

Building of Heavy Machinery

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The purpose of this paper is to draw attention to the changing pattern and scope of fabrication in building of heavy machinery. This is necessary in view of the requirement and demand and ever increasing size of heavy machinery with more rigorous and stringent service conditions. So far we are mostly acquainted with either fully cast or fully fabricated bodies for various heavy machineries. But both types of components do not satisfy fully all requirements like dynamic and fatigue stresses due to cyclic or shock load ; abrasion, erosion and corrosion problems : severe wear and tear as normally encountered in heavy machineries for cement, paper, sugar, chemical, material handling, thermal plants and equipments.

In our country, it is still very difficult to get large single piece castings of sufficient strength and soundness in quality suitable for heavy machinery building. This has been further complicated by non-availability of proper non-destructive testing facilities to ensure quality of the castings. So, for big single piece quality heavy castings we either get negative replies from the foundries or price and delivery are so prohibitive and risk of rejection due to major defects in the castings are so great that there remains no option but to abandon the project after preliminary study or to find out some other substitute. Sometimes after hundreds of hours

of costly machining operations, castings are liable to be rejected due to defects and suitable new replacement is too time-consuming an affair. In some cases, faults are suspected in sensitive stress bearing zone of castings but cannot be effectively determined by non-destructive testing due to nature of configuration and higher thickness of the casting. These may ultimately lead to failure under actual operational condition or loading. Also big castings are mostly associated with problems like wide variation in chemical compositions and hardness, heat treatment and transportation.

Similarly, non availability of high tensile, low alloy plates of various specifications and thickness put limitations in the use of only rolled steel material for heavy machine building in our country.

These problems can be solved very effectively and economically by welded fabrication of composite assemblies of rolled components, cast and forged components in the required combination and judicious selection of material for building heavy machinery which will satisfy all basic requirements-especially when heavy machinery are not manufactured in quantity and parameters vary from plant to plant.

In advanced countries, sophisticated equipment like turbine housing, heavy press bodies, rotors, heavy gear boxes etc. are already being fabricated with the combination of rolled, cast and forged components by welding.

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The following distinct advantages can be achieved out of these types of combination fabrication procedure by welding.

- (a) Direct reduction in weight and cost of savings thereby.
- (b) Reduction in total cost of the equipment by the combination of normal and sophisticated materials in place of manufacturing complete body with costly material.
- (c) By judicious selection of right material and configuration at the vital points of the body and eliminating sudden change in the section of the composite structure, stress concentration and fatigue can be reduced considerably. Life and reliability of the machine are further increased.
- (d) By reducing the cast and forged components of the whole structure to a manageable size and proportion better quality can be achieved and operations like annealing, non-destructive testing etc. can be carried out more effectively.
- (e) Big composite structures can be fabricated in small Sub-assemblies in the works, which can be transported by means of normal available facilities and erected at site easily.
- (f) Future modifications can be incorporated very economically.
- (g) Guarantee of quality heavy machinery can be ensured with better confidence.

Of course, building of vital components for heavy machinery by this type of combination of rolled and cast or forged components also require considerations like sound design concept for individual application, better stress analysis, correct weldment design and execution, pre and post heat treatment etc. where necessary.

With judicious and proper combination of present development of welding technology and material selection, the designer also can have maximum freedom in designing heavy machinery over other more conventional methods.

Heavy machine building which has just started in India on a large scale should incorporate this advance

concept of fabrication from the very beginning effectively.

Three actual case studies are also projected herewith to substantiate the above observations :

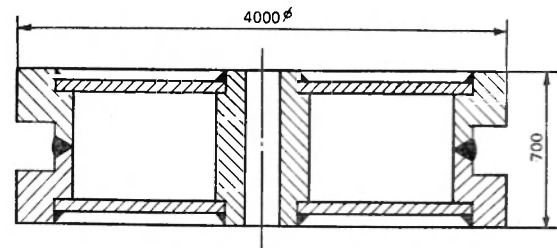


Fig. 1. Fabricated Gear Wheel—3800 PCD & 30 Modules.

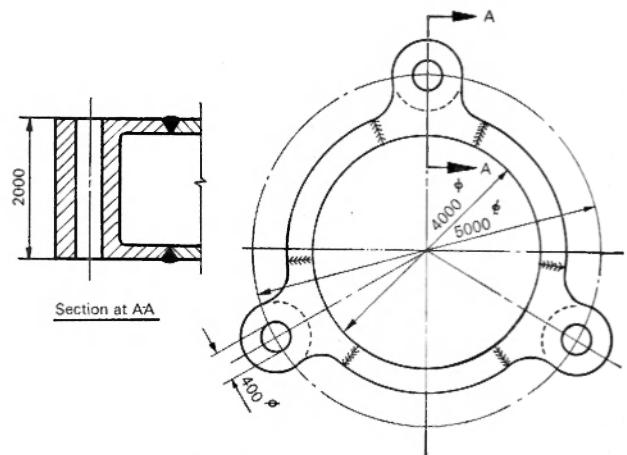


Fig. 2. Fabricated Rotary Table for Bucket Wheel Reclaimer of 2000 T/S hours.

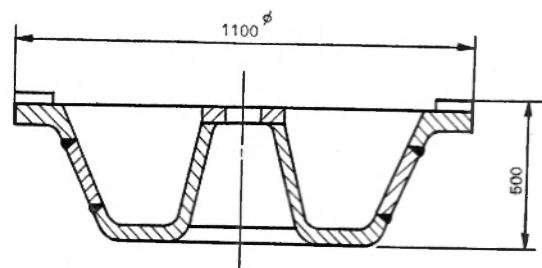


Fig. 3. Fabricated stainless steel Centrifugal Basket.