

- [54] APPARATUS AND METHOD FOR
REPOSITIONING EARTHEN MATERIAL

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- [22] Filed: **Jan. 15, 1973**

- [21] Appl. No.: 323,769

- [52] U.S. Cl..... 299/7, 47/1, 172/32,
209/44, 299/17, 299/31

- [51] Int. Cl. E02f 1/00, E20f 5/00

- [58] **Field of Search** 299/7-9,
299/17, 31; 37/142.5, 2; 209/44; 172/32

- [56]
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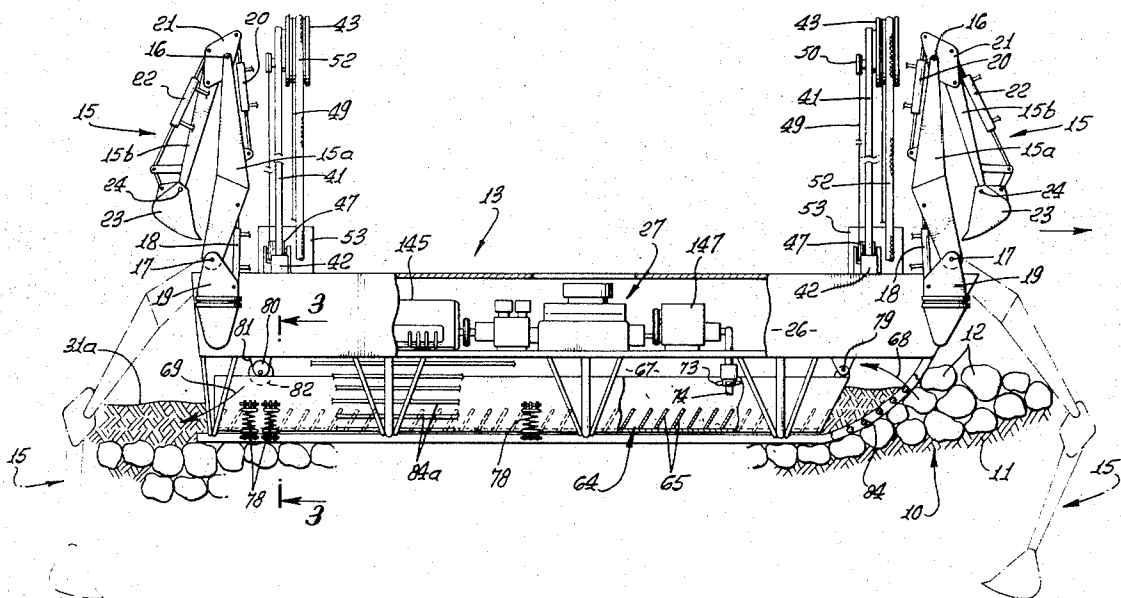
Attorney—William W. Haefliger et al.

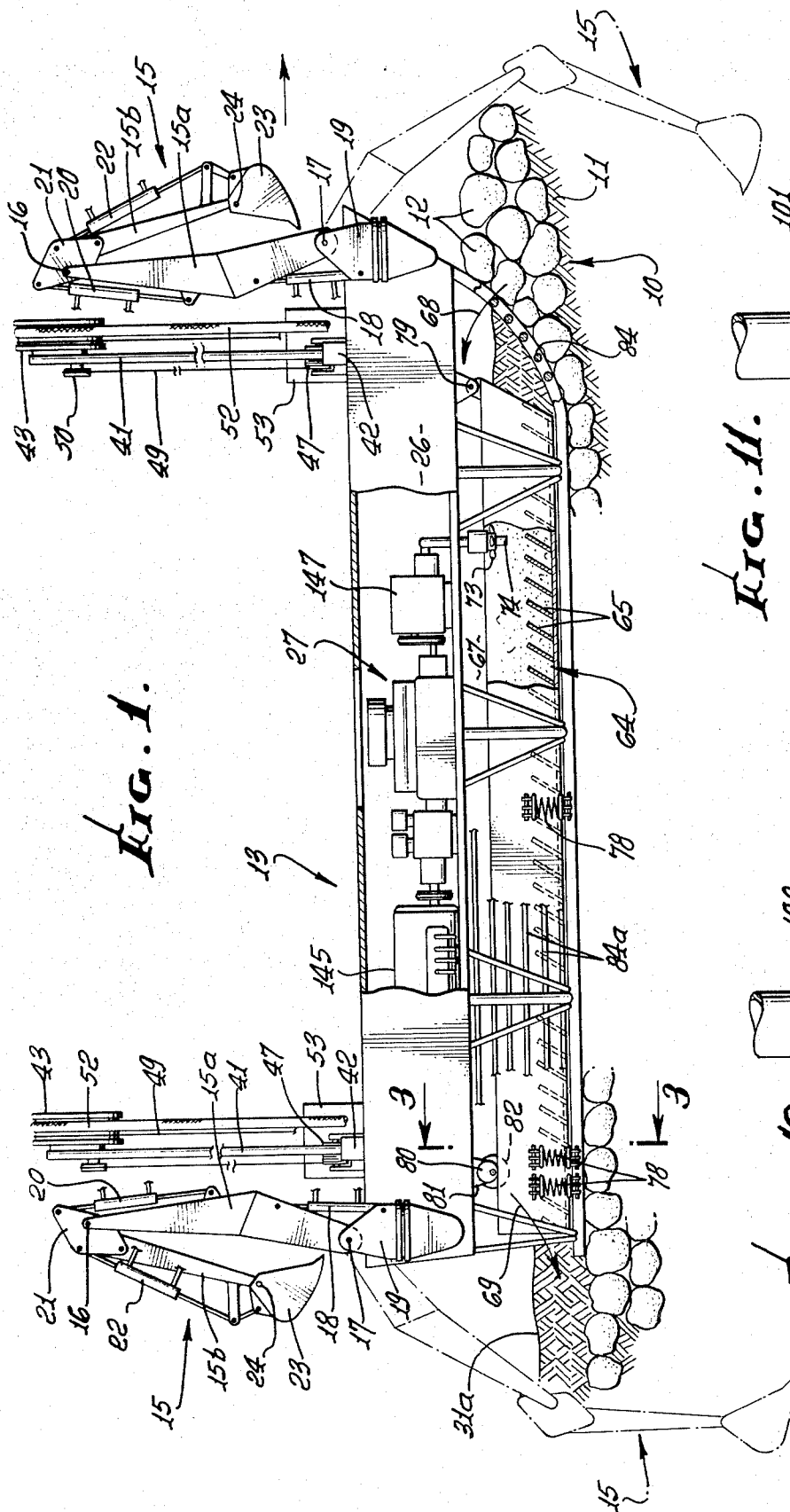
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ABSTRACT

Subterranean earthen material including intermixed soil and rocks is repositioned by delivering fluid under pressure downwardly to local portions of the material and effecting upward return flow of fluid through overlying material to effect sinking of rocks and upward displacement of soil, and depositing the soil in a surface layer overlying the sunken rocks. Also, precious metal particles may be removed from the upwardly displaced soil, in the manner described.

46 Claims, 13 Drawing Figures





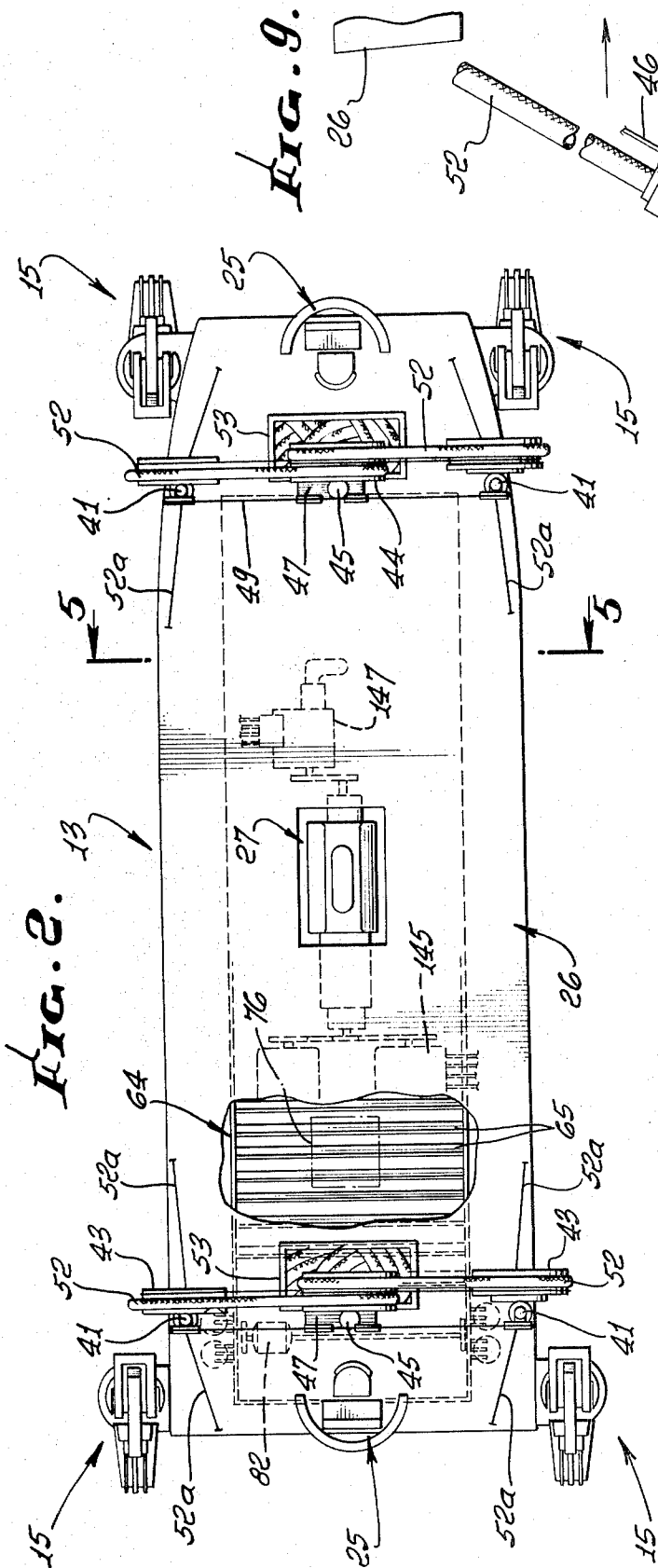
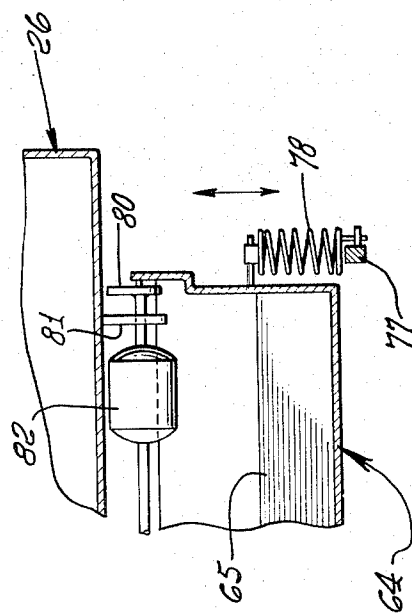
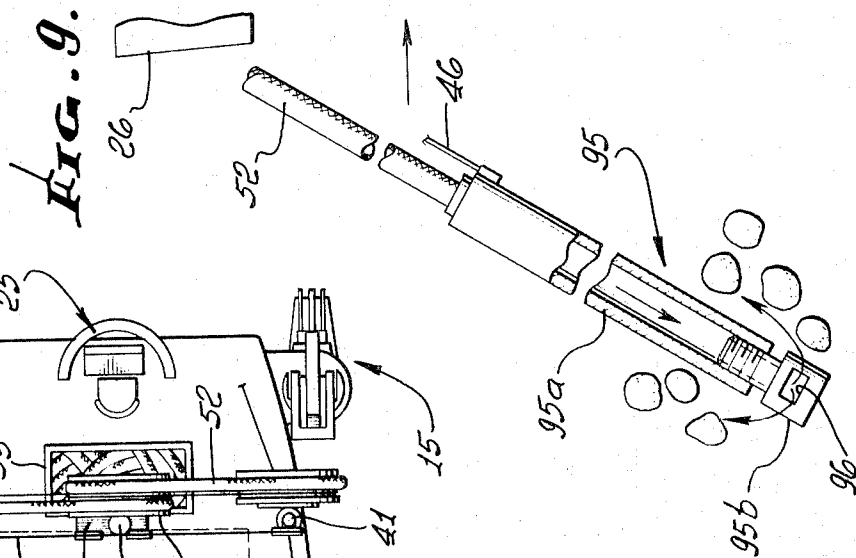


FIG. 6.

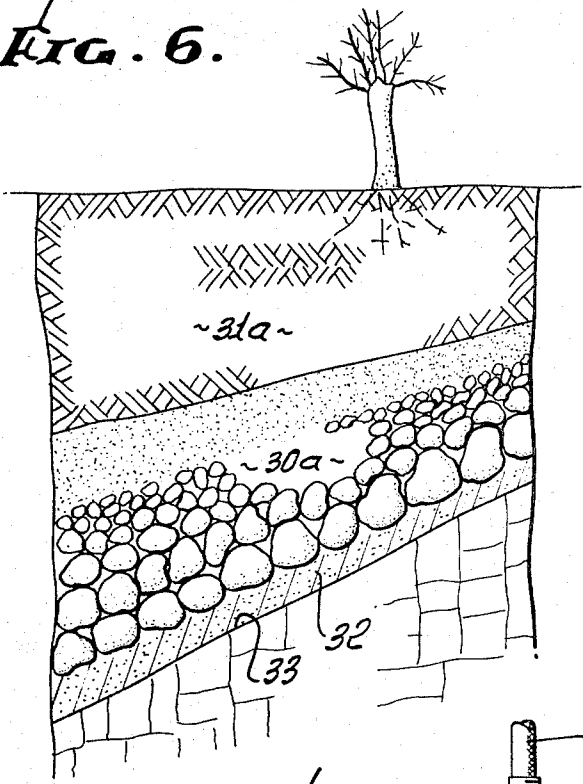


FIG. 7.

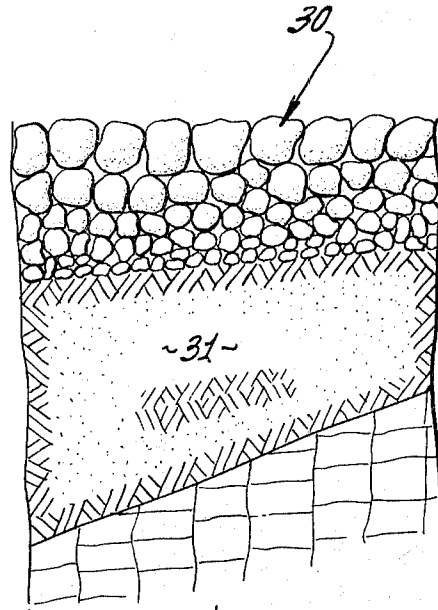


FIG. 12.

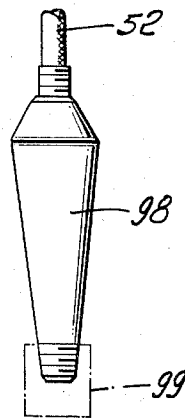


FIG. 4.

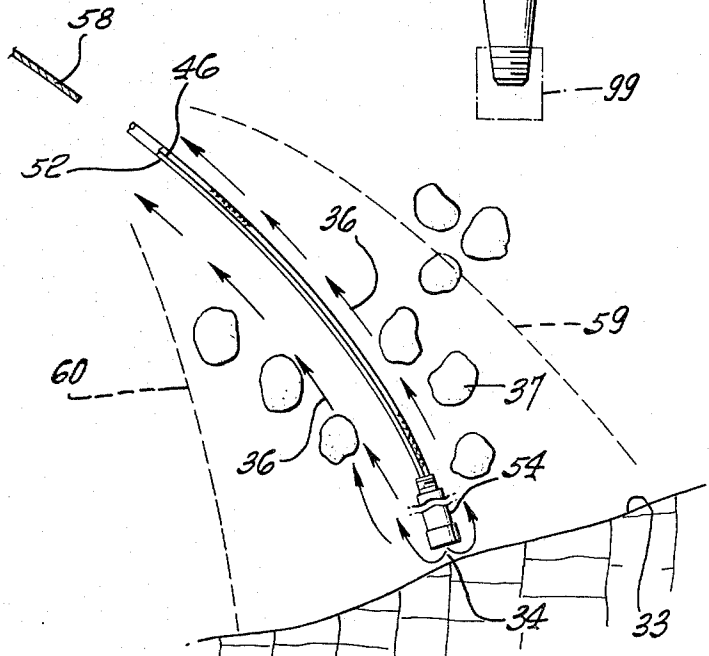


FIG. 8.

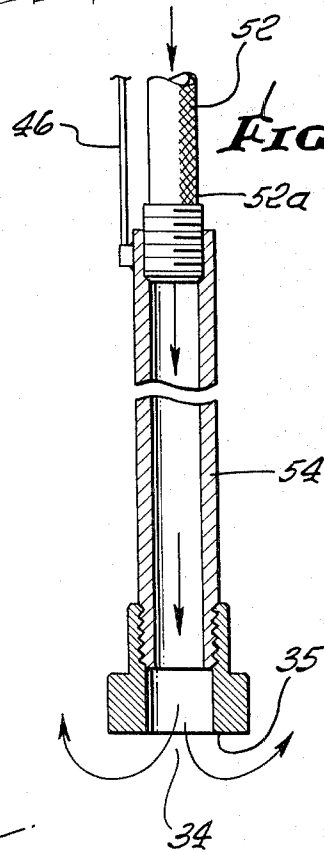


FIG. 5.

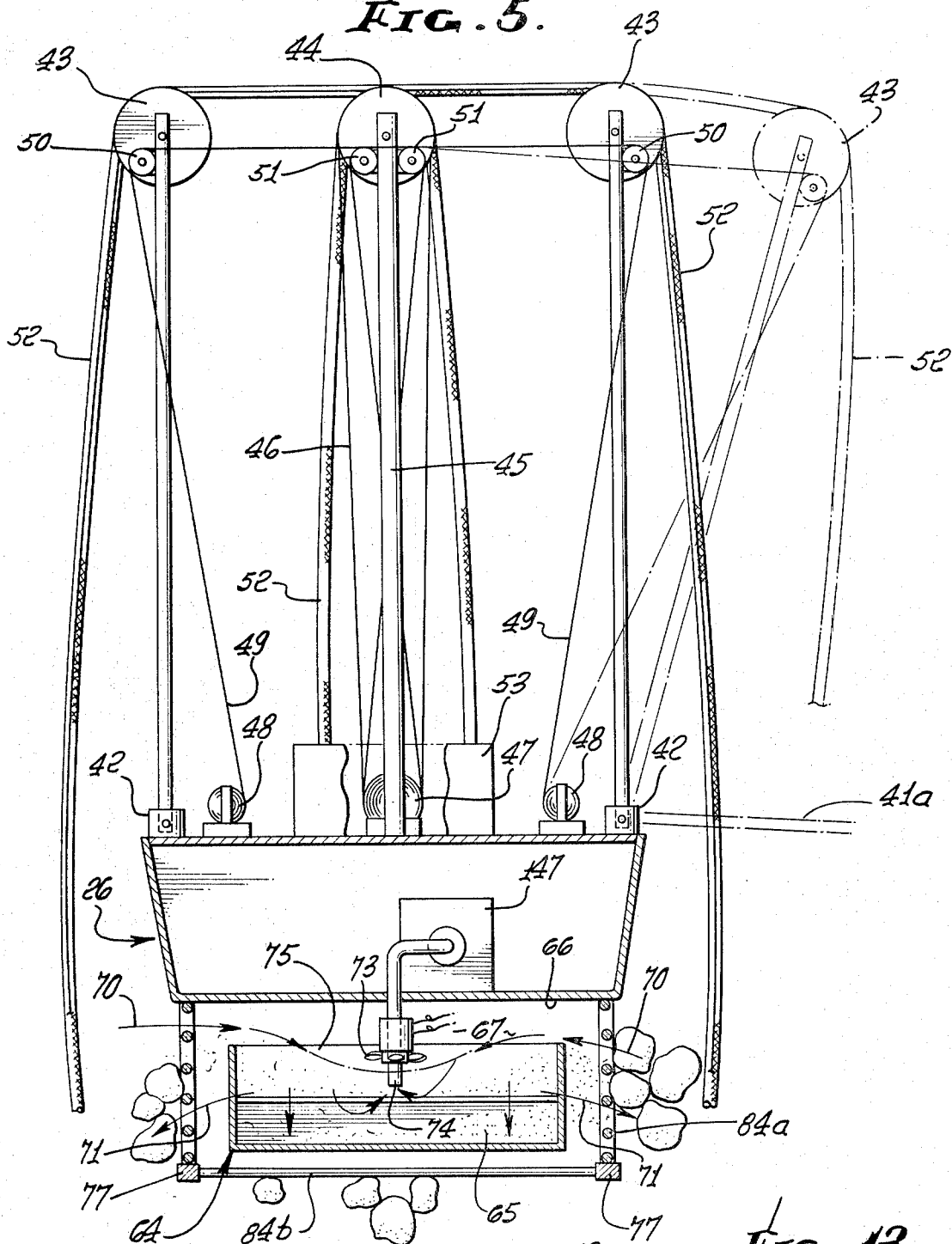
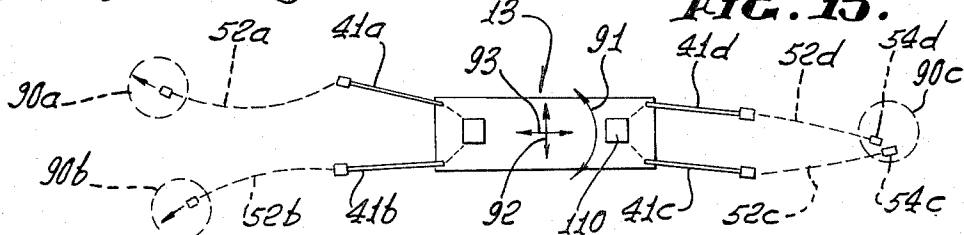


FIG. 13.



APPARATUS AND METHOD FOR REPOSITIONING EARTHEN MATERIAL

BACKGROUND OF THE INVENTION

This invention relates generally to land reclamation by displacement separation of underground material, and more particularly concerns hydraulic repositioning of subterranean earthen material including intermixed soil and rocks, as well as to recovery of metallic particles from the earthen material being repositioned.

In many areas of the world, surface soil and rocks have become intermixed to such great extent that the land is useless for farming or recreation. As an example, strip mining operations have been widely carried out to gain access to underground minerals, with resultant deposition of rocks over the soil, and mixing of soil with such rocks. In addition, mining operations in California have produced thousands of acres of such useless land, as a result of stripping the overburden off bedrock underlying streams where gold particles were concentrated, the intermixed soil and rocks having been re-deposited over the bedrock after dredging of the gold bearing layers, however, not all the gold was removed by the mechanical dredging methods that were employed, so that much gold remains in crevices at bedrock level. No way has been known, to my knowledge, to accomplish either reclamation of such land or recovery of unrecovered precious metal particles, in the simple manner as now offered by the present invention.

SUMMARY OF THE INVENTION

It is a major object of the invention to provide solutions to the above problems which will restore the land to usable form for farming or recreation, and which will permit simultaneous precious metal recovery.

Basically, and in its method aspects, the invention contemplates employment of a carrier vehicle for repositioning earthen material including intermixed soil and rocks, that vehicle being movable over the rough earthen terrain; and with local hydraulic agitation of the subterranean earthen material for effecting sinking of rocks relative to the vehicle, and for effecting depositions of a soil layer overlying the sunken rocks, in response to vehicle movement. The vehicle may be moved endwise, or sidewise or rotated, as will be seen, with resultant "puddling in" in a local area of the terrain, and water may be re-circulated for pressurization and injection underground to produce the subterranean agitation. Ever-widening areas of the terrain may thus be treated, for extensive land reclamation, and also precious metals may be recovered from the soil entrained in the rising water streams.

In its apparatus aspects the invention contemplates the provision of a carrier vehicle and advancing means operatively connected with the vehicle for elevating and advancing it over the terrain to be repositioned; together with other means carried by the vehicle for locally hydraulically agitating subterranean earthen material to effect sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the rocks. Such advancing means may include articulated legs; and the hydraulic agitator may include hydraulic ducting such as drill pipe, or a weighted hose adapted to hydraulically penetrate into the subterranean formation and produce the rising soil and water

stream for locally fluidizing the formation enabling sinking of rocks.

Additional features of the invention include the provision of separator structure such as a sluice carried by the vehicle beneath a floatable hull, there being a passage or zone between the sluice and hull to receive or pass the soil and water so that heavier metal particles may be captured by the sluice. In addition, water may be withdrawn from that zone for re-introduction to the subterranean formation under pressure produced by pump means, and soil may flow outwardly laterally of the carrier vehicle for deposition over the rocks. A grille may be provided about the sluice to prevent rock introduction to the sluice, and to enable vibration of the sluice, as will be seen.

These and other objects and advantages of the invention, as well as the details of illustrative embodiments, will be more fully understood from the following description and drawings, in which:

DRAWING DESCRIPTION

FIG. 1 is a side elevation showing one preferred form of apparatus incorporating the invention;

FIG. 2 is a top plan view of the the FIG. 1 apparatus;

FIG. 3 is an enlarged fragmentary vertical section taken on lines 3—3 of FIG. 1;

FIG. 4 is an elevation showing subterranean earth agitation apparatus in use;

FIG. 5 is an enlarged vertical section taken on lines 5—5 of FIG. 3;

FIG. 6 is a vertical section through an originally undisturbed underground formation;

FIG. 7 is a view like FIG. 6 showing the same formation after dredging or stripping to produce a top layer of rock;

FIG. 8 is an enlarged section taken through the washing shoe seen in FIG. 4;

FIGS. 9-12 show modified washing shoes; and

FIG. 13 is a schematic plan view.

DETAILED DESCRIPTION

In FIGS. 1-3, the apparatus for repositioning the earthen material 10, that includes intermixed soil 11 and rocks 12, comprises a carrier craft or vehicle 13, and means operatively connected with the vehicle for advancing it over the terrain to be repositioned. Such advancing means may, with unusual advantage, include articulated legs as for example are generally seen at 15 carried by the vehicle. The legs may be located at opposite ends of the vehicle, i.e. one at each corner, to have retracted raised positions as seen in full lines, and various extended i.e. "walking" positions (as seen in broken lines) in which the legs are lowered to grip the terrain in order to relatively raise, lower, advance and retract (linearly and/or rotatably) the carrier over rough as well as smooth terrain. The legs may include booms or links 15a and 15b pivotally interconnected at pivot locations 16, and the backhoe booms or links 15a may be pivotally supported at 17 on the carrier. Fluid pressure responsive actuators 18 are connected between leg support structure 19 on the vehicle and links 155a to extend and retract the latter; fluid pressure responsive actuators 20 are pivotally connected between links 15a and supports 21 for the inner ends of booms or links 15b to pivotally extend and retract the latter relative to links 15a; and fluid pressure responsive actuators 22 are pivotally connected between links 15b

and the claws or backhoes 23 (which are pivotally connected at 24 to the outer ends of legs 15b) in order to pivot the claws as required. Controls 25 are located at each end of the vehicle for operating the legs. Accordingly, the carrier vehicle may be moved (i.e. "walked") over very rough, rocky terrain and set down wherever desired in order to "puddle in", as will be described, for repositioning the terrain as by sinking the rocks and elevating the soil to reclaim the land in a most rapid and efficient manner.

The vehicle itself may include an elongated hull 26 designed to carry the pumping equipment 27, legs 15, controls 25 as well as other equipment to be described.

Also, the hull is sized to floatably support such equipment during the "puddling in" process to be described, the legs being long enough to be lowered and operated to enable walking of the vehicle out of a shallow puddle formed during reclamation. Also, the dug-in legs may resist vehicle movement, as may be desired.

In accordance with an important aspect of the invention, means is provided for locally hydraulically agitating the subterranean earthen material to effect sinking of rocks relative to the vehicle, and to effect deposition of a layer of soil overlying the rocks in response to vehicle advancement. In this regard, reference is made to FIG. 7 showing terrain wherein an upper layer 30 of rocks has been deposited over the top soil and sandy silt 31, typically as a result of past dredging activity. The latter was carried out in the past in certain areas of California to recover gold particles naturally deposited in a layer 32 just above sloping bedrock 33 as from streams flowing downstream from a "mother lode" of gold ore, as better seen in FIG. 6. During such recovery, the dredged land become useless for farming or recreation. Also, substantial amounts of the gold remained unrecovered due to inability of dredge buckets to closely scoop the bedrock or to scoop the cracks and crevices in the bedrock wherein gold particles naturally collect.

FIG. 6 shows the top soil 31a as it originally overlay the rocks in layer 30a, and it is a prime purpose of the invention to reposition the rocks and top soil from the condition as seen in FIG. 7 to a condition approximating that seen in FIG. 6, and in a most efficient manner; at the same time, it is a purpose of the invention to enable remanent gold or other precious metal recovery. The bedrock over which the terrain is to be repositioned typically lies between 20 and 150 feet below the surface; however, the invention is applicable to other areas, where bedrock may be much deeper, as for example in reclaiming land subjected to strip mining during coal or other mineral recovery.

The above referenced means for locally hydraulically agitating the subterranean material may typically include one or more elongated agitators operable to penetrate into and to agitate the earthen material to be repositioned, such agitators being carried by the vehicle for movement therewith. Further, such agitators may include ducts for flowing liquid downwardly into the soil and rocks subject to agitation, and means may be provided on the vehicle to supply or deliver pressurized fluid, such as water and/or air, to the ducts.

Turning to FIGS. 4, 5 and 8, one form of such ducting comprises a flexible hose 52 extending downwardly from a hose supply means 53 on the vehicle 13. A heavy weight, as for example a steel collar or shoe 54, may be connected with the outboard end 52a of the

hose to sink same in the fluidized earthen material and to resist the reaction force of the jet 34 emanating from the hose and hydraulic collar. Pressurized water, air or other hydraulic fluid jetting from the bottom terminal 35 of the collar entrains soil and sand for return flow upwardly through the formation and about the hose as indicated by arrows 36. This in turn fluidizes the formation about the hose to sufficient extent that rocks and boulders 37 gravitate downwardly, whereby the soil is repositioned upwardly and the rocks downwardly.

In this process, with the duct lower terminal located proximate bedrock 33, precious metal particles lying close to the bedrock or in cracks or crevices are washed loose and carried upwardly in the rising stream of water, soil and sand. The formation itself through which the duct has been lowered, as aided by hydraulic jetting, may or may not be saturated with water, i.e. below or above the water table level.

Initial launching of the weighted hose may be directed by a "shoe horn" 58 at an angle relative to vertical, and the hose may be repeatedly extended and withdrawn, i.e. endwise oscillated, to cause the cutting action of the hydraulic jet to form or cut a swath in a vertical plane, i.e. between broken lines 59 and 60, for example. Also, the hose may be dragged or oscillated in directions normal to or at angles to the plane of FIG. 4, as by carrier vehicle movement, whereby a wide upwardly facing zone of the bedrock may receive the washing action of the shoe 54.

A further aspect of the invention concerns the provision of control means on the carrier vehicle or craft for displacing an upper portion of the ducting relative to the carrier vehicle. Such control means may, with unusual advantage, comprise boom structure carried by the vehicle to support an above-ground portion of the hose or hoses for movement relative to the vehicle. In the example seen in FIGS. 1, 2 and 5, the boom structure includes multiple booms 41 the lower ends of which are universally pivotally supported at 42 (as by ball and socket) proximate the sides of the craft near its opposite ends, so as to be capable of lowering to near or below horizontal position as indicated at 41a in FIG. 5. This configuration facilitates the "trailing" mode of operation to be described.

The boom structure also includes sheaves 43 at the outboard ends of the booms, and over which upper, above-ground portions of the hoses are trained. The hoses are extensible or supplied as from coils within supply boxes 53 on the craft deck, as previously referenced, and they may extend upwardly therefrom toward idler sheaves 44 on masts 45, to be directed toward boom sheaves 43.

Further, the control means may include cables 46 the outboard ends of which are connected with the weighted lower ends of the hoses, as for example are provided by hydraulic collars 54. The cables extend upwardly generally alongside the hoses and have above ground portions supported by the boom structure, as for example sheaves 43, dual annular grooves in each of the latter respectively training a cable and its corresponding hose. The control means may also include actuator means in the carrier vehicle for selectively displacing the boom structures, and also for endwise extending and retracting the cables relative to the carrier. For example, powered winches 47 reel and unreel the cables 46, and powered winches 48 reel and unreel lines 49 controlling raising, lowering and swinging of

the booms. Lines 49 may typically be trained over small pulleys 50 and 51 respectively attached to the booms, and mast 45, as shown. Auxiliary lines 52a may be attached to the booms and to the carrier as seen in FIG. 2, for controlling swinging and orientation of the booms in different azimuthal directions.

FIG. 13 shows the booms 41a and 41b extending rearwardly of the vehicle, to trail the hoses 52a and 52b, the lower ends of the latter jetting water to wash the underground zones indicated generally at 90a and 90b. Turning of the vehicle and lateral and longitudinal movement thereof in directions indicated by arrows 91-93 aids such operation. Similar booms 41c and 41d extend forwardly of the vehicle, and hoses 52c and 52d extend underground therefrom. The jet terminal collar 54d of hose 52d is shown washing hose 52c at a stuck section thereof, underground.

The design and weighting of the hydraulic collar will normally be tailored to the volume of water that can be passed through same, with the collar having enough weight to wash itself down to desired depth. A number of different hydraulic collar designs may be employed, as for example where sampling shows that more gold is left behind in the first washing pass. The collar 54 shown in FIG. 8 is of straight through design, whereas the trailing type unit 95 of FIG. 9 can be used to reach out away from the carrier craft and to pump itself down through the formation causing the gravel to wash and re-wash toward the gold catching area. Unit 95 includes a tubular collar 95a and a removal shoe 95b which is three-cornered and has flat side walls. This design with a side outlet port 96 in one flat underside causes upward washing of the fluid toward the gold catching area.

The tubular weight 98 in FIG. 12 is tapered lengthwise to aid in prevention of sticking in the formation, there being a removable shoe 99 at the lower end thereof, and the hose 52 connected to the upper end. The modified cylindrical shoes 100 and 101 in FIGS. 10 and 11 have multiple side outlets 102 and 103. Outlets 102 extend radially, whereas outlets 103 extend radially and upwardly.

Separator structure may also be carried by the vehicle to be sunk downwardly in the earthen material in response to hydraulic agitation of the material, such separator structure having entrance and exit zones to pass the soil to be deposited over the rocks over which the vehicle moves. Such separator structure may include a sluice, as for example is generally indicated at 64, with riffle plates 65 extending upwardly and laterally to segregate metal particles from the soil and water flowing upwardly and over the sluice at 67 beneath the bottom 66 of the hull. The upward flow of water, soil and metal particles may enter the region 67 from a forward entrance zone 68, to flow rearwardly over the sluice and to ultimately discharge at exit zone 69 for deposition of soil in layer 31a, as previously described.

Reference to FIG. 5 shows water, soil and metal particles entering zone 67 via side inlet zones indicated by arrows 70, with soil discharge via side outlet zones indicated by arrows 71. Water and soil in region 67 is subjected to centrifugal displacement as by a rotating impeller 73, to segregate (by centrifugal action) the soil particles from the water being drawn into central intake pipe 74 delivering to the intakes of pumps 145 and 147 as previously described. As a result, the water surface level is lowered at 75, as in a vortex. The filled or

partly filled condition of the spaces between the sluice plates or riffles may be observed as by means of a transparent plate or plates 76 in the hull bottom.

Means is also provided to vibrate the sluice or sluice box 64 relative to the carrier vehicle to aid in the separation of metal particles from soil to be deposited in layer 31a. For this purpose, the sluice box may be mounted to the vehicle via a frame 77 projecting beneath the hull, and via springs 78 connecting the box to the frame; also, one end of the box may be pivotally connected at 79 with the hull, and the opposite end of the box vibrated up and down, against yieldable resistance imposed by the springs. The up and down vibratory force may be generated by rotating eccentrics or cams 80 interconnecting the box with a bracket 81 projecting from and below the hull. A fluid operated motor to rotate the cams is seen at 82 in FIG. 3.

In order to prevent entrance of rocks into zone 67, an openwork frame or grille extends about the sluice, a forward portion of the grille being seen at 84. That grille portion deflects rocks downwardly as the vehicle advances forwardly. The grille may also extend at the sides and beneath the sluice, as at 84a and 84b in FIG. 5, whereby the sluice may be vibrated up and down free of impact with rocks.

Broadly considered, the method of the invention may be considered to include the steps of moving the vehicle over earthen terrain to be repositioned, and locally hydraulically agitating subterranean earthen material for effecting sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the sunken rocks, in response to vehicle movement. In this regard, the vehicle may be moved endwise, or rotated about a vertical axis, or otherwise moved to "puddle into" a selected area of the terrain, and initially water may be supplied to the pumps and hydraulic agitators as from an external source such as a stream, lake or tank. During or after puddling into one spot with accompanying repositioning of the soil over the rocks, a water body is created from which suction may be taken by the pumps to enable further hydraulic agitation and working of the vehicle to "puddle into" ever-widening zones until a large area has been reclaimed. Vehicle movement may be effected as by the articulated legs described, or by other means.

The broad method of gold or other precious metal recovery includes delivering water in a pressurized jet stream to a zone wherein metal particles are concentrated and underlying a formation of intermixed soil and rocks, effecting upward return flow of intermixed soil and metal particles from that zone and through the formation, and receiving the upward return flow in a separation zone and therein separating the metal particles from the soil. Water may be taken from the separation zone for pressurization and delivery to the subterranean zone in a jet stream, and the latter may be oscillated up and down as by vehicle or duct movement.

Alternatively, and assuming that neither hose 52c or 52d is stuck, the two hydraulic collars 54c and 54d may be operated in proximity to one another as seen in FIG. 13 at a sub-surface location, one hose and collar 52c and 54c supplying water under pressure to the earthen material and the other collar and hose 54d and 54c withdrawing water and entrained sand and soil at that location for upward displacement and discharge at the zone 67 previously described near the separator structure. For this purpose, a suitable pump 110 may have

its suction side connected to hose 52d and its discharge side delivering to zone 67.

I claim:

1. In apparatus for repositioning earthen material including intermixed soil and rocks, the combination comprising
 - a. a carrier vehicle and advancing means operatively connected therewith for advancing the vehicle over terrain to be repositioned, and
 - b. other means carried by the vehicle including structure penetrating into the subterranean material and releasing pressurized water thereon for locally hydraulically agitating the subterranean earthen material to effect sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the rocks in response to vehicle advancement.
2. The combination of claim 1 wherein said other means includes an elongated agitator operable to penetrate into and to agitate the earthen material to be repositioned.
3. In apparatus for repositioning earthen material including intermixed soil and rocks, the combination comprising
 - a. a carrier vehicle and advancing means operatively connected therewith for advancing the vehicle over terrain to be repositioned, and
 - b. other means carried by the vehicle for locally hydraulically agitating subterranean earthen material to effect sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the rocks in response to vehicle advancement, said advancing means including articulated legs carried by the vehicle and fluid pressure responsive actuators connected with said legs to extend and retract same.
4. The combination of claim 3 wherein said other means includes multiple elongated agitators operable to penetrate into and to agitate the earthen material to be repositioned.
5. The combination of claim 4 wherein said elongated agitators include ducts for flowing liquid downwardly into the soil and rocks subject to agitation, and means on the vehicle to supply pressurized liquid to said ducts.
6. The combination of claim 5 wherein said vehicle is elongated and said legs are carried at longitudinally opposite ends of the vehicle and have retracted positions in which the legs are raised relative to the vehicle and extended positions in which the legs are lowered relative to the vehicle.
7. In apparatus for repositioning earthen material including intermixed soil and rocks, the combination comprising
 - a. a carrier vehicle and advancing means operatively connected therewith for advancing the vehicle over terrain to be repositioned, and
 - b. other means carried by the vehicle for locally hydraulically agitating subterranean earthen material to effect sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the rocks in response to vehicle advancement, said other means comprising an elongated duct having an open terminal to release pressurized water into the earthen material, weight means carried to sink said terminal in fluidized earthen material, and the

duct being flexible at a location between the vehicle and said weight means.

8. The combination of claim 7 including a cable extending from the vehicle and carrying the weight means, and the duct comprising a hose attached to the weight means.
9. The combination as defined in claim 7 including control means on the carrier vehicle for displacing an upper portion of the duct relative to the carrier vehicle.
10. The combination of claim 9 wherein said duct comprises an elongated flexible hose and said control means includes boom structure supporting an above-ground portion of the hose for movement relative to the carrier vehicle.
11. The combination of claim 10 wherein said control means includes a cable connected with the weight means and having an above ground portion supported by the boom structure.
12. The combination of claim 11 wherein said control means includes actuator means on the carrier vehicle for displacing the boom structure relative to the vehicle and for endwise extending and retracting the cable relative to the vehicle.
13. The combination of claim 10 wherein said duct comprises multiple ducts each including an elongated flexible hose, there being control means on the carrier vehicle for selectively displacing upper portions of the hoses relative to the vehicle, the outboard ends of the ducts being weighted, said control means comprising multiple boom structures one for each hose, multiple cables respectively connected with the weighted outboard ends of the ducts, and actuator means for displacing the boom structures relative to the vehicle and for endwise extending and retracting the cables relative to the vehicle.
14. The combination of claim 7 wherein said weight means comprises an elongated tubular weight connected in series with the flexible duct and a shoe removably attached to the tubular weight at the lower end terminal thereof.
15. The combination of claim 14 wherein the shoe has a side outlet.
16. The combination of claim 14 wherein the shoe has an end outlet.
17. The combination of claim 14 wherein the tubular weight is longitudinally tapered.
18. In apparatus for repositioning earthen material including intermixed soil and rocks, the combination comprising
 - a. a carrier vehicle and advancing means operatively connected therewith for advancing the vehicle over terrain to be repositioned,
 - b. other means carried by the vehicle for locally hydraulically agitating subterranean earthen material to effect sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the rocks in response to vehicle advancement, and
 - c. separator structure located to be sunk downwardly in the earthen material in response to hydraulic agitation of said material, and having entrance and discharge zones to pass soil to be deposited over the sunken rocks over which the vehicle moves.
19. The combination of claim 18 wherein said separator structure includes a sluice to segregate metal particles from the soil passing between said inlet and discharge zones.

20. The combination of claim 19 including means to vibrate said sluice relative to the vehicle.

21. The combination of claim 20 wherein the duct comprises a flexible hose connected with said water supply means, and elongated boom means on and movable relative to the carrier vehicle for displacing an above ground upper portion of the hose relative to the carrier vehicle.

22. The combination of claim 18 wherein said other means includes an elongated duct having an open terminal to release pressurized water to hydraulically agitate the earthen material for relative movement toward the separator.

23. The combination of claim 22 including means on the carrier vehicle to supply water to the duct.

24. The combination of claim 18 wherein said vehicle carries a lower openwork grille, and said separator means is elongated and carried to extend within said grille.

25. The combination of claim 24 wherein the vehicle includes a floatable hull above said frame and connected therewith.

26. The combination of claim 24 wherein the frame includes a forward grille projecting forwardly of said entrance zone to deflect rocks beneath the separator and to pass soil to said entrance zone in response to carrier vehicle forward advancement.

27. The combination of claim 18 wherein said other means includes

- a. an elongated duct to supply water to the subterranean earthen material to be agitated, and
- b. means to withdraw water from a zone directly above the separator means, for supply to said duct, and to pressurize the water supplied to said duct.

28. In the method of repositioning earthen material including intermixed soil and rocks, and employing a carrier vehicle the steps that include

- a. moving the vehicle over the earthen terrain to be repositioned, and
- b. locally hydraulically agitating subterranean earthen material by releasing water under pressure into the subterranean material for effecting sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the sunken rocks in response to vehicle movement.

29. The method of claim 28 wherein vehicle movement is carried out to repeatedly travel the vehicle over a selected zone of said earthen material until the material fluidizes, and including the step of floatably supporting the vehicle in the fluidized material.

30. The method of claim 29 including the step of separating metallic particles from the soil beneath the vehicle and during said vehicle movement.

31. The method of claim 30 wherein the separation step is carried out by effecting flow of fluidized soil over a sluice carried by the vehicle.

32. The method of claim 31 including the step of withdrawing water from a zone directly above the sluice and pressurizing and delivering said water to the locus of subterranean hydraulic agitation.

33. The method of claim 28 wherein said vehicle movement is carried out by clawing the terrain locally about the vehicle.

34. The method of claim 28 including the step of employing the forward lower extent of the vehicle to deflect rocks beneath the vehicle and to pass muddy soil

into the lower extent of the vehicle, in response to vehicle advancement.

35. The method of repositioning subterranean earthen material including intermixed soil and rocks, that includes

- a. delivering water under pressure downwardly to local subterranean portions of the subterranean earthen material and releasing the water into said material and effecting upward return flow of water through overlying material to effect sinking of rocks and upward displacement of the soil, and
- b. depositing said soil in a surface layer overlying the sunken rocks.

36. The method of claim 35 including the step of removing water from the upwardly displaced soil prior to deposition thereof in said layer.

37. The method of claim 35 wherein bedrock underlies said intermixed soil and rocks, and wherein said water delivery is effected to subterranean material proximate the upper surface of said bedrock.

38. The method of claim 37 wherein metal particles are concentrated proximate said bedrock upper surface, and said water delivery is carried out to entrain said particles for upward flow with said upwardly displaced soil.

39. The method of claim 38 including the step of separating the metal particles from the upwardly displaced soil.

40. The method of claim 39 wherein said particles include gold.

41. The method of claim 35 wherein pump means on a carrier craft is employed to deliver said water under pressure via multiple hoses to said local portions of the subterranean earthen material, and including the step of displacing upper above-ground portions of the hoses relative to the carrier craft, thereby to variably shift the subterranean loci of water delivery.

42. The method of claim 34 wherein said displacement of the upper portions of one hose is carried out to direct subterranean water delivery therefrom toward a portion of another hose which has become stuck in the underground formation.

43. In the method of recovery gold particles concentrated in a subterranean zone underlying a formation of intermixed soil and rocks, the steps that include

- a. delivering water in a pressurized jet stream to said zone and releasing said stream into said subterranean zone and effecting local upward return flow of water and intermixed soil and gold particles from said zone and through said formation, and
- b. receiving said upward return flow in a separation zone, and therein separating the gold particles from the soil.

44. The method of claim 43 including the step of recovering the return flow of water for pressurization and delivery to said subterranean zone in said jet stream.

45. The method of claim 44 including the step of oscillating said jet stream within the formation to effect underground displacement of the locus of delivery thereof to different of said subterranean zones.

46. In apparatus for repositioning earthen material including intermixed soil and rocks, the combination comprising

- a. a carrier vehicle and advancing means operatively connected therewith for advancing the vehicle over terrain to be repositioned, and

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b. other means carried by the vehicle for locally hydraulically agitating subterranean earthen material to effect sinking of rocks relative to the vehicle and for effecting deposition of a layer of soil overlying the rocks in response to vehicle advancement, said other means including first and second elongated ducts one having a subterranean outlet port, and

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the other having a subterranean inlet port in proximity to said one duct outlet port, and means for delivering water under pressure to said one duct for subterranean discharge via said outlet port, and for drawing water and entrained soil upwardly within said other duct via said inlet port.

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