FG01-95EE15617

Custom Electronics

FINAL REPORT OF

PROJECT 617, THE ENERGY SAVER

DOE/EE/15617--77

I. EXECUTIVE SUMMARY

The Project work was begun in January of 1995 and was completed in May of 1996. It was divided into two phases as follows:

PHASE I - Perform a broad Value Engineering Study to examine all parts and functions to lower costs, improve functioning and safety.

OUTCOME:

The results of the Phase I work was a total redesign of the original Energy Saver resulting in two components instead of three, a weight of four pounds versus the original fourteen pounds and a reduction from 21 pieces to 10 pieces. The manufactured cost dropped from \$350 to \$175. Based on these improvements the Value Improvement Project has been successful. The second generation unit was named the "BROIL-MASTER" and has been registered under the Provisional Application (Patent) Program.

PHASE II - Perform technical analysis to determine the potential energy savings of applications identified and collect data on host product gas consumption, payback period, and other cost/saving relationships. Document technical characteristics.

OUTCOME:

The Industrial search for energy project applications for our design was not successful. The review of other restaurant equipment revealed two potential applications:

1. Developing a third generation unit to be built into Char Broilers. This concept will need additional R&D funds.

2. Tie the Broil-Master controls into the Vent Hood control and signaling it to reduce air flow when the Broiler is in Idle. This will have to be pursued with the Vent Manufacturers.

Seven Broil-Master demonstration projects have been successfully completed. The Broil-Master has received certification from the American Gas Association and UL approval is due by the end of July. The Restaurant Equipment Test Center of Pacific Gas and Electric is interested in testing the Broil-Master sometime in 1996.

The Broil-Master was shown at an International Restaurant Equipment Show in September, 1995 and the National Restaurant Show in May, 1996. We now have under way four tests with chains and several other tests pending.

MASTER

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II. DETAILED REPORT

ORIGINAL OBJECTIVES - PHASE I

- A. Perform a Value Engineering Study to reduce number of parts and components, improve functionality and lower costs. Up grade to solid state parts where possible with the objective of fully automating the savings process.
- B. Search for and test new digital components and improve the producibility of components and reduce assembly, test, shipping and installation costs.
- C. Develop Engineering Prototype
- D. Prepare drawings, assemble prototype and test.

OUTCOMES:

A detailed analysis of the original product, invented in 1979, came to the following conclusions:

- The three piece unit was heavy, fourteen pounds, cumbersome and difficult to install
- The unit had an outdated metallic box with a 50's appearance
- Chains restaurants did not like the flexibility of the controls. They wanted some functions to be static or eliminated.
- The three piece unit consisted of 21 parts

An extensive review of Restaurant Equipment noted a switch from metal to plastic, from analog to digital and better looking Industrial Designs. Responding to all these concerns the following design changes were made:

- By inserting an orifice we were able to provide a fixed gas flow
- By selecting a fixed cycle timer we were able to freeze the time cycle
- The square metal box was replaced by a shapely plastic box
- Controls and control lights were eliminated or combined

These changes enabled the Broil-Master to go from three components to two, from fourteen pounds to four and from 21 parts to 10. The manufactured costs dropped from \$350 to \$175. Twelve prototypes were built for demonstration and passed all lab tests. The second generation energy saver was named the BROIL-MASTER, and a Provisional (Patent) Application has been received. By any measure this project was very successful in meeting all of its design objectives.

ORIGINAL OBJECTIVES - PHASE II

- A. Review the technical and operational specifications of other equipment in the restaurant environment to determine if gas conservation is feasible and The Energy Saver applicable.
- B. Expand search to include Industrial gas applications and equipment as well as gas appliances in the home. Analyze gas usage and potential savings.
- C. Develop Demonstration Project
- D. Obtain approval from key technical certification agencies
- E. Develop and document technical characteristics of the Energy Saver and its performance in various situations. Develop and document technical installation requirements.

OUTCOMES

A. A study was done in an Olive Garden restaurant for Darden Industries. We proposed a survey of all of their cooking equipment. They used 15 pieces, more than any other chain restaurant. We singled out Vent Hoods, Convection Ovens and Steam Tables as potential energy saving projects, in addition to the Broilers. Only the Convection Oven and possibly the Vent System may fit our application.

A study was done with Garland Commercial Industries utilizing their Convection Oven. We discovered the Convection Oven was highly efficient because of the wall insulation. During hold cycles they would lose very little heat, only 5 cents/hour. If the door was operated repeatedly, the cost would rise to 18-20 cents/hour.

We have begun talks with a Vent OEM concerning improvements with the new Broil-Master control being attached to a HI-Lo control on a dedicated broiler vent. Operating cost improvements would be small, but Air Conditioning losses could be reduced about the same amount as natural gas savings.

B. Little work was completed in this area. One potential client suggested an application with small industrial oven which often have large amounts of down time. However, he did not want to pursue the project at this time

C. A pre-production run of 50 units were assembled for evaluation and test. Seven have been installed and are now operating in restaurants. We have another four tests running and have six more chains interested in performing tests.

D. The Broil-Master has been approved by the American Gas Association for use in restaurants. UL has been very slow in its testing procedures and has added tests to the original test schedule. However, we expect their approval by July 31.

III. CONCLUSIONS AND RECOMMENDATIONS

RECOMMENDATIONS

1. The best new idea which emerged from our work was the concept of the third generation unit, a built in Dual Manifold for Char Broilers. However, when the concept was submitted to NIST in December, 1995 they turned it down as being too close to the Broil-Master concept. We are now looking for R&D money to fund this project.

2. The only thing our customers can find wrong with the Broil-Master now is that they would like the cook start cycle to be automatic, not semi-automatic. We have started to conceptionalize this work but again have no funds to carry it forward.

CONCLUSIONS

1. The reengineered product, the Broil-Master has been a technical success and has met or exceeded all of its design objectives. The product was introduced at an International Restaurant Show in September, 1995 and displayed at the National Restaurant Show in May of 1996. Ten chains are currently reviewing the Broil-Master for inclusion in their kitchens. The Pacific Gas and Electric Test Center will test a unit later this year.

2. Custom Electronics Inc owes NIST and DOE a hearty thank you for its support of the Broil-Master. Without this support the owners of CEI could never have gotten it off the ground.

3. However, we must again express our dismay, disappointment and anger at the long delays in processing our request. The entire process took thirty months. NIST used 13 of those months and ERIP 17 months. We had to get a \$50,000 loan to survive until the DOE funds were issued. Something is wrong with any process that lasts that long.

4. Finally, we want to single out our Inventory Coordinator, Phillip Hayes as the best thing in the whole process. Phillip listened to our complaints and harranges politely and then responded with sympathy. He was supportive, helpful and helped us shorten the process. Phillip always seemed to be rooting for us. He was not part of the problem, but a very efficient supporter. Besides the money he was the best thing that happened to us. Thank you Phillip!