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FUNCTIONAL ANALYSIS AND TECHNICAL SOLUTIONS TO ACHIEVE THE "MECHANICAL SYSTEM OF WASTE COLLECTION AND DISPOSAL BEACHES"

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Abstract: This paper analyses the functional and design solutions proposed to optimize the overall performance of the mechanical system of equipment for waste collection and sanitation sandy beaches. In these days of high quality requirements of tourism services and growing competition in the field, the theme of the work is of interest for companies producing such equipment and for most businesses that own spaces in areas where tourist offer includes sandy beaches and get beach in management and related sectors. The study aimed to establish technical solutions to achieve overall mechanical system that ensures the performance of duties for the specifications imposed by collection, temporary storage and disposal. For this purpose, a functional analysis of the system was performed first and Function Analysis System Technique (FAST) diagrams of the major functions were built, and then identified and associated technical functions for each of these solutions were proposed for achieving related. Machine operation designed based on technical solutions proposed was tested in conjuction with the specification requirements and the findings were used to optimize the performance of mechanical system analysis.
Keywords: waste collection, equipment, functional and design solutions, performance optimization

1. INTRODUCTION

Beach cleaning equipment are widely used both by firms that obtain in beach management sectors, as well as those dealing with planning sandy beaches in tourist areas. The equipment provided by the companies producing special organs work, for waste removal and sanitation beaches are generally drawn or semi-mounted. According to their mode of work, they can be on discontinuous action, where successively removing waste and relatively large stones or Continuous when, in addition to waste collection, loosens sand and sieved soil layer. Modern machinery specialized in cleaning sandy beaches uses the concept of modular waste collection (collection, temporary storage and disposal large and small). Thus, unlike other machines in the same category, such as the ones shown in Figures 1 and 1b, which can only collect small waste, the machine analysed in this paper and shown schematically in Fig. 1c, performed the following three types operations: large waste collection: algae, bottles and plastic bags, packing cartons and various plastics, etc; small waste collection at the surface or in depth: shells, debris and broken glass, cigarette butts, paper, etc.. ;temporary storage and disposal of all waste collected then.

Fig. 1. Equipment cleaning beaches: a, b - Classic; c-with collection, storage and disposal

2. THE STUDY PROBLEM

Functional analysis was performed using methods like Application aux Techniques d'Entreprise (APTE) and Function Analysis System Technique (FAST) [10], [11], [15] which is based on the

study of product relationships with the environment and highlights the service functions and constraints that must meet product designed [4]. Functional analysis is necessary to:

- ✓ functional specification content, which expresses the fundamental need of the user client functions [12].
- ✓ critical analysis of product design, which aims to ensure the competitiveness of the product made: highlights functional flows and elements involved in their implementation; leads to the elimination of unnecessary costs and oversized value criteria [11].

For "Mechanical waste collection and sanitation beaches" have been identified:

- ✓ neighboring environments (sand, dirt, user, tractor, environment, observer);
- ✓ service functions of designing and correlations between these elements in order to establish proposals for technical solutions to achieve the product [1], [5], [6].

2.1. Interactions diagram and Function Analysis System Technique (FAST) diagrams of the main functions:

In the diagram shown in Fig.2 are highlighted: interactions with key equipment in the environment that influences its operating parameters; main function that it must satisfy (FP1 – Clean sand impurities); design constraints, C1 - commissioning of the system; C2 - towing system; C3 - power; C4 - reducing pollution; C5 - resistance to aggression environmental factors; C6 - product design and aesthetics; C7 - Protection of the observer; C8 - user protection.

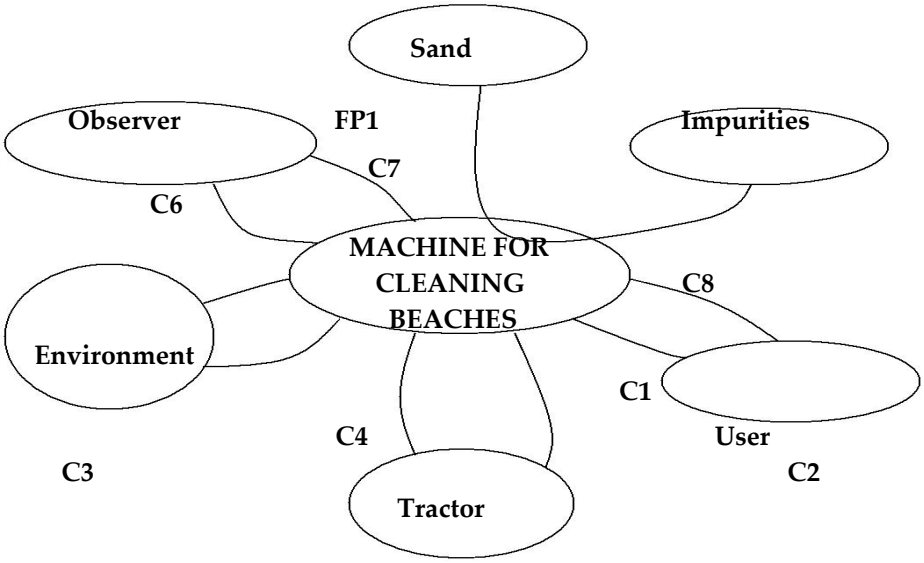

Fig. 2. Interaction diagram and design constraints associated

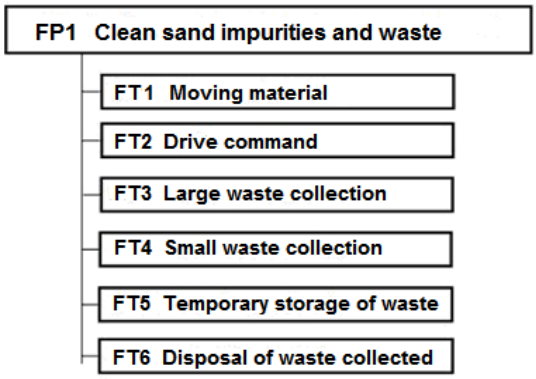

Fig.3. Function Analysis System Technique (FAST) diagram part of the main function FP1 – cleaning sand impurities and waste

Satisfying design constraints and providing opportunities to fulfill their technical functions identified below, are decisive elements of stage setting technical solutions for implementation of the system. In this respect, the Function Analysis System Technique (FAST) diagram was drawn first main function which must satisfy the system analyzed, namely the function FP1 – Clean sand impurities Fig.3, diagram includes technical functions noted FT1-associated FT6.

Then, were developed partial Function Analysis System Technique (FAST) diagrams of main technical functions FT3 – Large waste collection; FT4 – small waste collection; FT5 – storage of waste, shown in Fig.4, Fig.5 and Fig. 6, in which are highlighted both their sub-functions, as well as proposed technical solutions [8], [9], [10], [13].

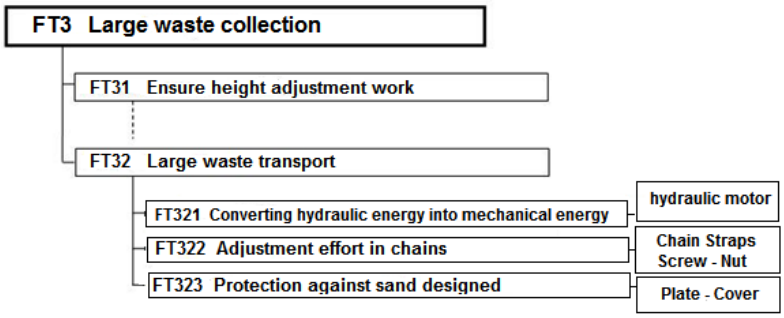

Fig.4. Function Analysis System Technique (FAST) diagram part of the technical function FT3 – Large waste collection

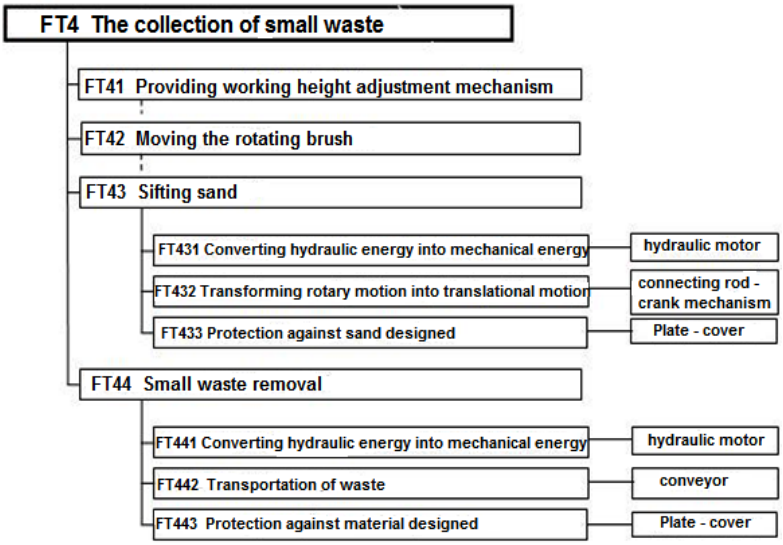

Fig.5. Function Analysis System Technique (FAST) diagram part of the technical function FT4 – small waste collection

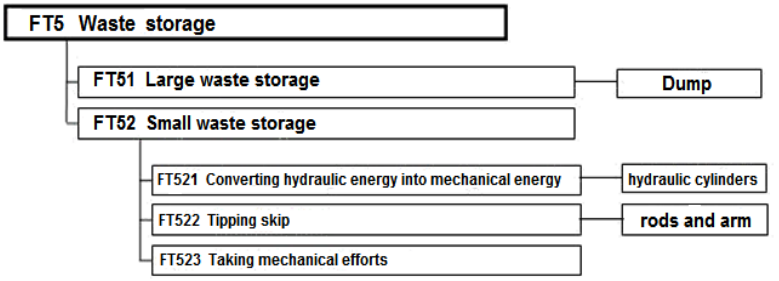

Fig.6. Function Analysis System Technique (FAST) diagram part of the technical function FT5 – waste storage

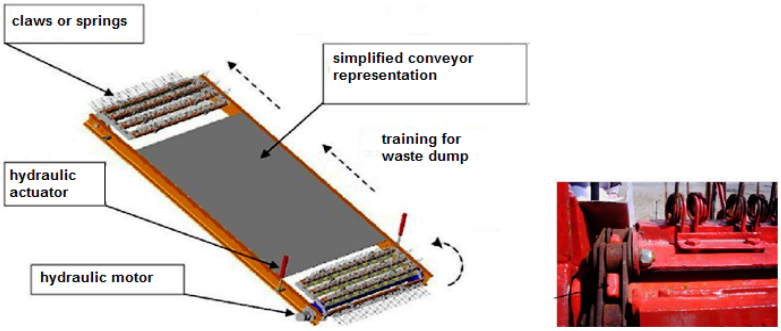

Fig.7. Large subset waste collection - a; Detail of structure Forwarder – b

The proposed technical solutions have been used to analyse the functioning of the Assembly.

2.2. Operation and resolving technical analysis to achieve mechanical system

Analysis of the mechanical assembly operation of waste collection and cleaning the beaches was made and correlated with previously proposed technical solution, entered the charts and Function Analysis System Technique (FAST) diagram part of the main technical features of the system requirements.

Large waste collection is carried by conveyor type "Pick-up", Fig.7, which is part of the plate carriers; provided that the pulling chains and bearing the burdens that elements have plates / brackets support. Body Type conveyor consists of two chains with brackets, bolts, bushings and rollers, which are profiled plates attached articulated and these plates are fixed claws (springs) that penetrate soil, sand. Involvement chains are achieved with two pairs of profiled sprockets and chain tension is carried out using a screw tensioning device. The chain wheels are driven in one movement of the shaft, the whole being driven by a hydraulic motor. Working height of the conveyor is controlled by two hydraulic actuators and the waste collected is being discharged in the bucket truck.

Small waste collection is carried out by means of the Sub-Assembly presented schematically in Fig. 8, whose active components are rotating brush and scraping blade. Scraping blade is driven hydraulically and can penetrate into the sand on a depth of approximately 5 cm, and the rotating brush with nylon bristles, is coached in motion by a hydraulic motor, the motion of rotation being guided through two bearings with bearings. The rotating brush projects the dirty sand on a oscillating motion grill driven by crank

system, which is controlled, in turn, by a hydraulic motor, Fig.9. Alternatively rectilinear translational movement of the grid has the effect of sieving the sand and deposit of dirt on the carpet conveyor, which then discharges into a collecting tank.

Temporary storage and disposal of waste collected: large waste is discharged directly into the dump via conveyor "Pick-up", and small waste is temporarily stored in a vat; this drum, filling the trailer is tilted, the operation is done through subassembly arm-rods, Fig.10, hydraulically actuated. On reaching top bin, hopper is emptied by gravity, due to its geometric position and shape. When the bucket is also filled, the wastes are discharged on a conveyor belt through a manual sunroof, during this operation the drum is raised above the bin.

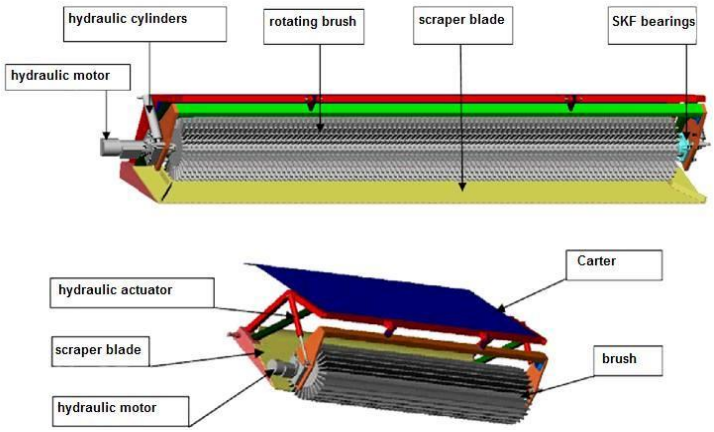

Fig.8. Subassembly for small-sized waste collection

As a result of this study, in Fig. 10 a schematically proposed solution is shown for achieving ensemble "Mechanical waste collection and cleaning the beaches" in 3D representation made in the automatic calculation program Autodesk Inventor Professional.

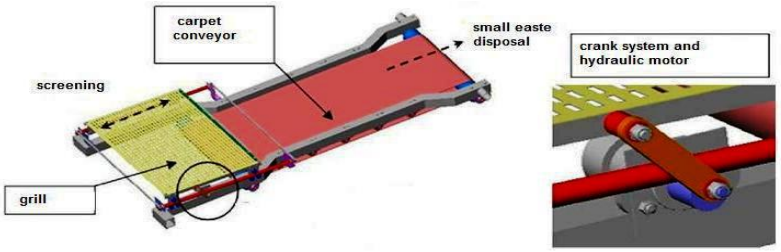

Fig.9. Subassembly for the separation and removal of small waste

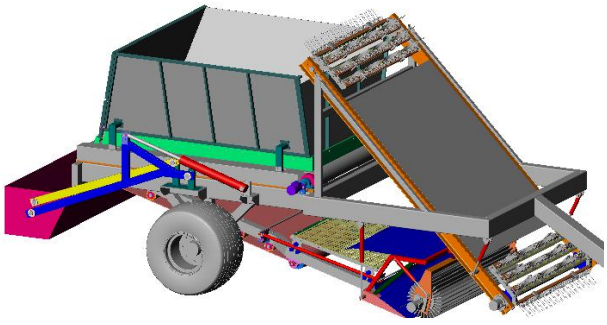
Fig.10. The proposed technical solution for achieving mechanical system. 3D representation

3. CONCLUSIONS

The study aimed to establish technical solutions to achieve overall mechanical system that ensures performance performing the functions required by the functional specification. Based on these results, it is possible to conclude that the use of functional analysis is an effective and systematic way to the establishment of the technical solution to achieve mechanical system subject under study, so that the solution developed design complies with the requirements imposed by the functional specification. Survey results are used to optimize the overall performance of mechanical system analysis.

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