Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2474877 A1 2003/12/24

(21) 2 474 877

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2003/05/08
(87) Date publication PCT/PCT Publication Date: 2003/12/24
(85) Entrée phase nationale/National Entry: 2004/07/28
(86) N° demande PCT/PCT Application No.: EP 2003/050154
(87) N° publication PCT/PCT Publication No.: 2003/106056
(30) Priorité/Priority: 2002/06/13 (10/171,103) US

(51) Cl.Int.^{7}/Int.Cl.^{7} B07B 1/00, B29C 65/76, B07B 1/46, B01D 33/03, B09B 5/00

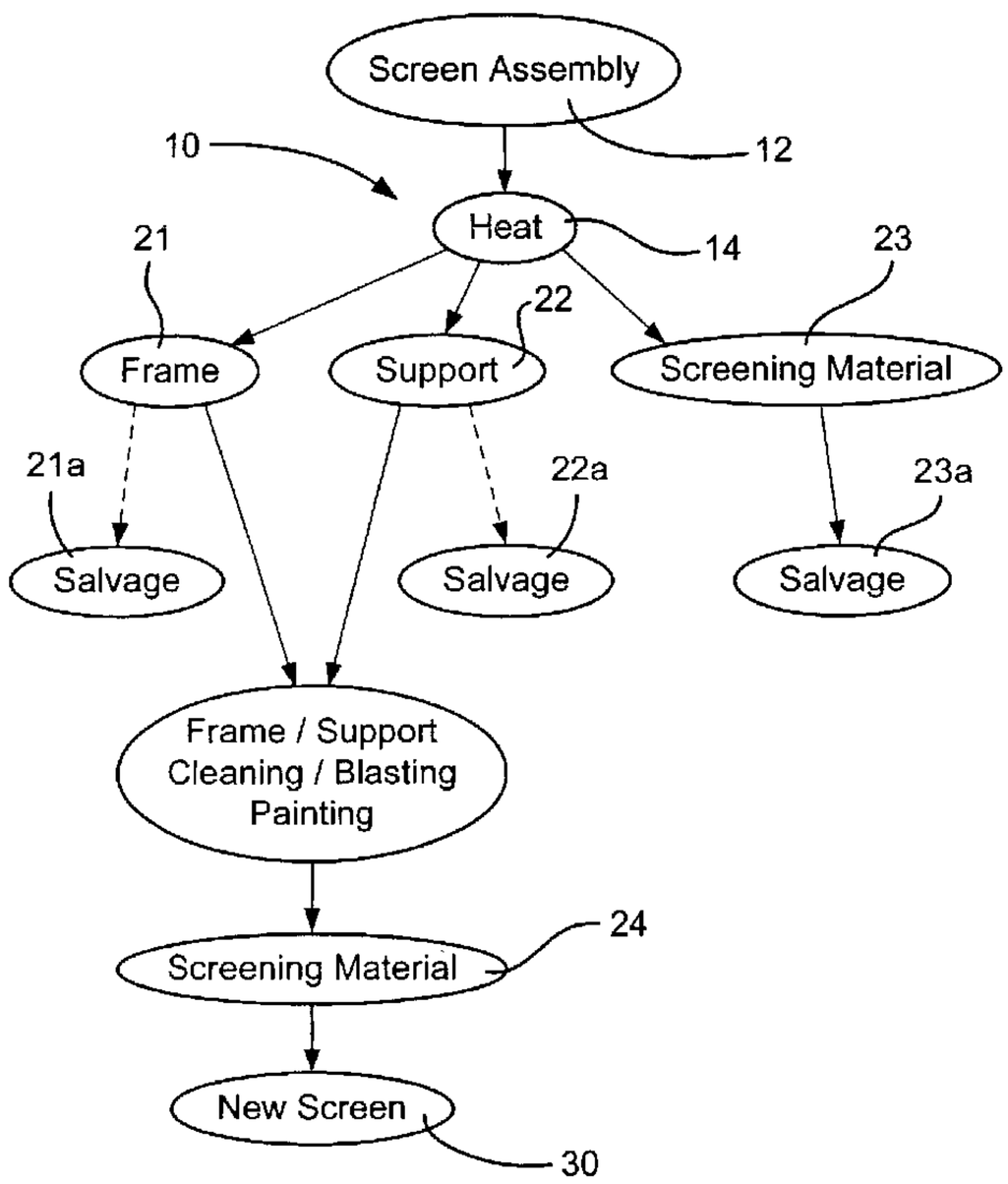
(71) Demandeur/Applicant:
VARCO I/P, INC., US

(72) Inventeurs/Inventors:
WARD, KERRY THOMAS, US;
PERSON, DAVID V., US;
GRAHAM, DOUGLAS, US;
ADAMS, THOMAS COLE, US

(74) Agent: MCFADDEN, FINCHAM

(54) Titre : PROCEDE DE RECYCLAGE D'ELEMENTS D'ENSEMBLE CRIBLE, ET PROCEDE DE REALISATION D'ENSEMBLE CRIBLE A PARTIR DE CES ELEMENTS

(54) Title: A METHOD FOR RECLAIMING PARTS OF A SCREEN ASSEMBLY AND A METHOD FOR MAKING A SCREEN ASSEMBLY USING THE RECLAIMED PARTS



(57) Abrégé/Abstract:
A method for reclaiming parts of a screen assembly for a vibratory separator, the screen assembly having a support apparatus and screening material secured thereto with securing material, the method comprising the step of applying heat to the securing material sufficient to degrade the securing material to facilitate separation of the supporting apparatus from the screening material. A method for making a screen assembly for a vibratory separator, the method comprising the steps of reclaiming a supporting apparatus from a predecessor screen assembly using the method of the invention, further comprising the step of connecting new screening material to the supporting apparatus.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 December 2003 (24.12.2003)

PCT

(10) International Publication Number
WO 03/106056 A1

(51) International Patent Classification[7]: B07B 1/00, 1/46, B09B 5/00, B29C 65/76, B01D 33/03

(21) International Application Number: PCT/EP03/50154

(22) International Filing Date: 8 May 2003 (08.05.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/171,103 13 June 2002 (13.06.2002) US

(71) Applicants *(for all designated States except US)*: **VARCO I/P, INC.** [US/US]; One BriarLake Plaza, 2000 West Sam Houston Parkway South, Suite 1700, Houston, TX 77042 (US). **LUCAS, Brian, Ronald** [GB/GB]; Lucas & Co., 135 Westhall Road, Warlingham, Surrey CR6 9HJ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **WARD, Kerry, Thomas** [US/US]; 13527 Post Oak Glen Lane, Cypress, TX 77429 (US). **PERSON, David, V.** [US/US]; 2351 Chappell Lane, Missouri City, TX 77459 (US). **GRAHAM, Douglas** [US/US]; 238 Plantation Road, Houston, TX 77024 (US). **ADAMS, Thomas, Cole** [US/US]; 27306 Teepee Trail, Hockley, TX 77447 (US).

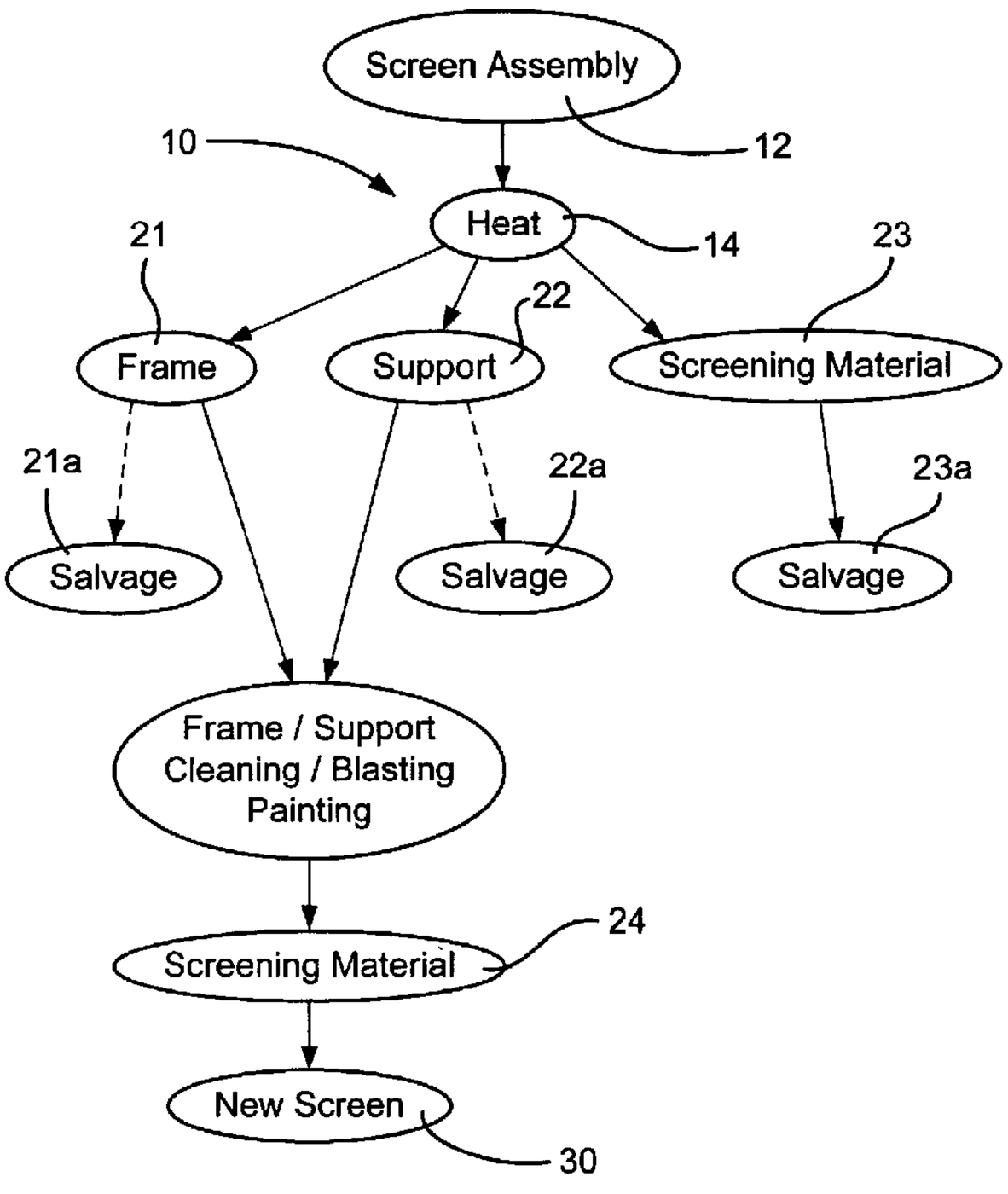
(74) Agent: **LUCAS, Brian, Ronald**; Lucas & Co., 135 Westhall Road, Warlingham, Surrey CR6 9HJ (GB).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: A METHOD FOR RECLAIMING PARTS OF A SCREEN ASSEMBLY AND A METHOD FOR MAKING A SCREEN ASSEMBLY USING THE RECLAIMED PARTS



(57) Abstract: A method for reclaiming parts of a screen assembly for a vibratory separator, the screen assembly having a support apparatus and screening material secured thereto with securing material, the method comprising the step of applying heat to the securing material sufficient to degrade the securing material to facilitate separation of the supporting apparatus from the screening material. A method for making a screen assembly for a vibratory separator, the method comprising the steps of reclaiming a supporting apparatus from a predecessor screen assembly using the method of the invention, further comprising the step of connecting new screening material to the supporting apparatus.

WO 03/106056 A1

WO 03/106056 A1

Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A METHOD FOR RECLAIMING PARTS OF A SCREEN ASSEMBLY AND A METHOD FOR MAKING A SCREEN ASSEMBLY USING THE RECLAIMED PARTS

The present invention relates to a method for reclaiming parts of a screen assembly and a method for making a screen assembly for a vibratory separator using the reclaimed parts.

A wide variety of industries use vibratory separators to separate materials such as liquids from solids or solids from solids. Typically such separators have a basket or other screen holding or mounting apparatus mounted in or over a receiving receptacle or tank and vibrating apparatus for vibrating the basket. One or more screens or "screen assemblies" are mounted in the basket. Material to be treated is introduced to the screen(s) and separated material on top of the screen(s) flows off an end of an end screen

In the drilling of a borehole in the construction of an oil or gas well, a drill bit is arranged on the end of a drill string and is rotated to bore the borehole. A drilling fluid known as "drilling mud" is pumped through the drill string to the drill bit to lubricate the drill bit. The drilling mud is also used to carry the cuttings produced by the drill bit and other solids to the surface through an annulus formed between the drill string and the borehole. The drilling mud contains expensive synthetic oil-based lubricants and it is normal therefore to recover and re-use the used drilling mud, but this requires the solids to be removed from the drilling mud. This is achieved by processing the drilling fluid. The first part of the process is to separate the solids from the solids laden drilling mud. This is at least partly achieved with a vibratory separator, such as those shale shakers disclosed in US 5,265,730, WO 96/33792 and WO 98/16328.

Shale shakers generally comprise an open bottomed basket having one open discharge end and a solid walled feed end. A number of rectangular screens are arranged in the basket, which are held in C-channel rails located on the basket walls, such as those disclosed in GB-A-2,176,424. The basket is arranged on springs above a receptor for receiving recovered drilling mud. A skip or ditch is provided beneath the open discharge end of the basket. A motor is fixed to the basket, which has a drive rotor provided with an offset clump weight. In use, the motor rotates the rotor and the offset clump weight, which causes the basket and the screens fixed thereto to shake. Solids laden mud is introduced at the feed end of the basket on to the screens. The shaking motion induces the solids to move along the screens towards the open discharge end. Drilling mud passes through the screens. The recovered drilling mud is received in the receptor for further processing and the solids pass over the discharge end of the basket into the ditch or skip.

The screens are generally of one of two types: hook-strip; and pre-tensioned.

The hook-strip type of screen comprises several rectangular layers of mesh in a sandwich, usually comprising one or two layers of fine grade mesh and a supporting mesh having larger mesh holes and heavier gauge wire. The layers of mesh are joined at each side edge by a strip which is in the form of an elongate hook. In use, the elongate hook is hooked on to a tensioning device arranged along each side of a shale shaker. The shale shaker further comprises a crowned set of supporting members, which run along the length of the basket of the shaker, over which the layers of mesh are tensioned. An example of this type of screen is disclosed in GB-A-1,526,663. The supporting mesh may be provided with or replaced by a panel having apertures therein.

The pre-tensioned type of screen comprises several rectangular layers of mesh, usually comprising one or two layers of fine grade mesh and a supporting mesh having larger mesh holes and heavier gauge wire. The layers of mesh are pre-tensioned on a rigid support comprising a rectangular angle iron frame and adhered thereto. The screen is then inserted into C-channel rails arranged in a basket of a shale shaker. An example of this type of screen is disclosed in GB-A-1,578,948.

A further example of a known rigid support is disclosed in PCT Publication No. WO 01/76719, which discloses, amongst other things, a flat panel like portion having apertures therein and wing portions which are folded to form a support structure, which may be made from a single sheet of material. This rigid support has been assigned the Trade Mark "UNIBODY" by the applicants.

The layers of mesh in a screen wears out frequently and therefore the screen needs to be easily replaceable. Shale shakers are generally in the order of 5ft wide and 10ft long. A screen of dimensions 4ft wide by 10ft long is difficult to handle, replace and transport. It is known to use two, three, four or more screens in a single shale shaker. A standard size of screen currently used is of the order of 4ft by 3ft.

In many cases when a screen fails or exceeds its useful life, it is simply discarded. Typically none of the component parts is re-used in another screen or screen assembly.

As disclosed in the Fleet Street Report [2000] FSR 204, parts of screen assemblies have been reclaimed for use in new screen assemblies. The method disclosed therein describes stripping, sandblasting, re-coating a frame of the screen assembly with curable adhesive, obtaining new mesh, tensioning same and applying the tensioned mesh to the curable adhesive on the frame and

heating the assembly to cure the adhesive. However, this method is messy and is time consuming. Sand blasting may damage parts of the screen assemblies.

The invention also relates to a method for making a screen assembly for a vibratory separator using parts recovered from a screen or screen assembly, for example from a used screen assembly or from one that has been rejected during a manufacturing process. All of or some of the reclaimed parts may be sent for scrap in a condition which makes processing thereof straight forward.

In accordance with the present invention, there is provided a method for reclaiming parts of a screen assembly for a vibratory separator, the screen assembly having a support apparatus and screening material secured thereto with securing material, the method comprising the step of applying heat to the securing material sufficient to degrade the securing material to facilitate separation of the supporting apparatus from the screening material.

The securing material is powderized, degraded, turned to ash, broken down and/or cooked off. The degrading of the securing material may loosen or free parts of the supporting apparatus, as well as loosening or freeing the screening material from the supporting material. Using the method of the invention, a significant part of the screening material from a screen assembly can be recovered and the stainless steel can then be used in applications other than on screen assemblies, for example, in basic processes to make items out of stainless steel. If support apparatus including frames and tubular frame, perforated plate, coarse wire mesh and said strip support are recovered using methods according to the present invention cannot be recovered in sufficiently good shape for re-use in new screen assemblies or in other apparatuses or equipment, the

metal in them can be salvaged for use in other applications or in basic manufacturing processes. In certain aspects this may be true when the frame or support of the screen or screen assembly is made from metals such as steel, carbon steel, stainless steel, aluminium, aluminium alloys, brass, bronze, zinc, and zinc alloys.

Preferably, the securing material is at least one of hot melt glue, epoxy, plastic, sewing material and a curable adhesive. Advantageously, the supporting apparatus is from the group consisting of tubular frame, perforated plate, coarse wire mesh, and strip support. Preferably, said support apparatus comprise a rigid frame. Advantageously, one of said tubular frame, perforated plate, coarse wire mesh and said strip support is supported by said rigid frame. Preferably, the supporting apparatus comprises a plurality of openings to allow fluid or small particles to flow therethrough.

Preferably, the screening material comprises a plurality of layers of screening material. Advantageously, the plurality of layers of screening material are connected together by connection means. Preferably, the connection means is from the group consisting of epoxy, glue, plastic and sewing material.

Advantageously, the step of applying heat is carried out in an oven, the method further comprising the step of placing said screen assembly in said oven. Preferably, a plurality of screen assemblies are placed in said oven together. Advantageously, the plurality of screen assemblies are arranged substantially horizontally and stacked one on top of the other. Preferably, a blow torch is used.

Preferably, the securing material is heat is applied at a temperature of at least 700 °F (371°C) for at least 4 hours. The heating process may also be used to remove

coatings from the supporting apparatus. Such a coating is paint.

Advantageously, where the supporting apparatus is made of steel the screening material is stainless steel bonded together and bonded to the supporting apparatus by epoxy, the method further comprising the step of heating the epoxy for at least 4 hours at least 700 °F (371°C).

Preferably, the method further comprises the step of cleaning the supporting apparatus after the heating step.

Advantageously, the screening material is stainless steel. Preferably, the supporting apparatus is made of steel.

The present invention also provides a method for making a screen assembly for a vibratory separator, the method comprising the steps of reclaiming a supporting apparatus from a predecessor screen assembly using the method of the invention, further comprising the step of connecting new screening material to the supporting apparatus. Advantageously, the method further comprises the step of cleaning the supporting apparatus to remove securing material therefrom prior to connecting the screening material thereto. Preferably, the screening material is connected to the supporting apparatus with securing material from the group consisting of epoxy, glue, and plastic.

The present invention also provides a screen assembly for a vibratory separator made by the method of the invention.

The present inveiton also provides a screen assembly for a vibratory separator comprising supporting apparatus with a plurality of openings therethrough, screening material on the supporting apparatus over the plurality of openings, the supporting apparatus recovered from a predecessor screen assembly by applying heat to the predecessor screen assembly, the predecessor screen

assembly having the supporting apparatus and predecessor screening material secured to the supporting apparatus by securing material, the heat applied to the predecessor screen assembly sufficient to degrade the securing material so that separation of the supporting apparatus from the screening material and recovery of the supporting apparatus is facilitated, the supporting apparatus from the group consisting of tubular frame, perforated plate, coarse wire mesh, and strip support, the screening material comprising a plurality of layers of screening material, the plurality of layers of screening material connected together by connection means, the connection means from the group consisting of epoxy, glue, and plastic, and the screening material connected to the supporting apparatus by material from the group consisting of epoxy, glue, and plastic.

For a better understanding of the present invention, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a schematic diagram that illustrates steps in a method in accordance with the present invention;

Figure 1A is a side view of a screen assembly in accordance with the present invention; and

Figure 2 is a schematic view of screen assemblies in an oven for heating by a method in accordance with the present invention.

Figure 1 is a schematic diagram showing illustrates steps in a method in accordance with the present invention, the steps generally identified by reference numeral 10. A screen assembly 12 comprising a frame 21, a support 22 on the frame 21, and screening material 23 connected to and on the support 22 is subjected to heat 14, for example, in an oven, to degrade and/or cook off material that secures together parts of the screen assembly 12 (and, optionally, to degrade, etc. paint and/or coating on the screen assembly). Sufficient heat is applied for a sufficient period of time to loosen or free the frame 21, support 22, and screening material 23 from each other or to facilitate such loosening or freeing. Any of these parts may, in accordance with the present invention, be salvaged as salvage 21a, 22a, and 22b, respectively. Alternatively, any of these parts may be recovered for re-use.

As shown in Figure 1, the recovered frame 21 and/or the recovered support 22 are cleaned, water blasted, and/or sand blasted; optionally primed, painted, heated, and/or otherwise prepared for re-use; and then combined with new screening material 24 to form a new screen assembly 30 (which may be any known screen assembly that employs one or more of the recovered parts).

It is within the scope of this invention for the screen material 23 to be one, two, three or more layers and to be of any mesh size or opening size, including, but not limited to any known fine, medium and/or coarse mesh or screening material used on any known screen or screen assembly for vibratory separators or shale shakers. It is within the scope of this invention for the screen material to be secured to the frame and/or support and/or for multiple layers of such material to be connected together by any know method and/or material, including, but not limited to, by epoxy, glue, plastic, adhesive, and/or sewing material used on any known screen or screen assembly for vibratory separators or shale shakers. It is within the scope of this invention for the frame 21 to be any known frame for any known screen or screen assembly for vibratory separators or shale shakers. It is within the scope of this invention for the support 22 to be any known support for any known screen or screen assembly for vibratory separators or shale shakers, including, but not limited to, tubular frame, coarse wire mesh, perforated plate supports and strip supports.

Figure 1A shows a typical screen assembly 30a which has a lower support apparatus 30b and three layers 30c of screening material secured to the supporting apparatus 30b, for example with epoxy, glue, plastic, adhesive or sewing material. The layers of screening material all be of the same mesh size, or the lower mesh may be of larger mesh size and used to support the upper layers of screening material. The screen assembly of this embodiment may be secured to a frame, or may be connected to hookstrips at opposing ends for use in connecting the screen assembly to a shale shaker. Alternatively, the screen assembly may be used without frame or hookstrips.

Figure 2 shows an oven 40 with supports 42 on which

are placed a plurality of screen assemblies 44 (which may be any screen assembly described herein). The screen assemblies 44 are subjected to sufficient heat in the oven for a sufficient time period to cook off material used to hold parts of the screen assemblies together. In one particular aspect of the present invention, the screen assemblies 44 have parts that are secured together by epoxy material [for example, as disclosed in U.S. patents 6,290,068; 6,209,726; 6,202,856; 5,927,511; 5,944,993; 6,220,448 (all fully incorporated herein for all purposes) and in the references cited therein] and they are, in one aspect, subjected to heat of at least 700 °F (371°C) for at least 4 hours - although it is within the scope of this invention to employ a temperature and time period sufficient to effect the degrading, etc. of the epoxy for example, but not limited to, at 800 °F (427°C) for 5 or more hours. In one aspect, the temperature is about 850 °F (454°C); the time period is 7 to 8 hours; the frames (tubular steel frames) and supports (if present, for example perforated metal plates or strip supports) are recovered for re-use; and the screening material (one or multiple layers of stainless steel material) is salvaged (not for re-use in new screen assemblies). In one aspect, the oven 40 is vented through vent apparatus 46 and cooked-off material vented from the oven 40 is, optionally, fed to an incinerator 48 in which it is incinerated.

In accordance with the present invention either such material can be substantially cooked off from a screen assembly during heating, or it can be degraded, powderized, or turned to ash to a sufficient degree so that complete removal of the material by, for example, grinding, water blasting or sand blasting is facilitated. In one aspect, for example with epoxies, it is not necessary, in accordance with the present invention, that

all adhesive bonds between the epoxy and the screen parts be broken in order to facilitate separation of screen assembly parts and it is not, in accordance with the present invention, necessary to completely oxidize all of the epoxy. Any time period of heating at a temperature sufficient to result in a loss of adhesive integrity which will facilitate the separation and recovery of parts may be employed in accordance with the present invention.

CLAIMS:

1. A method for reclaiming parts of a screen assembly for a vibratory separator, the screen assembly having a support apparatus and screening material secured thereto with securing material, the method comprising the step of applying heat to the securing material sufficient to degrade the securing material to facilitate separation of the supporting apparatus from the screening material.

2. A method as claimed in Claim 1, wherein the securing material is at least one of hot melt glue, epoxy, plastic, sewing material and a curable adhesive.

3. A method as claimed in Claim 1 or 2, wherein the supporting apparatus is from the group consisting of tubular frame, perforated plate, coarse wire mesh, and strip support.

4. A method as claimed in Claim 1, 2 or 3, wherein said support apparatus comprise a rigid frame.

5. A method as claimed in Claim 3 and 4, wherein one of said tubular frame, perforated plate, coarse wire mesh and said strip support is supported by said rigid frame.

6. A method as claimed in any preceding claim, wherein the screening material comprises a plurality of layers of screening material.

7. A method as claimed in Claim 6, wherein the plurality of layers of screening material are connected together by connection means.

8. A method as claimed in Claim 7, wherein the connection means is from the group consisting of epoxy, glue, plastic and sewing material.

9. A method as claimed in any preceding claim, wherein said supporting apparatus comprises a plurality of openings to allow fluid or small particles to flow therethrough.

10. A method as claimed in any preceding claim, wherein the step of applying heat is carried out in an oven, the

method further comprising the step of placing said screen assembly in said oven.

11. A method as claimed in Claim 10, wherein a plurality of screen assemblies are placed in said oven together.

12. A method as claimed in Claim 11, wherein said plurality of screen assemblies are arranged substantially horizontally and stacked one on top of the other.

13. A method as claimed in any preceding claim, wherein the securing material is heat is applied at a temperature of at least 700 °F (371°C) for at least 4 hours.

14. A method as claimed in any preceding claim, wherein the supporting apparatus is made of steel the screening material is stainless steel bonded together and bonded to the supporting apparatus by epoxy, the method further comprising the step of heating the epoxy for at least 4 hours at least 700 °F (371°C).

15. A method as claimed in any preceding claim, further comprising the step of cleaning the supporting apparatus after the step of heating the securing material.

16. A method as claimed in any preceding claim, wherein the screening material is stainless steel.

17. A method as claimed in any preceding claim, wherein the supporting apparatus is made of steel.

18. A method for making a screen assembly for a vibratory separator, the method comprising the steps of reclaiming a supporting apparatus from a predecessor screen assembly using the method as claimed in any preceding claim, further comprising the step of connecting new screening material to the supporting apparatus.

19. A method as claimed in Claim 18, further comprising the step of cleaning the supporting apparatus to remove securing material therefrom prior to connecting the screening material thereto.

20. A method as claimed in Claim 18 or 29, wherein the

screening material is connected to the supporting apparatus with securing material from the group consisting of epoxy, glue, and plastic.

21. A screen assembly for a vibratory separator made by the method as claimed in any of Claims 18 to 20.

Fig.1

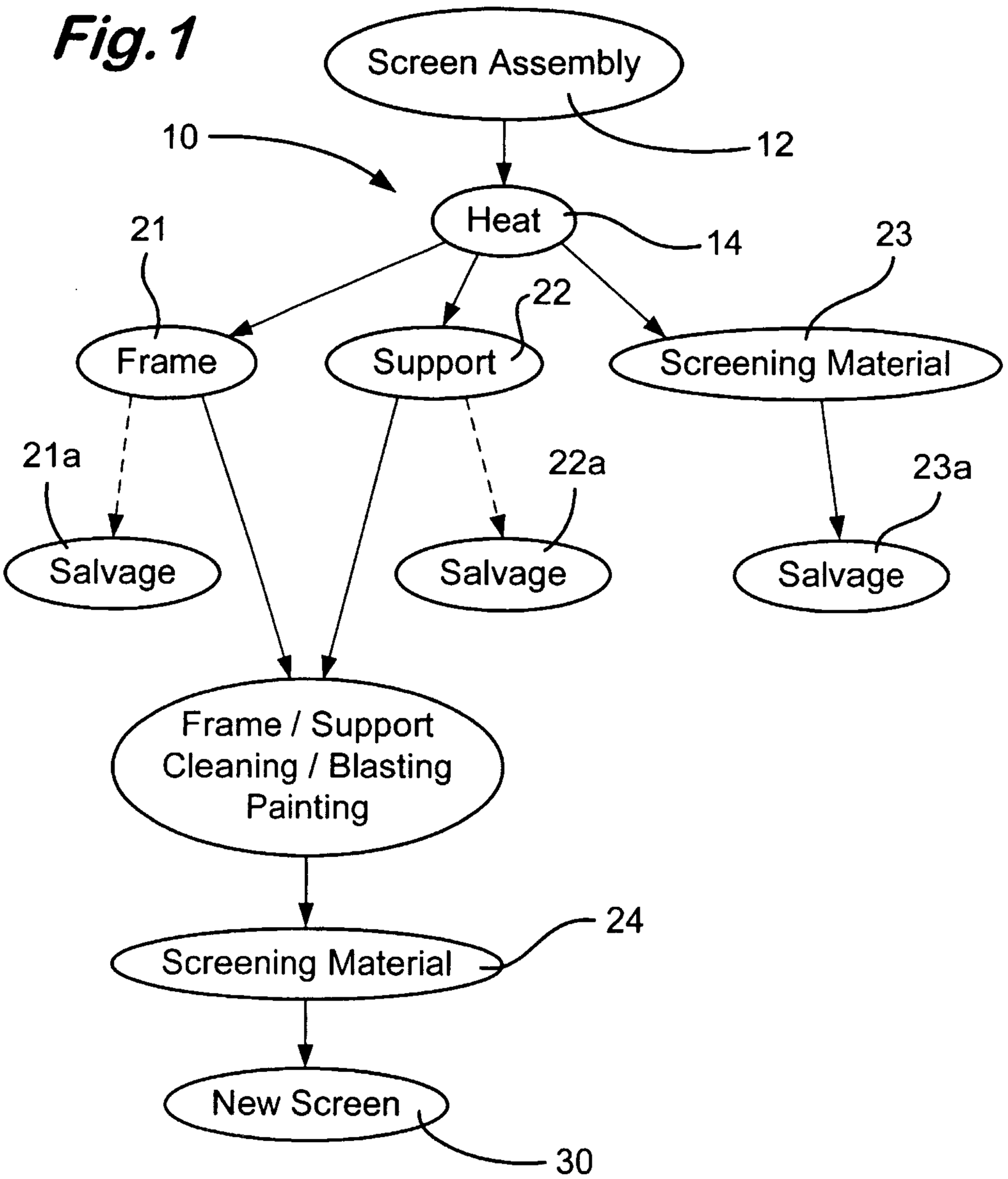

Screen Assembly
10
12
Heat
14
21
22
23
Frame
Support
Screening Material
21a
22a
23a
Salvage
Salvage
Salvage
Frame / Support
Cleaning / Blasting
Painting
24
Screening Material
New Screen
30

Fig.1A

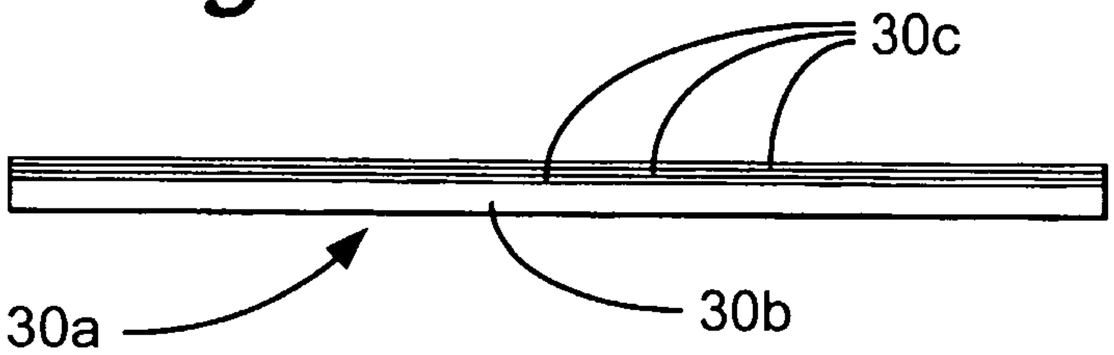
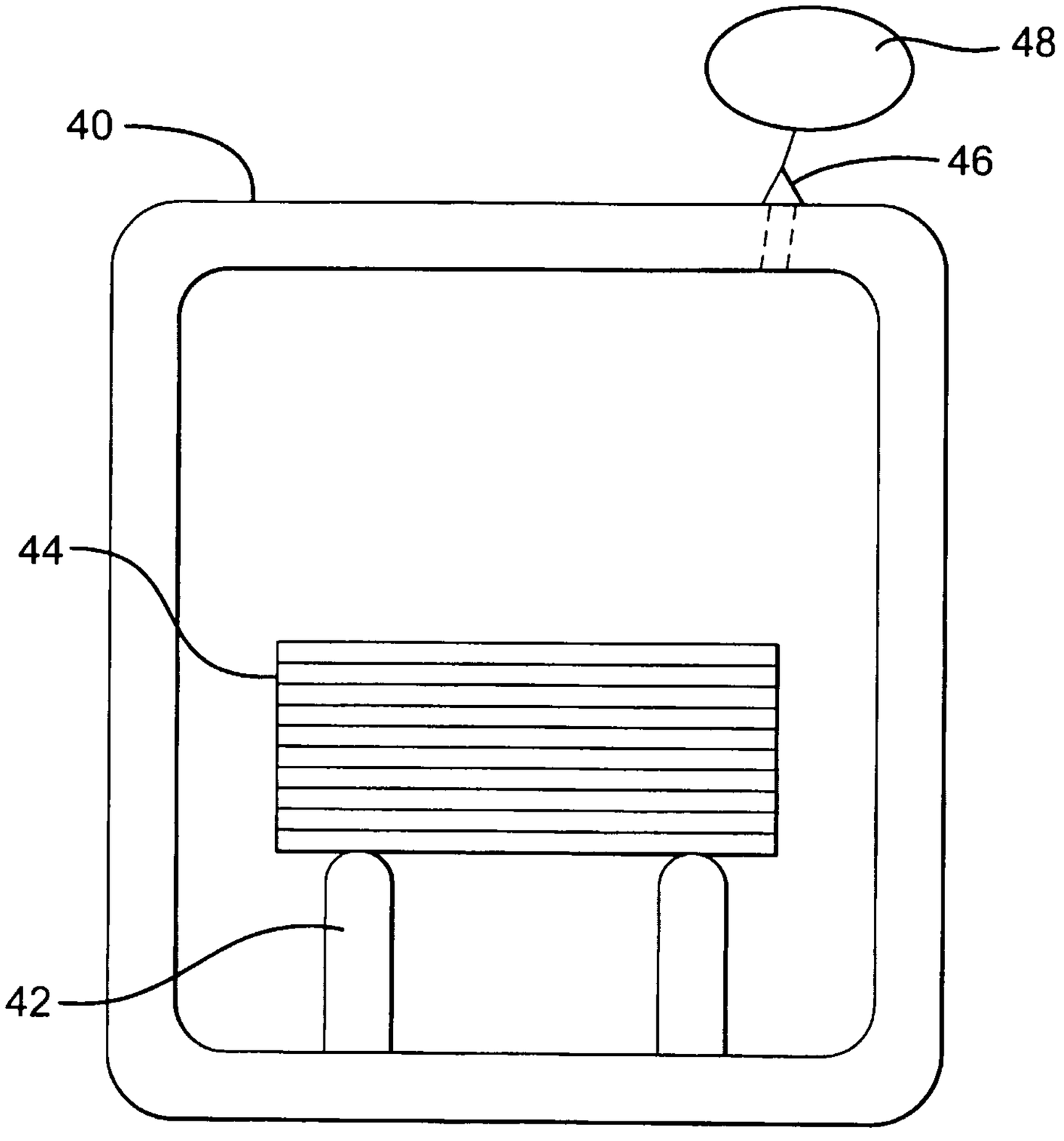
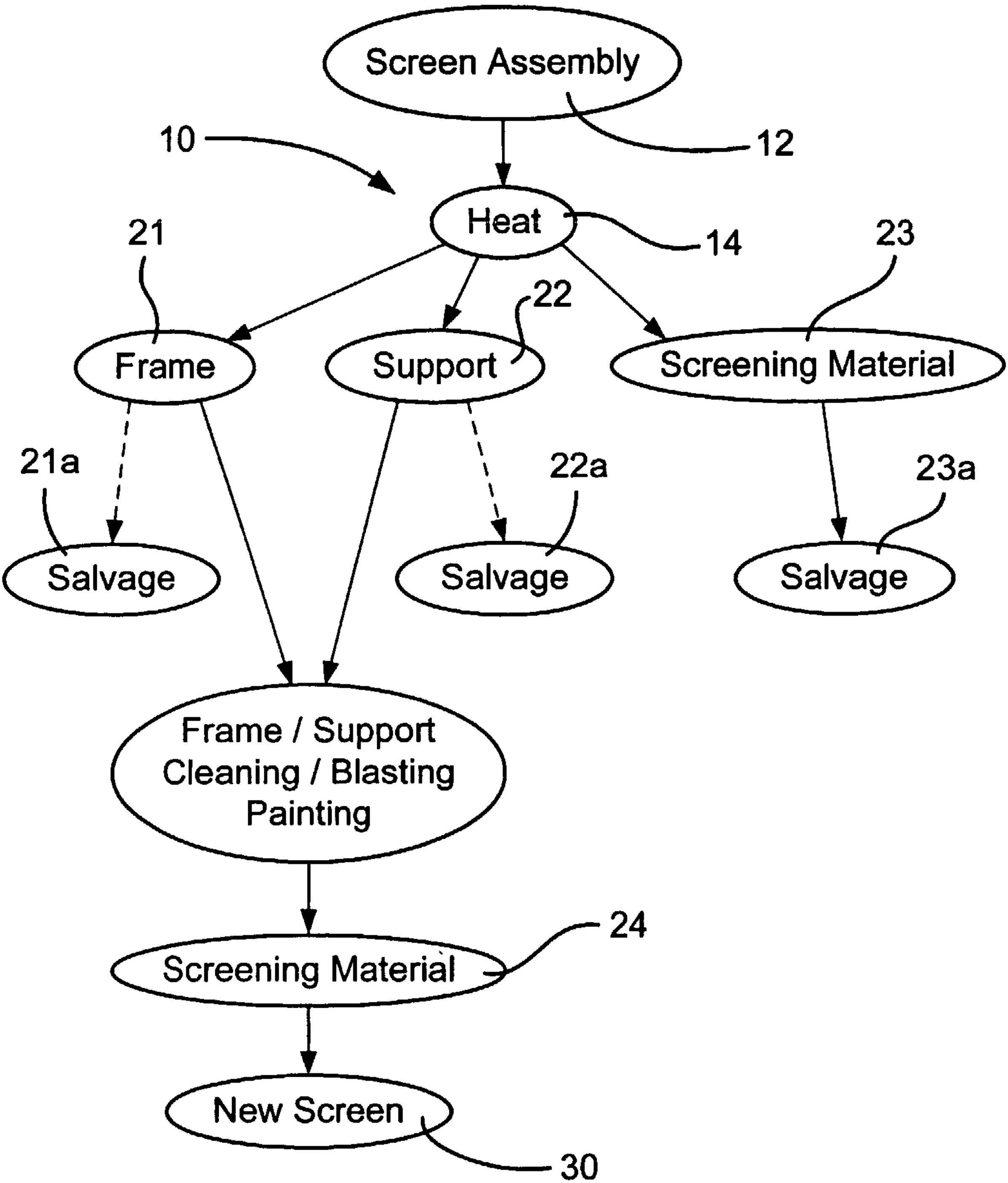

30c
30a
30b

Fig.2




Screen Assembly
10
12
Heat
14
21
23
22
Frame
Support
Screening Material
21a
22a
23a
Salvage
Salvage
Salvage
Frame / Support
Cleaning / Blasting
Painting
24
Screening Material
New Screen
30