RRS NEWS

FOR THE ADVANCEMENT OF
ROCKETRY AND ASTRONAUTICS

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Reaction Research Society

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REACTION RESEARCH SOCIETY

NEWS

FOR THE ADVANCEMENT OF ROCKETRY AND ASTRONAUTICS

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The RRS NEWS is published quarterly by the Executive Council of the Reaction Research Society Incorporated.

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REACTION RESEARCH SOCIETY MEETING NOTICE

Headquarters Section Discussion Meetings are held on the second Monday of each month, except when a holiday interferes. This year, the September meeting will be Tuesday, the 10th; and the November meeting will be Tuesday, the 12th. The meetings are held at the Casa Verdugo Branch of the Glendale Public Library 1151 North Brand Boulevard in Glendale, at 7:30 p.m.

In September, there will be movies and an informal lecture on the instrumentation of rockets.

REVIVAL OF THE RRS NEWS

Many organizational and technical problems have beset the publication of the News. The greatest of these problems was the lack of personnel interested in journalism. To compound this problem, our insurance was cancelled without explanation, effectively stopping our testing. Without testing, the production of news articles was also halted.

Since April of this year, the R.R.S. has undergone a major re-organization. New officers were elected, and new policies adopted. A mail rocket firing and a public firing are being planned. While every effort is being made to obtain the necessary insurance, other legal approaches to our test problems are being investigated.

In the near future a general change in the format of the RRS NEWS is planned. The cover and departmentalized technical presentation will be changed to create better reading material.

Your suggestions, contributions, and help in improving the RRS NEWS will be sincerely welcomed.

RE-ELECTION OF OFFICERS

New officers were elected to serve the remainder of 1963. Larry Larson was elected President; Ed Parker, Vice-President; and Richard Butterfield, Secretary-Treasurer. The annual election (officers for 1964) will be in December.

REPORT ON THE HYDROGEN PEROXIDE ROCKET

The Society has available, copies of it's 24 page, illustrated report, "Development and Testing of a Hydrogen Peroxide Rocket", by David Elliott and Lee Rosenthal.

The price is $2.00 postage paid, ($1.50 ppd to members).

OUTLINE ON MAKING RESEARCH REPORTS

Advancement in all fields of technology, including rocket research would be impossible without the exchange of information. This, in reality, means that progress for any technical man is rostricted when he is unable to present technical information. To be of the greatest value, investigation and facts must be recorded so others may understand, To be able to present a program of research in a form of organized logical conclusions will provide the opportunities toward later professional progress

Rocket researchers should learn the steps used in preparing technical papers or reports to the best of their ability. Using these steps will make researchers more proficient in writing comprehensive reports. Proof of each step to the investigation will be made possible and unnecessary data and explanations will be eliminated.

In technical reports and papers of investigation there are these important entries.

I. Introduction.

II. Methods.

III. Data.

IV. Evaluation of data.

V. Recommendations and conclusions.

The technical writer introduces his subject and states the purpose of the investigation. The introduction should include simple coverage of the subject and pertinent basic facts.

The technical paper must carry details explaining the problems and methods of the investigation.

Gathering the data is one of the more important steps. This data must be conveyed on paper in the form of graphs, charts or sucessive ratios. Proof or lack of proof in any scientific investigation appears within the data.

Evaluation of the data should produce facts to substantiate the hypothesis. If the facts do not substantiate the hypothesis it is necessary to re-examine the project.

From a thorough review of facts, will come the statements to be presented in the conclusion. They will be direct answers to the questions asked in the introduction.

Ref: The Craft of Technical Writing, by Daniel Marder, The Macmillan Co, N.Y. , 1960.

THE MOVIE ROCKET

In November of 1961, the Reaction Research Society was approached by a semi-professional motion picture director, Les Rendelstein, who wanted to make a short film based on an amateur rocket firing. Les wanted a large rocket "about 6 or 8 inches in diameter and about 8 feet tall" with some sort of "nosecone with a compartment in it."

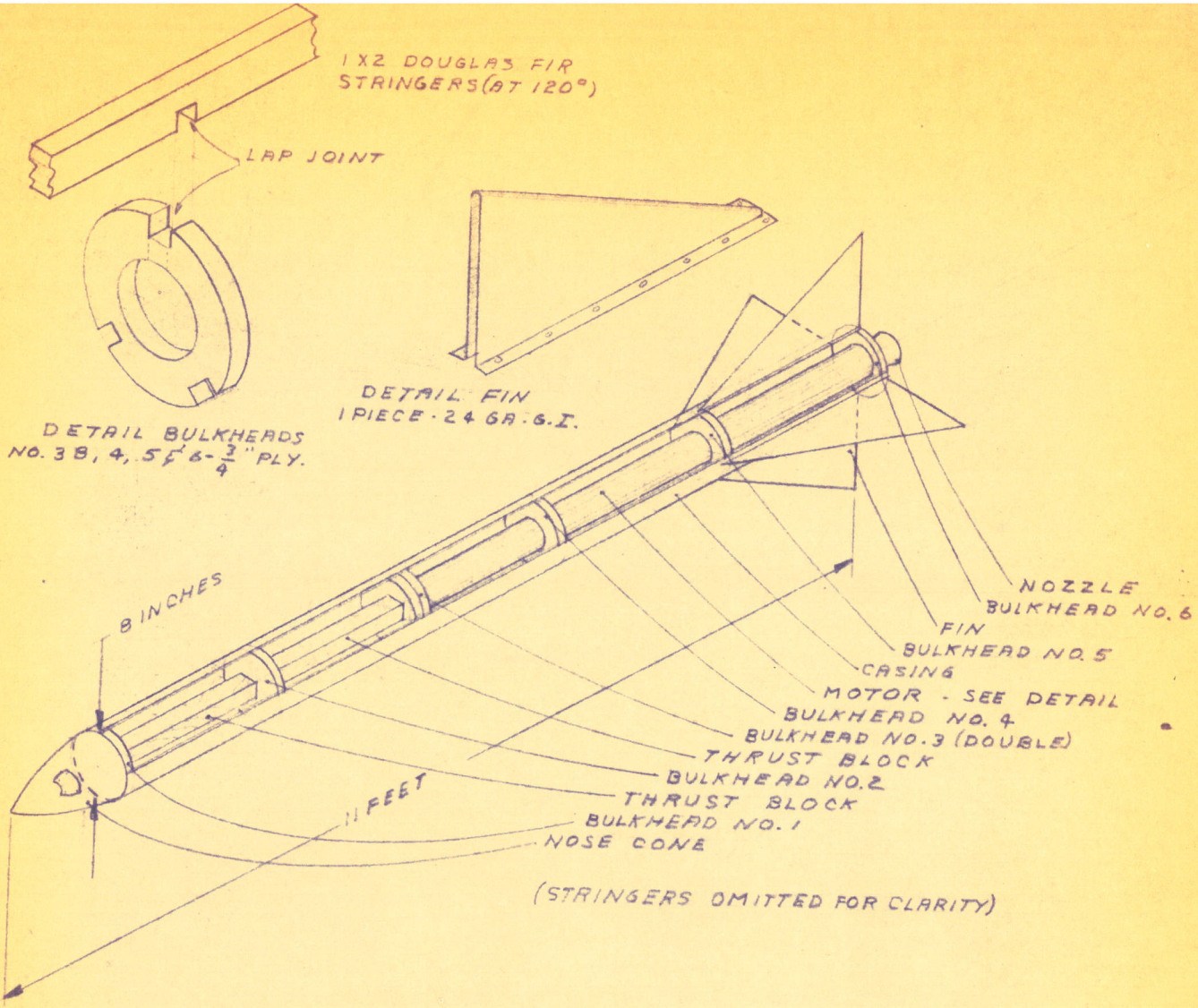
After some considerations regarding takeoff acceleration and cost, it was decided to build a large dummy rocket shell with a "small" micrograin motor inside it. This arrangement would give low acceleration to facilitate tracking by the movie crew.

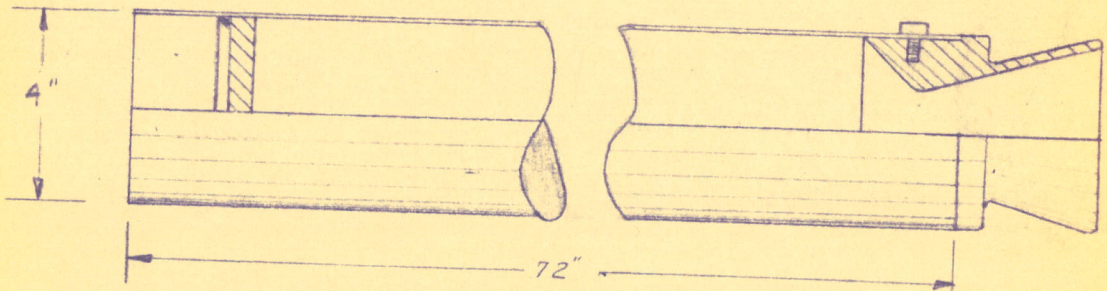
A 24 gauge galvanized steel flue pipe, 8 inches in diameter and 10 feet long, was purchased to serve as the rocket's airframe. The motor was identical to a design previously proven by Richard Butterfield, a piece of 4 inch outside diameter steel tubing (SAE 1015) 6 feet long, having a wall thickness of 0.065 inch. The nozzle was machined from an iron casting and was held in place with 8 5/16 Allen head capscrews. A liberal coating of sodium silicate was applied to the surface between the tube and the nozzle in an attempt to reduce the possibility of "blow-by" of the exhaust gases. The sheet steel airframe was stiffened with three 1" by 2" wooden stringers running its full length. The stringers were supported on six 3/4 inch plywood bulkheads, the lower three of which were bored out to accept the 4 inch diameter motor. The nosecone was made of fiberglass and the four fins were made of 24 gauge galvanized steel.

After filming most of the movie the fueling and firing sequences were taken. The rocket was put into a launching rack 12 feet tall, aimed properly, and armed.

At 12;30 P.M. on March 24, 1962, the rocket was fired. It burned 46 pounds of micrograin propellant in 0.83 seconds, producing a thrust of approximately 1,000 pounds. The relatively slow acceleration of about 13 g's provided everyone with a beautiful view of the entire flight. The rocket coasted to about 1500 feet and had a range of 1440 feet. Upon impact the nosecone was shattered and the front 30 inches of the airframe was compressed to a length of 2 inches. The motor tore loose, punching its way through the forward bulkheads, but was not damaged.

The rocket provided the photographers with a good prop for use with their actors, and an exceptionally stable, easily photographed flight. The rocket is considered to have been a complete success.

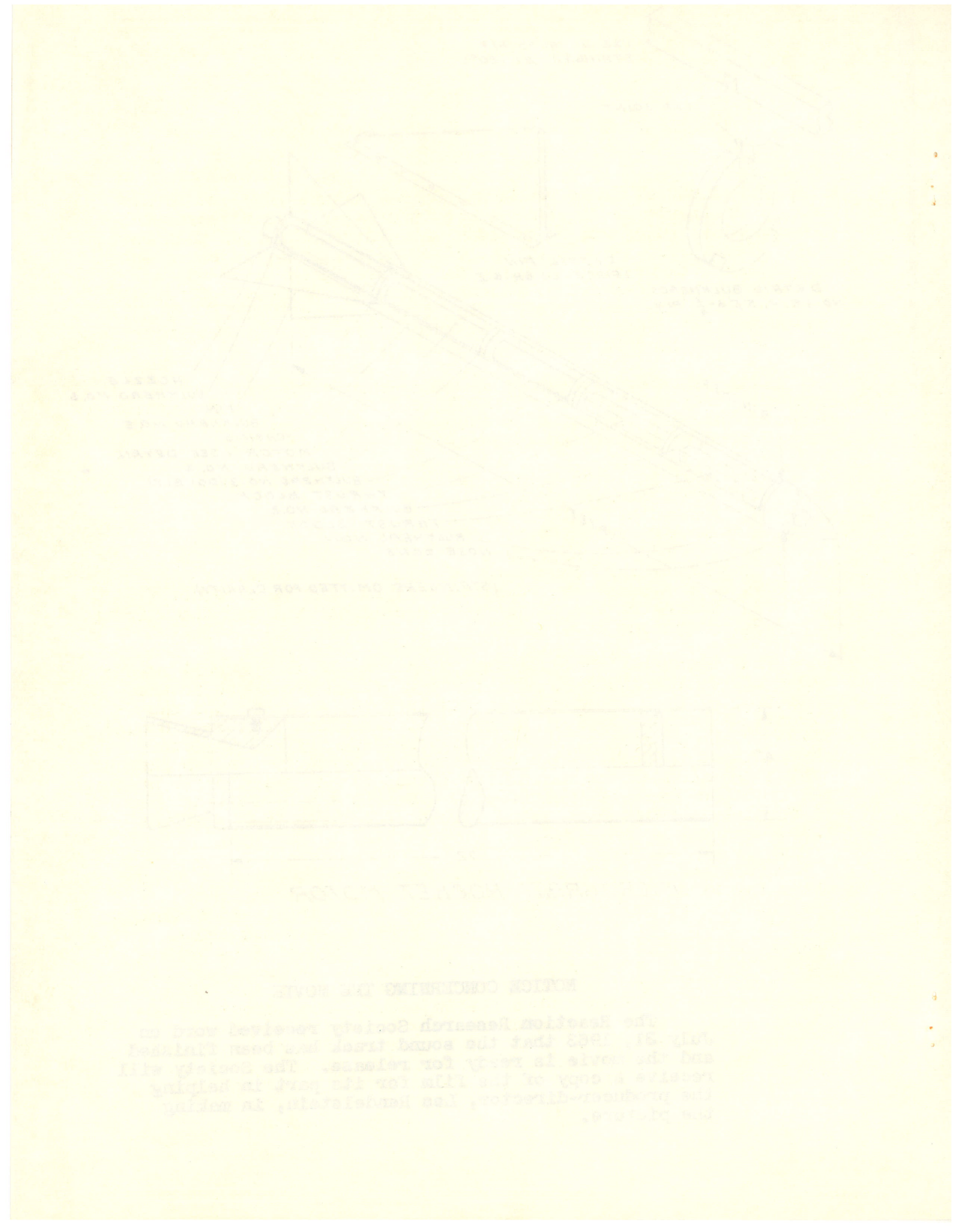




MICROGRAIN ROCKET MOTOR

NOTICE CONCERNING THE MOVIE

The Reaction Research Society received word on July 31, 1963 that the sound track has been finished and the movie is ready for release. The Society will receive a copy of the film for its part in helping the producer-director, Les Rendelstein, in making the picture.



FLAME PROPAGATION IN A LIQUID FUEL CHAMBER

by R. E. NELSON

The study of flame propagation in a liquid fuel chamber is a very difficult one in that there is a major lack of accurate experimental information to back the general theories that have been presented. In each of the references listed, in one manner or another, there was a comment to the fact that there was a deficiency in knowledge of rocket engine combustion. Reference 3 states that "The theoretical calculations of combustion rates in bi-propellant motors must be regarded as one of the most important unsolved problems in rocket engineering."

With the above paragraph in mind, this paper will try to present a general picture of the liquid rocket engine combustion process from the injection to the reaction phases. Some of the more important parameters to consider are listed below:

1. Self ignition temperature of the propellants.
2. Flame temperature.
3. Limits of inflammability.
4. Burning velocities.
5. Methods of injection.
6. Temperature course through the flame front.
7. Location of the reaction zone in this temperature field.
8. Concentration of active radicals through the flame front.
9. Reactions involved.

Four separate processes appear to make up the overall steady state combustion picture. The first of these processes is the injection of the liquid propellants into the chamber, and the effects of various styles and types of injection patterns. Secondly there is the process of mixing and preheating of the injected propellants to obtain even propellant distribution in the gaseous phase. Ignition of the mixed propellants is the third phase process The reaction phase is important in that all the propellant must be completely reacted in order that the complete energy of the propellant can be utilized.

Before steady state is reached there is a starting transient which may be of interest to examine. During startup, the propellants are injected into a chamber which is at atmospheric pressure. The propellants flow toward the nozzle and ignite somewhere close to the nozzle entrance. As ignition is accomplished there is a rapid increase in pressure at the ignition position. The rapid pressure increase causes a presure wave which travels upstream toward the injector, increasing the temperature and pressure ahead of it. As a result, the ratio of chemical reaction of the propellant ahead of the pressure wave increases. At some location combustion occurs and the flame moves downstream until some equilibrium position is reached.

(to be continued)

THE REACTION RESEARCH SOCIETY

The Reaction Research Society is a non-profit civilian organization whose purpose is to aid in the development of reaction propulsion and its applications, and to promote interest in this new science.

The Society was organized in January, 1943, and from that time to the present has static fired and flight tested several hundred rockets, using both liquid and solid propellants. They have held two rocket mail flights, carrying special philatelic mail in experiments designed to call attention to the use of rockets for practical, peaceful purposes, and have established several altitude and other records for non-professional rockets and missiles.

The Reaction Research Society publishes RRS NEWS & ROCKET DIGEST containing notices and information about both Society and national activities in the rocket field, which is sent to all members as a part of their membership.

There are opportunities for persons of widely diverse interests to take an active part in the Society's work. Technical skill is not necessary for participation in many projects.

Active membership in the Reaction Research Society is for the interested and qualified persons who by their membership indicate their willingness to engage in the activities of the Society. Active membership is $5.00 per year.

Associate membership is for persons who cannot devote sufficient time to Society work to warrent an active membership. Associate membership is $3.00 per year.

If you are interested in joining the Society, or desire more details, please write to:

Secretary
Reaction Research Society
Box 1101, Glendale 5, California

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