereby material on said floor will be struck and broken, and means for supporting said hammer mechanism adapted to move said hammer and guide over any portion of said floor. 50 55

In testimony whereof I affix my signature, 60
in presence of two witnesses.

ALEXANDER G. MCGREGOR.

Witnesses:

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A. J. HILL.