Aug. 11, 1959 A. CORBIN 2,899,088

MOBILE LIFTING AND CONVEYING APPARATUS

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Fig. 1

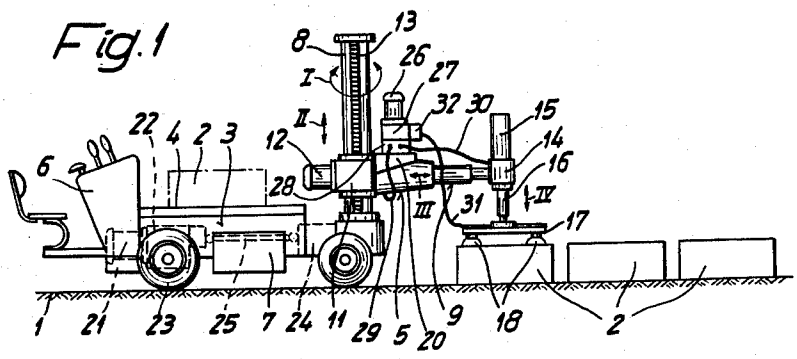


Fig. 2

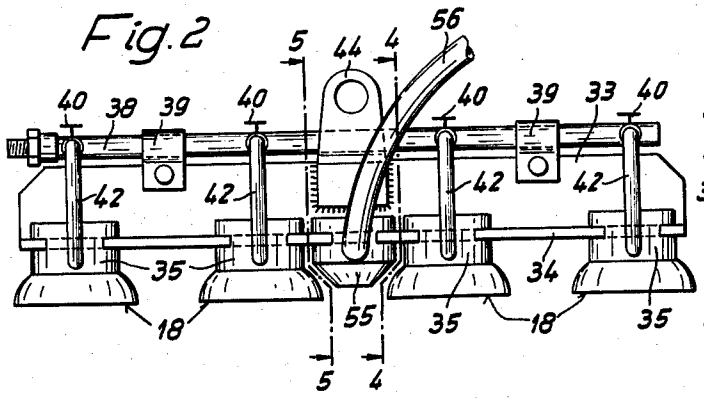


Fig. 4

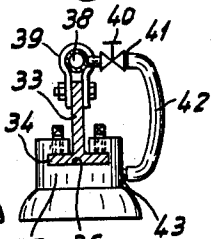


Fig. 3

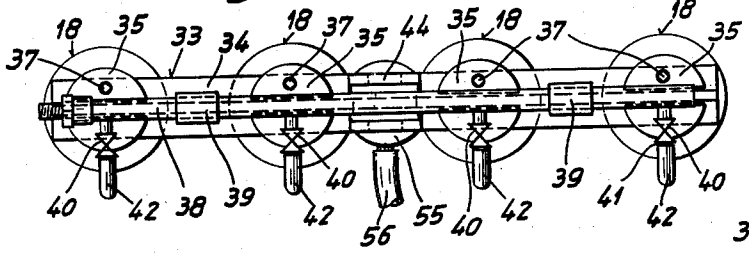
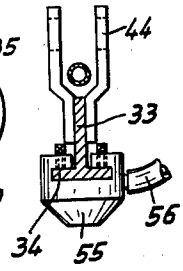


Fig. 5



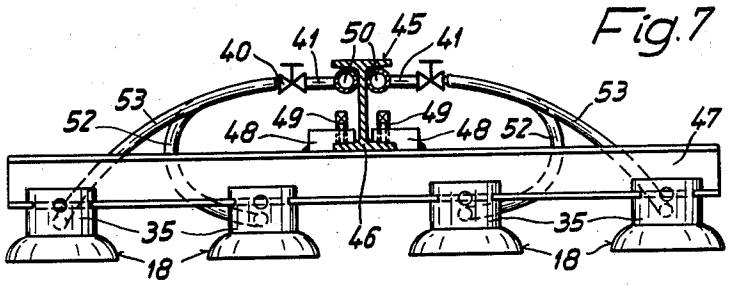
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MOBILE LIFTING AND CONVEYING APPARATUS

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Fig. 7



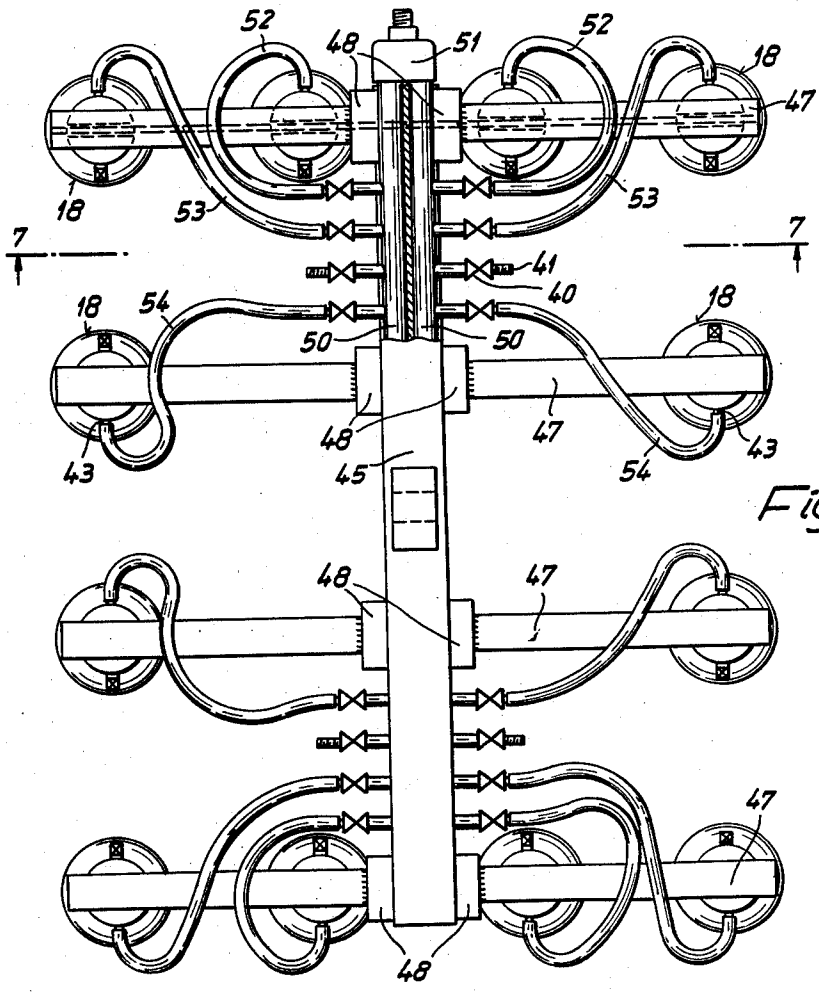


Fig. 6

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MOBILE LIFTING AND CONVEYING APPARATUS

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Claims priority, application Germany May 15, 1956

8 Claims. (Cl. 214—75)

The invention relates to a mobile lifting and conveying apparatus of the kind which consists of a mechanically propelled vehicle having a lifting mechanism arranged on the vehicle and actuated by the same source of power as that used to drive the vehicle.

Such lifting and conveying apparatus, adapted to suit the particular purpose of use, are known in many forms of construction, for instance, as truck cranes or floor cranes, high lift trucks, stackers, more particularly tip, fork, telescopic and electric stackers and the like.

The object of the present invention is to provide a mobile lifting and conveying apparatus of the above-mentioned kind which is particularly suitable for the moving of cut stones having at least one substantially flat surface. The moving of cut stones is particularly difficult and cannot be accomplished with the usual gripping mechanisms adapted to grip piece and stacked goods and which operate mostly with a pincer action, if these cut stones are disposed closely adjacent to one another.

According to the present invention, a mobile lifting and conveying apparatus particularly suitable for the moving of cut stones is characterised in that the lifting mechanism is provided with a pneumatically operated load-gripping device or arrangement, the adjustable suction pump of which is driven from the same source of power as that used for driving the vehicle.

Further features and advantages of the invention are explained in greater detail in the following description of the accompanying drawings which illustrate one embodiment of the invention by way of example only and in which:

Fig. 1 is a side elevation illustrating diagrammatically the mobile lifting and conveying apparatus according to the invention;

Fig. 2 is a detail side elevation of a carrying member of the apparatus formed from a horizontally extending girder and having four suction heads;

Fig. 3 is a plan view of the carrying member shown in Fig. 2;

Fig. 4 is a cross section taken on the line 4—4 of Fig. 2;

Fig. 5 is a cross section taken on the line 5—5 of Fig. 2;

Fig. 6 is a plan view of a modified form of carrying member in which the horizontally extending girder is provided with displaceable and adjustable cross pieces on which the suction heads are adjustably mounted; and

Fig. 7 is a cross section taken on the line 7—7 of Fig. 6 and viewed in the direction of the arrows.

Fig. 1 of the drawings illustrates the complete lifting and conveying apparatus as intended for the moving of blocks of stone 2, which are shown resting on the ground 1 with very little space between them. The blocks may, however, touch one another. The apparatus comprises a truck-like vehicle 3 having a loading surface 4, a lifting mechanism 5 situated at the front and seating and control gear, generally designated 6, at the rear for the driver and

operator. The vehicle 3 is driven by an electric motor 21 which has a flanged connection with a gear transmission mechanism 22 which is located directly on the axle of the rear wheels, one of which is shown at 23, near the driver's position and which drives said wheels and so the vehicle 3. The source of energy for the motor 21 driving the vehicle 3 is an accumulator 7 situated underneath the loading surface 4. This accumulator 7 also forms the source of energy for driving other motors 12 and 26, which effect the actuation of the lifting mechanism 5 and the pneumatic gripping apparatus later described.

The lifting mechanism 5 comprises preferably cylindrical guide column 8 mounted on the front of the vehicle 3 and rotatable in the direction of the arrow I about its longitudinal axis. Mounted to move vertically up and down on column 8, as indicated by the arrow II, is a telescopic jib 9 which has a sleeve 11 slidable on column 8 and on which the driving motor 12 for effecting the vertical movement of the jib 9 is preferably flanged. This vertical movement may be effected, for instance, by means of a pinion (not shown) located on the sliding sleeve 11 and a rack 13 mounted on the column. The rotation of the guide column 8 is effected by means of a gear transmission mechanism 24 which, in turn, obtains its drive from the gear transmission mechanism 22 by way of a cardan shaft 25. The means for lifting, swinging and extending the jib may be of any suitable and conventional type as e.g. disclosed in the U.S. Patent No. 2,812,070 to Delzer.

At the free front of the jib 9 which is variable with respect to its useful length, as shown by the arrow III, is located the pneumatic gripping mechanism which is preferably constructed to move up and down relatively to the jib 9. In the embodiment shown in Fig. 1, a head piece 14, located on the free end of the jib 9, carries a guide cylinder 15 in which a lifting rod 16 may be raised and lowered, as indicated by the arrow IV, hydraulically or pneumatically. The free end of the lifting rod 16 is provided with a linked carrying member 17 on which are arranged the actual cup or saucer-shaped suction heads 18 which are shown disposed on the plane or flat upper surface of a stone block 2 so as to firmly adhere thereto for the purpose of raising the stone block, when a vacuum is established in the suction heads. Said vacuum is preferably adjusted approximately to the order of 0.1 kg. per sq. cm. Since the number of suction heads is determined by the weight of the stone block to be raised, it is possible when dealing with lightweight blocks for the gripping mechanism to be provided with only one suction head 18.

To establish the requisite vacuum in the suction heads 18, a suction pump 27 is used which may form a structural component of a pump unit 19 located on a bracket 20 projecting from the sleeve 11 above the jib 9. Apart from the suction pump 27, the pump unit 19 may also contain a pressure pump 28 for the pneumatic or hydraulic actuation of both the telescopic jib 9 and the lifting rod 16 of the gripping mechanism. Both pumps 27 and 28 are driven from the common electric driving motor 26 which receives its power from the battery 7 of the vehicle. The feeding of the driving medium from the pressure pump 28 to the jib 9 and to the guide cylinder 15 and the return of the medium therefrom, is effected by two flexible hose pipes 29 and 30, while a flexible suction pipe 31 is arranged to convey air from the suction heads 18 to the suction pump 27 in order to establish and maintain the required vacuum in the heads 18. It is advisable to insert in the suction air pipe 31 a filter for the separation of the stone dust which is usually present in the suction air. As shown in Fig. 1, such a filter 32 may be structurally combined with the pump unit 19. It may, however, also be located in any other suitable

place on the vehicle. Apart from being fed or removed through the illustrated flexible hose pipes **29**, **30**, **31**, the compressed air or the suction air may also be fed or removed through ducts, pipe lines, or the like, which are not shown in the drawings and which may be contained inside the carrying member **16**, the lifting rod **14** and the jib **9**.

The pump unit **19** may be accommodated on the vehicle **3** instead of on the sleeve **11**. The suction pump **27** is adjustable with respect to its output in order to vary the effect of the pneumatic gripping mechanism within a given range and in particular to adjust this effect so that, during the lifting operation, the suction is continuously maintained, a feature which is particularly necessary in the case of porous stones or stones in which the surfaces thereof, intended for the application of the suction heads of the gripping mechanism, have a certain amount of roughness. In the case of these stones it is usually not possible to obtain a proper sealing action with suction heads provided in the usual manner with resilient sealing members.

In order that the pneumatic gripping mechanism may be adapted not only to the existing ratios of weight of the stone to be raised, but also to the profile of the surface of the stone to which the gripping mechanism is to be applied, the suction heads are individually removable from their common carrier and the suction pipe lines leading to each suction head may be individually shut off. In addition, the suction head carrier is adapted to suit any varying arrangement of the suction heads. The carrier may, as shown in Figs. 2 to 5, consist of a horizontally disposed girder **33** which is preferably made from a corresponding length of structural steel bar having a high-webbed T-cross section. On the horizontal flange **34**, which faces the stone to be raised, are slid four suction heads **18** by way of a corresponding T-groove **36** formed in their head members **35**. The suction heads are adjustably mounted at relatively uniform spaced intervals along the girder flange **34** by means of clamping screws **37**, one of which is carried by each head. The suction air is removed from the suction heads **18** by a collecting pipe **38** which extends over the entire length of the girder **33**. Pipe **38** is mounted on the vertical web of the girder by means of clips **39** and has branch connecting sockets **41** provided with stop cocks **40** which communicate through flexible hoses **42** with nipple means **43** for attaching the hoses to the suction head **18**. Apertured lugs **44** serve to connect the girder **33** to the lifting mechanism of the vehicle **3**. The gripping mechanism shown in Figs. 2 to 5 is intended to move oblong prismatic stones such as curb stones. The gripping mechanism may be longer and may carry more or less than four suction heads **18** in accordance with the length of stones to be raised.

For moving stones on which the gripping mechanism has to be applied to a broad surface area of the stone, it is advisable to use the gripping device shown in Figs. 6 and 7. This gripping device is formed of a horizontally extending girder **45** of structural steel having a preferably I-shaped cross section. Displaceably mounted on the lower flange **46** of girder **45** are four cross girders **47**, also of I-shaped cross section. These cross girders are placeably held by means of claws **48** and are clamped at the desired spaced relationship by means of screws **49**. On the lower horizontal flanges of the cross girders **47**, as in the case of the gripping mechanism shown in Figs. 2 to 5, suction heads **18** are slid in the desired number and secured in the desired spaced relationship. The suction air is removed from the suction heads **18** by two collecting pipes **50** secured to the horizontal girder **45** and connected at one end by a common connecting piece **51**. Branching off from each of these collecting pipes **50** are a sufficient number of connecting sockets **41** provided with stop cocks **40** from which, as required, hose pipes **52**, **53** and **54** lead to connecting nipples **43** of the suction heads **18**.

In order to prevent or minimise the entry of stone dust, which has settled on the surfaces of the stone blocks, into the suction air pipe line, the gripping mechanism may be fitted with a cleaning device which is arranged to come into action before the application of the gripping mechanism and removes the stone dust by the spraying of water, for example. In the case of the gripping mechanism embodied in Figs. 2 to 5 a spray head **55** is arranged for cleaning purposes between the two centre suction heads **18**. This spray head **55**, which is slid on to the flange **34** of the beam **33** and detachably mounted in a similar manner to the suction heads **18**, is fed with water through a flexible pipe line **56**, a water container being provided on the vehicle for this purpose. Instead of removing the dust by the spraying of water the dust may be removed by applying to the stone a powerful jet of compressed air before the application of the gripping mechanism. To produce this blast jet, in the event of the jib **9** and the lifting member **15**, **16** not being pneumatically actuated, a special compressed air pump would be provided on the vehicle **3** or a blow head, corresponding to the water jet head **55**, may be connected to the pressure side of the suction pump **27**.

All the functions of the above-described lifting and conveying apparatus are effected centrally from the driving and operating position **6** which contains the operating and control members necessary for this purpose. In use, the operator drives the present apparatus into the vicinity of the stone block **2** which is to be moved. The lifting mechanism **5** with its jib **9** directed away from the vehicle, is at its lowest position. As soon as the gripping mechanism with its lifting rod **16** is approximately in the centre of the surface of the stone (which may be achieved by suitably shortening or lengthening and/or laterally swinging the jib **9**) the gripping mechanism, after the actuation of the spraying or blowing device **55**, **56** if necessary, is lowered on to the stone **2** until the suction heads **18** are disposed thereon. Then the suction pump **27** is started and operated to its full capacity until the vacuum necessary for the lifting is produced. The stone block **2** is now raised by means of the lifting mechanism **5** and conveyed in its lifted condition by the vehicle **3** as far as the desired place. The stone may be then set down in front of or at the side of the vehicle, as desired. If the stone blocks **2** are to be conveyed over lengthy distances, it is advisable (as shown in chain dotted lines in Fig. 1) to deposit them on the loading surface **4** of the vehicle **3**, for which purpose the jib **9** carrying the raised stone block is swung through 180°.

It is again expressly pointed out that the inventive concept incorporated in the described apparatus lies in the combination of a mechanically propelled vehicle having a mounted or attached lifting mechanism or device, pneumatic gripping mechanism or apparatus and the drive of the lifting and gripping mechanisms being from the same source of energy or power as that of the vehicle.

Therefore, those embodiments of the invention in which a lifting apparatus is used operating according to a principle different from the one described, or where the source of power or energy of the vehicle **3** is derived from diesel electric machinery or a combustion engine actuating through gears and clutches, both the vehicle and the lifting and gripping apparatus and the other auxiliary devices, are also regarded as coming within the scope of this invention as defined by the claims.

I claim:

1. A mobile lifting and conveying apparatus, particularly suitable for the moving of cut stones having at least one substantially flat surface, comprising in combination a mechanically propelled vehicle, a power unit for driving the vehicle, a lifting mechanism mounted on

the vehicle near its front end, a loading platform on the vehicle in the rear of said lifting mechanism, said lifting mechanism including a jib mounted for up and down movement as well as for horizontal swinging movement so as to extend with its free end forward in one position and above said platform in another position, a driving transmission between said lifting mechanism and said power unit, a pneumatically operated load-gripping mechanism comprising at least one suction head carried at the free end of the jib, an adjustable suction pump operatively connected with said load-gripping mechanism and a driving transmission between the suction pump and said power unit driving the vehicle.

2. In a mobile lifting and conveying apparatus, particularly suitable for the moving of cut stones having at least one substantially flat surface, comprising a mechanically propelled vehicle, a power unit for driving the vehicle, a lifting mechanism mounted on the vehicle, a driving transmission between said lifting mechanism and said power unit, the combination with said lifting mechanism of a pneumatically operated load-gripping mechanism, an adjustable suction pump operatively connected with said load-gripping mechanism and a driving transmission between the suction pump and the power unit driving the vehicle, said load-gripping mechanism comprising a common carrier member, a plurality of suction heads mounted on said carrier member, said carrier member and said suction heads being formed with co-operating means whereby the suction heads are individually detachable from said carrier member, and a plurality of suction pipes communicating between individual suction heads, respectively and said suction pump and including each an individually operative shut-off cock.

3. Apparatus according to claim 2 in which said common carrier member is constructed to receive and locate a varying number and arrangement of suction heads.

4. Apparatus according to claim 2 in which the carrier member is in the form of a horizontal girder on which the individual suction heads are attachable in any desired spaced relationship through detachable securing means.

5. Apparatus according to claim 2 in which the carrier member consists of a horizontally extending girder and at least two-cross girders detachably and adjustably mounted thereon, each cross-girder being arranged to receive and locate suction heads in a detachable and adjustable manner.

6. In a mobile lifting and conveying apparatus, particularly suitable for the moving of cut stones having at least one substantially flat surface, comprising a mechanically propelled vehicle, a power unit for driving the vehicle, a lifting mechanism mounted on the vehicle, a driving transmission between said lifting mechanism and said power unit, the combination with said lifting mechanism of a pneumatically operated load-gripping device, an adjustable suction pump operatively connected with said load-gripping device, a driving transmission between the suction pump and the power unit driving the vehicle, spray means associated with said load-gripping device, and means for delivering a cleaning fluid to said spray means for discharge therefrom onto a cut stone prior to being gripped by said load-gripping device.

7. A mobile lifting and conveying apparatus according to claim 6 including air filter means interposed pneumatically between said suction pump and said load-gripping device.

8. Apparatus according to claim 2, further comprising a suction air collecting pipe attached to said carrier, connecting nipples spaced along said air collecting pipe, said suction pipes leading to the respective suction heads and being attached to said nipples, and said shut-off cocks being provided between said air collecting pipe and said nipples, respectively.

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