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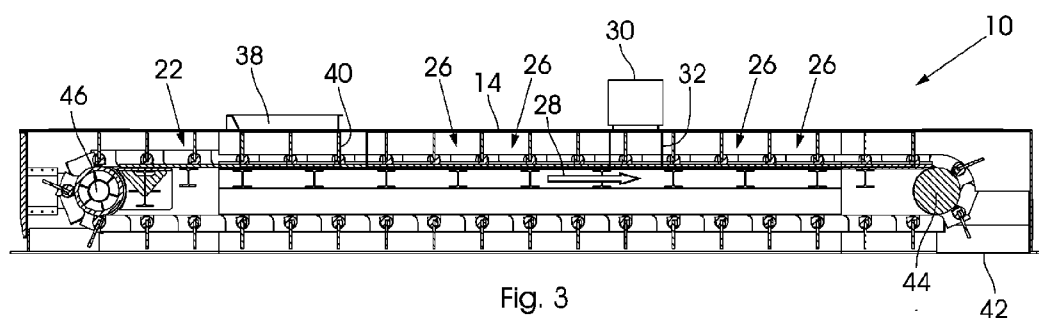


Fig. 3

(57) Abstract: A system (10) for treating mined ores utilising high intensity electromagnetic radiation, such as microwave radiation, and a method utilising said system (10). The system comprises a main structure (12) defining an internal volume (14) between a floor (16), roof (18) and opposing sidewalls (20), a displacement arrangement (22) and a treatment device (30) associated with a treatment zone (32) within the internal volume (14). The displacement arrangement (22) comprises a plurality of partitions (24) which define a plurality of compartments (26) within the internal volume. The plurality of partitions (24) is configured to be displaced, in use, through the internal volume (14) in a displacement direction (28). Material is operatively received in the compartments (26), displaced in the displacement direction (28) by the displacement arrangement (22) through the internal volume (14), and treated by the treatment device (30) as it is displaced through the treatment zone (32).



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SYSTEM AND METHOD FOR TREATING MINED MATERIAL

BACKGROUND TO THE INVENTION

5 This invention relates to the treatment of mined materials, such as mined ores. More particularly, the present invention relates to system and method for treating mined ores with high intensity electromagnetic radiation, such as microwave radiation.

10 The use of high intensity microwave radiation in the treatment, and more particularly, the fragmenting, of mined ores, is known in the art. Generally, constituents of mined ore have different thermal expansion coefficients. Exposure to the high intensity microwave radiation causes unbalanced thermal expansion of the constituents, resulting in the formation of micro and macro cracks along grain boundaries within the mined ore. The presence of these grain boundary cracks, in turn, reduces energy consumption during downstream crushing or fragmenting processes and
15 improves mineral liberation.

Throughout this disclosure, “microwave systems” will be taken to refer to systems or plant used in the course of the treatment of mined ore with high intensity microwave radiation. It will be appreciated that the ore, before being treated by such a microwave system, is already, to a
20 degree, fragmented.

Due to the intensity of the microwave radiation, microwave systems used during these processes need to incorporate safety features that prevent leakage of microwave radiation to the atmosphere or surrounding areas or structures.

25 Known in the art (and such as described in WO 2006/030327 A2) is a microwave system incorporating vertical ducts through which mined ore is allowed to flow under the influence of gravity. Typically, inner surfaces of the duct are lined with ceramic, abrasion resistant materials. A microwave treatment zone is created within the vertical duct. The treatment zone is generally
30 associated with a “window” of a ceramic material, through which the microwaves can easily propagate into the treatment zone. With the exception of the window, the duct is manufactured from a highly microwave reflective material, to prevent microwaves from escaping through the duct into the atmosphere.

However, it will be appreciated that microwave radiation may still penetrate along or against the flow of the mined ore. Consequently, dimensions, and particularly, the length of the duct needs to be designed to eliminate microwave radiation exiting an inlet or outlet of the duct, or at least reduce the intensity of the microwaves so exiting the inlet or outlet of the duct.

5

Also known in the art (and such as described in WA 2014/066941 A1), is a microwave system of the kind described above, further including externally or circumferentially arranged microwave reflective formations, which are provided for attenuating penetration or propagation of electromagnetic radiation from the treatment zone, along or against the flow of the mined ore.

10

It will be appreciated that vertical ducts used in the microwave systems as described above, are associated with practical implications, such as the overall size of the system, requirements in terms of elevating materials, downstream processing including impact absorption of freefalling materials, and the like. Furthermore, due to the high and changing flow rate of the ore (caused by the acceleration of the ore under the influence of gravity), the intensity of the microwave radiation is high and needs to be controlled meticulously.

15

It is accordingly an object of the invention to provide a system and a method for treating mined ore by means of high intensity electromagnetic radiation, that will, at least partially, address the above disadvantages.

20

It is also an object of the invention to provide a system and method for treating mined ore by means of high intensity electromagnetic radiation, which will be a useful alternative to existing systems and methods.

25

SUMMARY OF THE INVENTION

In accordance with a first aspect of the invention, there is provided a system for treating mined material, the system comprising:

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a main structure defining an internal volume between a floor, roof and opposing sidewalls, the internal volume having a substantially constant cross-section along a length thereof;

a displacement arrangement comprising a plurality of partitions, the displacement arrangement arranged to extend through the internal volume such that a plurality of compartments is defined within the internal volume between consecutive partitions, the plurality of partitions configured to be displaced, in use, through the internal volume in a displacement direction; and

35

a treatment device associated with a treatment zone which is defined within the internal volume,

wherein, in use, material is received in the plurality of compartments and displaced in the displacement direction by the displacement arrangement through the internal volume and treated
5 by the treatment device as it is displaced through the treatment zone.

Each of the plurality of partitions may be dimensioned so as to extend substantially across the internal volume in use. More particularly, a shape and size of each partition may be substantially similar to that of the cross-section of the internal volume. Each of the plurality of partitions may
10 be manufactured from a substantially electromagnetic reflective material, thereby, in use, to attenuate (at least to a degree) propagation of electromagnetic radiation from the treatment zone in a direction of, or against, the displacement direction. Each of the plurality of partitions may be manufactured from stainless steel.

15 The floor and opposing side walls of the internal volume may be lined with a ceramic material.

A wall portion of the main body adjacent the treatment zone may comprise a window of a material substantially transparent to electromagnetic radiation.

20 The treatment device may be a microwave device, with which a flux of microwave radiation may be emitted to the treatment zone, in use.

The main structure may be arranged such that the displacement direction extends substantially horizontally. The displacement arrangement may typically comprise a drag-chain conveyor
25 arrangement. The drag-chain conveyor arrangement may comprise a first and second chain, each chain made up of a plurality of chain links and arranged on opposite sides of the internal volume. The first and second chains may be interconnected by a plurality of drag bars. Each drag bar may be associated with a respective one of the plurality of partitions.

30 The main structure may include a first and second side compartment on opposing sides of the internal volume, and along which the first and second chains extend in use.

Each of the opposing sidewalls may comprise a longitudinally extending slot along a length of the internal volume, the arrangement such that each drag bar, as its associated partition is displaced

through the internal volume, extends across the internal volume and through the slots of each sidewall.

Each drag chain may be associated with a plurality of cover plates, arranged within the respective side compartment. The arrangement may be such that the slot, along its length, may be covered by cover plates, in use.

Each cover plate may be manufactured from a substantially electromagnetically reflective material.

Each cover plate may be arranged to allow pivoting thereof relative to adjacent cover plates.

The system may further comprise a head pulley and tail pulley around which the drag-chain conveyor arrangement is arranged. A return portion of the drag-chain conveyor may extend between the head and tail pulleys and outside of the internal volume.

Further in accordance with the first aspect of the invention, the system may comprise and a feed chute for depositing material into the plurality of compartments before being displaced into the internal volume, and a discharge chute through which material is discharged after having been displaced through the internal volume and treated in the treatment zone.

In accordance with a second aspect of the invention, there is provided a method of treating material, comprising the steps of:

displacing a plurality of compartments containing material, through an internal volume of a system; and

exposing the material to electromagnetic radiation, as the material passes through a treatment zone defined within the internal volume.

The method may include the step of feeding material into each of the plurality of compartments, before said compartment is displaced into the internal volume, through a feed chute.

Further according to the second aspect of the invention, the method may include the step of discharging material from each of the plurality of compartments after said compartment has exited the internal volume.

Each of the plurality of compartments may be defined between two consecutive partitions which form part of a displacement arrangement.

5 The method may also comprise the step of displacing the partitions by means of a first and second drag chain arrangement.

The system may be a system according to the first aspect of the invention.

10 The term "microwave energy" is understood herein to mean electromagnetic radiation that has frequencies in the range of 0.1-300 GHz.

The present invention includes using continuous microwave energy.

15 However, the invention also extends to the use of pulsed microwave energy.

The present invention includes using continuous or pulsed high energy microwave energy.

20 The term "high energy" is understood herein to mean values substantially above those within conventional household microwaves, i.e., substantially above 1 kW.

Preferably the energy of the microwave energy is at least 5 kW, 10 kW, 15 kW and 20 kW.

More preferably the energy of the microwave energy is at least 50 kW.

25 The use of microwave energy in accordance with the present invention may be as described in International publication numbers WO03/102250 and WO06/034553, the disclosures of which are incorporated herein by reference.

30 The use of pulsed microwave energy minimises the power requirements of the method and maximises thermal cycling of the ore particles. Preferably the pulsed microwave energy includes pulses of short duration.

35 The term "short duration" is understood herein to mean that the time period of each pulse is less than 1 second.

The pulse time period may be less than 0.1 second.

The pulse time period may be less than 0.01 second.

- 5 The pulse time period may be less than 0.001 second.

The time period between pulses of microwave energy may be set as required depending on a number of factors as hereinbefore described.

- 10 Preferably the time period between pulses is 10 - 20 times the pulse time period.

The ore stream may be exposed to one or more pulses of microwaves. This can be achieved in a single installation which releases microwave energy in pulses. This can also be achieved in an installation having multiple exposure points at spaced intervals along a path of movement of the ore stream, with each of the exposure points releasing its own characteristic microwave energy in pulses or continuously.

The wavelength of the microwave energy and the exposure time may be selected depending on relevant factors as hereinbefore described.

20 Relevant factors may include ore type, particle size, particle size distribution, and requirements for subsequent processing of the ore.

BRIEF DESCRIPTION OF THE DRAWINGS

25 The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

- 30 **Figure 1** shows a side view of a system for treating mined material in accordance with the invention;
- Figure 2** shows a top view of the system of Figure 1;
- Figure 3** shows a sectioned side view of the system of Figure 1;
- Figure 4** shows a detailed sectioned side view of a receiving zone associated with a feed chute of the system of Figure 1;

- Figure 5** shows a detailed sectioned side view of a treatment zone of the system of Figure 1;
- Figure 6** shows a detailed sectioned side view of a tail pulley associated with a drag chain arrangement forming part of the system of Figure 1;
- 5 **Figure 7** shows a detailed sectioned side view of a cover plate associated with the drag-chain arrangement forming part of the system of Figure 1;
- Figure 8** shows a front view of the system of Figure 1;
- Figure 9** shows a sectioned front view of the system of Figure 1;
- 10 **Figure 10** shows a detailed sectioned front view of a side compartment of the system of Figure 1;
- Figure 11** shows a top view of the drag-chain arrangement of the system of Figure 1;
- Figure 12** shows a partial detailed top view the drag chain arrangement of Figure 11;
- Figure 13** shows a partial detailed perspective view of the drag-chain of Figure 11;
- Figure 14** shows a further partial detailed perspective view of the drag-chain of Figure 11;
- 15 **Figure 15** shows a further partial detailed perspective view of the drag-chain of Figure 11;
- Figure 16** shows a further partial detailed sectioned front view of a side compartment of the system of Figure 1;
- Figure 17** shows a partial side view of an endless chain of the drag-chain of Figure 11;
- 20 **Figure 18** shows a partial detailed perspective view of an internal volume of the system of Figure 1, wherein some components have been omitted;
- Figure 19** shows a detailed perspective view of a chain link and cover plate of the drag-chain of Figure 11, which chain link is associated with a drag bar and partition;
- Figure 20** shows a detailed perspective view of a chain link and cover plate of the drag-chain of Figure 11, which chain link is not associated with a drag bar and partition;
- 25 **Figure 21** shows a further detailed perspective view chain link and cover plate of Figure 19;
- Figure 22** shows a further detailed perspective view chain link and cover plate of Figure 20; and
- Figure 23** shows a partial detailed perspective view of the drag-chain of Figure 11.

30 **DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS**

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various

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ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited
5 otherwise, the terms "mounted", "connected", "engaged" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings and are thus intended to include direct connections between two members without any other members interposed therebetween and indirect connections between members in which one or more other members are interposed therebetween. Further, "connected" and "engaged" are not restricted to
10 physical or mechanical connections or couplings. Additionally, the words "lower", "upper", "upward", "down" and "downward" designate directions in the drawings to which reference is made. The terminology includes the words specifically mentioned above, derivatives thereof, and words or similar import. It is noted that, as used in this specification and the appended claims, the singular forms "a," "an," and "the," and any singular use of any word, include plural referents
15 unless expressly and unequivocally limited to one referent. As used herein, the term "include" and its grammatical variants are intended to be non-limiting, such that recitation of items in a list is not to the exclusion of other like items that can be substituted or added to the listed items.

Referring to the drawings, in which like numerals indicate like features, a non-limiting example of
20 a system for treating mined material in accordance with the invention is generally indicated by reference numeral 10.

In this context, the term "mined material" refers to an ore such as copper containing ore, nickel containing ore, iron containing ore or other suitable ores. Furthermore, the mined material may
25 have undergone certain levels of crushing or processing before being treated by means of the system 10. Such pre-crushing or pre-processing is known in the art and will not be further discussed herein.

As is discussed more fully below, in the examples shown in the figures and described herein, the
30 treatment of the ore relates to microwave radiation treatment of the ore. That said, even though not detailed herein, it is foreseen that the system 10 may find application outside of this type of treatment.

The system 10 comprises a main structure 12 which defines an internal volume 14 (which internal
35 volume is best indicated in figure 3). It will be appreciated that the "internal volume" 14 refers to

an active volume in which the treatment of the ore is carried out, and not a total volume encapsulated by the main structure 12. Therefore, and as is discussed and more fully described in what follows, certain components of the system 10 are arranged within a volume encapsulated by the main structure 12 but are specifically not received within the internal volume 14. The
5 compartmentalising within the system 10 plays an important part in the functioning of the system 10.

The internal volume 14 is defined between a floor 16, a roof 18 and opposing side walls 20 (shown as 20.1 and 20.2 in the figures). The internal volume 14 has a substantially constant rectangular
10 cross-sectional shape along its entire length, and therefore, the floor 16 and roof 18 extend substantially parallel and linearly relative to each other, while the opposing side walls 20 also extend substantially parallel and linearly relative to each other.

The system 10 also includes a displacement arrangement 22 which is provided for displacing the
15 material through the internal volume 14. The internal volume 14 is therefore stationary, and material is transported or displaced through the internal volume 14 by means of the displacement arrangement 22.

The displacement arrangement 22 takes the form of a drag-chain conveyor 34, comprising a
20 plurality of partitions 24, which are equidistantly spaced. The partitions 24 function as drag plates of the drag chain conveyor 34. In use, the partitions 24 sequentially enter the internal volume 14, and are displaced there along and out of the internal volume 14.

At any moment during operation, within the internal volume 14, a plurality of distinct compartments
25 26 are created between the partitions 24 (which are within the internal volume at that moment). In use, these compartments 26 are displaced through the internal volume 14, as the displacement arrangement 22 is displaced relative to the internal volume 14.

A shape and size of each partition 24 is substantially similar to the cross-sectional shape and size
30 of the internal volume 14, such that the partitions 24, when located inside the internal volume 14, extend substantially across the internal volume 14, and therefore between the floor 16 and roof 18 and between the opposing side walls 20, with a relatively tight fit.

The compartments 26 are displaced through the internal volume 14 in a displacement direction,
35 indicated by the arrow 28 in figure 3.

In use, each compartment 26 is filled with material before same enters the internal volume 14 (or at least before same enter the treatment zone as discussed more fully below). A discrete volume (or at least no more than a predetermined volume) of material is therefore contained within each compartment 26 and displaced through the internal volume 14 in use.

The system 10 includes a treatment device 30, which is typically mounted to an outer surface of the roof 18 of the main structure 12. The treatment device 30 is associated with a treatment zone 32, within the internal volume 14. Therefore, material displaced through the internal volume 14, is displaced through the treatment zone 32, where the material is treated by the treatment device 30. The treatment zone 32 is wholly within the internal volume 14 and fully encapsulated therein. As mentioned, in the example shown, the treatment device is a microwave device. The microwave device emits a flux (intermittently or constantly) of microwave radiation into the treatment zone 32 of the internal volume 14. The flux of microwave radiation is therefore used to treat the material in the treatment zone 32.

It will be appreciated that the internal volume 14 extends upstream and downstream, beyond the treatment zone 32.

The spacing of the partitions 24 is such that a number of partitions 24 are, at any moment during operation of the system, arranged both upstream and downstream of the treatment zone 32 and within the internal volume. The significance hereof will become apparent from what follows.

The partitions 24 are manufactured from a material which is highly reflective of electromagnetic radiation, such as stainless steel. Therefore, at any given moment, the partitions 24 upstream and downstream of the treatment zone 32 within the internal volume inhibit propagation of electromagnetic radiation in directions upstream and downstream of the treatment zone 32, by reflecting electromagnetic waves back in a direction towards the treatment zone 32. In this way, propagation of electromagnetic waves in the upstream or downstream directions is attenuated, at least to a large degree. In fact, it has been found that the intensity of electromagnetic radiation within each subsequent compartment 26 (in either the upstream or downstream direction away from the treatment zone 32), is reduced by an order of magnitude.

It will therefore be appreciated that the partitions perform three main functions: firstly, they aid in the displacement of the material; secondly, they facilitate the attenuation of the propagation of the

electromagnetic radiation; while thirdly, the partitions physically limit the application volume of material to be treated, thereby allowing for the development of high energy densities within the compartments.

- 5 Furthermore, lengths of portions of the internal volume 14 on the upstream and downstream sides of the treatment zone 32, are such that the intensity of the electromagnetic flux that propagate out of the internal volume 14 (if any), is negligible or at least low enough that it does not pose a threat to hardware and/or personnel with which it may come into contact.
- 10 The floor 16, roof 18 and opposing side walls 20 that define the internal volume 14 are also manufactured from a material which is highly reflective of electromagnetic radiation (such as stainless steel). That said, the floor 16, and opposing side walls 20 are subjected to extremely high levels of abrasion (since the partitions 24 effectively “push” material through the internal volume 14) and are therefore lined with wear resistant material that is transparent to microwave
- 15 (such as ceramic materials).

Furthermore, a “window” 36 is created in the roof 18 proximate the treatment zone 32, to allow electromagnetic radiation to propagate from the treatment device 30 into the treatment zone 32. The window 36 may be covered by a material which is highly transparent to electromagnetic

20 waves (such as a ceramic material). The treatment device 30 may be contained within a housing of stainless steel, to prevent leakage of electromagnetic waves to an outside environment. The electromagnetic radiation is therefore focussed and directed into the treatment zone 32.

As is shown in the figures, the internal volume 14 extends substantially horizontally. It will,

25 however, be appreciated that the system 10 is not limited to such an orientation. For example, it is foreseen that, in embodiments not shown in the figures, the internal volume may extend at an incline or decline to a horizontal plane or even substantially vertically. Associated structural changes would be required when implementing such embodiments, such as, for example, changes to chutes, strengthening of structural components and the like. Such embodiments,

30 however, are deemed to fall within the ambit and scope of the present disclosure.

The system 10 further includes a feed chute 38 of the known kind, with which the material is fed into the various compartments 26. The feeding of the material into the compartments occurs in a feeding zone 40, which is situated up-stream of the internal volume 14. It will be appreciated that

35 compartments 26 are sequentially filled as the partitions 24 are displaced through the feeding

zone 40. Therefore, the rate at which material is fed through the feed chute 38 is controlled, based on the size of the compartments 26, and the velocity at which the displacement arrangement 22 is operated.

- 5 It will be appreciated that the amount of time spent by a particular compartment 26 within the treatment zone 32, is directly linked to the velocity at which the displacement arrangement 22 is operated. This velocity therefore has a direct bearing on the way in which the treatment device 30 is operated (the intensity of the flux, whether the flux is pulsed or constant, and the like).
- 10 The system 10 also includes a discharge chute 42 which is situated downstream of the internal volume 14 and through which material is deposited or discharged after having been treated in the treatment zone 32.

The drag chain conveyor 34 includes a head pulley 44 and tail pulley 46 around which the drag
15 chain conveyor 34 is arranged and by means of which the drag chain conveyor 34 is driven in use. The head and tail pulleys (44, 46) are of known construction and arrangement and will not be described further herein.

The drag chain conveyor 34 comprises a first and second endless chain (48, 50) which extend
20 around the head and tail pulleys (44, 46). Portions of the first and second chains run on opposite sides of the internal volume 14 and are contained in first and second side compartments (52, 54) which are separated from the internal volume 14 by means of the opposing side walls 20. That said, the first and second side compartments (52, 54) are still wholly enclosed by the main structure 12. In this way, electromagnetic radiation which may leak from the internal volume 14 is
25 contained by the enclosed side compartments (52, 54).

The first and second chains (48, 50) are substantially similar. Each is made up of a plurality of chain links 56 which are allowed to pivot relative to each other, so as to be displaceable around the head and tail pulleys (44, 46).

30

The first and second chains (48, 50) are interconnected by a plurality of drag bars 58. Each drag bar 58 extends between a chain link 56 of the first chain 48, and a chain link 56 of the second chain 50. Furthermore, each drag bar 58 is associated with an individual partition 24. Each individual partition 24 is supported, held in place, and displaced, by a respective drag bar 58. It

will be appreciated that with each full rotation or cycle of the drag chain conveyor 34, each drag bar 58 is displaced through the internal volume 14.

Each of the two opposing side walls 20 comprise a longitudinally extending slot 60 along its whole length, through which the drag bars 58 extend in use, and along which the drag bars 58 are displaced.

To avoid or inhibit electromagnetic radiation from escaping from the internal volume 14 through the slot 60, each chain (48, 50) is provided with a plurality of cover plates 62. As shown, the arrangement is such that the whole length of the slot 60 is covered by cover plates 62. The cover plates 62 are therefore sized to overlap the slot 60. The cover plates are manufactured from stainless steel, and therefore, again, reflects electromagnetic radiation towards the internal volume 14 or into the compartments 26. The cover plates 62 are fixed to the chain (48 or 50 as the case may be) and are therefore displaced with the chain. Each chain link 56 is associated with a separate cover plate 62. The separate cover plates 62 are arranged to allow pivoting relative to each other, to facilitate being displaced around the head and tail pulleys (44, 46).

The chain links 56 are interconnected to form knuckle joints. Each chain link 56 comprises a fork end 64 and an eye end 66 with a collar 68. A knuckle pin 70 extends through the fork end 64, and in use, through the collar 68 of an adjacent link 56. The knuckle pin 70 is held in place by fixing pins 72. Adjacent chain links 56 can pivot relative to each other about the respective knuckle pins 70.

The knuckle pins 70 have an outer eye 74, which is coupled to the drag bar 58 and/or the cover plate 62 via a U-bracket 76. It will be appreciated that the drag bar 58, cover plate 62 and U-bracket 76 may all be interconnected or coupled.

The cover plates 62 take the form of an assembly of components, such as a backing plate 78 and an inner plate 80, which are bolted or otherwise fixed together. The inner plate 80 has a rounded end 82 proximate the drag bar (which rounded end has a centre point which coincides with the knuckle pin 70 about which pivoting occurs) while an opposite end of the inner plate 80 has a rounded cut-out 84, which, in use, receives the rounded end 82 of an adjacent inner plate 80.

An end region of the backing plate 78 overlaps the rounded end 82 of the inner plate 80 and inhibits radiation from penetrating through the swivel joint formed between the rounded end 82 and cut-out 84 of two adjacent inner plates 80 and through the slot 60.

- 5 Supporting blocks 86 extend from the inner plate 80 and in use, extend through the slot 60. Since these supporting blocks 86 experience high levels of wear, they are manufactured from a wear resistant material.

It will be appreciated that not all chain links 56 are associated with a drag bar 58 or partition 24.

- 10 As shown in figures 19 to 23, chain links associated with drag bars 58 are designated by reference numeral 56.1, while chain links not associated with drag bars 58 are designated by reference numeral 56.2. In general, and as best illustrated in figure 23, the chain links 56.1 and 56.2 are arranged in alternating fashion.

- 15 It will be appreciated that the provision of a displacement arrangement 22, means that the system 10 may be operated in a substantially horizontal orientation. This has distinct advantages in terms of material handling, and the control over the speed and flow rate of material through the treatment zone 32. The throughput of the system 10 is therefore consistent and controlled. Furthermore, due to the limited size of the compartments 26, and the fact that the compartments are defined
20 between partitions which are reflective to microwave radiation, the energy density of the microwave radiation in the treatment zone 32 is focussed, improving the general efficiency of the treatment process (which in this case, may be a fracturing process). Also, the partitions function as chokes, attenuating the propagation of electromagnetic radiation in the upstream and downstream directions. Furthermore, the main structure encapsulates large parts of the system
25 10, thereby enabling better control over electromagnetic radiation. In this way, the system may more safely and efficiently be operated.

- It will be appreciated that the above description only provides an example embodiment of the invention and that there may be many variations without departing from the spirit and/or the scope
30 of the invention. It is easily understood from the present application that the particular features of the present invention, as generally described and illustrated in the figures, can be arranged, and designed according to a wide variety of different configurations. In this way, the description of the present invention and the related figures are not provided to limit the scope of the invention but simply represent selected embodiments.

The skilled person will understand that the technical characteristics of a given embodiment can in fact be combined with characteristics of another embodiment, unless otherwise expressed or it is evident that these characteristics are incompatible. Also, the technical characteristics described in a given embodiment can be isolated from the other characteristics of this
5 embodiment unless otherwise expressed.

CLAIMS

1. A system for treating mined material, the system comprising:

5 a main structure defining an internal volume between a floor, roof and opposing sidewalls, the internal volume having a substantially constant cross-section along a length thereof;

10 a displacement arrangement comprising a plurality of spaced apart partitions, the displacement arrangement arranged to extend through the internal volume such that a plurality of compartments is defined between consecutive partitions within the internal volume, each partition configured to be displaced, in use, through the internal volume in a displacement direction; and

a treatment device associated with a treatment zone which is defined within the internal volume,

15 wherein, in use, material is displaced in the displacement direction by the displacement arrangement through the internal volume and treated by the treatment device as it is displaced through the treatment zone.

2. The system according to claim 1, wherein each of the plurality of partitions is dimensioned so as to extend substantially across the internal volume in use, and wherein a shape and size of each partition is substantially similar to that of the cross-section of the internal volume.

3. The system according to claim 1, wherein each of the plurality of partitions is manufactured from an electromagnetic reflective material, thereby, in use, to attenuate propagation of electromagnetic radiation from the treatment zone.

4. The system according to claim 3, wherein each of the plurality of partitions is manufactured from stainless steel.

5. The system according to claim 1, wherein the floor and opposing side walls of the internal volume are lined with a ceramic material.

6. The system according to claim 1, wherein a wall portion of the main body adjacent the treatment zone comprises a window of a material substantially transparent to electromagnetic radiation.

7. The system according to claim 1, wherein the treatment device is a microwave device, with which a flux of microwave radiation is emitted to the treatment zone, in use.
- 5 8. The system according to claim 1, wherein the main structure is arranged such that the displacement direction extends substantially horizontally.
9. The system according to claim 1, wherein the displacement arrangement comprises a drag-chain conveyor arrangement.
- 10 10. The system according to claim 9, wherein the drag-chain conveyor arrangement comprises a first and second chain, each chain made up of a plurality of chain links and arranged on opposite sides of the internal volume, the first and second chains connected by a plurality of drag bars, each drag bar associated with a respective one of the plurality of partitions.
- 15 11. The system according to claim 10, wherein the main structure includes a first and second side compartment on opposing sides of the internal volume, within and along which the first and second chains extend in use.
- 20 12. The system according to claim 11, wherein each of the opposing sidewalls comprises a longitudinally extending slot along a length of the internal volume, the arrangement such that each drag bar, as its associated partition is displaced through the internal volume, extends across the internal volume and through the slots of each sidewall.
- 25 13. The system according to claim 12, wherein each drag chain is associated with a plurality of cover plates, arranged proximate the respective sidewall, the arrangement such that the slot, along its length, is covered or overlaid by cover plates, in use.
- 30 14. The system according to claim 13, wherein each cover plate is manufactured from an electromagnetically reflective material.
15. The system according to claim 13, wherein each cover plate is configured to allow pivoting thereof relative to adjacent cover plates.

16. The system according to claim 9, further comprising a head pulley and tail pulley around which the drag-chain conveyor arrangement is arranged, and wherein a return portion of the drag-chain conveyor extends between the head and tail pulleys and outside of the internal volume.
- 5
17. The system according to claim 1, further comprising a feed chute for depositing material into the plurality of compartments and a discharge chute through which material is discharged after having been displaced through the internal volume and treated in the treatment zone.
- 10
18. A method of treating mined material, comprising the steps of:
displacing a plurality of compartments containing material through an internal volume of a system; and
exposing the material to electromagnetic radiation as the material passes through a treatment zone defined within the internal volume.
- 15
19. The method according to claim 18, including the step of feeding material through a feed chute into each of the plurality of compartments, before said compartment is displaced through the treatment zone.
- 20
20. The method according to claim 18, including the step of discharging material from each of the plurality of compartments after said compartment has exited the internal volume.
21. The method according to claim 18, wherein the system comprises a system according to claim 1.
- 25
22. The method according to claim 18, wherein each of the plurality of compartments is defined between two consecutive partitions which form part of a displacement arrangement of the system.
- 30
23. The method according to claim 22, comprising the step of displacing the partitions by means of a drag chain conveyor arrangement.

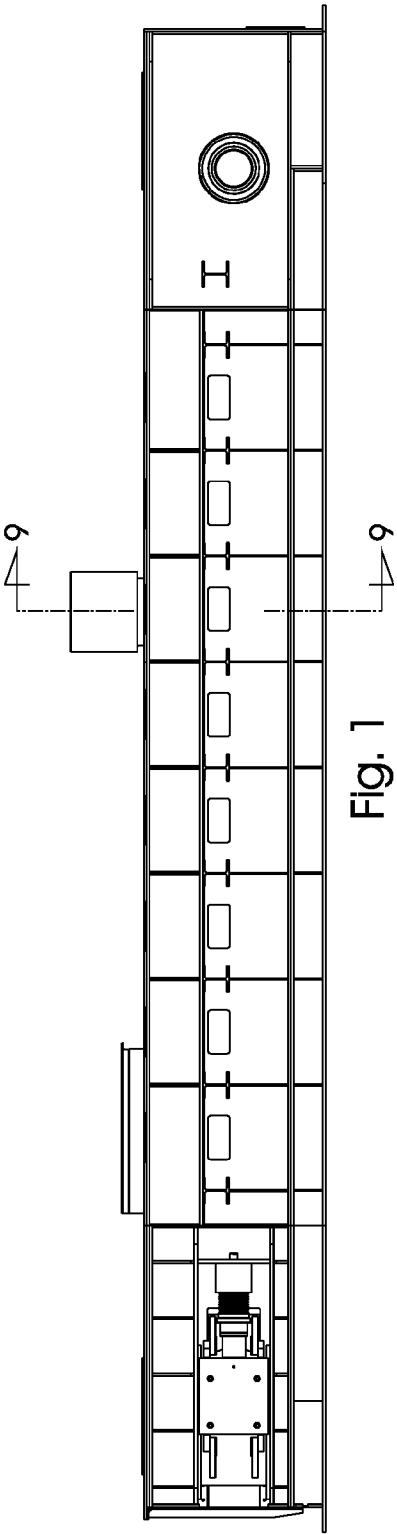


Fig. 1

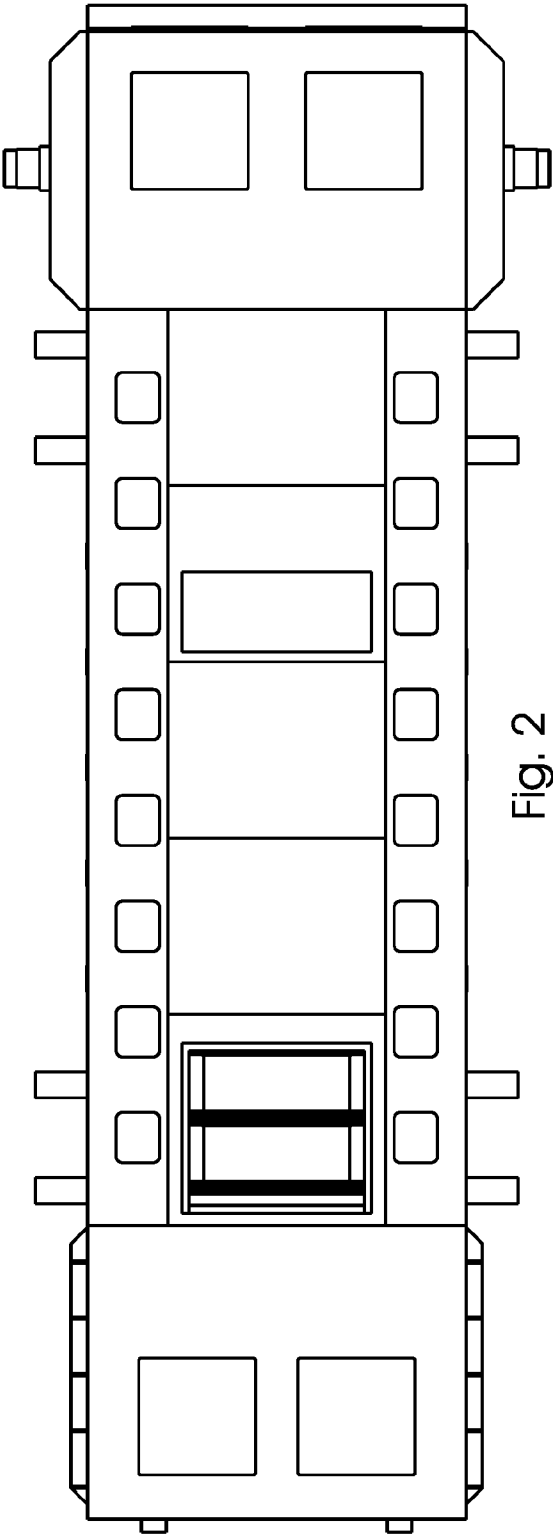
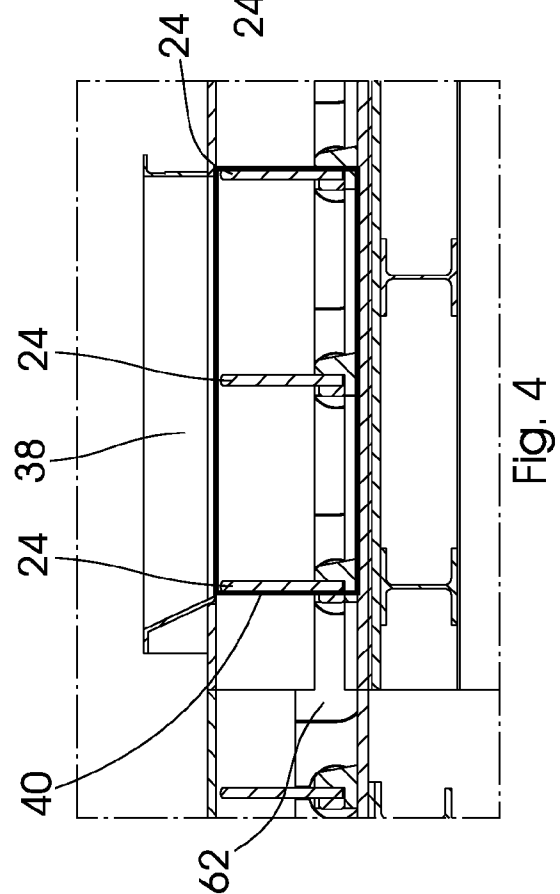
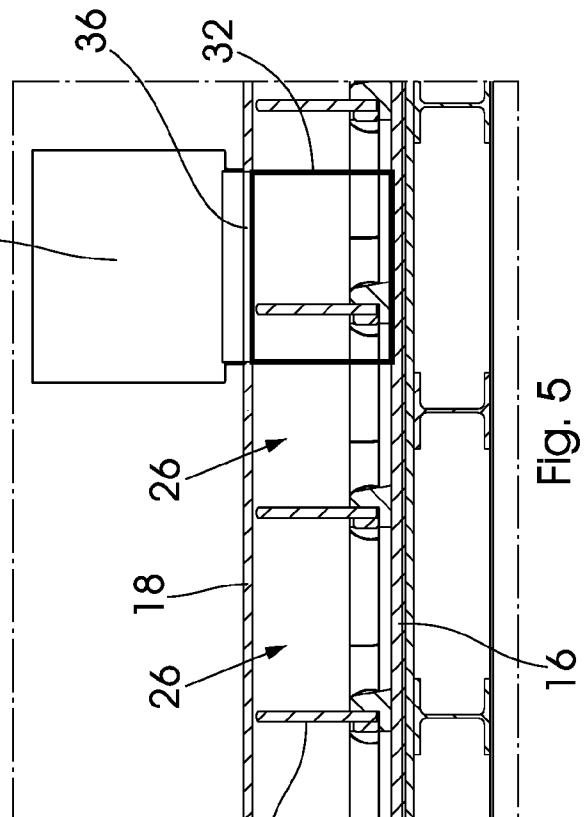
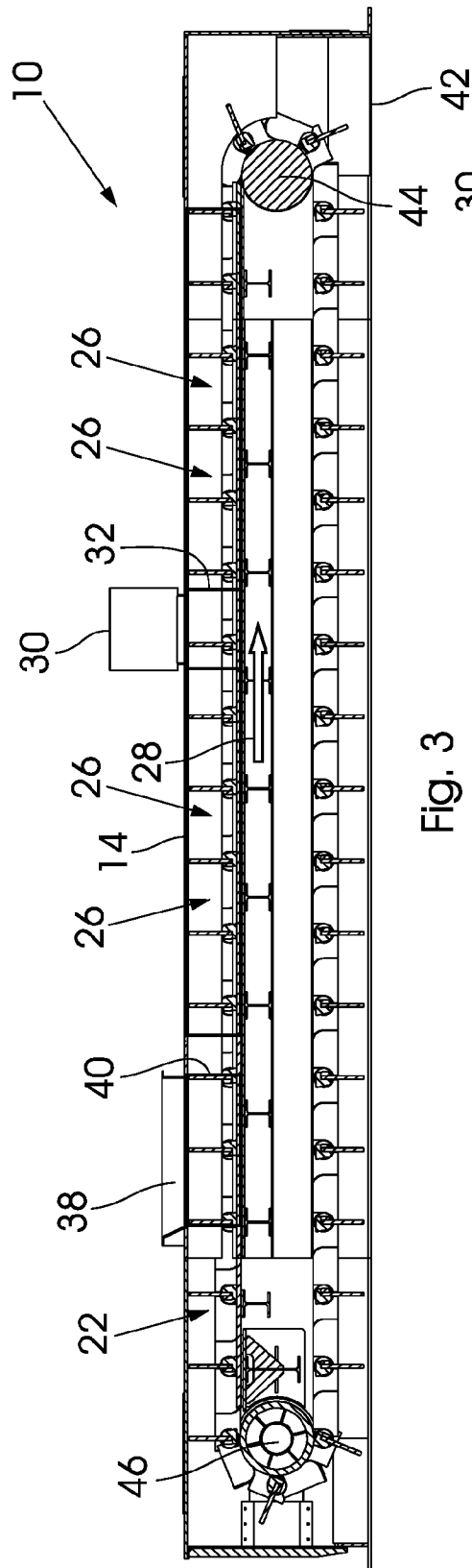


Fig. 2



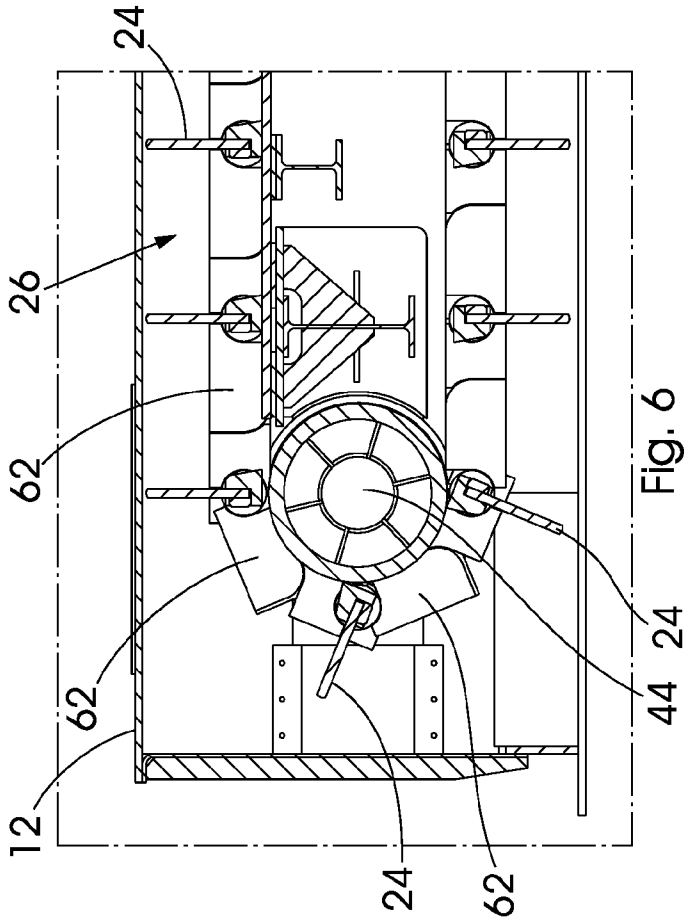


Fig. 6

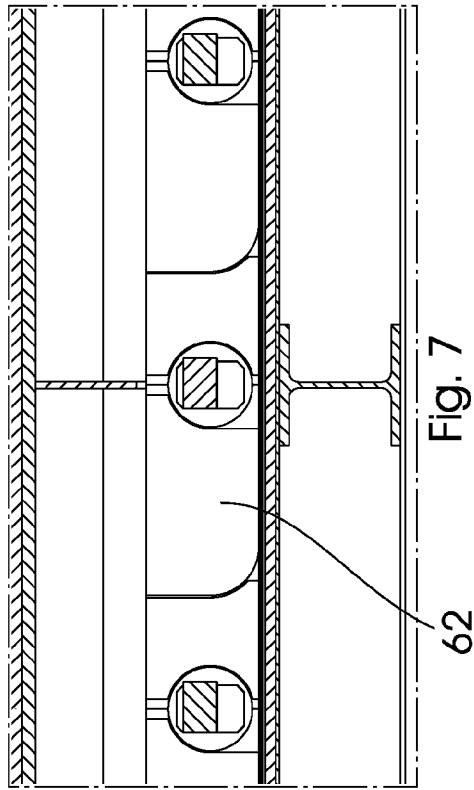


Fig. 7

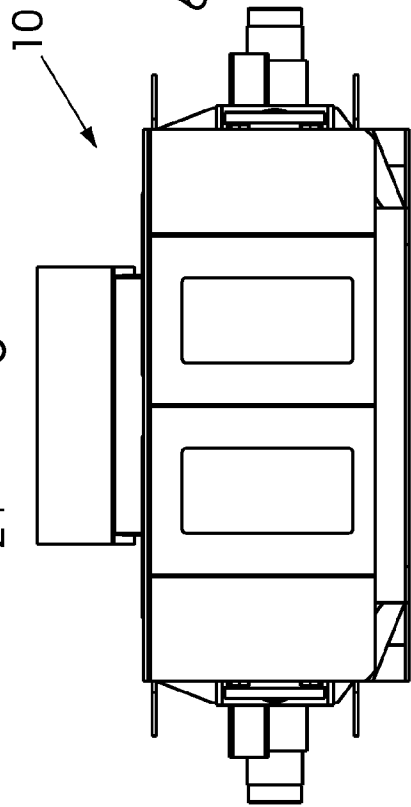


Fig. 8

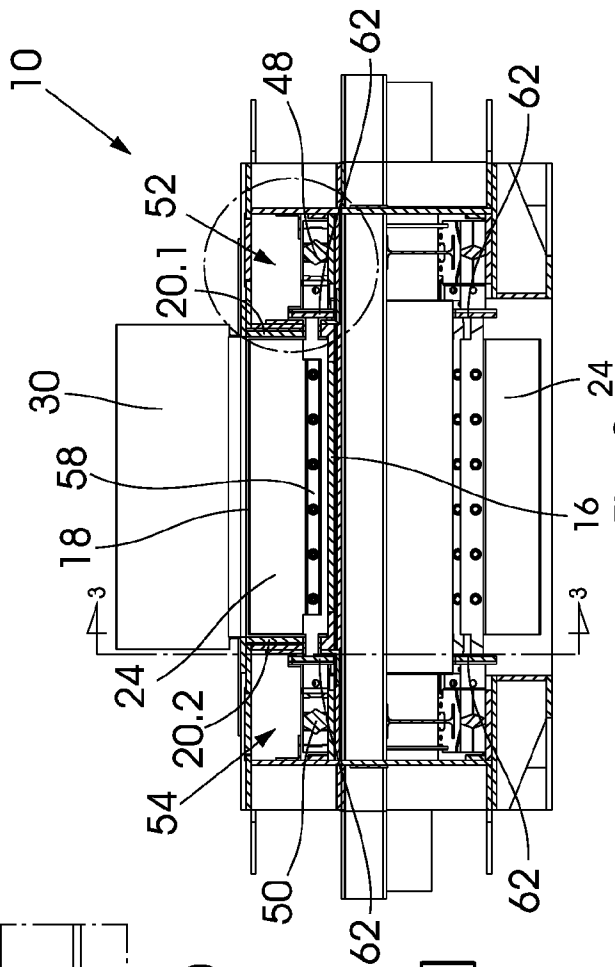


Fig. 9

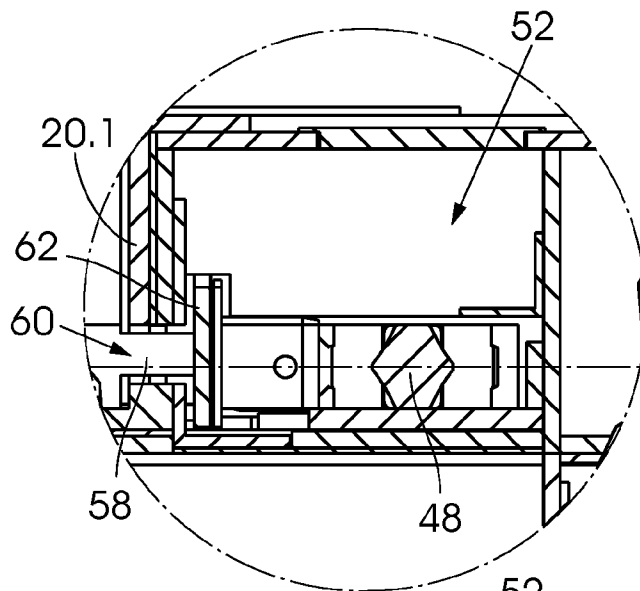


Fig. 10

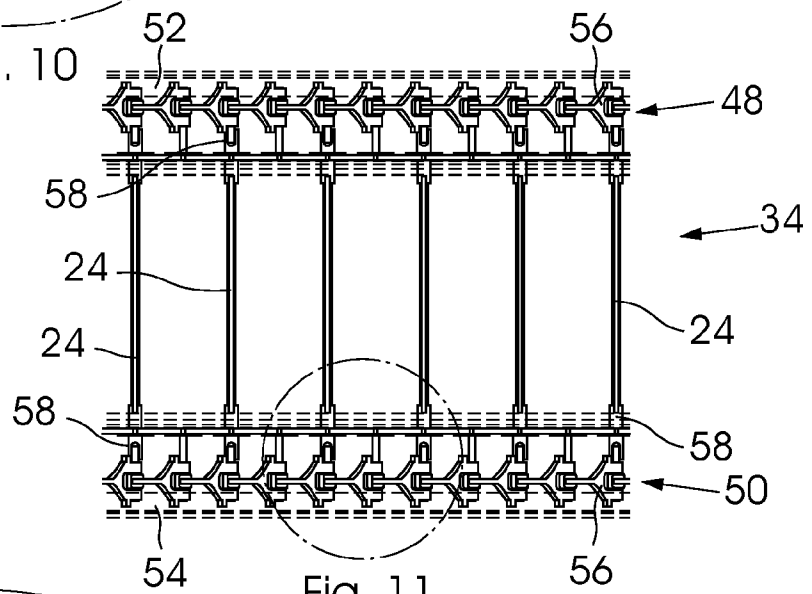


Fig. 11

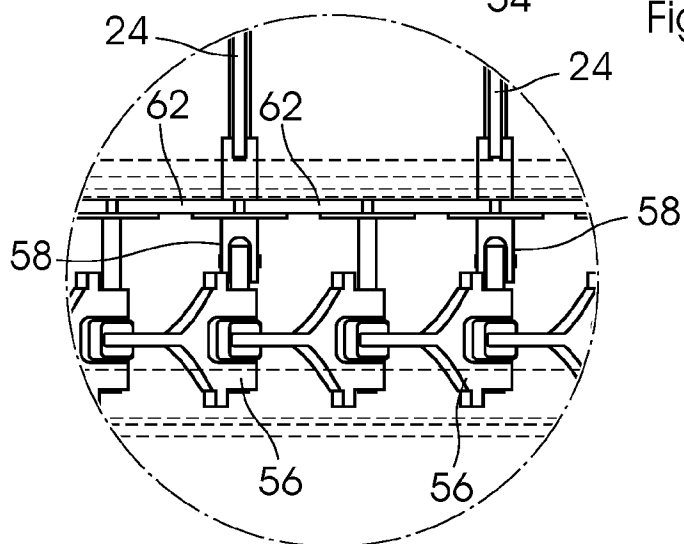


Fig. 12

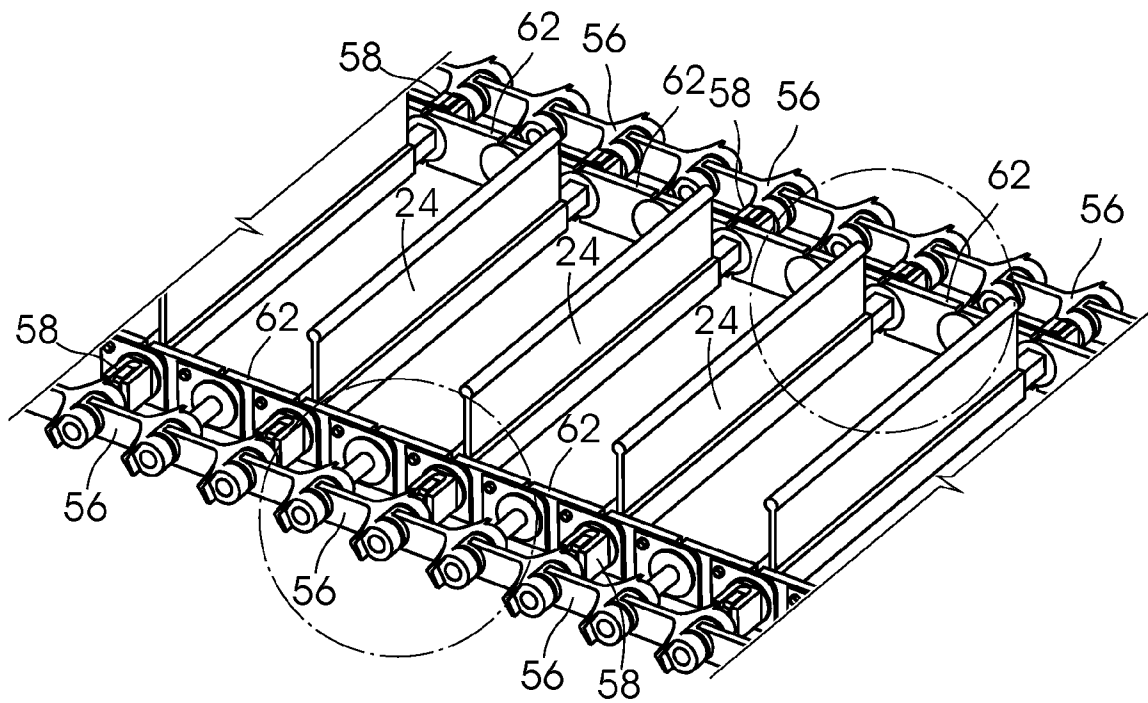


Fig. 13

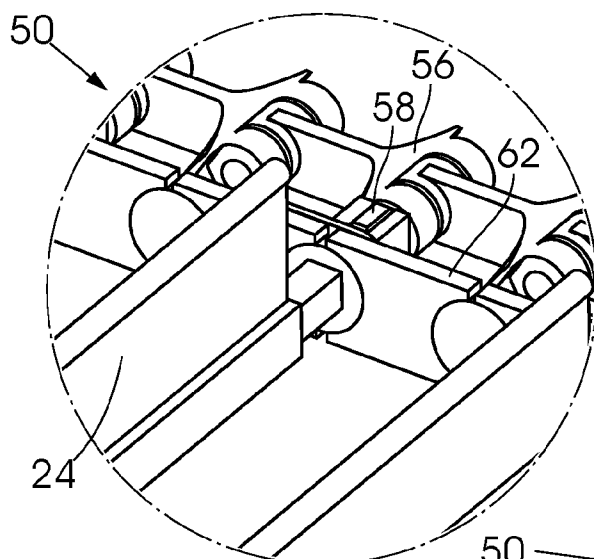


Fig. 14

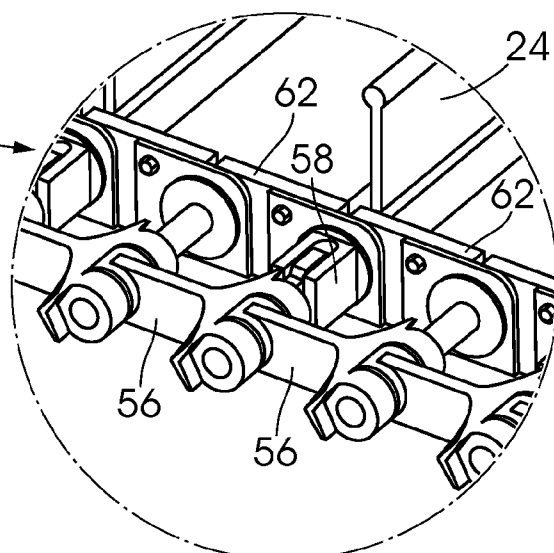
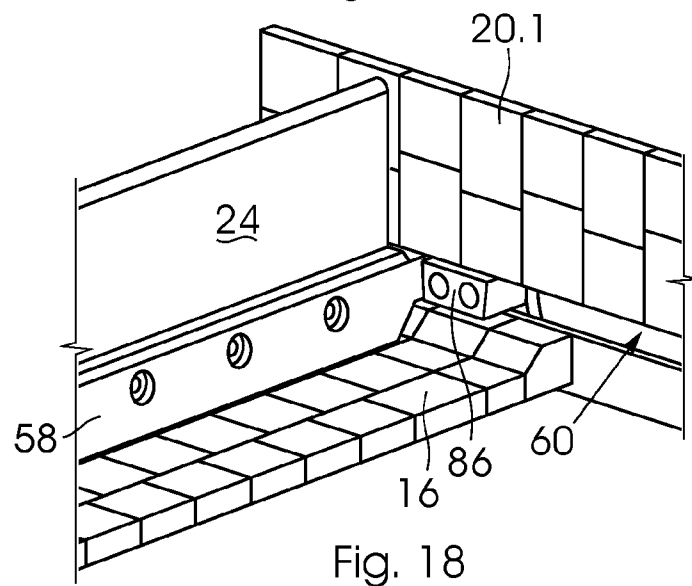
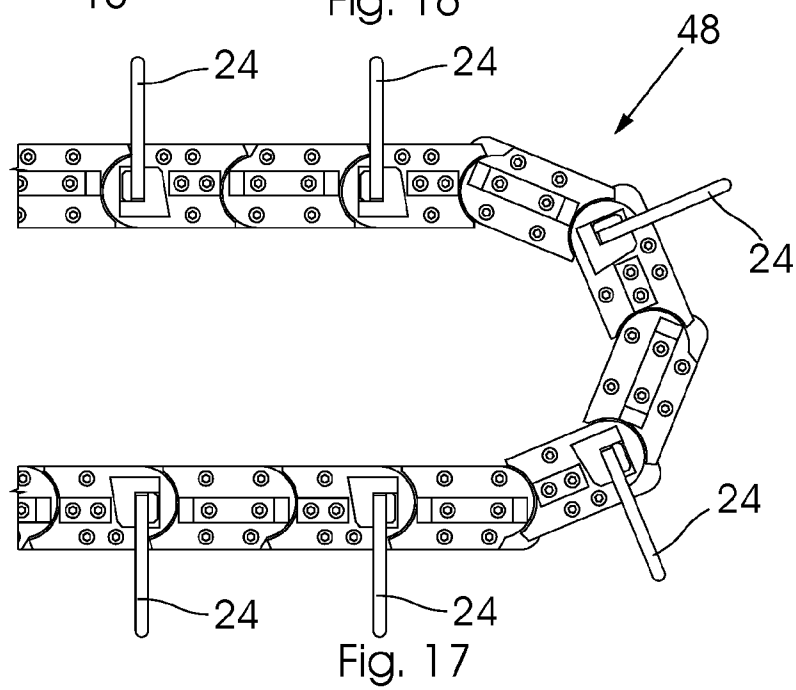
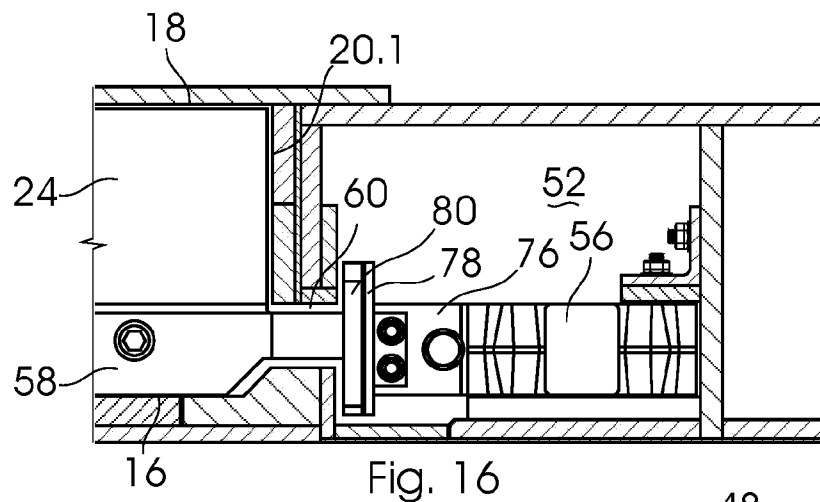
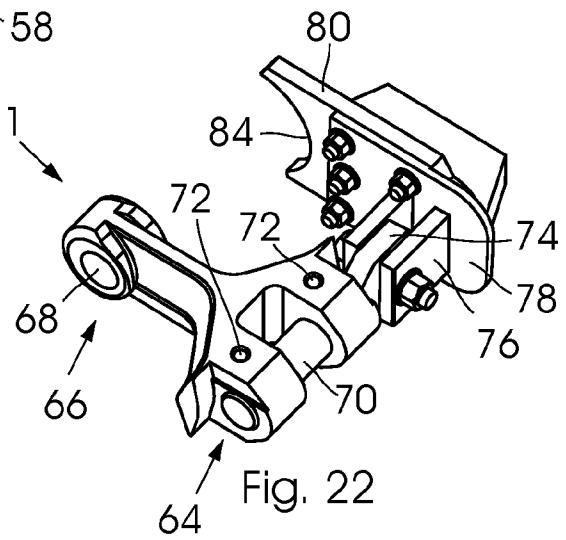
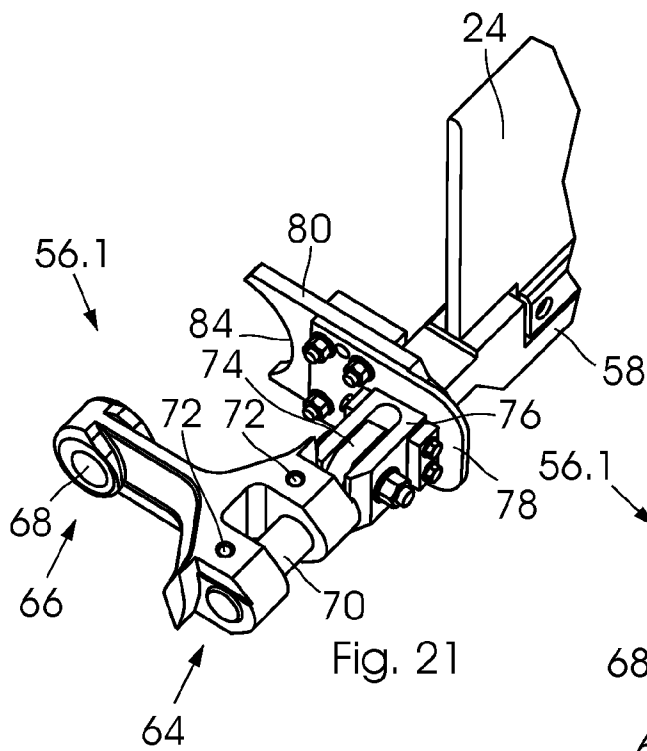
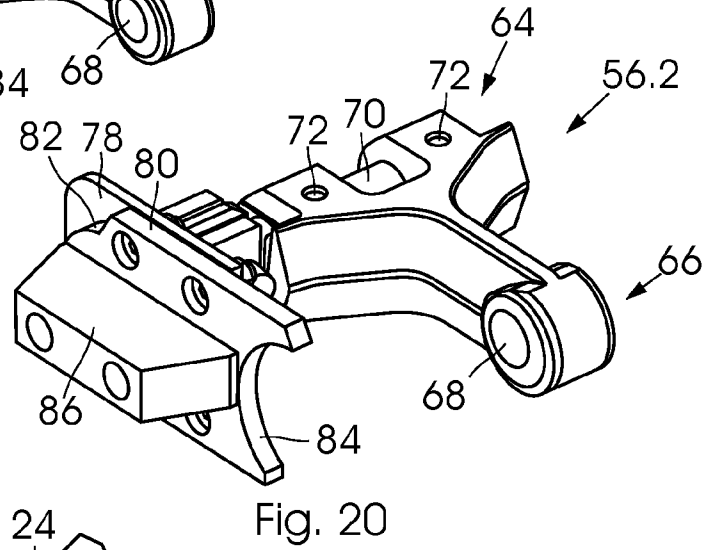
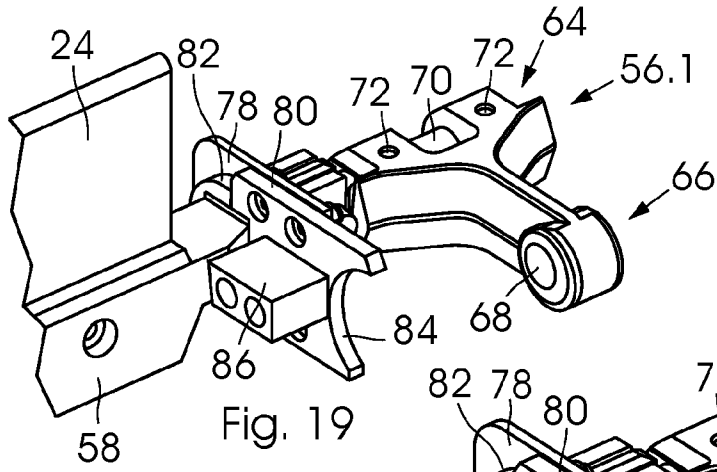


Fig. 15





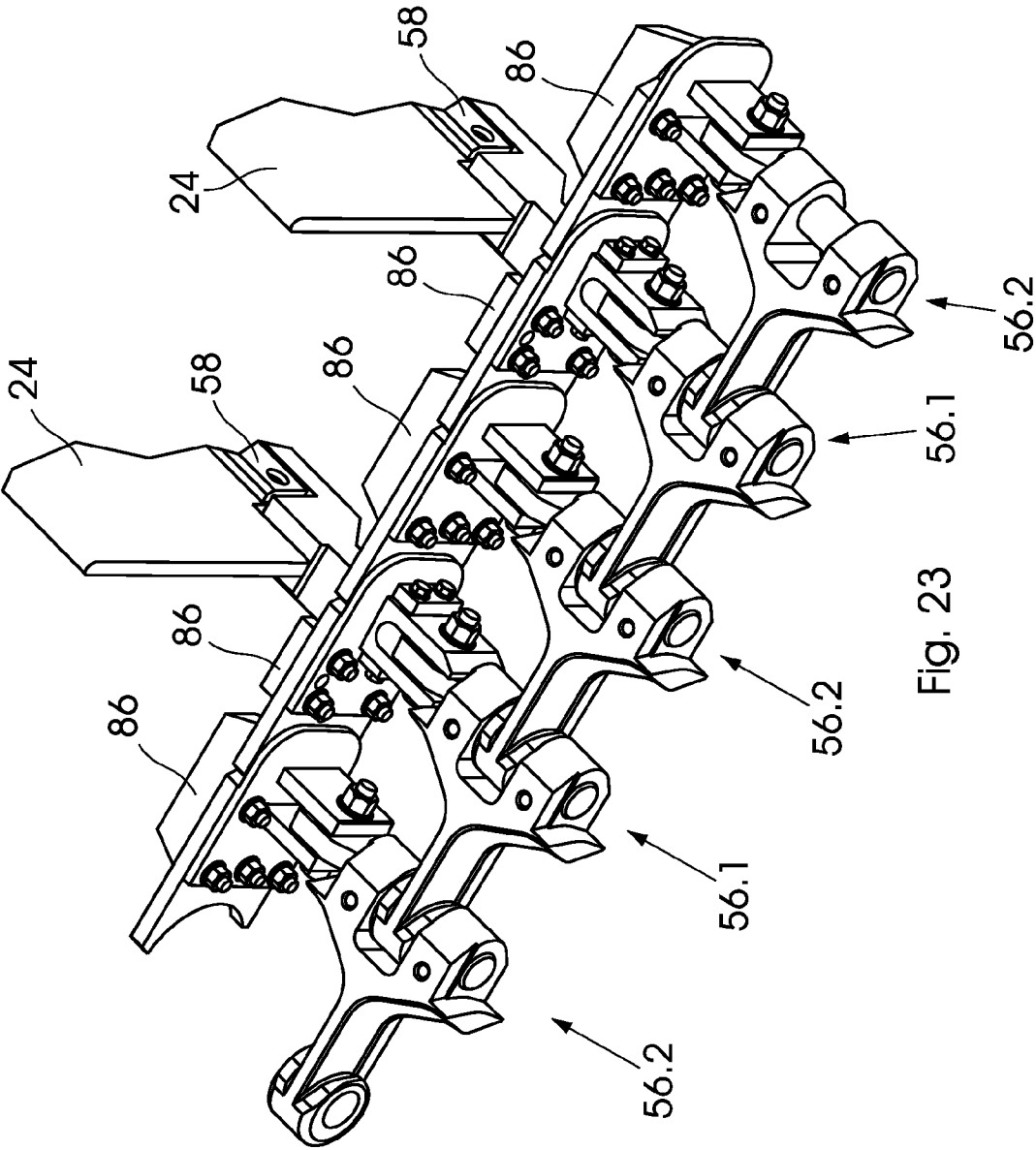


Fig. 23