responses will naturally follow the discussion format specified in the TPR.

The TPR represents the total task as seen by the Government. We will assume that the Government people have done their homework and the TPR is a complete and understandable document. It now becomes your task to respond as completely and as understandably in your technical and cost proposals. And to paraphrase an old and overworked cliche: "May the best proposal win."

VALUE ENGINEERING

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Martin Company

Value Engineering is an organized approach for reducing costs. Value Engineering is the application of techniques to identify the function or functions of a product or service; determine the absolute necessity of all functions; establish a monetary value for the essential functions, and provide these functions reliably at the proper time and place at lowest overall cost. We believe it must apply to all operating levels from concept to grave - life cycle. It must also be organized - plant-wide, project-wide.

A typical finished analysis is probably the best way to show you what the definition really means. In Figure 7 you see an electronic tube clip. This is a three-piece assembly. Two pieces are of aluminum with silicon rubber coated on the inside and a spring steel clip slips over the assembly. It is a standard military product commonly used in the aircraft industry for electronic tubes. The clip provided the function it was suppose to provide. During the flight test other components on the circuit board developed vibration to an extreme extent. We either had to dampen the vibration of the individual parts or figure a way to encapsulate and dampen the vibration with single operation. The solution involved a closed cell material. It eliminated the vibration problem. It is well to understand the circuit designer had no responsibility in terms of solving the vibration problem. This was done in manufacturing engineering with advice from the original design group. Tube clips were really considered an inexpensive part. No effort was made to remove the tube clip cost at the time of the encapsulation. Upon examining our high cost areas, we found tube clips were costing this company $125,000 per year. This prompted a review of the item. In analyzing the functional capability, Figure 8 shows the four tube clip functions. Figure 9 indicates whether or not the particular functional capability of the tube clip is necessary in the existing situation. Figure 10 shows the functional worth assessed to each function.

The first function "mechanical fastener" could be accomplished by a stand-off clamp for two cents. This was the functional worth of this function. The second function "radio frequency shielding" could be accomplished by applying common aluminum foil. We estimated the worth of this function at one-half cent. The third function "heat sinking" was a more difficult one to accomplish. However, this function could be accomplished by increasing the thickness of the foil or by using a metal tube. We assess ourselves three cents as a functional worth in this case. The fourth function "vibration dampener" is shown as a functional worth slight of zero. This is no criticism of the vibration dampener capability of the tube clip. It is merely a practical assessment of this function's worth. The total, five cents, represents a cost to produce target against which the designer had to work in an attempt to secure a less costly yet equally reliable product. If the designer can design to meet these estimates of functional worth we will realize a major reduction in program cost. In this particular case we did accomplish a design but our buying operation could not meet the five cent target;

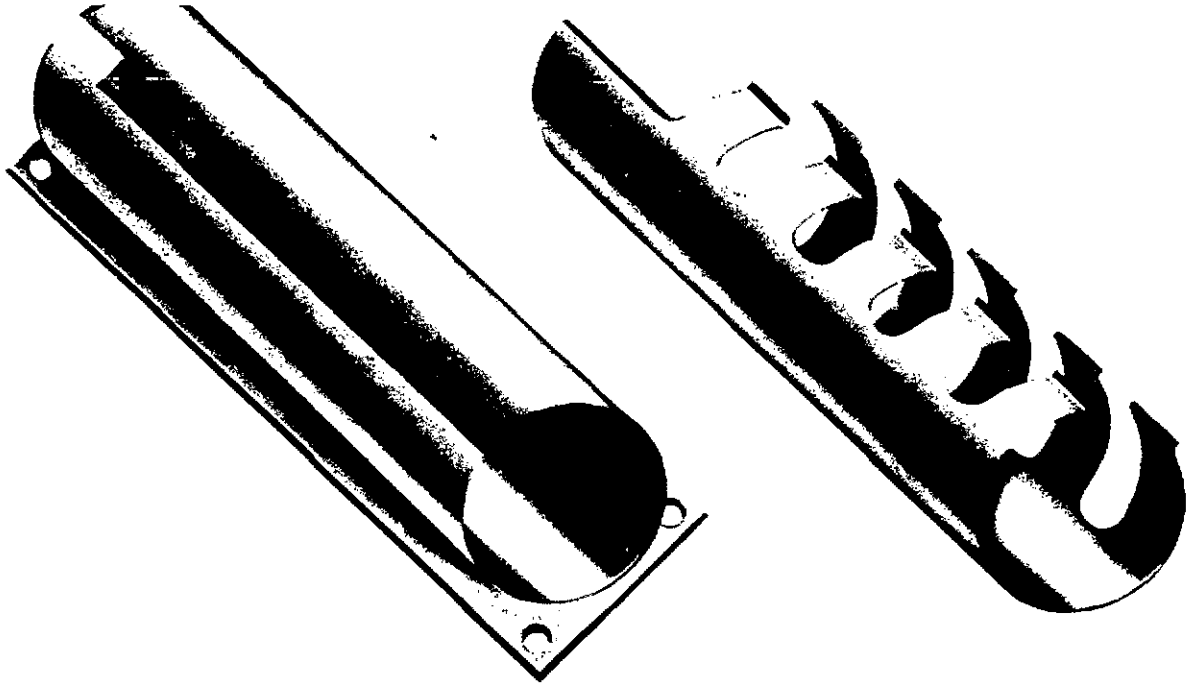


Figure 7. Electronic Tube Clip (Before)

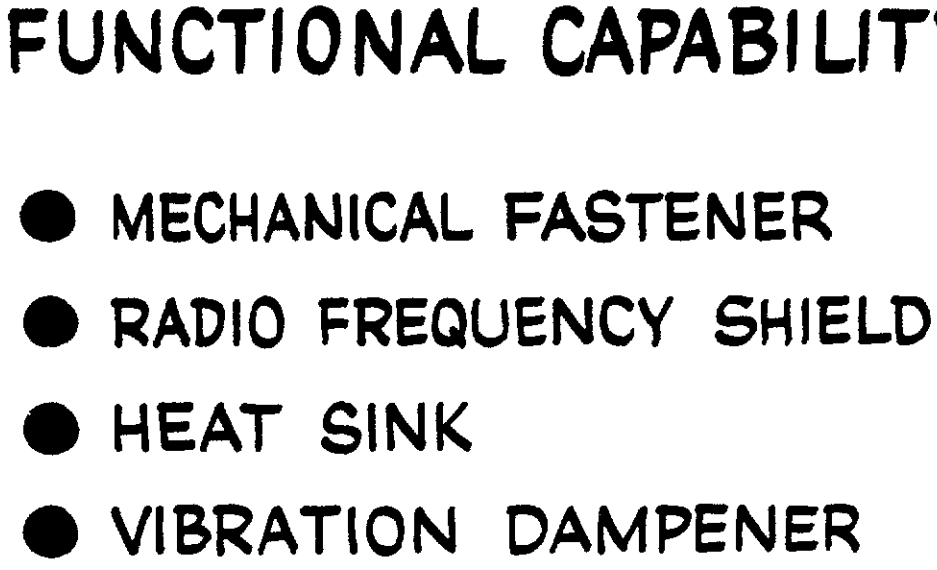


Figure 8. The Four Tube Clip Functions

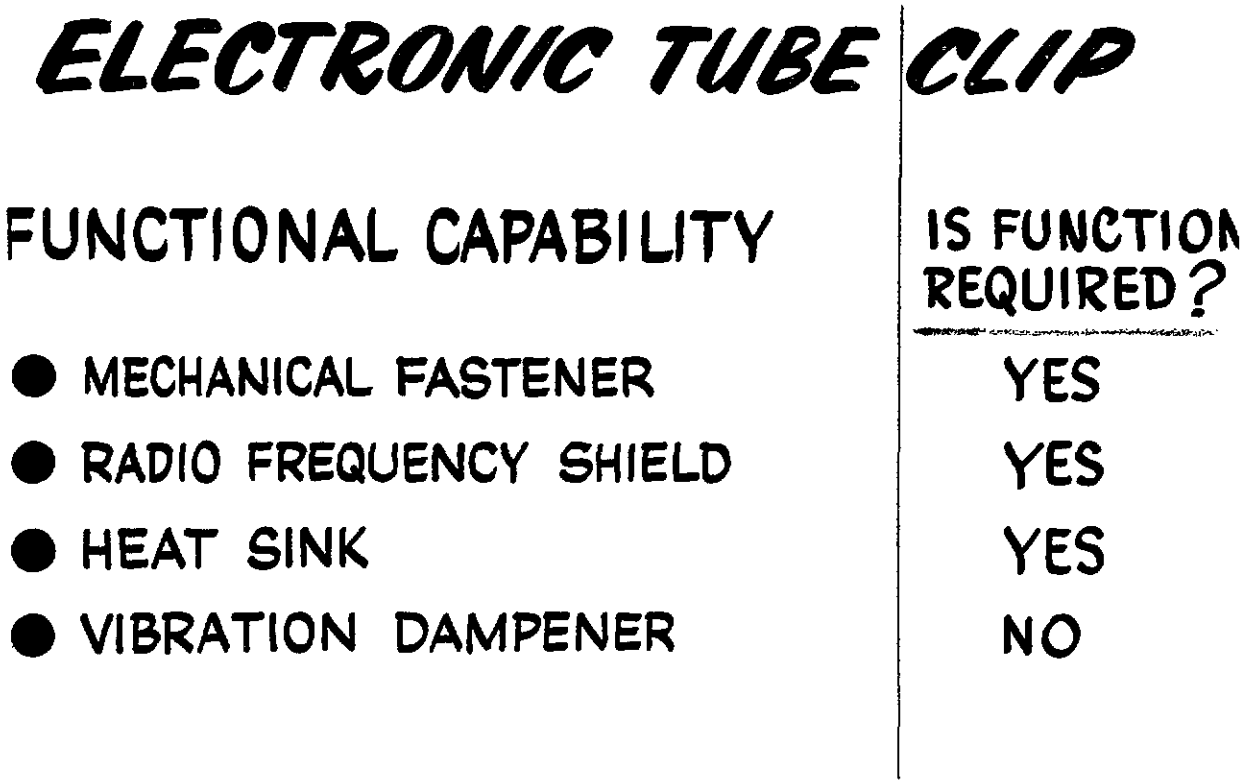


Figure 9. Tube Clip Capabilities

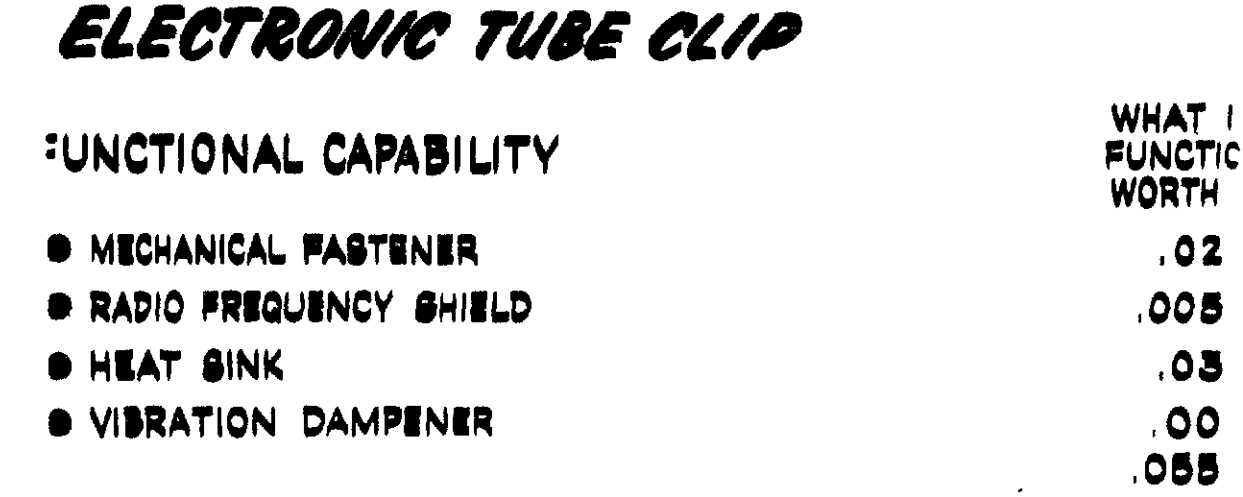


Figure 10. Tube Clip Capabilities Value

however, the price was reduced to approximately twelve cents. A second look at the source provided a three cent item to adequately perform all the functions required. The final production was fabricated from a piece of ribbon stock formed to accept the electron tube and slip over the edge of a circuit board. Figure 11 shows the end product.

Some people argue such changes are only appropriate when large numbers of items are involved. Figure 12 shows a tool used for putting solid propellant samples under tension. It serves as a storage tool in environmental test conditions. The best price available in a quantity of 2,000 was $18.95 for an item containing twenty-six detail parts. Figure 13 shows the new tool that replaced the twenty-six detail part unit. The new tool has six detail parts and was bought for $4.50. The price included an extrusion die and the necessary cost to make changes.

The best time to secure VE savings is prior to the final release, i.e., engineering release with customer sign-off, for production. Figure 14 shows a before and after picture of an AC-DC converter. It is interesting that we had very few items to produce. The difference in the two examples is dramatic and the cost impact of this change is equally dramatic.

You will notice that we have made a definite improvement in providing a much simpler product. Such actions are highly desirable; however, they create several unusual situations.

a. The simplest design is almost always the hardest to achieve; therefore, we have created a problem for the designer. This is the man who is least controlled in terms of his output yet his approach to the design solution casts the die in terms of ultimate costs of manufacture and maintenance of the item.

b. Costs to produce the final product design are not necessarily reduced in terms of design and testing. In fact, design and test costs probably will increase. Savings will come from lower life cycle cost.

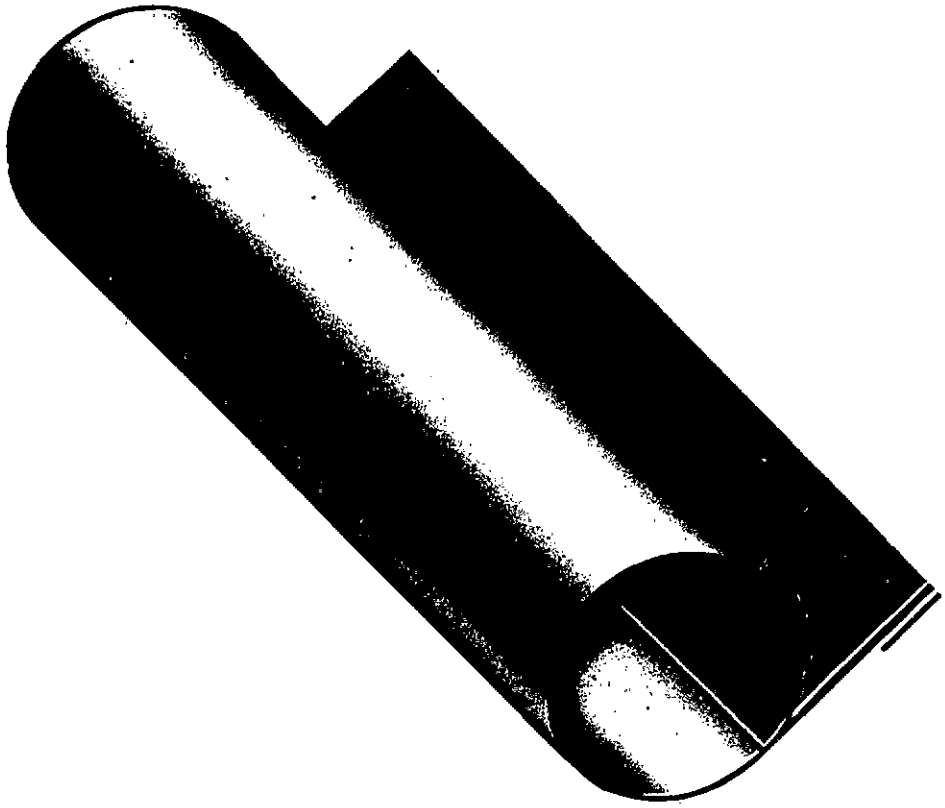
c. Costs to produce the simplified product are usually reduced significantly. For example, the tool shown in slide 8 performs the functions satisfactorily. A simpler, better tool resulted. The ease in using enhances tool value.

d. Simplicity of a design, assuming comparable quality of produced parts, will give you a better reliability factor if for no other reason then the number of detail part failure probabilities are reduced.

e. The simple product or procedure is far superior for the military. It is much less expensive to document and to train personnel to use and maintain.

f. The simple product is materially easier and less expensive to support from the user or logistic point of view. The man in the field has less parts to carry, probably less test equipment and tools. There is a reduction in procurement and depot support commensurate with the result of the simplification. All items do not have to fly, yet man rated specifications sometimes get involved. It will be worth your time to consider the items real environment when specifications are written.

All these benefits can be realized but it takes two to make it work. Nothing will happen unless both parties come to an agreement and decide it should take place and are willing to do something to make it happen. Any change will create some risks. We must evaluate the risk against the benefits gained and act with dispatch. Keep in mind that we'd still be riding around in Model T's and DC-3's if someone had not taken a calculated risk to change a product and to improve a situation.



AFTER

Figure 11. Electronic Tube Clip (After)

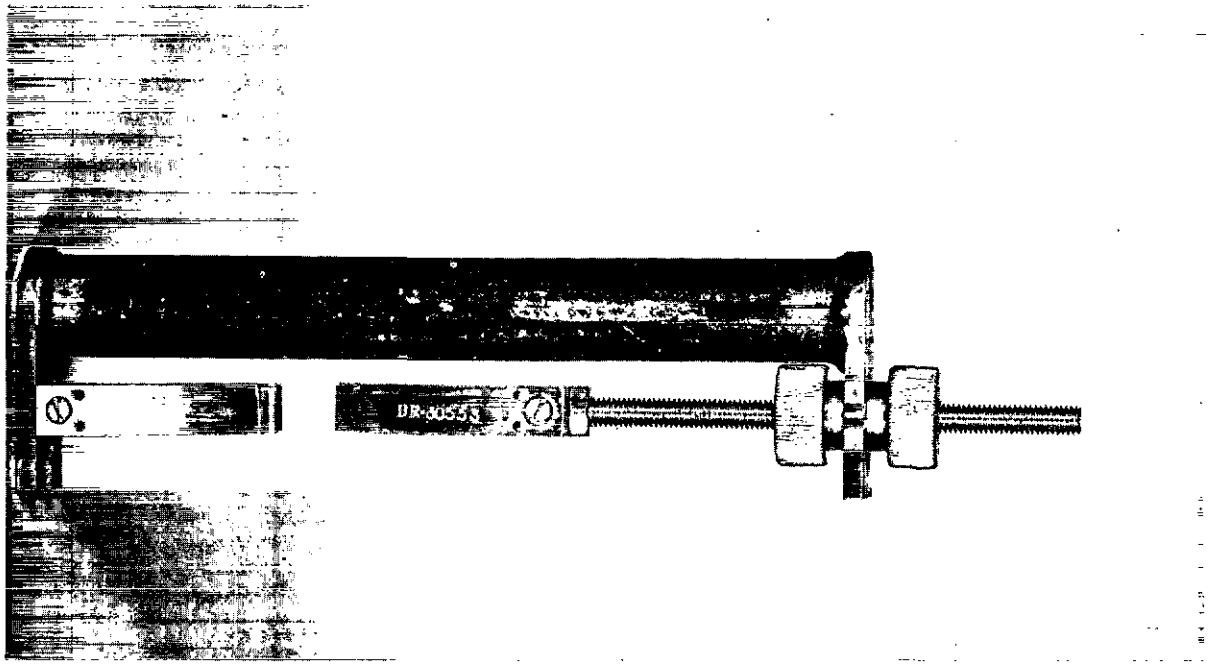


Figure 12. Environmental Test Storage Tool (Before)

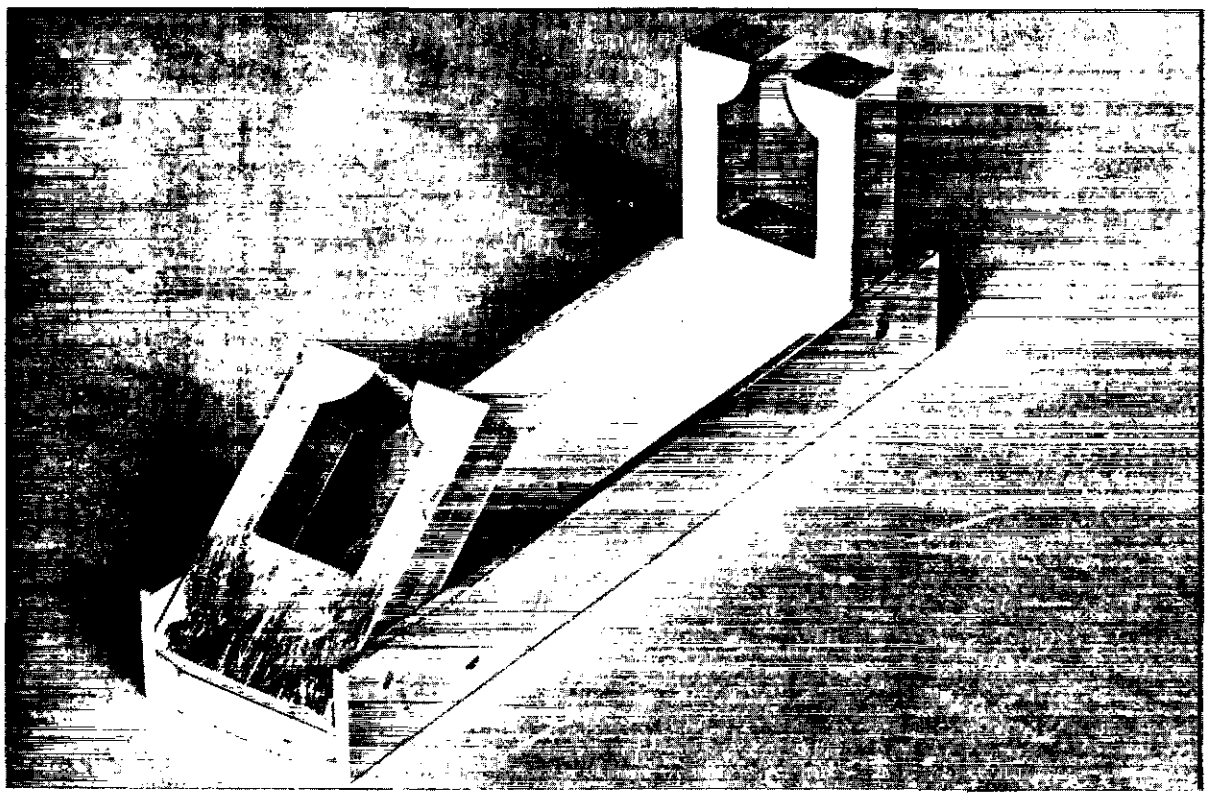


Figure 13. Environmental Test Storage Tool (After)

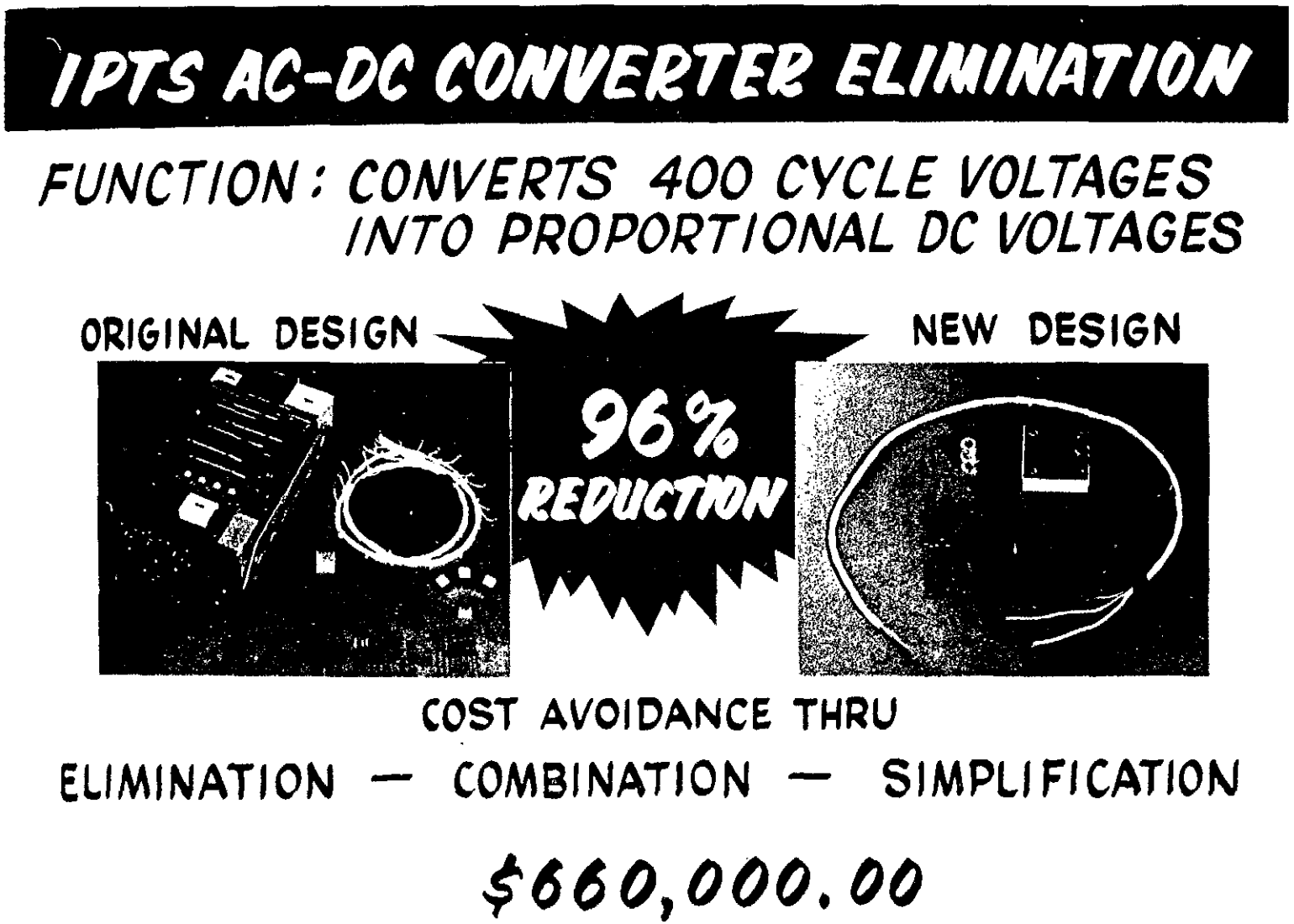


Figure 14. AC/DC Converter (Before and After)