This invention relates to the lifting, supporting and moving of loads.

Often it is required to lift, and move, heavy loads under circumstances in which it is difficult to insert lifting devices, such as jacks, and/or wheels, beneath the load. Whilst it may be possible to lift the load by mobile crane, access to the load may be restricted, and the combined mobile crane and load may be of such an overall size that movement of the crane and load is extremely difficult.

According to the invention in one aspect a method of moving a load comprises positioning over the load a gas-retaining envelope adapted to envelop the load while presenting an open mouth towards the surface on which the load is supported, attaching the load to the envelope and introducing gas into the envelope to raise the pressure therein sufficiently to take at least a major part of the weight of the load so that it may be moved more readily.

According to the invention in another aspect there is provided apparatus for moving a load comprising a gas-retaining envelope adapted to be positioned over a load so as to envelop it while presenting an open mouth towards the surface on which the load is supported, means for attaching the load to a part of said envelope and means for introducing into said envelope gas at sufficient pressure to raise at least the part of said envelope to which the load is attached so as to take at least a major part of the weight of said load so that the load may be more easily moved.

The envelope may be flexible, at least in part, and may be inflated by the gas introduced into it.

In one form the envelope is of double-walled flexible construction so that it may be inflated between the walls to effect it.

Moreover the envelope may be provided with means for setting up a curtain of moving gas flowing from at least a part of the periphery of the envelope towards the surface over which the apparatus is operating so as to assist in the retention of a pressurised cushion of gas within the envelope if and when the periphery thereof leaves the said surface. Such means may comprise simple outlet means suitably located and distributed around the periphery of the envelope and positioned so as to direct escaping gas downwardly and preferably somewhat inwardly from the lower edge towards the ground or other surface.

The invention will be readily understood by the following description of certain embodiments of the invention in conjunction with the accompanying drawings, in which:

FIGURE 1 is a plan view of the embodiment of FIGURE 2, the hollow inflatable envelope being inflated by air from the compressor 11. The load 12 is attached to the load attachment means 13 as before. In this example, however, a separate section or duct 25 is formed at the bottom edge of the envelope 10. The bottom surface of the duct 25 is provided with a continuous port 26. Air is fed from the compressor 11 to the duct 25 and issues from the port 26 in a downwards and inwards direction to form a curtain of moving air 27. In operation, the envelope 10 may first be inflated and then air supplied to the duct 25, or, alternatively, air may be supplied to the duct 25 at the same time as the envelope is inflated. In either case,
the air issuing from the port 26 flows inwards under the envelope to form the cushion of pressurised air, the bottom edge of the envelope remaining in contact with the surface. Once the cushion is formed, the inflated envelope and the load will lift clear of the surface, the gap between the bottom of the envelope and the surface being formed by the air curtain 27. Although the air issues from the curtain forming port 26, initially in a downwards and inwards direction, it is deflected by the cushion pressure round and outwards as shown.

The use of an air curtain to seal the gap between the bottom of the gas-retainin envelope and the surface, as shown in FIGURE 3, provides either a clearance similar to that provided in FIGURES 1 and 2 with a smaller air flow requirement, or an increased clearance for the same air flow.

FIGURE 4 illustrates a plan view of the embodiment illustrated in FIGURE 3, although it will be appreciated that the plan views of the embodiments illustrated in FIGURES 1 and 2 will be very similar. In the example shown, the plan form is circular, but obviously this plan form can be varied depending upon the actual construction of the envelope.

An air curtain may also be used in conjunction with the embodiment shown in FIGURE 1, by providing a duct having a port or ports at a suitable position. For example, a duct 30 may be formed at the bottom edge of the envelope 10, as illustrated in FIGURE 5. Alternatively, a duct 31 may be positioned some distance up inside the envelope as in FIGURE 6, the bottom edge 32 of the envelope being of re-entrant form to direct the air forming the curtain initially inwards.

The construction of the envelope illustrated in FIGURES 2 and 3 can vary. FIGURES 7, 8 and 9 illustrate variations in the construction of the envelope illustrated in FIGURE 2, although similar variations can be used for the envelope illustrated in FIGURE 3.

In FIGURE 7, the envelope is formed of two sheets of material 40 and 41 connected together by means of members 42. The members 42 can be in the form of webs which can subdivide the space between the sheets 40 and 41 into separate air-tight chambers. Alternatively, the members 42 can be in the form of perforated webs or cords.

FIGURE 8 illustrates a construction in the form of individual tubes 45 joined together, side by side. An alternative use of tubes is illustrated in FIGURE 9 where the tubes 48 are spaced apart and connected by a flexible sheet 49. The construction of FIGURE 9 would require a large umbrella comprising a gas-retaining envelope of flexible material adapted to be positioned over the load so as to envelop it while presenting an open mouth towards the surface on which the load is supported, said envelope comprising two sheets of material spaced apart to define a closed space and cooperating with said surface to form a cushion space wherein a gaseous pressure may be maintained, means for detachably connecting the load to a part of said envelope internally thereof, means for introducing into said cushion space gas at sufficient pressure to inflate said envelope and to raise at least the part of said envelope to which the load is connected relative to the surface sufficiently to take a major part of the weight of said load off said surface so that the load may be more easily moved, and means for supplying gas under pressure to said closed space.

1. Apparatus as claimed in claim 1 wherein the two sheets of material are attached together at spaced apart locations.

2. Apparatus as claimed in claim 1 wherein the gas introduced into the cushion space is at a lower pressure than the gas supplied to the said closed space.

3. Apparatus as claimed in claim 1 wherein the gas introduced into the cushion space is at a lower pressure than the gas supplied to the said closed space.

4. Apparatus for moving a load which is normally supported by a supported tube surface comprising a gas-retaining envelope of flexible material adapted to be positioned over the load so as to envelop it while presenting an open mouth towards the surface on which the load is supported, said envelope cooperating with said surface to form a cushion space wherein a gaseous pressure may be maintained, means for detachably connecting the load to a part of said envelope internally thereof, means for introducing into said cushion space gas at a sufficient pressure to raise the envelope, and the load, clear of the said surface, and means for causing a gas to issue from the lower edge of the envelope to form at least one cushion of moving gas which flows across the gap between the lower edge of the envelope and the said surface, the curtain of moving gas assisting in retaining the gas inside the cushion space.

5. Apparatus as claimed in claim 4 wherein the curtain of moving gas serves at least in part as the means for introducing the gas into the cushion space.

6. Apparatus as claimed in claim 4 wherein the means for causing a gas to issue from the lower edge of the envelope comprises a duct extending round the lower edge of the envelope, and at least one port formed in the bottom of the duct.

(References on following page)
5 References Cited by the Examiner

UNITED STATES PATENTS

2,886,265 5/1959 Ritter et al. 244—117
2,941,762 6/1960 Blair et al. 244—117
3,019,756 2/1962 Murri
3,042,129 7/1962 Wade
3,086,753 4/1963 Cushman
3,106,373 10/1963 Bain et al. 244—117
3,161,247 12/1964 Mackie

6 OTHER REFERENCES


WILLIAM FELDMAN, Primary Examiner.
PHILIP ARNOLD, Examiner.
R. M. WOHLFARTH, O. M. SIMPSON, Assistant Examiners.