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Mobile Rescue Equipment for Emergency Response and Recovery

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Abstract- Emergency response during rescue operations will be successful with the use of fast-reliable mobile equipment that provides the minimum time of the transactions. The proposed concept of mobile equipment contributes to this problem. The main elements of the basic requirements for the quality of its manufacture and use are represented. An example of a constructive scheme of fast assembled jib crane is shown.

Keywords: Fast-mobile equipment, rescue operations, jib crane, order of operations, constructive section.

Introduction

During emergency situations (ES) a factor of the possible minimum time for release from the rubble and rescue of victims is a matter of life and death. As a rule, when the destructions are widespread, there is a deficiency of the conveyor equipment for the rescue operations mechanization. Their delivery to a place of the emergency situation is complicated, and in many cases, when the destructions are widespread, the access route of automobile cranes is almost impossible. The use of the technology of layer-by-layer removal of the rubble, as the safest one, demands a great number of lifting mechanisms, especially during the removal of the destroyed multistory buildings and constructions [1-3].

Reduction of time of dismantling of blockages requires creation of the specialized mobile fast-combined crane providing effective and safe carrying out rescue operations.

The crane has to meet the following requirements:

1. The design has to be modular. Modules have to be the safest for the use and convenient for the fast assembly.

2. Ensuring of the fast, high-quality and guaranteed safe assembly (removal) and taking the crane into a working condition [4].

3. The weight of each module should not exceed 150 kg and have adaptations for the safe carrying not less than by four rescuers. The number of modules with the maximum weight has to be minimal.

4. The jib of the crane has to include the separate sections which are compactly stacked together with other modules for a convenience of transportation by the freight vehicle, helicopter, the trailer to the bulldozer or other cross-country vehicle.

5. The package have to include the autonomous power installation - the electric generator, a set of various quick-change load gripping adaptations and means of mechanization of the removal works.

6. The service of the crane, carrying out of the rescue and the urgent condition - recovery work have to be carried out by a specially preparatory crew of the rescuers who are capable to ensure the safety of the executed works at the minimal period of time [5].

7. Rescuers have to be provided with the special equipment for carrying out the rescue operations; it is appropriate to use the equipment for carrying out the mine-rescue works and climbing equipment as the initial basic option.

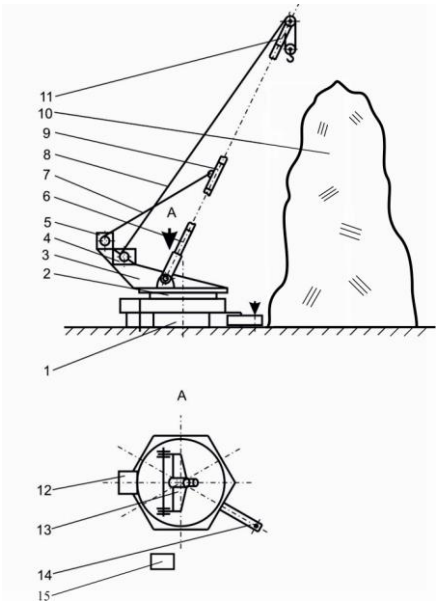

Fig. 1. The scheme of the combined load-lifting equipment where: 1 – a basic platform; 2 – a rotary platform; 3 – a frame; 4 - a block of the drive of lifting of loads, 5 - a block of the drive of raising of a jib, 6 – a jib section; 7 – a rope of raising of a jib; 8 – a rope of lifting of loads; 9 – a jib section with fastening of a rope of raising of a jib; 10 – an object; 11 – a trailer section, 12 - a block of the drive of a rotary platform; 13 – a basic section; 14 – an outrigger; 15 – a mobile electric generator.

Fig. 1 shows the constructive scheme of the fast-mobile load-lifting equipment - the jib crane with a loading capacity of 1 … 2 ton-force [6-8].

The crane is delivered in unassembled form by any freight vehicles of the corresponding loading capacity as close as possible to the place of the most probable finding of victims. The installation place of the basic platform of the crane is chosen.

If the fragments of buildings do not allow making it, the modular parts of the crane are manually transferred to the place of assembly of the crane and the further carrying out of the rescue operations.

The fast assembly of the equipment is carried out by forces of a crew of the special rescue team owning skills of work with the use of load-lifting equipment of a special purpose.

The speed of the assembly is reached due to application of special gripping elements and a design of locks clamps for each element of the module or section of the jib.

Approximate order of carrying out the rescue operation with the use of the crane [9]:

1. Clearing of the place for the crane installation by means of the bulldozer or manually be a rescue team with the use of manual tools and adaptations.

2. The installation of the basic platform 1 with a rotary platform 2 on the prepared place.

3. The installation of six outriggers 14 with providing conditions of rigidity of the all basic base of the crane with the movement of telescopic sliding outriggers. Outriggers have to be established in such way in order to provide a stability of the crane during the rescue operations.

4. The installation of the frame 3, the block of lifting of loads 4 and the block of lifting of the jib 5.

5. The installation of the basic section 13, the sections of the jib 6, the section of the arrow 9 with fastening of a rope of lifting of the jib, the section trailer 11. The installation is made in the horizontal provision of the jib along the object.

6. Reeving of ropes 7 of lifting of the jib and ropes 8 of the lifting of loads, a connection of the polyspast block with a hook.

7. On the trailer section 11 the gripping elements for fixing of ropes, on which the mechanisms blocks of a suspension bracket of the rescuers' equipment working at the top of the object are attached, have to be provided.

8. Sections of the jib 6 must have the steps and handrails allowing the rescuers to move on the jib upward and back for moving to a zone of the rescue operations on the top of the object and back.

9. The check of correctness of the executed assembly operations by a little turning of driving mechanisms manually.

10. A connection of actuating units to a network of the power supply of the electric generator. The lifting of the jib at an angle of about 60 … 70 degrees relating to horizontal line. The check of the rotary equipment by turning on the drive of turn and rotation to 360 degrees. In some cases the drive of turn can be manual.

11. The check of the drive of lifting of the jib and the drive of lifting of loads by lowering and a lifting of the jib and load without the loading on a hook.

12. The check of loading capacity of the crane by lifting of any load by the weight, corresponding to the crane loading capacity. Strapping cables and adaptations have to be included in the package of the saving equipment of the rescuers' crew.

13. The crane is ready to carrying out the removal rescue operations.

14. Rescuers with sets of removal mechanisms move on the object on the jib of the crane and on the special device ensuring the safety of their work during the removal of the object and a strapping of elements of the object during the work with the crane.

15. The special devices have to be used from the base of equipment of the mine rescuers or the base of the climbing equipment.

The removal of the rubble is carried out by a crew (at least from six people) method of layer-by-layer removal of fragments. The head of a crew defines a method and working methods and looks after an observance of security measures. If it would be necessary, the crane moves along the object by means of the winch or transferred in parts to other place.

Features of a design of the crane

1. Possibility of a manual transportation of the equipment at the emergency place.

2. Adjustable outriggers allow installing the equipment on the unprepared surface, on a slope or even on the rubble.

3. The special design of locks has to provide the fast, high-quality assembly of all modules of the crane and the jib with the use of the additional fixing devices providing the accuracy of the assembly and reliability of the crane in operating time.

4. An existence of the additional load gripping devices increases the speed of the manual assembly.

5. The safety of trailer elements of sections of the jib when transporting has to be ensured by the special strong protective covers.

Fig. 2 shows the outline version of the constructive scheme of the crane jib 12 m long.

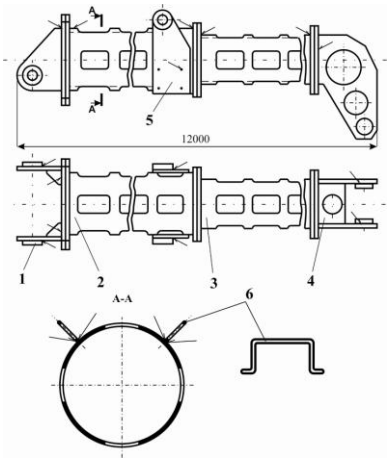

Fig. 2. The outline option of the jib of the crane 1 – the basic block; 2 – the lower rack; 3 – the top rack; 4 – the lifting block; 5 – the collar; 6 – the handrail.

The design of the jib consists of 6 basic elements; on racks of pipe sections the cuts - the steps and handrails welded on racks are provided. Steps and handrails are intended for convenience of rescuers movement on the top of the object. To be provided special gripping elements in the

block lifting for fastening of ropes of a safety set of the known saving equipment applied by climbers or mine rescuers.

The design of basic elements of the crane has to provide its working capacity even during the aftershocks of the earthquake.

The present offer contains the basic elements of strategy of carrying out the rescue operations. Designing of elements of the crane is "know-how", because the methods of creation of the reliable fast-combined saving equipment in usual engineering practice are unknown. Predesigns of time of carrying out rescue operations at rescue and urgent emergency recovery operations on the object like a 5-storeyed house or smaller number of stories show that it is possible to make a full dismantle in 12 hours, this size can both decrease and increase, everything depends on the scale of destructions of the object, the design of the crane and rescuers' qualification.

Conclusion

The present paper is offered for the use in the deal of the equipment for the rescue of victims during an emergency situation, probability of manifestation of which is unknown, and human life needs to be saved in a short period of time by means of the prepared in good time high-speed equipment.

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