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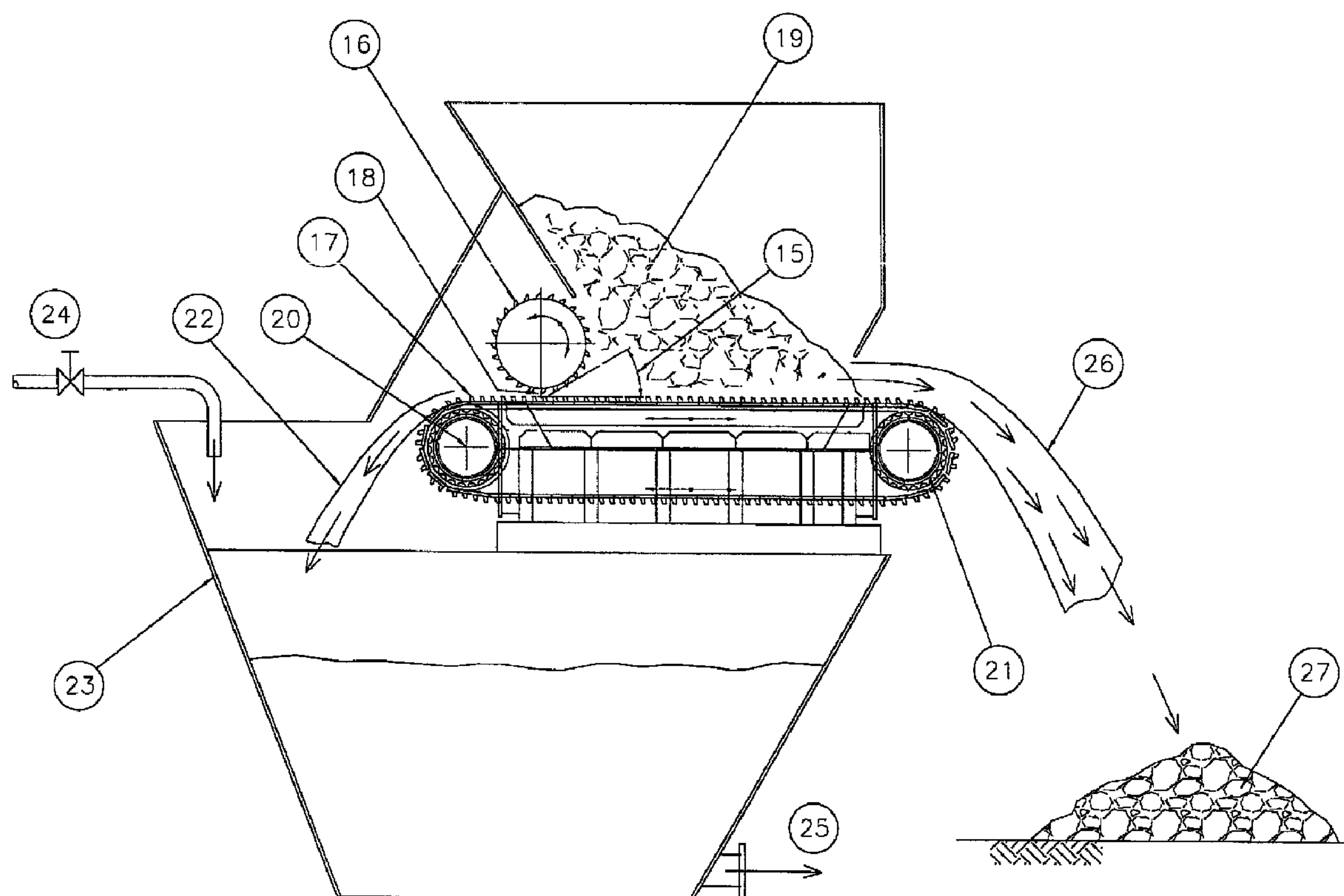
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(54) Titre : **CONCASSEUR A TRI AUTOMATIQUE**

(54) Title: **SELF CLEARING CRUSHER**



(57) **Abrégé/Abstract:**

An improved crusher assembly comprising a housing with a receiving hopper; a single horizontal crushing roll being positioned laterally above a cooperating flat and substantially horizontal crushing surface; a gap set between the crushing roll and the crushing surface defining a crushing zone; the crushing roll being provided with support means and rotation means; the crushing surface being constructed as an endless chain of connected plates having joint means and connecting means between adjacent ones of the plates and being guided to wrap around a head pulley and a tail pulley defining longitudinally opposing ends of the endless



(57) **Abrégé(suite)/Abstract(continued):**

chain; the upper reach of the endless chain being arranged as a live bin bottom for the receiving hopper and having support means and motivating means so as to convey ore placed thereon into contact with the crushing roll; the combined effect of rotating the crushing roll and motivating the crushing surface being to draw the ore substantially horizontally into the crushing zone and to discharge crushed ore to a subsequent process at one end of the endless chain; the rotation of the roll and the motivation of the crushing surface being selectively reversible so as to reject any uncrushable objects at the longitudinally opposing end of the endless chain.

Abstract

An improved crusher assembly comprising a housing with a receiving hopper; a single horizontal crushing roll being positioned laterally above a cooperating flat and substantially horizontal crushing surface; a gap set between the crushing roll and the crushing surface defining a crushing zone; the crushing roll being provided with support means and rotation means; the crushing surface being constructed as an endless chain of connected plates having joint means and connecting means between adjacent ones of the plates and being guided to wrap around a head pulley and a tail pulley defining longitudinally opposing ends of the endless chain; the upper reach of the endless chain being arranged as a live bin bottom for the receiving hopper and having support means and motivating means so as to convey ore placed thereon into contact with the crushing roll; the combined effect of rotating the crushing roll and motivating the crushing surface being to draw the ore substantially horizontally into the crushing zone and to discharge crushed ore to a subsequent process at one end of the endless chain; the rotation of the roll and the motivation of the crushing surface being selectively reversible so as to reject any uncrushable objects at the longitudinally opposing end of the endless chain.

Self Clearing Crusher

1 INTRODUCTION AND PRIOR ART

2

3 Oil-sand mining and processing equipment technology is unique to the deposits
4 found in Northern Alberta, Canada, in terms of the evolution of process equipment
5 suitable for mining and processing the oil-sand ore. In the oil-sand mine, equipment
6 used to excavate and transport the run-of-mine (ROM) oil-sand ore is as large in scale
7 as at any world-wide mining operations, typically using electric-hydraulic shovels of up to
8 62 cubic metre capacity buckets loading into haulage trucks of up to 400 tons capacity to
9 transport the ROM oil-sand ore to a centralized oil-sand slurry preparation facility.

10 Due to the massive scale of the mining equipment and the characteristics of the
11 oil-sand itself, the ore mined typically contains a very large range of lump sizes spanning
12 from 3,500 mm weighing up to 30 tonnes, down to clay particles of a less than one
13 millimeter diameter. The ROM oil-sand ore typically contains up to 15% free water, 6%
14 to 18% bitumen and 75% to 85% solids of which 95% is sand content by weight and also
15 contains amounts of siltstone rock having an unconfined compressive strength of 165 to
16 221 MPa as a waste component.

17 The harsh environmental conditions at oil-sand operations encompass an
18 ambient temperature range from +35 degrees Celsius down to -51 degrees Celsius.
19 Materials handling properties of the ROM ore are highly variable over this temperature
20 range. The oil-sand ore comprises frozen, highly abrasive lumps in winter but exhibits
21 sticky, cohesive behaviour in summer, largely due to the influence of the contained
22 moisture and bitumen components.

23 A slurry preparation process step is typically required to prepare all ROM ore to
24 be suitable for long-distance transport in the form of a water slurry to be pumped to a
25 remote upgrading facility, at single-stream production rates which may exceed 10,000
26 tonnes per hour of ROM oil-sand ore. Typical prerequisites for efficient slurry pumping
27 are crushing the oil-sand ore to minus 100 mm followed by the preparation of a
28 homogeneous water slurry, typically with a consistency of about 64% solids by weight at
29 a slurry specific gravity of 1.5.

30 All mining and slurry preparation equipment is required to function with
31 unhindered effectiveness and productivity under these extreme ambient conditions.

32 Current practice for oil-sand slurry preparation in the industry requires the use of
33 multiple series-wise equipment processing steps to accomplish controlled ore feeding,
34 screening and crushing prior to slurry pipelining. Designers and equipment vendors are
35 challenged to create a processing facility containing multiple items of equipment,

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1 typically having intermediary gravity feed and conveying transfer stages. The oil-sand
2 slurry preparation equipment, for example, is typically housed within large, structural
3 steel modules located within the active oil-sand mining area. These modules must be
4 constructed suitably for re-location on a typical frequency of 1 to 3 years per operating
5 location.

6 Disadvantages of the prior art for oil-sand slurry preparation arise largely from
7 adapting conventional process equipment and conventional process flowsheet logic to
8 the Canadian oil-sand context. Disadvantages include the primary constraint of using
9 conventional dual-roll crushing equipment which cannot process uncrushable objects
10 such as, for example, tramp pieces of steel which often report to the crusher along with
11 the oil-sand ore.

12 It is common in the art for such dual roll crushers to be constructed with one fixed
13 and one movable roll, adjusted to have a gap there-between and rotating so as to
14 continuously draw the oil-sand ore material to be crushed between the rolls. In such a
15 case it is common design practice for the movable roll of the crusher to "release" against
16 the resistance of an uncrushable object, causing the normally fixed gap between the
17 dual rolls to momentarily open up so as to pass the object. Heavy springs or hydraulic
18 actuators or other means may be employed to enable such momentary release to occur,
19 even though the rotation of the rolls may actually continue. Clearly, oversize oil-sand
20 ore material will also be momentarily allowed to pass through the crusher along with the
21 uncrushable object and this is highly undesirable for the successful operation of the
22 downstream processes, particularly the oil-sand slurry preparation and pumping steps.

23 Alternately, the uncrushable object may be too large to pass through even the
24 momentarily enlarged gap, either stalling the crusher, or at least blocking a portion of the
25 oil-sand ore flow path and potentially causing damage to the crusher teeth. In this case
26 the ore crushing operation must undergo a potentially lengthy shut down to enable
27 clearing of the crusher feed hopper and roll gap and repairing of any damage that has
28 occurred. In this event, preparation and hydro-transport of the oil-sand slurry to the
29 remote processing facility must be terminated until the blockage is removed and the
30 crushing operation is resumed.

31 A serious corollary issue in the prior art is that the urgency of resuming
32 production quickly in combination with the difficulty of clearing a plugged crusher hopper
33 and roll gap creates a worker-safety hazard that contribute to high accident incidence
34 rates in the workplace.

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Known art in roll crusher design comprises an assembly including a housing arranged with dual, horizontally mounted crusher rolls operating cooperatively with a set gap relationship there-between, the oil-sand ore being gravity fed in a substantially vertical material flow path into contact with the counter-rotating crusher rolls, suitably large teeth on the rolls drawing the ore into the crushing zone with free-fall gravity discharge from the rolls. Any uncrushable object entering the crushing zone along with the oil-sand ore is either trapped above the rolls if it is too large or will pass through the roll gap under the releasing action of the movable crusher roll. In the latter case, both the uncrushable object and some amount of uncrushed oil-sand ore will pass to the subsequent processing step with potentially damaging results.

IMPROVED ROLL CRUSHER

An improved roll crusher design enabling a "self-clearing" capability is the subject of this invention. The preferred embodiment of such a crusher will comprise an assembly including a housing arranged with a single, horizontal crusher roll superpositioned above an opposed, cooperating horizontal flat crushing surface and having a gap set there-between defining the crushing zone. The flat surface forms an initial collection area to receive the oil-sand ore to be crushed and is also motivated to convey the oil-sand ore horizontally towards the rotating crushing roll. Both the flat surface and the roll may be equipped with suitably large teeth so as to grip lumps of the ore and to draw lumps of the ore thereby into the crushing zone to be crushed. For practical purposes the movable flat crushing surface can be configured into an endless conveying surface having a head pulley and a tail pulley defining both the horizontal limits of the upper flat surface and the conveyor's return path. The flat crushing surface forming the conveying surface can be configured from individual, rigid metal plate elements arranged to be connected to each subsequent adjacent metal plate element in the form of an endless chain by using pivot or hinge pin joints connecting the adjacent plates.

In this improved crusher design the oil sand ore is fed horizontally into the crushing gap by the motivating action of the flat crushing surface, until the crushing teeth themselves, both on the roll and on the flat crushing plate, grip lumps of the ore and force them into the crushing zone. Crushed ore passing through the crushing zone can then be conveyed and discharged off the crushing surface adjacent to the head pulley of the crushing conveyor into a subsequent processing step, for example a slurry preparation step, for the crushed oil-sand ore. In the case of an uncrushable object

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entering the gap, the upper crushing roll will preferably not release, that is, the gap will not increase as it does in a conventional dual roll crusher design. Rather, the motivating means of both the flat crushing surface and the rotating crusher roll will be reversed, causing the uncrushable object to be released from the crushing zone and to be conveyed away from the crushing zone and discharged to an adjacent reject pile off the tail end of the conveyor. Following this simple self-clearing step, the crusher can revert to normal operation having suffered only a few moments of lost production time. In this case both the uncrushable object and some amount of the uncrushed oil-sand ore will be wasted to the rejects pile adjacent to the tail pulley, but will have been prevented from damaging or interfering with any aspect of the subsequent processing step.

All of the operations of this improved self-cleaning crusher would also be amenable to automation using, for example, high motor torque on the crushing roll drive motor or the crushing conveyor drive motor to initiate a timed, self-cleaning cycle.

WITH REFERENCE TO THE FIGURES

Figure 1 is a simplified isometric view of a prior-art, dual-roll crusher assembly;

Figure 2 is a simplified elevation view of a prior-art dual-roll crusher assembly of Figure 1 showing more clearly the relationship of the crusher rolls and a simulated lump to be crushed.

Figure 3 is a simplified elevation view of a prior-art dual-roll crusher assembly of Figure 2 showing an enlarged gap between the crusher rolls.

Figure 4 is a simplified view of an improved single-roll hybrid crusher assembly embodying features enabling the crusher to be self-clearing when uncrushable objects enter the crushing zone along with oil-sand ore.

Figure 5 is a simplified view of a an improved single-jaw hybrid crusher assembly embodying features enabling the crusher to be self-clearing when uncrushable objects enter the crushing zone along with oil-sand ore.

In Figure 1, a prior art dual-roll crusher assembly is shown mounted on a structural base 1 comprising a fixed roll 2 and a movable roll 3, with projecting shaft 4 on the fixed roll for mounting a drive means (not shown) and projecting shaft 5 on the movable roll for mounting a drive means (not shown), both rolls being held by the structural base 1 in a substantially parallel relationship with each other and in a substantially horizontal plane and having a nominal gap 6 maintained between them. Fixed crusher roll 2 is arranged with bearing means 7 in bearing holder means 8 at each

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1 end thereof and movable roll 3 is arranged with bearing means 9 (not shown) in bearing
2 holder means 10 at each end thereof. Bearing holder means 10 is arranged with slide
3 means 11 at its base and coupling means 12 enabling attachment of actuator means 13
4 which can be motivated to slide the movable pulley assembly to the left or to the right,
5 effectively increasing or decreasing the nominal gap 6 between the rolls. A spherical
6 shape 14 is illustrated above the gap between the crusher rolls 2 and 3 to simulate a
7 lump of ore which initially encounters the rolls under the influence of gravity, and can
8 then be drawn further into the crushing zone by the gripping influence of the teeth on the
9 rolls, thereby being forced to pass through the gap, which is the crushing zone. The
10 shape 14 is typically irregular in shape and can be significantly larger in diameter than
11 the nominal gap width between the crusher rolls.

12 In Figure 2 the prior-art dual-roll crusher assembly mounted on base 1 having
13 fixed roll 2 and movable roll 3 is shown with a simulated ore lump 14 entering the
14 crushing zone between the two rolls. The nip angle 15 is shown to be a geometrical
15 relationship between the lump size, the roll diameter and the gap width between the rolls.
16 In the illustration, the teeth on the surface of the rolls are shown as intermeshing in the
17 gap.

18 In the prior-art dual-roll crusher of Figure 3 the effect of increasing the gap by
19 movement of movable roll 3 to the left is to allow lump 14 to drop further into the
20 crushing zone under the influence of gravity, thus enabling the teeth on the rolls to more
21 easily "grip" the lump and force it into the crushing zone. This momentary releasing of
22 the movable roll is typically allowed to occur when an uncrushable object, such as steel,
23 enters the crushing zone of the crusher along with normal ore. Clearly, during the time
24 that the crushing gap is thus enlarged, large lumps of oil-sand ore as well as the
25 uncrushable object would be able to pass through the gap into the subsequent process
26 stream. If the uncrushable object is too large, it may actually cause the crusher rolls to
27 jam and stall or at best, the object would remain above the rolls causing partial blockage
28 of the crusher and potentially damaging the crusher teeth.

29 The improved single-roll hybrid crusher of Figure 4 comprises an assembly
30 including a housing with a receiving hopper arranged with a single, horizontal crusher
31 roll 16 positioned laterally above an opposed, cooperating horizontal flat crushing
32 surface 17 and having a gap 18 set there-between defining a crushing zone. The details
33 of the supports and drive for the crusher roll or the flat crushing surface are not shown in
34 the figure. The flat crushing surface first forms an initial oil sands ore collection zone 19
35 to receive the ore and is also motivated to convey the ore horizontally towards the

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1 rotating crushing roll 16. Both the flat crushing surface 17 and the crushing roll 16 may
2 be equipped with suitable teeth so as to grip lumps of the ore and to draw them thereby
3 into the gap 18 to be crushed. Due to the geometric relationship of using a round
4 crushing roll 16 in conjunction with the flat crushing surface 17, the total effective nip
5 angle 15 of Figure 4 will be half that of the prior art dual-roll crusher of Figure 2, thus
6 facilitating the entry of large lumps into the crushing gap.

7 For practical purposes the movable flat crushing surface 17 can be configured
8 into an endless crushing and conveying surface having a head pulley 20 and a tail pulley
9 21 defining both the horizontal, opposing limits of the upper flat surface and the
10 conveyor's return path. The flat crushing surface 17 which also forms the conveying
11 surface can be configured from individual metal plate elements arranged to be
12 connected to each adjacent metal plate element in the form of an endless chain by using
13 pivot or hinge pin joints connecting the adjacent plates.

14 The detail of the plates, their connection together at adjacent pivoting joints, the
15 means of support of the flat crushing surface and the drive of the crushing conveyor are
16 not shown in the figure, although the design and construction of the crushing conveyor
17 may be recognized by those practiced in the art as similar to the design and construction
18 of a steel apron conveyor.

19 Crushed oil-sand ore having passed through gap 18 can be conveyed and
20 discharged off the conveying and crushing surface at the position of the head pulley 20
21 of the crushing conveyor into a subsequent processing step, for example a slurry
22 preparation step in vessel 23 in which it will be mixed with incoming water 24 prior to
23 being withdrawn at nozzle 25 for subsequent handling as a slurry. In the case of an
24 uncrushable object entering the crushing zone 18, the upper crushing roll 16 will
25 preferably not release, that is, the gap will not increase as it is designed to do in a prior-
26 art dual-roll crusher design. Rather, a self-clearing operation can be initiated in which
27 the motivating actions of both the rotating crusher roll 16 and the flat crushing surface 17
28 can be reversed, causing the uncrushable object to be released from the crushing gap
29 and to be conveyed away from crushing zone 18 and discharged as intermittent stream
30 26 to an adjacent rejects pile 27 off the flat conveying and crushing surface at the
31 position of the tail pulley 21 of the crushing conveyor. Following this self-clearing action,
32 normal crushing operation can resume.

33 The improved single-roll hybrid crusher assembly is so named because the
34 combination of a single crushing roll and a movable horizontal flat crushing surface was
35 previously unknown in the art.

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1 Although some amount of uncrushed oil-sand ore will have been wasted to the
2 rejects pile 27 along with the uncrushable object, damage to the crusher or interference
3 with any aspect of the subsequent crushed oil-sand processing steps will have been
4 prevented by the self-clearing operation of the improved crusher. Further benefits are
5 that little crushing production time will have been lost and the potentially unsafe work
6 practice of manually removing the uncrushable object from the crushing zone will have
7 been avoided.

8 If crusher roll 16 and flat crushing surface 17 are equipped with teeth, it will be
9 appreciated by one familiar with the art that the relative wear rates of the teeth may be
10 affected by the relative tip speeds of the teeth. It may become advantageous, therefore,
11 to optimize the relative relationship of tip speeds of the teeth between the horizontal
12 crusher roll and the horizontal flat crushing surface, including the alternatives of making
13 the tip speeds the same or making one faster than the other. Also, the shape of the
14 teeth and the method of supporting the teeth may be optimized for either direction of
15 rotation of the horizontal crusher roll or motivation of the horizontal flat crushing surface.

16 The single-jaw hybrid crusher assembly of Figure 5 shares many attributes with
17 the single-roll hybrid crusher of Figure 4. Referring to both figures the single crushing
18 roll 16 is replaced by a shaped heavy metal jaw 28 positioned above an opposed,
19 cooperating horizontal flat crushing surface 17 and having a gap 18 set there-between
20 defining a crushing zone. The details of the supports for the crusher roll or the flat
21 crushing surface are not shown in the figure, but the design and construction features of
22 the endless flat crushing and conveying surface having a head pulley 20 and a tail pulley
23 21 are the same, being motivated to convey the ore horizontally towards the heavy metal
24 jaw 28. In this case only the flat crushing surface 17 can be usefully equipped with
25 suitable teeth, so as to grip lumps of the ore with the teeth and to draw the lumps
26 thereby into gap 18 to be crushed. Due to the geometric relationship of using a shaped
27 jaw 28 in conjunction with the flat crushing surface 17, the total effective nip angle 15 of
28 Figure 5 can be suitably configured to facilitate the entry of large lumps into the crushing
29 zone, typically by arranging the crusher gap 18 as a decreasing taper, enabling lumps to
30 enter deeper into the crushing zone as they progressively break down into smaller sized
31 pieces. The role of the heavy metal jaw 28 in this hybrid crusher configuration is
32 substantially passive as a reaction surface for lumps of ore being driven by the force and
33 power of the crushing surface 17 which provides all of the conveying and crushing power.
34 Heavy metal jaw 28 is equipped with actuator 29 by which crushing gap 18 and nip
35 angle 15 may be adjusted.

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1 In the case of an uncrushable object entering the crushing zone 18 of Figure 5,
2 the heavy metal jaw 28 will preferably not release, that is, the gap will not increase as it
3 is designed to do in the prior-art dual-roll crusher design. Rather, a self-clearing
4 operation can be initiated in which the motivating action of the flat crushing surface 17
5 can be reversed, causing the uncrushable object to be released from the crushing gap
6 and to be conveyed away from crushing zone 18 and discharged as intermittent stream
7 26 to an adjacent rejects pile 27 off the flat conveying and crushing surface at the
8 position of the tail pulley 21. Following this self-clearing action, normal crushing
9 operation can resume.

10 The improved single-jaw hybrid crusher assembly is so named because the
11 combination of a single crushing jaw and a movable horizontal flat crushing surface was
12 previously unknown in the art.

13
14 Although the horizontal flat crushing surface corresponding to the endless chain
15 of connected horizontal plates is shown in Figures 4 and 5 to be horizontal in both the
16 lateral and the longitudinal directions so as to maintain a uniformly spaced gap with
17 respect to the laterally oriented horizontal crushing roll or heavy metal jaw, respectively,
18 the designer may find it advantageous to arrange the longitudinal reach of the conveying
19 and crushing surface to be either inclined or declined, as will be determined by the
20 relative height of the head pulley to the tail pulley.

21 Although the crushing zone is nominally restricted to the region of the gap 18
22 between crushing roll 16 or heavy metal jaw 28 and the crushing surface 17, the
23 longitudinal reach of the crushing surface extending towards tail pulley 21 also performs
24 a desirable pre-sizing function on the ore at the bottom of the receiving hopper, in that
25 ore lumps are pressed forcibly against the moving crushing surface by the vertical and
26 lateral extent and weight of the ore in the receiving hopper, even before entering the
27 defined crushing zone. It will be readily appreciated by one practiced in the art that no
28 such pre-sizing function is possible with prior art dual-roll crusher of Figures 1, 2 and 3.

29 It could also be anticipated by one practiced in the art to automate the self-
30 clearing operation of the improved crusher by causing the reversal of direction of rotation
31 of the crusher roll of Figure 4 and the direction of motivation of the crushing surface of
32 Figures 4 and 5 based upon measuring loads imposed on the crusher. This might be
33 accomplished by measuring either or both of the torque applied by the rotation means
34 for the crusher roll or the motivating force means of the horizontal flat crushing surface to
35 detect the presence of an uncrushable object having entered the crushing zone. Should

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1 such measured values exceed a predetermined value, it could be presumed that an
2 uncrushable object had entered the crushing zone and that it should be rejected to the
3 rejects pile by reversal of the direction of rotation of the crusher roll and the direction of
4 motivation of the horizontal flat crushing surface for a predetermined time duration.

5 It will also be apparent to one practiced in the art that this improved crusher
6 design need not be limited to oil-sands ore but may be equally appropriate for other
7 crushing applications involving ores of hard or soft rocks or for any applications where
8 there is some probability of receiving foreign material such as steel along with the
9 material to be crushed and in which the cost or difficulty of removing the uncrushable
10 material and repairing of consequent damage may be high or the activity itself may be
11 considered to be unsafe for direct human intervention.

Self Clearing Crusher**CLAIMS**

What I claim as my invention:

1. In an ore preparation facility where ore is to be processed by crushing, an improved crusher assembly comprising a housing with a receiving hopper for said ore; a single horizontal crushing roll being positioned laterally above a cooperating horizontal flat crushing surface; a gap set between said horizontal crushing roll and said horizontal flat crushing surface defining a crushing zone; said horizontal crushing roll being provided with support means and rotation means; said horizontal flat crushing surface being constructed as an endless chain of connected horizontal plates having joint means and connecting means between adjacent ones of said plates; said endless chain of connected horizontal plates being guided to wrap around a head pulley and a tail pulley defining horizontally opposing ends of said endless chain; the upper reach of said endless chain of connected horizontal plates corresponding to said horizontal flat crushing surface; said horizontal flat crushing surface having support means and motivating means; said horizontal flat crushing surface also being arranged as a live bin bottom for said receiving hopper on said upper reach thereof to hold and convey said ore placed on said upper reach thereof;
- the operation of said improved crusher assembly being to convey said ore in said receiving hopper by motivating said horizontal flat crushing surface so as to move said ore into contact with said rotating single horizontal crushing roll; the combined effect of said rotation of said crushing roll and said motivation of said horizontal flat crushing surface being to force said ore into said crushing zone so as to crush said ore and also to convey said ore after crushing so as to be discharged at said head pulley position of said endless chain by means of gravity.
2. An improved crusher assembly as in Claim 1 in which said ore can alternatively be discharged off said endless chain of connected horizontal plates by motivating said endless chain in a reversed direction so as to convey said ore to be discharged at said horizontally opposing end from said head pulley position of said endless chain by means of gravity.

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- 1 3. An improved crusher assembly as in Claim 1 in which either or both of said
2 crushing roll and said horizontal flat crushing surface are equipped with teeth.
3
- 4 4. An improved crusher assembly as in Claim 3 in which the tip speed of said teeth
5 on said single horizontal rotating roll and the tip speed of said teeth on said
6 horizontal flat crushing surface are equal.
7
- 8 5. An improved crusher assembly as in Claim 3 in which said teeth may be
9 designed to assist said crushing of said ore for either direction of said rotation of
10 said horizontal crusher roll or either direction of said motivation of said horizontal
11 flat crushing surface.
12
- 13 6. An improved crusher assembly as in Claim 1 in which either or both of said
14 rotating means of said single rotating horizontal crusher roll and said motivating
15 means of said horizontal flat crushing surface is equipped with sensing means for
16 measurement of rotational torque or motivating force, respectively.
17
- 18 7. An improved crusher assembly as in Claim 6 in which either or both of said
19 rotation of said horizontal crusher roll and said motivation of said horizontal flat
20 crushing surface is controlled to reverse directions at a predetermined set-point
21 of said rotational torque or said motivating force, respectively.
22
- 23 8. An improved crusher assembly as in Claim 1 in which said endless chain of
24 connected horizontal plates is a steel apron conveyor.
25
- 26 9. An improved crusher assembly as in Claim 1 for preparing ore to become
27 suitable for subsequent slurry transportation.
28
- 29 10. An improved crusher assembly as in Claim 1 in which said endless chain of
30 connected horizontal plates may be inclined or declined in a longitudinal direction
31 with respect to said head and said tail pulleys while remaining horizontal in a
32 lateral direction.
33
- 34 11. An improved crusher assembly as in Claim 1 in which the longitudinal extent of
35 said horizontal flat crushing surface is determined so to optimize pre-sizing of

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1 said ore by said horizontal crushing surface in said receiving hopper prior to said
2 ore being conveyed into said crushing zone adjacent to said crushing roll.

3
4 12. An improved crusher assembly as in Claim 1 in which the vertical extent of said
5 receiving hopper is determined so as to optimize pre-sizing of said ore in said
6 receiving hopper by said horizontal crushing surface prior to said ore being
7 conveyed into said crushing zone adjacent to said crushing roll.

8
9 13. In an ore preparation facility where ore is to be processed by crushing, an
10 improved crusher assembly comprising a housing with a receiving hopper for
11 said ore; a single heavy metal jaw being positioned laterally above a cooperating
12 horizontal flat crushing surface; a gap set between said heavy metal jaw and said
13 horizontal flat crushing surface defining a crushing zone; said heavy metal jaw
14 being provided with support means; said horizontal flat crushing surface being
15 constructed as an endless chain of connected horizontal plates having joint
16 means and connecting means between adjacent ones of said plates; said
17 endless chain of connected horizontal plates being guided to wrap around a head
18 pulley and a tail pulley defining horizontally opposing ends of said endless chain;
19 the upper reach of said endless chain of connected horizontal plates
20 corresponding to said horizontal flat crushing surface; said horizontal flat
21 crushing surface having support means and motivating means; said horizontal
22 flat crushing surface also being arranged as a live bin bottom for said receiving
23 hopper on said upper reach thereof to hold and convey said ore placed on said
24 upper reach thereof;

25
26 the operation of said improved crusher assembly being to convey said ore in said
27 receiving hopper by motivating said horizontal flat crushing surface so as to
28 move said ore into contact with said heavy metal jaw; the combined effect of said
29 motivation of said horizontal flat crushing surface moving said ore into confined
30 contact with said heavy metal jaw being to force said ore into said crushing zone
31 so as to crush said ore and also to convey said ore after crushing so as to be
32 discharged at said head pulley position of said endless chain by means of gravity.
33 14. An improved crusher assembly as in Claim 13 in which said ore can alternatively
34 be discharged off said endless chain of connected horizontal plates by motivating
35 said endless chain in a reversed direction so as to convey said ore to be

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- 1 discharged at said horizontally opposing end from said head pulley position of
- 2 said endless chain by means of gravity.
- 3

FIGURE 1

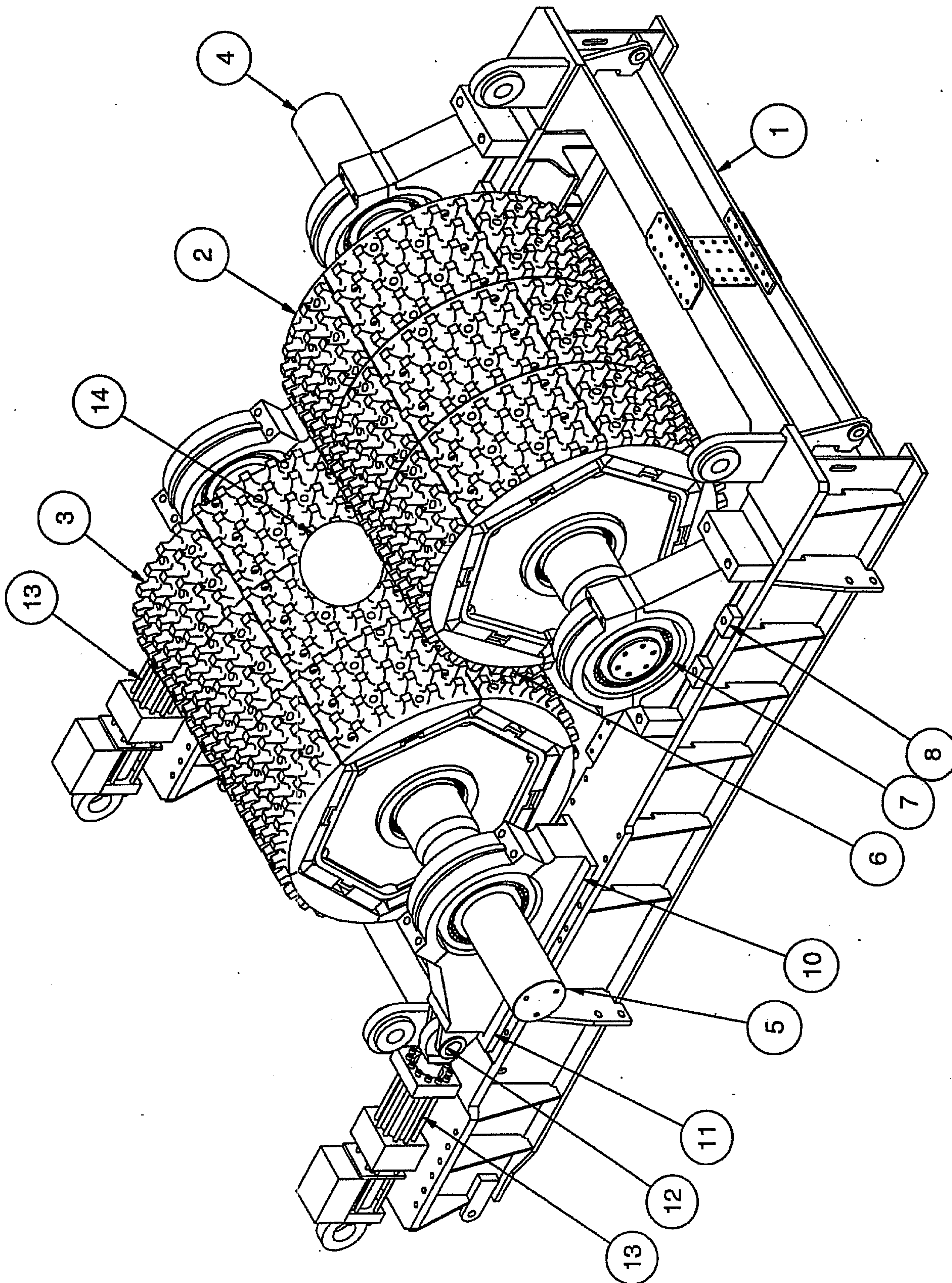


FIGURE 2

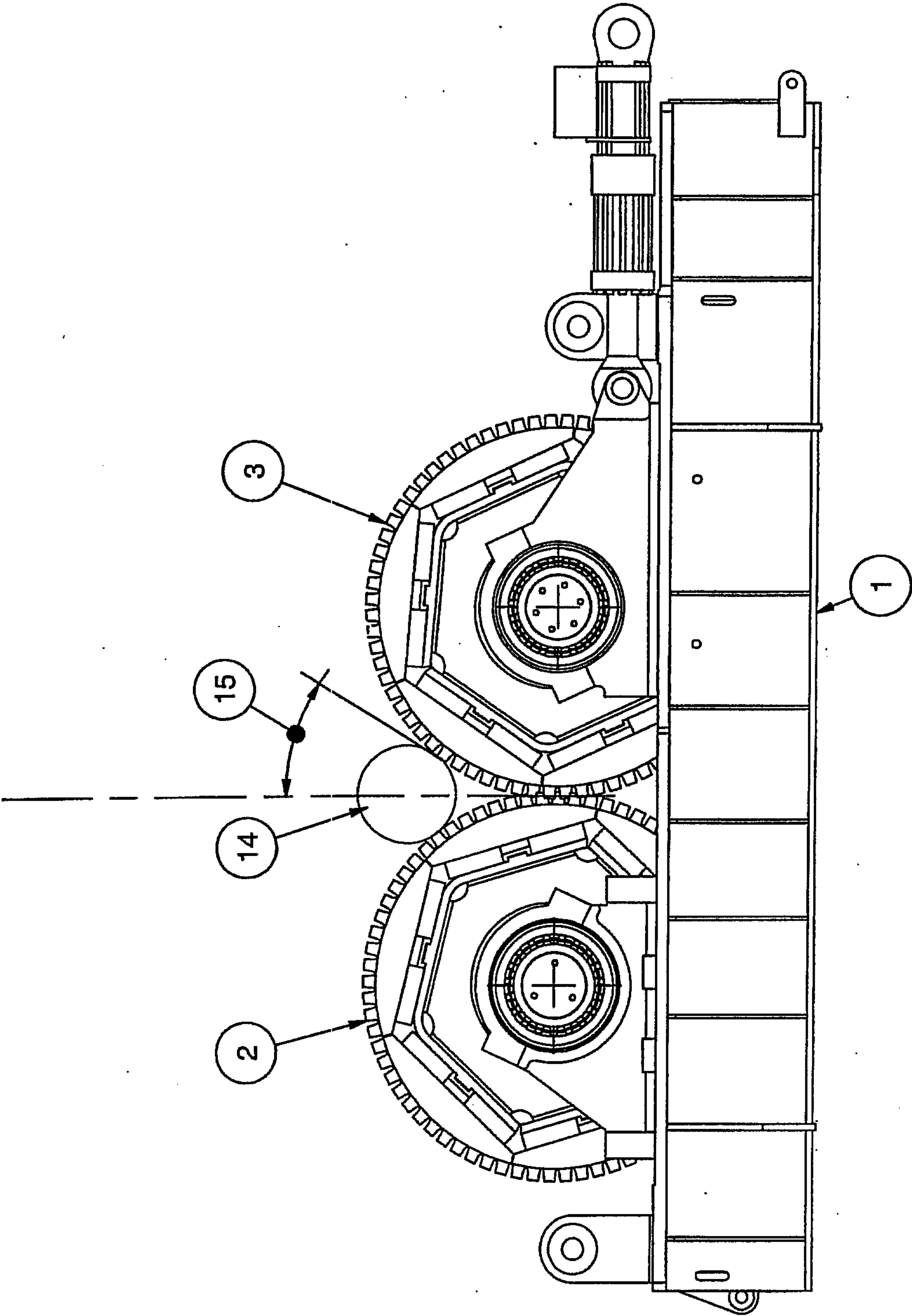


FIGURE 3

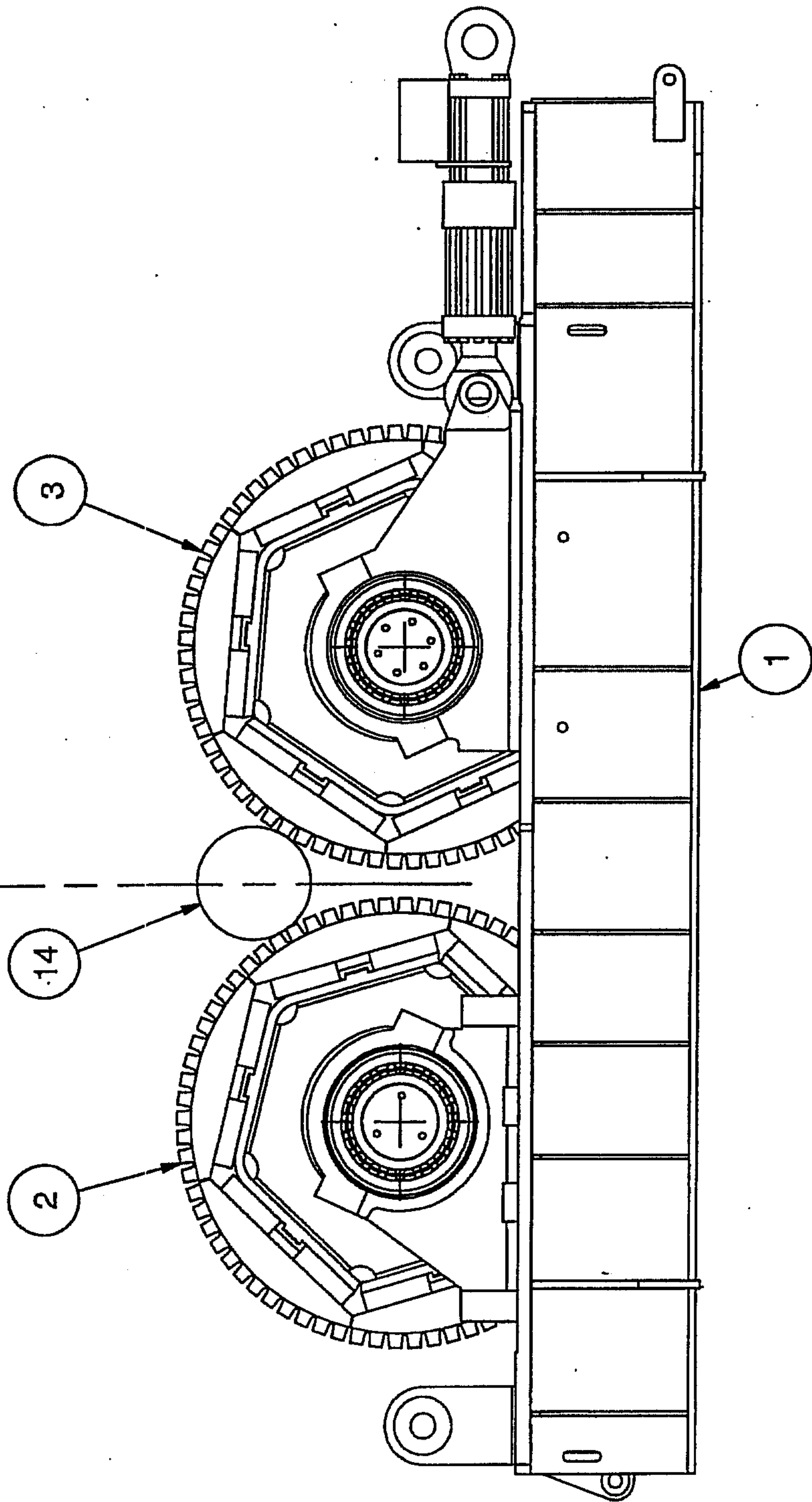


FIGURE 4

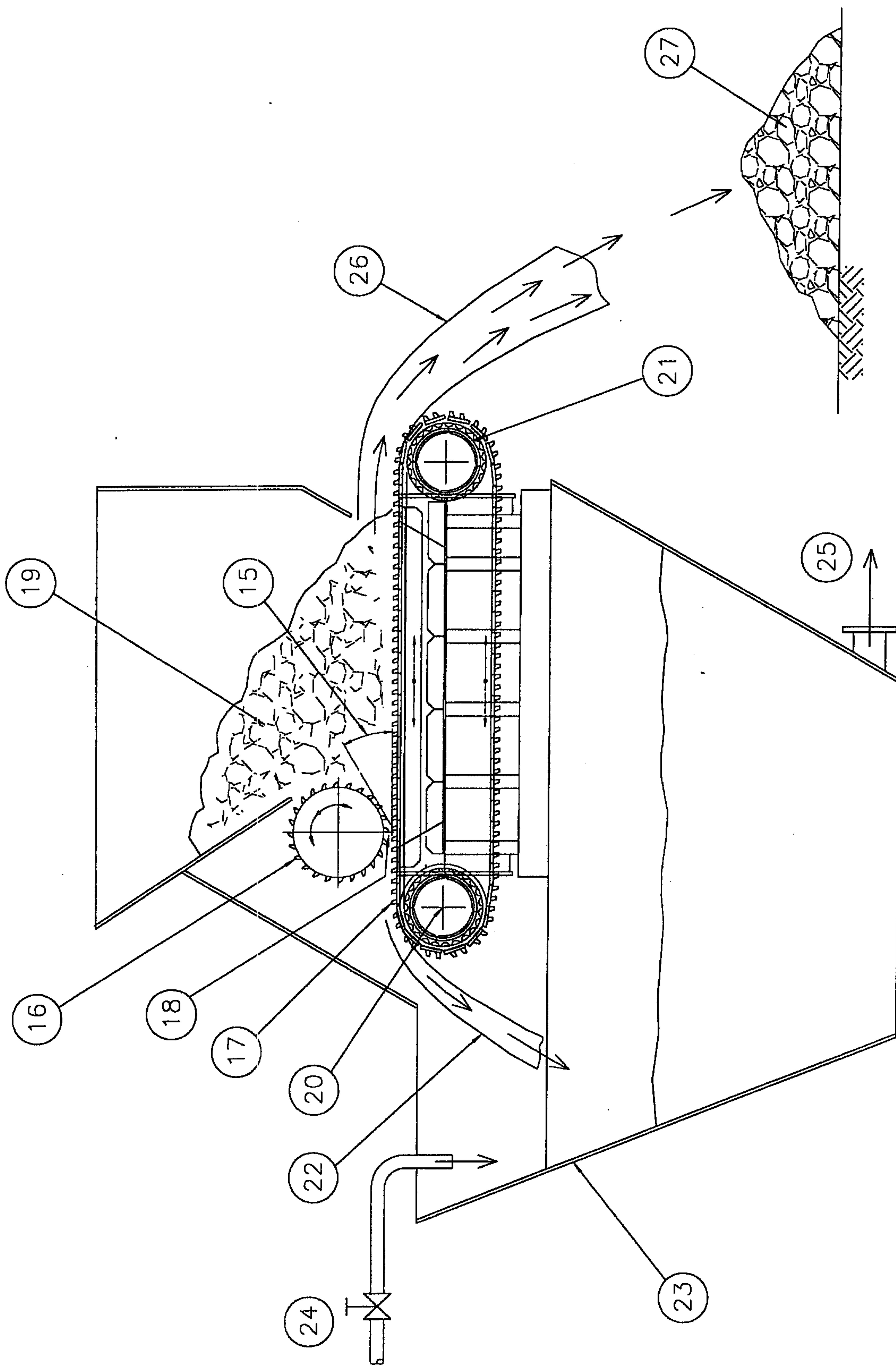


FIGURE 5

