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(54) **PIPE COATING APPARATUS**

VORRICHTUNG ZUR BESCHICHTUNG VON ROHREN

APPAREIL DE REVETEMENT DE CONDUITES

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US-A- 1 883 964 **US-A- 2 133 014**
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Description

[0001] This invention is concerned with the coating of pipes of the type used in subterranean or submerged pipelines for the recovery of oil, gas, slurries or like pipeable materials from a subterranean well. In particular, though not exclusively, it is concerned with pipes in which a steel pipe section is covered with a bituminous-type anticorrosion coating.

[0002] In a typical coating method uniform lengths of steel pipe are accumulated for coating and each in turn is lifted, e.g. by overhead crane, on to conveyor means for individual coating treatment. The conveyor means causes each pipe to rotate about its longitudinal axis while it is passed longitudinally past different treatment stations. Typically the pipes are pre-heated to remove all moisture before being shot blast cleaned to remove all dirt and foreign matter in order to ensure an optimum coating-to-pipe bond. A primer is then applied by a measured spray. Thereafter a bituminous-type coating, usually asphalt or coal tar, is poured as a flood coat over the rotating pipe. A glass fibre inner wrap followed by an asbestos felt, glass fibre or glass cloth outer wrap can be simultaneously wound on to the pipe during the coating process. Finally whitewash or a similar solar protection agent is then applied to the coated pipe to prevent adhesion between adjacent pipes and to minimise the effects of direct sunlight upon the integrity of the coating.

[0003] A standard inspection is then carried out to check the dielectric strength, bonding and thickness of the coating. Pipes coated thus and reinforced with the necessary glass fibre inner wraps and felt or glass outer wraps provide adequate protection for normal in line temperatures of up to 80°C (coal tar) or 70°C (asphalt) maximum for oil, gas or water lines.

[0004] Known flood coating methods in use are wasteful and cause excessive mess due to the spillage around the pipe of the bituminous type coating. The handling of the pipe during the coating step is also difficult to automate satisfactorily. Furthermore the pipe handling apparatus such as support buggies become fouled with the coating during the passage thereof beneath the coating applicator.

[0005] US-A-2 133 014 proposes a bitumen applicator with a controllable shut-off to enable termination of the coating transversely whereby an annular band of uncoated pipe surface remains, and further proposes that beneath the applicator there is a drip catch device with optional recycle pump. Pipes to be coated are connected by coupling connectors and the connected pipes are passed through for coating from dollies on a feed-in track terminating before the applicator on to similar dollies on a take-off track placed just after the applicator. In this way sequential pipes provide mutual support during coating via their connectors without having to pass a support dolly under the applicator during the coating step.

[0006] An object of the present invention is to provide improvements in the coating of pipes, and generally obviate or mitigate the problems of known commercial coating processes.

[0007] Thus the invention to be more particularly described hereinafter addresses these problems by providing apparatus for coating of pipes including unique pipe handling means adapted to contact a pipe at predetermined times and in a predetermined manner permitting each pipe to be progressively advanced through the coating booth without the integrity of the applied coating being compromised by the pipe handling means and thereby minimising the risk of the handling apparatus being fouled by coating spillage.

[0008] According to the invention said handling means includes a pipe feed mechanism for introducing a pipe lengthwise in the direction of its longitudinal axis to the coating booth whilst simultaneously applying an appropriate degree of rotation about that longitudinal axis, which mechanism has a pipe hold-down feature whereby the leading end of the pipe is permitted to project freely into the booth whilst another part of the pipe is restrained to avoid the pipe toppling into the booth due to lack of support at the leading end, and said handling means further includes at least first and second pipe end supports for picking up the coated pipe as it exits the coating booth. The first and second pipe end supports are provided on remote controlled vehicles which are preferably rail guided, and independently operable to convey respectively the leading and trailing ends of the pipe as it emerges from the coating booth. Thus it will be recognised that the pipe enters the booth as an unsupported overhang which is readily flood or curtain coated since no support mechanism can interfere with the application of the coating. The remote or trailing end of the pipe which has not yet entered the booth is subject to a "hold down" to stabilise the pipe delivery for coating purposes. As the pipe emerges from the coating booth a first end support device is activated to contact the leading end of the pipe and convey it on a remotely controlled vehicle away from the booth. After a suitable time delay (calculated to be about the time the trailing end of the pipe emerges from the coating booth), a second support device is activated to contact the trailing end of the pipe and convey it on a second vehicle away from the coating booth. It will be understood that the operation of the first and second vehicles is synchronised such that they operate in tandem and contact the pipe surface only near the ends of the pipe so that again there is minimum risk of contact or interference with the applied coating. Conveniently the said vehicles are shuttled back and forth in a repeatable cycle which can be appropriately timed and coordinated with downstream pipe conveying or offloading devices to permit both vehicles to be returned for pipe end pick up whilst the next pipe in turn is entering the booth and undergoing coating. The invention permits an essentially continual and generally uninterrupted coating opera-

tion to be operated.

[0009] The remotely operable support devices may include arms which may be rapidly deployed from a stand off position to a pipe contacting position by pivoting, swinging, sliding or like action.

[0010] According to one embodiment of the invention there is provided a pipe conveyor whose final point of delivery is just short of a flood or curtain coating device provided within a coating station. A pair of parallel rails extends away from coating station to a pipe offloading area. Mobile carriers, positioned on the rails adjacent to the coating station, stand ready to receive a coated pipe emerging from the coating station. Once coated, the pipe is conveyed away from the coating station firstly by one such carrier engaging the leading end of the emerging coated pipe and subsequently on other carrier co-operating in tandem with the first to support the trailing end of the pipe. The pipe would then be collected from the mobile carriers which are returned to their initial position ready to receive another pipe. The collection device may be a hoist, overhead gantry mounted crane, or other suitable lifting device adapted to minimise the risk of damage to the pipe coating. However preferably the carriers themselves are provided with offloading lever mechanisms whereby the pipe may be laterally displaced from the carriers onto a storage facility or conveyor device.

[0011] In a preferred embodiment the mobile carrier pipe supports are idler rollers mounted on hinged support arms. Said arms are curved in shape such that, when not held in contact with the pipe they may be positioned so as not to impede either the flow of coating material applied to the surface of the pipe, or the flow of excess coating material from the undersurface of the pipe.

[0012] Thus further according to this invention there is provided a method of coating a series of pipes in a flood or curtain coating station comprising the steps of providing a pipe conveyor whose final point of delivery is just short of a flood or curtain coating device provided within said coating station, conveying a pipe in the direction of its longitudinal axis whilst rotating it about that axis and causing the one end of the pipe to project under the flood or curtain coating device whilst holding down a remote part of the pipe, by such means as an overhead clamp adapted to make contact with the pipe by provision of roller devices, to stabilise the pipe, conveying the pipe further into the coating station by means of said conveyor and applying a coating by means of said coating device to coat said pipe, providing a plurality of mobile pipe carriers provided with deployable pipe supports and control means to operate a first and a second pipe carrier in a synchronised sequence related to the passage of the pipe through the coating station, actuating the first pipe carrier to provide support for the pipe as the pipe begins to emerge from the coating station, and after a predetermined time delay actuating the second pipe carrier to provide support for the trailing end of the

pipe, and operating the mobile carriers in tandem to carry the coated pipe away from the coating station.

[0013] An embodiment of the present invention will now be described with reference to the following drawings, in which:

Fig. 1 shows a side view of pipe transportation and bituminous coating apparatus in accordance with the present invention, with a pipe shown at the commencement of the coating process;

Fig. 2 shows a side view of pipe transportation and bituminous coating apparatus in accordance with the present invention, with a pipe shown midway through the coating process;

Fig. 3 shows a side view of pipe transportation and bituminous coating apparatus in accordance with the present invention, with a pipe shown at the end of the coating process;

Fig. 4 shows a side view of pipe transportation and bituminous coating apparatus in accordance with the present invention, with a pipe shown in the "kick out" position;

Fig. 5 shows a side view of a leading pipe carrier;

Fig. 6 shows a side view of a trailing pipe carrier;

Fig. 7 shows a front view of a trailing pipe carrier.

[0014] Coating apparatus **5** provided by this invention includes a static conveyor **10** for transporting pipes **15**, **15'** in series to the entrance of a coating delivery station **20** whilst rotating them about their longitudinal axis. Mobile pipe carriers **25**, **25'**, initially positioned adjacent to the static conveyor **10**, are supported on rails **30**. Said rails **30** lead from the static conveyor **10**, past the coating delivery station, to a pipe unloading area **35**. A collection pan **40** is provided below the delivery station **20** to collect any coating material which fails to adhere to the pipes.

[0015] The leading portion **45** of pipe **15** is passed by the static conveyor **10** to the leading pipe carrier **25**. Said leading pipe carrier is provided with a drive unit **50** with which to engage the leading portion **45** and maintain the rotation imparted to the pipe **15** by the static conveyor **10**. Coating material is applied to the rotating pipe **15** as it passes the coating delivery station **20**. The static conveyor **10** is provided with a hold down unit **55** (in the form of an overhead clamp adapted to make contact with the pipe by provision of means of roller devices) to prevent the leading portion **45** of the pipe **15** from pivoting downwards before it reaches the leading pipe carrier **25**.

[0016] Once the drive unit **50** is engaged, the leading pipe carrier **25** advances along the rails **30** and thus con-

tinues to move the pipe 15 past the coating delivery station 20. As the trailing portion 45' of the pipe 15 approaches the end of the static conveyor 10 it is supported by rollers 60 mounted on the trailing pipe carrier 25', thus allowing the pipe 15 to continue to rotate under the influence of the drive unit 50. Once the trailing pipe carrier 25' has received the trailing portion 45' of the pipe 15, it too advances along the rails 30 at substantially the same speed as the leading pipe carrier 25. The two carriers 25, 25' transport the rotating pipe 15 to the unloading area 35, whereupon it is ejected from the carriers 25, 25' by lever units 65 and 65'. The empty carriers 25, 25' then return along the rails 30 to their original positions ready to receive the next pipe 15' from the static conveyor 10.

[0017] A pipe carrier 25 (shown in Fig. 5) comprises a wheeled chassis 70 surmounted by a drive unit 50, driven support rollers 75 which serve to connect the drive unit 50 to the pipe 15, and a lever unit 65 to eject the pipe 15 from the carrier 25. The lever unit 65 is composed of a concave load bearing surface 80 connected to a support frame 85 by pins 90, the support frame 85 being attached in turn to the chassis 70. A hydraulic ram 95 is mounted between the load bearing surface 80 and the chassis 70. Extension of the ram 95 causes the load bearing surface 80 to rotate about the pins 90 and come into contact with the pipe 15 and, with further extension, tip the pipe 15 from the carrier 25.

[0018] Referring to Figures 6 and 7 there is shown a trailing pipe carrier 25' comprising a wheeled chassis 100, a lever unit 65' and a pair of support arms 105. Said chassis 100 straddles the collection pan 40 when the carrier 25' is in its initial position adjacent to the static conveyor. Hence, during the coating operation, excess coating material may flow unimpeded from the under-surface of the pipe to the collection pan 40. Support arms 105 are connected by pins 110 to the chassis 100, and are surmounted by rollers 60. The arms 105 can be rotated about the pins 110 by the action of hydraulic rams 115 positioned between the arms 105 and the chassis 100. This enables the rollers 60 to be moved into and out of contact with the pipe 15 as shown in Figure 7. In use, the arms 105 and rollers 60 are only moved into contact with the pipe 15, in order to support it, as the trailing portion 45' approaches the end of the static conveyor 10. In this way the rollers 60 do not impede the passage of the majority of the pipe 15 past the coating delivery station. Furthermore, when not in contact with the pipe 15 the rollers 60 and arms 105 may be held in a position remote from the flow of coating material.

[0019] It should be understood that foregoing illustrative description of the performance of the invention is given by way of example only, and the specific detail described in that illustrative embodiment is not intended to indicate that variants thereof are not possible. Indeed those skilled in this art will be well able to recognise that the specific form of the carriers can be varied according to choice. For example the first carrier may be actuated

by contact with the pipe emerging from the coating station so that drive means for advancing the first carrier is not essential since forward motion is still being imparted to the pipe by the conveyor on the other side of the coating station. Obviously once the pipe leaves the conveyor the second carrier would need to be driven to continue the progression of the pipe out of the coating station. Similarly the specific drive mechanisms may be operated by a variety of systems as known in this art for other purposes. Moreover the carriers themselves need not be rail guided vehicles but could be soft tyred or track-laying vehicles. It will be recognised that the invention as herein disclosed provides a simple and relatively easily constructed solution to long-standing problems experienced in this art.

Claims

1. Apparatus for the coating of pipes e.g. with a bituminous material, comprising a coating station (20), a pipe conveyor (10) arranged in proximity to said coating station, means for rotating the conveyed pipe about its longitudinal axis, a plurality of mobile pipe carriers (25, 25'), and control means for synchronising the movement of the carriers with the pipe carried thereon relative to said coating station, **characterised by** means (55) provided external to the coating station for holding at least a portion of one pipe on a support as it is conveyed into the coating station.
2. Apparatus (5) for the coating of pipes (15, 15'), such as is claimed in claim 1, wherein the coating station provides for coating pipes sequentially in a flood coating station booth (20) including a flood coating device and a catchment device (40) for collecting excess coating for recycling, and there is provided means for introducing a pipe (15) lengthwise in the direction of its longitudinal axis to the coating booth whilst simultaneously applying an appropriate degree of rotation about that longitudinal axis and permitting the pipe to be progressively advanced through the coating booth without the need for pipe supports passing under the flood coating, and including pipe handling means adapted to contact a pipe at predetermined times and in a predetermined manner, wherein said handling means includes a pipe feed mechanism (10) which has a pipe hold-down feature (55) whereby the leading end (45) of the pipe is permitted to project freely into the booth whilst another part of the pipe is restrained to avoid the pipe toppling into the booth due to lack of support at the leading end, and said handling means further includes at least first and second pipe end supports (60, 75) for picking up the coated pipe as it exits the coating booth.

3. Apparatus according to claim 2, wherein the first and second pipe end supports are provided on remote controlled vehicles (25,25') which are independently operable to carry respectively the leading and trailing ends (45,45') of the pipe as it emerges from the coating booth.
4. Apparatus according to claim 3, wherein the vehicles are rail guided.
5. A method of coating a series of pipes in a flood or curtain coating station comprising the steps of
 - providing a pipe conveyor whose final point of delivery is just short of a flood or curtain coating device provided within said coating station,
 - conveying a pipe in the direction of its longitudinal axis whilst rotating it about that axis and causing the one end of the pipe to project under the flood or curtain coating device whilst holding down a remote part of the pipe, by such means as an overhead clamp adapted to make contact with the pipe by provision of roller devices, to stabilise the pipe,
 - conveying the pipe further into the coating station by means of said conveyor and applying a coating by means of said coating device to coat said pipe,
 - providing a plurality of mobile pipe carriers provided with deployable pipe supports and control means to operate a first and a second pipe carrier in a synchronised sequence related to the passage of the pipe through the coating station,
 - actuating the first pipe carrier to provide support for the pipe as the pipe begins to emerge from the coating station, and after a predetermined time delay actuating the second pipe carrier to provide support for the trailing end of the pipe, and
 - operating the mobile carriers in tandem to carry the coated pipe away from the coating station.

Patentansprüche

1. Vorrichtung zur Beschichtung von Rohren beispielsweise mit einem bituminösen Material, umfassend eine Beschichtungsstation (20), einen Rohrförderer (10) angeordnet in der Nähe zu der genannten Beschichtungsstation, Einrichtungen zum Drehen des geförderten Rohres um seine Längsachse, eine Mehrzahl von mobilen Rohrträgern (25, 25'), und Steuereinrichtungen zur Synchronisierung der Bewegung der Träger mit dem darauf getragenen Rohr relativ zu der genannten Beschichtungsstation, **gekennzeichnet durch** Einrichtungen (55) vorgesehen extern zu der Beschichtungsstation zum Festhalten von zumindest einem Teil von einem Rohr auf einer Stütze, während es in die Beschichtungsstation gefördert wird.

2. Vorrichtung (5) zur Beschichtung von Rohren (15, 15'), wie in Anspruch 1 beansprucht, wobei die Beschichtungsstation für die aufeinanderfolgende Beschichtung der Rohre in einer Flutungsbeschichtungsstationskabine (20) sorgt, einschließlich einer Flutungsbeschichtungseinrichtung und einer Aufzufangeinrichtung (40) zum Sammeln von überschüssiger Beschichtung zum Zurückführen, und es sind Einrichtungen vorgesehen zum längsweisen Einführen eines Rohrs (15) in der Richtung seiner Längsachse zu der Beschichtungsstationskabine, während gleichzeitig ein geeignetes Maß an Drehung um diese Längsachse aufgebracht wird, und dem Rohr erlaubt wird, durch die Beschichtungsstationskabine hindurch fortschreitend vorangebracht zu werden, ohne die Notwendigkeit Rohrstützen unter der Flutbeschichtung hindurchzuführen, und einschließlich Rohrhandhabungseinrichtungen, angepaßt um ein Rohr zu vorbestimmten Zeiten in einer vorbestimmten Weise zu berühren, wobei die Handhabungseinrichtungen einen Rohrzufuhrmechanismus (10) umfassen, der eine Niederhalteeinrichtung (55) besitzt, wobei dem vorderen Ende (45) des Rohrs ermöglicht wird, frei in die Kabine hineinzuragen, während ein anderer Teil des Rohres festgehalten wird, um ein Kippen des Rohrs in die Kabine aufgrund mangelnden Stützens an dem Vorderende zu vermeiden, und wobei die Handhabungseinrichtungen weiter zumindest erste und zweite Rohrendstützen (60, 75) zum Aufnehmen des beschichteten Rohrs umfassen, während es aus der Beschichtungsstationskabine austritt.
3. Vorrichtung nach Anspruch 2, wobei die erste und zweite Rohrendstütze auf ferngesteuerten Fahrzeugen (25, 25') vorgesehen sind, die unabhängig voneinander betreibbar sind, um das vordere Ende beziehungsweise das hintere Ende (45, 45') des Rohres zu tragen, während es aus der Beschichtungsstationskabine austritt.
4. Vorrichtung nach Anspruch 3, wobei die Fahrzeuge schienengeführt sind.
5. Ein Verfahren zur Beschichtung einer Serie von Rohren in eine Flutungs- oder Vorhangbeschichtungsstation, bestehend aus den Verfahrensschritten des
 - Liefers eines Rohrförderers dessen letzter Lieferpunkt gerade kurz vor einer Flutungs- oder Vorhangbeschichtungseinrichtung innerhalb der Beschichtungsstation vorgesehen ist,
 - Transportieren eines Rohres in Richtung seiner Längsachse, während es um diese Achse gedreht wird, und Bewirken, daß das eine Ende des Rohres unter die Flutungs- oder Vorhangbeschichtungseinrichtung sich erstreckt, während ein entfernter Teil des Rohres mittels solchen Einrichtungen wie eine

von oben angeordnete Klammer niedergehalten wird, die angepaßt ist, um mit dem Rohr durch die Bereitstellung von Rolleneinrichtungen in Kontakt zu treten, um das Rohr zu stabilisieren, Weiterfördern des Rohres in die Beschichtungsstation mit Hilfe des Förderers und Aufbringen einer Beschichtung mit Hilfe der Beschichtungseinrichtung, um das Rohr zu beschichten, Liefern einer Vielzahl von mobilen Rohrträgern, versehen mit ausbreitbaren Rohrstützen und mit Steuer-
 5
 10
 15
 20
 25

einrichtungen, um einen ersten und einen zweiten Rohrträger in einer synchronisierten Aufeinanderfolge bezogen auf den Durchtritt des Rohres durch die Beschichtungsstation hindurch zu betreiben, Betätigen des ersten Rohrträgers, um eine Stütze für das Rohr zu liefern, während das Rohr aus der beschichteten Station auszutreten beginnt, und nach einer vorbestimmten Zeit Betätigen des zweiten Rohrträgers um für das hintere Ende des Rohres eine Stütze zu liefern, und Betreiben der mobilen Träger im Tandem, um das beschichtete Rohr weg von der Beschichtungsstation zu bringen.

Revendications

1. Appareil pour le revêtement de tuyaux, par exemple, avec un matériau bitumineux, comprenant un poste de revêtement (20), un convoyeur de tuyau (10) agencé à proximité dudit poste de revêtement, des moyens pour faire tourner le tuyau transporté autour de son axe longitudinal, une pluralité de dispositifs de support de tuyau mobiles (25, 25') et des moyens de commande pour synchroniser le déplacement des dispositifs de support avec le tuyau supporté sur ceux-ci par rapport audit poste de revêtement, **caractérisé par** des moyens (55) prévus à l'extérieur du poste de revêtement pour maintenir au moins une partie d'un tuyau sur un support alors qu'il est transporté dans le poste de revêtement.
2. Appareil (5) pour le revêtement de tuyaux (15, 15'), selon la revendication 1, dans lequel le poste de revêtement effectue le revêtement de tuyaux de manière séquentielle dans une cabine de poste de revêtement par arrosage (20) comprenant un dispositif de revêtement par arrosage et un dispositif de réception (40) pour recueillir le revêtement excédentaire à des fins de recyclage, et des moyens sont prévus pour introduire un tuyau (15) dans le sens de la longueur dans le sens de son axe longitudinal par rapport à la cabine de revêtement tout en appliquant simultanément un degré de rotation approprié autour de cet axe longitudinal et en permettant au tuyau d'avancer progressivement dans la cabine de revêtement sans qu'il soit nécessaire

que les supports de tuyau passent sous le revêtement par arrosage, et comprenant des moyens de manipulation de tuyau adaptés pour entrer en contact avec un tuyau à des instants prédéterminés et d'une manière prédéterminée, dans lequel lesdits moyens de manipulation comprennent un mécanisme d'avance de tuyau (10) qui présente une caractéristique de maintien de tuyau (55) de telle manière que l'extrémité avant (45) du tuyau soit autorisée à s'étendre librement dans la cabine tandis qu'une autre partie du tuyau est retenue afin d'éviter que le tuyau ne bascule dans la cabine du fait d'une absence de support au niveau de l'extrémité avant, et lesdits moyens de manipulation comprennent en outre au moins des premier et deuxième supports d'extrémité de tuyau (60, 75) pour reprendre le tuyau revêtu alors qu'il quitte la cabine de revêtement.

3. Appareil selon la revendication 2, dans lequel les premier et deuxième supports d'extrémité de tuyau sont prévus sur des véhicules commandés à distance (25, 25') qui peuvent être commandés de manière indépendante pour respectivement supporter les extrémités avant et arrière (45, 45') du tuyau alors qu'il émerge de la cabine de revêtement.

4. Appareil selon la revendication 3, dans lequel les véhicules sont guidés sur des rails.

5. Procédé de revêtement d'une série de tuyaux dans un poste de revêtement par arrosage ou en rideau comprenant les étapes consistant à :

prévoir un convoyeur de tuyau dont le point final de livraison se situe juste avant un dispositif de revêtement par arrosage ou en rideau prévu à l'intérieur dudit poste de revêtement, transporter un tuyau dans le sens de son axe longitudinal tout en le faisant tourner autour de cet axe et amener ladite extrémité du tuyau à s'étendre sous le dispositif de revêtement par arrosage ou en rideau tout en maintenant une partie éloignée du tuyau, par des moyens tels qu'un dispositif de serrage supérieur adapté pour entrer en contact avec le tuyau par la prévision de dispositifs à rouleaux, afin de stabiliser le tuyau, transporter le tuyau davantage dans le poste de revêtement au moyen dudit convoyeur et appliquer un revêtement au moyen dudit dispositif de revêtement afin de revêtir ledit tuyau, prévoir une pluralité de dispositifs de support de tuyau mobiles pourvus de supports de tuyaux susceptibles d'être déployés et de moyens de commande pour actionner un premier et un deuxième dispositifs de support de tuyau en une séquence synchronisée avec le

passage du tuyau dans le poste de revêtement,
actionner le premier support de tuyau afin d'as-
surer le support du tuyau alors que le tuyau
commence à émerger du poste de revêtement
et, après un délai prédéterminé, actionner le 5
deuxième dispositif de support de tuyau afin
d'assurer le support de l'extrémité arrière du
tuyau, et
actionner les dispositifs de support mobiles en
tandem afin de transporter le tuyau revêtu loin 10
du poste de revêtement.

15

20

25

30

35

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45

50

55

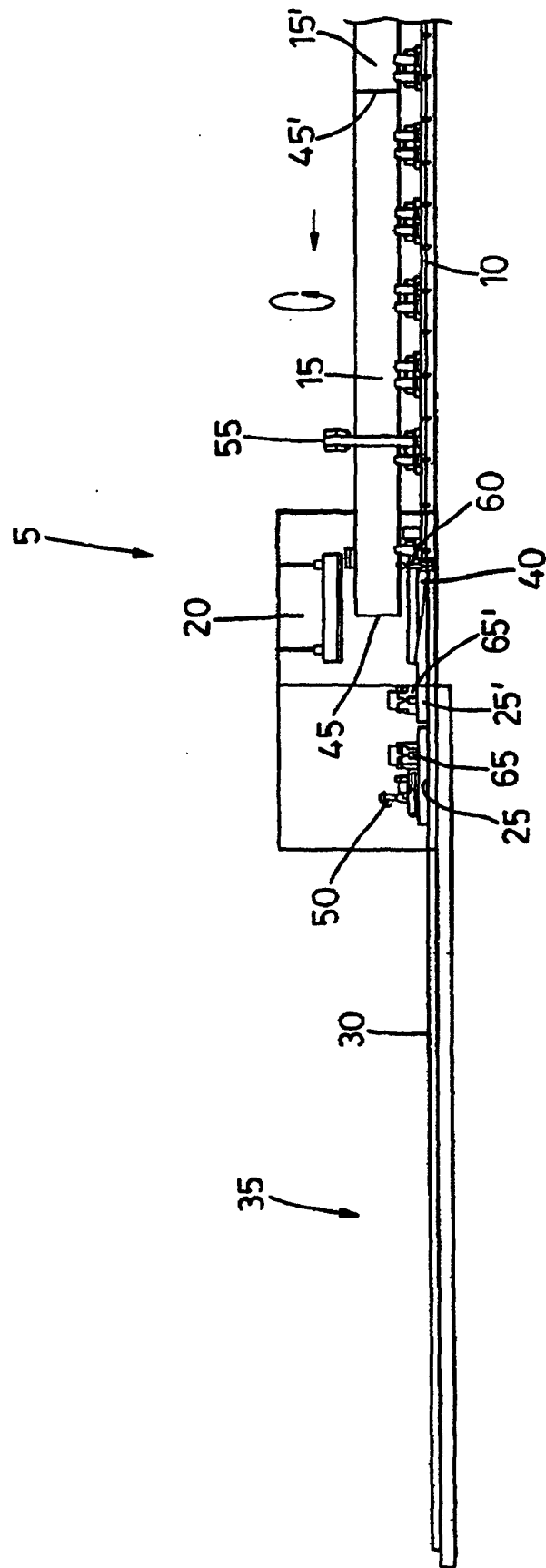


Fig. 1

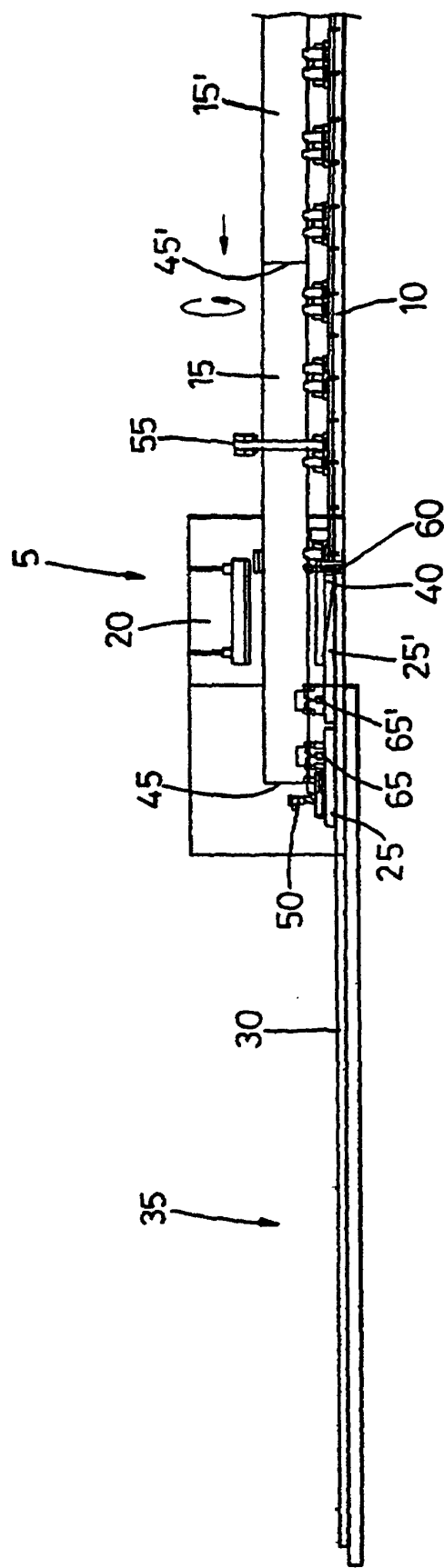


Fig. 2

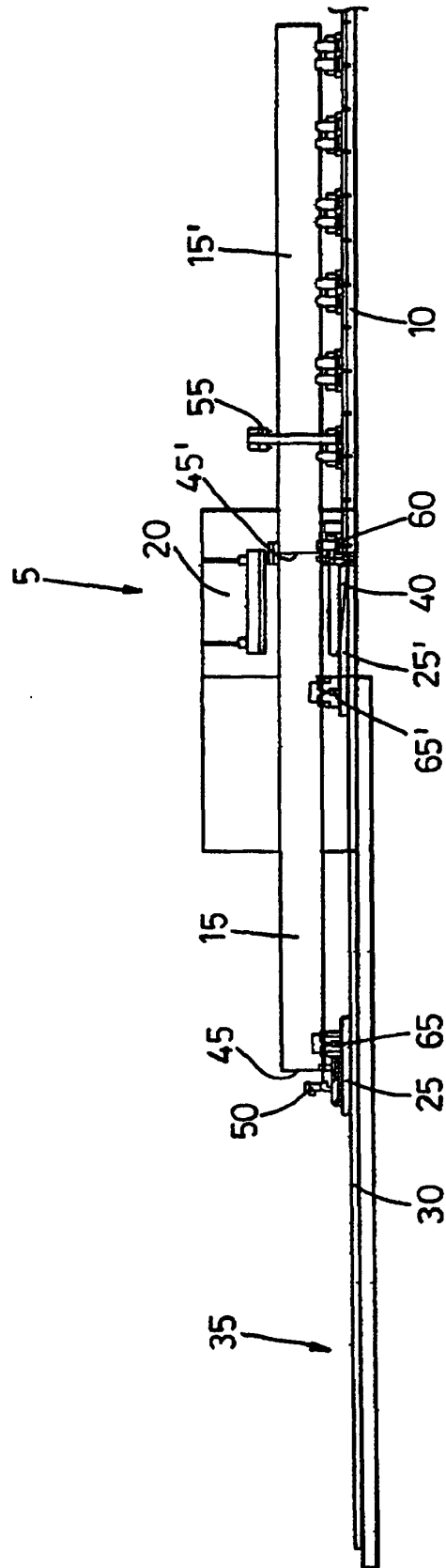


Fig. 3

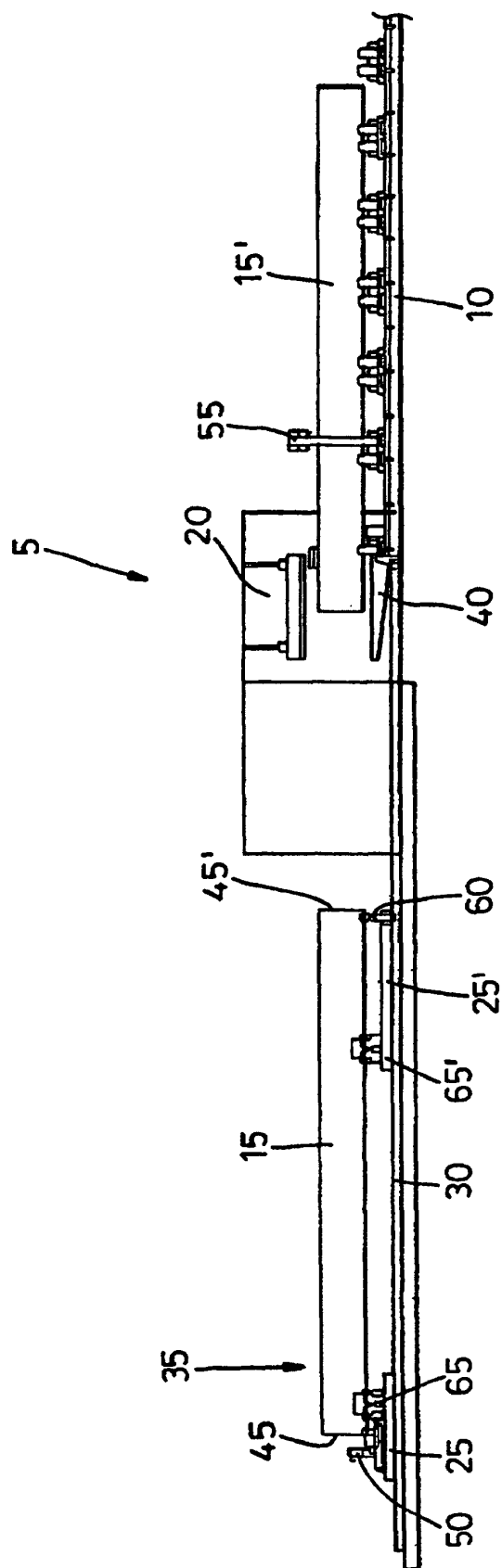


Fig. 4

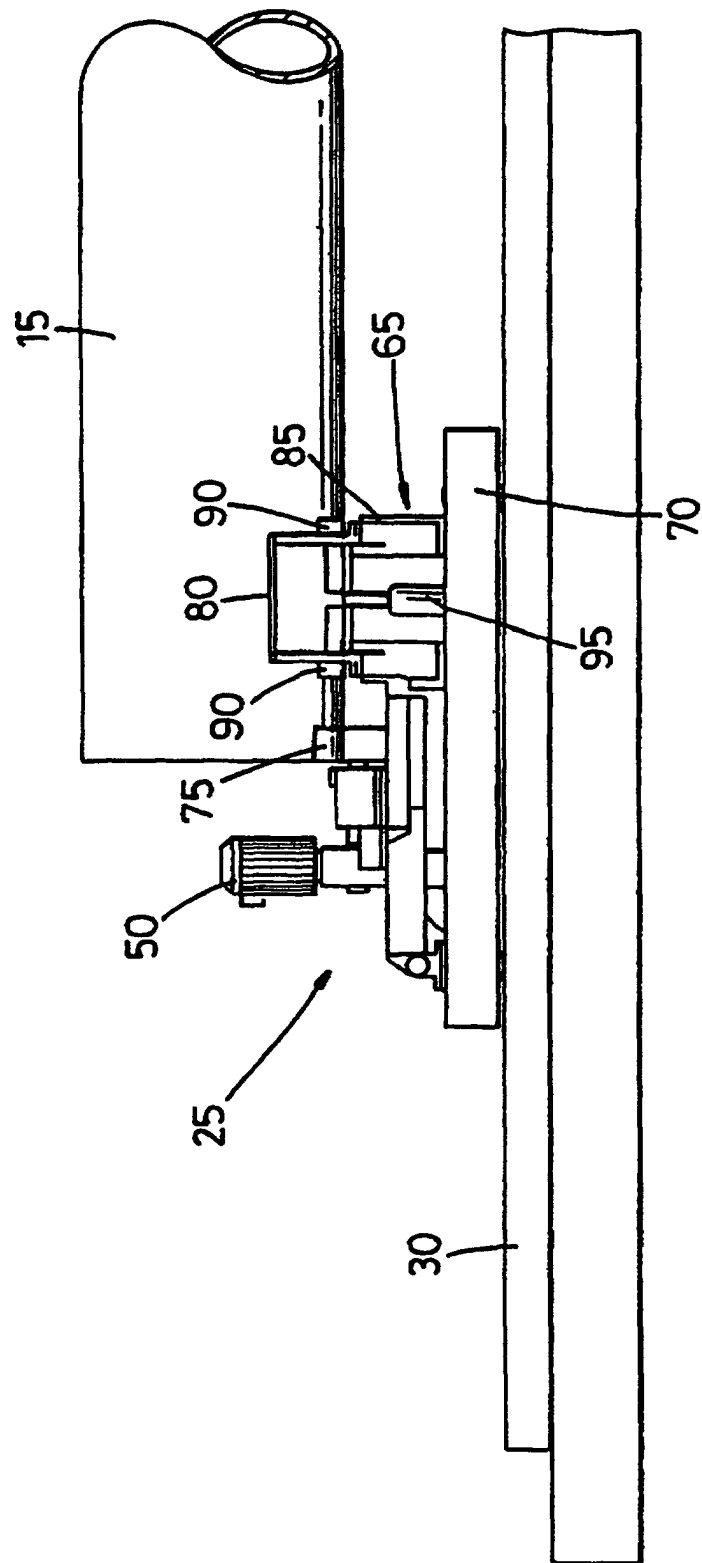


Fig. 5

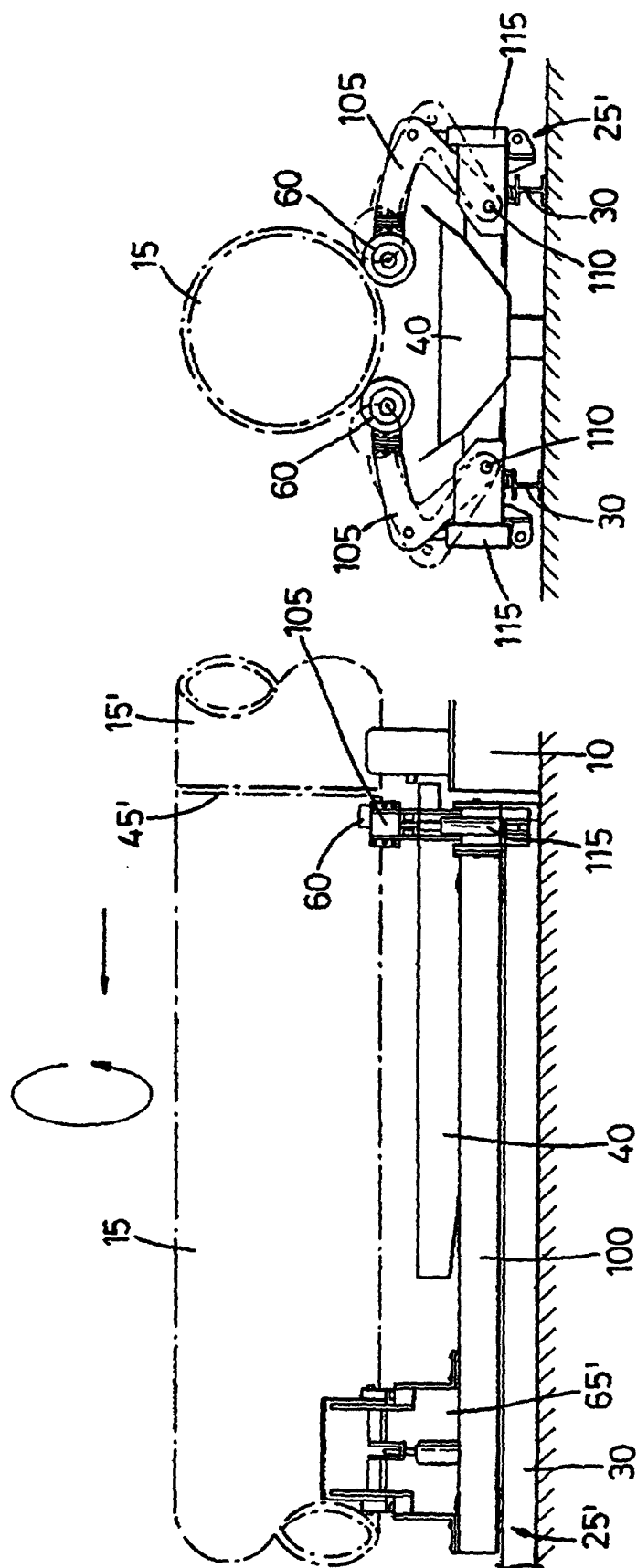


Fig. 7

Fig. 6