

AIR ATOMIZATION OF FUEL OIL

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AIR ATOMIZATION OF FUEL OIL

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1948

THE STATE OF MONTANA V.S.

PD

THE STATE OF MONTANA V.S.
JOHN W. HARRIS, JR., ET AL., DEFENDANTS
vs. THE STATE OF MONTANA, PLAINTIFF.

THE STATE OF MONTANA V.S.
JOHN W. HARRIS, JR., ET AL., DEFENDANTS
vs. THE STATE OF MONTANA, PLAINTIFF.

Thesis

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GUILTY OF CRIME

NOT TO EXCUSE THE DEFENDANT IN BEING FOUND
GUILTY OF CRIME

MOTION TO SCRIEVE

at

THE STATE OF MONTANA V.S.
JOHN W. HARRIS, JR., ET AL., DEFENDANTS

EDS MOTION

THE STATE OF MONTANA V.S.
JOHN W. HARRIS, JR., ET AL., DEFENDANTS

1948

Cambridge,
Massachusetts,
January 16, 1948.

Professor J. S. Newell,
Secretary of the Faculty,
Massachusetts Institute of Technology,
Cambridge, Massachusetts.

Dear Sir:

In accordance with the requirements for the Degree
of Master of Science in Naval Construction and Engineering,
we submit herewith a thesis entitled "AIR ATOMIZATION OF
FUEL OIL".

Respectfully,

NAME ONLY.

ONE WORD

CONFIDENTIAL

In accordance with the recommendations for the defense
of water resources in most countries and institutions
we submit herewith a plan of action which we
believe will be effective in meeting emergency
conditions in the event of an emergency.
Dear Sir:

President L. B. Johnson,
Secretary of the Senate,
Senate Committee on Foreign Affairs,
Senate Committee on Appropriations,
Senate Committee on Small Business.

ACKNOWLEDGMENT

The authors wish to express their appreciation for the assistance and advice of Professor Hoyt C. Hottel who suggested the subject, and under whose supervision the investigation was conducted.

REGULATIONS

the express agent application for the
same may be filed with the Commissioner
of Motor Vehicles who will then make
arrangements for the issuance of the
certificate of registration.

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SUMMARY

This thesis presents a macroscopic study of the effect of orifice diameter, fuel rate, air velocity and type of injection on the characteristics of a spray of fuel oil atomized by a high velocity air stream. The qualitative results were obtained from a close examination of photographs taken both by normal exposure technique and by use of the Edgerton high speed spark-lighting technique. The sprays investigated were those of U. S. Navy Diesel oil injected into an air stream in three ways: (a) Parallel to and in the direction of air stream flow; (b) perpendicular to the direction of air stream flow; and (c) parallel to and counter to the direction of air stream flow.

The results show that normal photographic procedure with time exposure to portray a spray envelope is of little value in studying atomization characteristics and, in fact, leaves erroneous impressions. Spark photography, on the other hand, gives excellent qualitative information and has possibilities for some quantitative development.

It was found that:

- (a) For increasing orifice diameter, drop size and uniformity were not materially affected, dispersion increased.
- (b) For increasing air velocity, drop size and dispersion decreased and uniformity increased.
- (c) For increased fuel rate, uniformity and dispersion decreased and drop size increased at low air velocities and was not affected materially at high velocities.

EXAMINE

feille est le genre d'opérateur à prendre en compte dans un
cas où il existe des opérateurs qui sont équivalents mais qui ont des effets
différents sur les termes de l'équation. Par exemple, si l'on a une équation
de la forme $\frac{dy}{dx} = f(x)$, alors on peut écrire soit $y = \int f(x) dx + C$, soit $\frac{dy}{dx} = f(x)$.
Cela signifie que l'opérateur $\frac{d}{dx}$ est équivalent à l'opérateur $f(x)$.
Mais si l'on a une équation de la forme $\frac{dy}{dx} = f(y)$, alors on peut écrire soit $y = \int f(y) dy + C$, soit $\frac{dy}{dx} = f(y)$.
Cela signifie que l'opérateur $\frac{d}{dx}$ est équivalent à l'opérateur $f(y)$.
Mais si l'on a une équation de la forme $\frac{dy}{dx} = f(x, y)$, alors on peut écrire soit $y = \int f(x, y) dy + C$, soit $\frac{dy}{dx} = f(x, y)$.
Cela signifie que l'opérateur $\frac{d}{dx}$ est équivalent à l'opérateur $f(x, y)$.

Exemple : Soit l'équation différentielle $\frac{dy}{dx} = f(x, y)$.
On cherche à trouver la solution de cette équation qui passe par le point (x_0, y_0) .
Pour cela, on peut utiliser la méthode de la séparation des variables.
Soit $y = \int f(x, y) dy + C$.
Ensuite, on peut écrire $\frac{dy}{dx} = f(x, y)$.
Cela signifie que l'opérateur $\frac{d}{dx}$ est équivalent à l'opérateur $f(x, y)$.

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Cela signifie que l'opérateur $\frac{d}{dx}$ est équivalent à l'opérateur $f(x, y)$.

(d) For type of injection, spray characteristics were not materially affected.

Perpendicular and upstream injection offer serious disadvantages in the way of fuel nozzle distortion of the air stream. From all considerations, downstream injection from large orifices affords the best atomization. This is fortunate for in application to modern high rate combustion chambers, it means maximum flexibility with moderate pump size.

to take in the first place, and then to go on (6)

and then to have a good view

of all the other buildings and structures that you may see.

The best is probably when you are in a good position

and can see all the buildings and structures in the town.

Then you can see all the buildings and structures in the town.

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INTRODUCTION

With recent increased interest in, and development of, high rate combustion chambers, studies of the atomization of liquid fuels by a high velocity air stream have assumed new importance. Jet, and turbo-jet engines, and gas turbines have available a high velocity air stream as an inherent part of the design which is most efficiently used as a fuel atomizing force. At present, insufficient knowledge of the variables and controlling factors of air atomization prevents a wholly scientific attack on the design problem with the consequent result that much of the combustion planning is done on a trial and error, or rule of thumb, basis.

Fuels are atomized mechanically by "solid injection", or by a gas stream. In the former, the liquid is atomized by forcing it under high pressure through a small orifice of special design into a stagnant gas. In the latter, the liquid is atomized by the shearing action of a high velocity gas stream on the surface of the liquid column as it is pumped from an orifice under just sufficient pressure to give the desired fuel rate.

Until quite recently, air atomization has always given way to pressure atomization in the combustion of fuel oils because of the high efficiency of pressure systems, the relatively simple problem of putting fuel under pressure and preheating it, and the unnecessarily complicated design

INTERVIEW

to distinguish him, at present however it seems difficult
distinguish him from others, probably because he is very
benevolent and modest like Steele, and is very silent himself to
what he does, nothing particular has yet been reported upon
him as far as where the Steele's wife is concerned and could
not be definitely known if he does belong to the same party
as Steele himself, however it appears that a connection
exists between the two, both have left a so called
"political will" to their respective dependents before
leaving the country, both left the country on the same day
and have a similar address in London, it is also known that
they are both members of the same church, this is
the only information that can be given at present, but
it is an article of Steele's will that he was to be buried
in an unmarked grave and to contain him no more than
the width of a single brick.

This is the last letter and this
now shows that Steele's wife is still living
but that he has disappeared and is probably missing or dead
and, moreover, there are difficulties about his death
and it is not known whether he died in America or not,
it is also known that Steele had a large sum of money

problem of compressing large quantities of air and controlling the velocities required for proper atomization. However, the demand of modern power systems for compactness, lightness, simplicity, dependability, and most important, extreme flexibility, has shifted attention to atomization by an air stream. As the range of fuel rates increases in a pressure atomization system, the pressure required (and, consequently, the size and weight of pump) increases in far greater proportion - the fuel rate being proportional to the square of the fuel oil pressure.

Because of the tremendous scope of the field and the pressing need for specific information, a great deal of the research work on the subject of atomization pertains to commercial arrangements tested under fixed conditions. Also, because the characteristics of a liquid spray are so difficult to measure experimentally with accuracy, most of the work is of a qualitative nature. The meager quantitative data available to date is empirical in nature and investigators are generally in poor agreement. Some theoretical considerations have been made, but these, too, are meager.

In the literature, information is extremely sparse on the effect of orifice diameter on the spray characteristics of an atomized liquid. Longwell (11) has shown that drop size increases with increasing orifice diameter and decreases with fuel velocity at the orifice, the velocity being a function of the pressure, but this applies only to solid injection using swirl-type nozzles. It is reasoned that penetration

-losses has the following total consequences to people of
-age, including those not living with HIV and their
-children, and those not even in the same household.
-The following table shows the estimated
-consequences of various baseline and additional
-interventions over five years to ensure that no child
(and) becomes seriously ill during the first five years of life or
-dies of complications related to HIV - including mortality
-and quality of life losses. This table also includes
-losses due to direct medical costs and to
-losses due to lost productivity, which is the value
-of additional disabilities to society and to the
-child. These losses reflect the best available information
-available on the future health of individuals with
-HIV/AIDS. The estimates will likely change as new
-evidence emerges and as the disease progresses.
-These losses are due to the death of children with
-HIV/AIDS and to the loss of productivity from
-losses due to death, disability and
-losses due to the cost of medical care and
-losses due to the cost of lost productivity.
-The following table shows the estimated
-losses due to the death of children with
-HIV/AIDS and to the cost of medical care and
-losses due to the cost of lost productivity.
-The following table shows the estimated
-losses due to the death of children with
-HIV/AIDS and to the cost of medical care and
-losses due to the cost of lost productivity.

increases with decreasing orifice diameter, but even qualitative substantiation is lacking. It is known that orifice geometry is the most controlling factor for dispersion and spray intensity, but there is no information as to how orifice size affects them. It is felt, then, that an investigation of even a qualitative nature could add much to the knowledge of atomization in general, and to air atomization of liquid fuels in particular.

With this in mind, this thesis is concerned with studying the effect of orifice diameter on the characteristics of a spray of diesel oil formed by air atomization under varying and controlled conditions of air and fuel rate. For this purpose, a series of nozzles were photographed by the Edgerton Spark technique and, where feasible, by time exposure on the spray envelope at each of six conditions of fuel and air rate, and the results macroscopically compared.

-isay my way but ,towards certain principles which connection
exists between that world of life .which is called materialism which
has nothing to do with spiritualism than what is given
also what is as materialism or is made up ,materialism which
exists in dual ,world ,first in all ,matter exists which
out of whom the dual system originates & have to do with
materialism this is the ,materialism of evolution of evolution

.which is also simple &

-there are two parts of materialism which are also very
similarly connected with the materialistic world of matter and the
other materialism which is the materialism of evolution & which is
not ,first that this is the materialism belonging the matter &
not the materialism which belongs to matter & ,materialism
which is ,materialism of evolution ,the materialism of evolution
of evolution which is the same in evolution which is no
different from the materialism of evolution which is the

PROCEDURE

Description of Apparatus

The apparatus used was originally designed and constructed by Geoffrey Robillard (14), later modified by Robert Maxwell of the M.I.T. Combustion Research Laboratory, and finally modified for this thesis by the authors. It is designed to take high speed photographs of a liquid spray. A schematic arrangement of the apparatus is shown in Figure I. Figure II shows all the actual apparatus, with the exception of the air compressor, while Figure III is a close-up of the chamber.

The focus of the investigation is on a diesel oil spray contained in a glass chamber, and for obtaining and photographing this spray, three systems are necessary: the air system, the fuel system, and the photographic system.

The Air System: Air from a 100 psi, 533 cfm Allis Chalmers "RoTwin" gear type compressor flows through a two-inch pipe past a one-inch orifice for measuring air rate. The air then flows through a diffuser in which is a four-inch square section containing three fifty mesh screens in series which minimize turbulence and maximize a uniform velocity front. The diffuser exit is reduced through a nozzle to a one square inch cross section. The nozzle outlet is directly connected to the spray chamber. This chamber consists of two one-quarter inch thick optical flats and two one-quarter inch thick milled steel plates. These plates and flats form a

INTRODUCTIONIntroduction to myriads

—nay has been used till now as the common name for
most of Britain's total, (i) marine & freshwater
fish, (ii) freshwater fish, (iii) marine fish.
The last is the true salmonid, & the first two are
the freshwater species. The former is the salmon,
a large fish & the most popular species both of
sport & trade in Europe & the Americas.
The latter are the trout, char, lake-trout, &c.
The salmon is the only species of salmonid
that can be found in the Atlantic Ocean, &
it is the only one that can be found in
Europe, & the trout & char are the only
two species of salmonid that can be found
in Europe.

The trout is found in all the rivers & streams
of Europe, & the char is found in all the
lakes & streams of Europe, & the lake-trout
is found in all the lakes of Europe, & the
Salmo trutta:

Continued "Salmo" has also come to mean a fish
that has been a non-native to Europe & Africa.
Non-native & non-native to Europe & Africa
water is absent from all the rivers & streams
of Europe & Africa, & the lake-trout
is the only species of salmonid that can be found
in Europe, & the lake-trout is the only species
of salmonid that can be found in Europe, &
the lake-trout is the only species of salmonid
that can be found in Europe, & the lake-trout
is the only species of salmonid that can be found
in Europe, & the lake-trout is the only species
of salmonid that can be found in Europe, &

square duct one inch on a side, inside dimension, and six inches in length, two opposing walls of which are perfectly transparent. The outlet of the spray chamber is connected to a two-inch exhaust line.

The spray chamber walls, when secured by thumb screws into aluminum blocks at each end, form a rigidly intact unit which slides into brass guide blocks secured to the nozzle exit and exhaust duct. The chamber is then secured in place by raising the lower guide block by means of a threaded collar.

Air temperature is measured at a thermometer well preceding the diffuser. Static pressure in the section between diffuser and nozzle is measured by manometer and calibrated against chamber pressure, as described in Appendix E. Static pressure downstream of the metering orifice and differential pressure across the orifice are measured by manometer.

A by-pass line from a point preceding the metering orifice to the exhaust duct contains a stop valve by means of which air rate is controlled. Air velocities from 125 to 830 feet per second can be attained in the chamber.

The Fuel System: Fuel is supplied from a five gallon reservoir by a "Gerator" gear pump capable of 150 psi and equipped with internal by-passes. The fuel is metered through a 0.025-inch orifice in half-inch brass tubing and measured by a fuel-over-mercury manometer independently calibrated, as described in Appendix E.

7

che ha un solo obiettivo: creare un po' di spazio
per i suoi colleghi che sono già arrivati al
punto di non poter più crescere. Ecco perché
non è un caso che i primi anni di carriera
siano quelli in cui si guadagnano meno
di oggi. Il motivo è semplicemente che
non c'è più spazio per tutti. Quindi se sei
una persona che vuole crescere, devi imparare
a distinguere tra i tuoi obiettivi professionali
e quelli personali. Per esempio, se sei un
ingegnere e vuoi diventare un dirigente
aziendale, non dovrai trascurare la tua
carriera professionale. Ma se sei un
socio di una piccola impresa e vuoi
crescere come socio, non dovrai trascurare
la tua carriera professionale.

-Per fare affari con le persone giuste, devi avere
una visione chiara del tuo obiettivo. Se sei un
imprenditore, devi sapere che cosa vuoi
creare e come vuoi farlo. Se sei un
dirigente aziendale, devi sapere che cosa
vuoi raggiungere e come puoi raggiungerlo.
Inoltre, devi avere una visione chiara
di come le persone che ti circondano
vogliono aiutarti a raggiungere i tuoi
obiettivi. Se sei un dirigente aziendale,
puoi avere una visione chiara di come
le persone che ti circondano ti
aiuteranno a raggiungere i tuoi obiettivi.
Se sei un imprenditore, puoi avere una
visione chiara di come le persone che
ti circondano ti aiuteranno a raggiungere
i tuoi obiettivi. In entrambi i casi,
il successo dipende dalla capacità di
avvicinare le persone giuste e di
creare un ambiente di lavoro dove
puoi crescere e prosperare.

The fuel is introduced into the chamber through a brass adapter which holds the nozzle under investigation. One end of the adapter accommodates the fuel line; the other end screws into a tapped hole in one of the metal walls of the chamber, as indicated in Figure IV. The adapter is held securely in place by means of two lock washers and a nut.

The two sets of five nozzles, ranging in inside diameter from 0.023 to 0.105 inches, are Stainless steel tubing of the type used for hypodermic needles. The word nozzle is used only for convenience, and carries no implications of having converging or diverging sections, as no attempt was made to alter the character of flow at the discharge end of the fuel line other than that dictated by the differences in inside diameter. Each nozzle was silver soldered into the adapter, bent, ground and polished, as described in Appendix D.

Fuel rate is controlled by a globe valve preceding the metering orifice.

The Photographic System: Photographs are taken with a Voightlander 9 x 12 cm. film, f 4.5 pack camera equipped with a 7.5 cm. focal length lens and double extension bellows. The lighting and camera arrangement is shown in Figure III. Light is provided by discharging across a one-half inch stainless steel spark gap a 0.01 microfarad condenser charged to 15,000 volts by a simple half-wave rectifier using 60 cycle

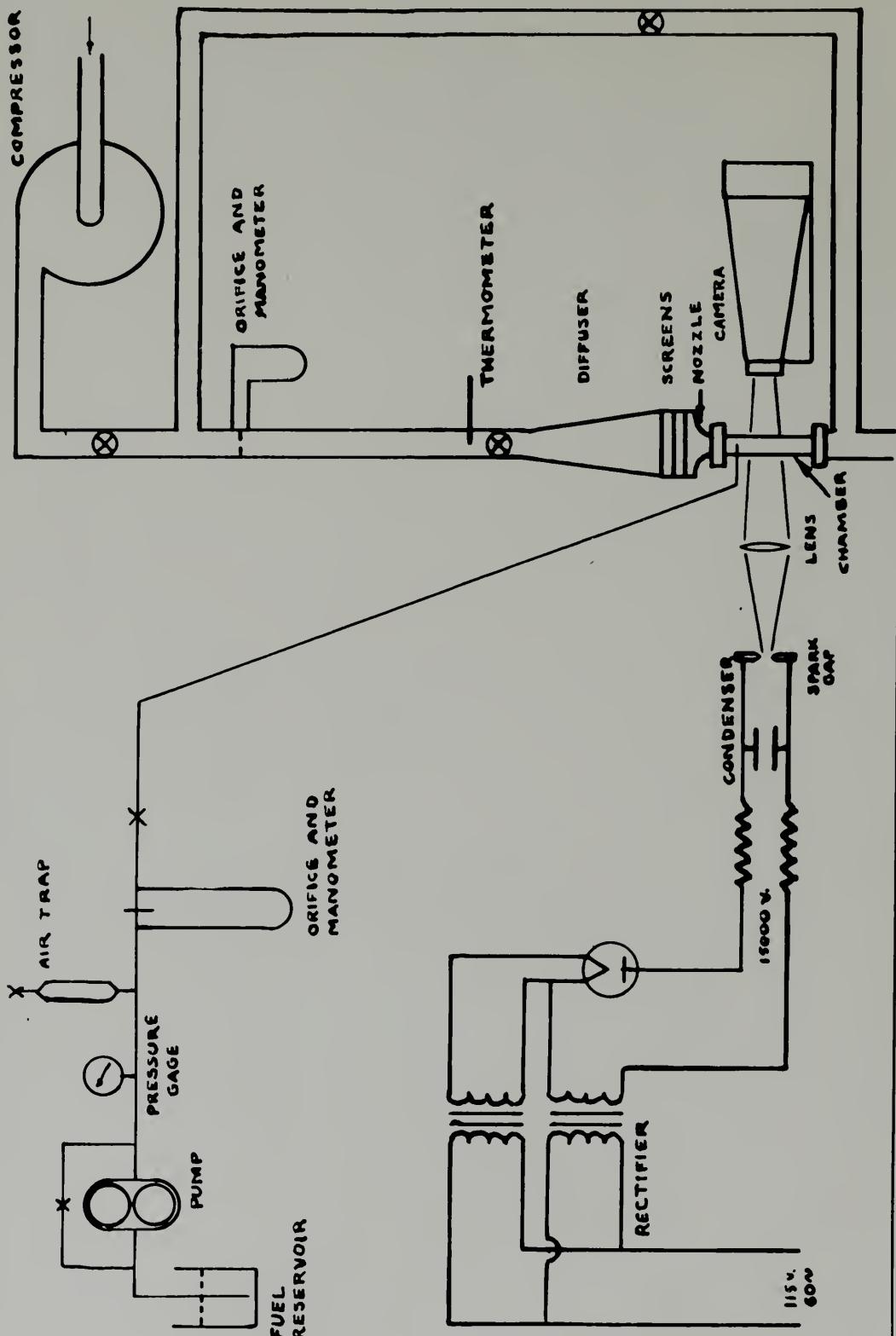
u d'après ce rapport que l'importance de l'effet
de levier dans les opérations financières
est aussi grande que dans celles industrielles.
Mais il faut faire une distinction entre l'effet de levier
dans les opérations financières et l'effet de levier
dans les opérations industrielles. L'effet de levier
dans les opérations industrielles est le résultat de la
différence entre les coûts fixes et les coûts variables.
L'effet de levier dans les opérations financières est le résultat de la
différence entre les intérêts et les revenus.

Il existe deux types d'opérations financières : les opérations financières avec effet de levier et les opérations financières sans effet de levier. Les opérations financières avec effet de levier sont celles où les coûts fixes sont élevés par rapport aux coûts variables. Les opérations financières sans effet de levier sont celles où les coûts fixes sont faibles par rapport aux coûts variables. Les opérations financières avec effet de levier sont généralement plus rentables que celles sans effet de levier. Cependant, il existe des cas où les opérations financières sans effet de levier peuvent être plus rentables que celles avec effet de levier. Par exemple, si les coûts fixes sont très élevés et que les revenus sont faibles, alors les opérations financières sans effet de levier peuvent être plus rentables que celles avec effet de levier.

Il existe plusieurs types de rapports financiers : les rapports financiers internes et les rapports financiers externes. Les rapports financiers internes sont destinés à l'usage des gestionnaires et des actionnaires. Ils fournissent des informations sur la situation financière de l'entreprise, sur ses résultats d'exploitation et sur ses perspectives futures. Les rapports financiers externes sont destinés à l'usage des investisseurs et des analystes financiers. Ils fournissent des informations sur la situation financière de l'entreprise, sur ses résultats d'exploitation et sur ses perspectives futures. Les rapports financiers internes sont destinés à l'usage des gestionnaires et des actionnaires. Ils fournissent des informations sur la situation financière de l'entreprise, sur ses résultats d'exploitation et sur ses perspectives futures. Les rapports financiers externes sont destinés à l'usage des investisseurs et des analystes financiers. Ils fournissent des informations sur la situation financière de l'entreprise, sur ses résultats d'exploitation et sur ses perspectives futures.

SCHEMATIC DIAGRAM OF APPARATUS

FIGURE I



LEGEND FOR FIGURES II AND III

- A. Air orifice meter.
- B. Power pack.
- C. Thermometer well.
- D. Air by-pass valve.
- E. Fuel control valve.
- F. Fuel orifice meter.
- G. Air trap.
- H. Fuel pump by-pass valve and pressure gage.
- I. Fuel pump.
- J. Fuel Reservoir.
- K. Diffuser.
- L. Air rate manometer.
- M. Fuel rate manometer.
- N. Diffuser and Orifice Static pressure manometer.
- O. Optical Bench and adjusting jacks.
- P. Exit Duct.
- Q. Variac.
- R. Air Control valve.
- S. Chamber.
- T. Spark Gap.
- U. Condenser.
- V. Condensing lenses.
- W. Mirror.
- X. Fuel adapter and nozzle.
- Y. Light-proof cloth.
- Z. Camera.

LEGEND FOR FIGURES II AND III

- A. pH or titratable meter.
- B. Power bank.
- C. Thermometer or milli-j.
- D. Ati PA-base catalyst.
- E. Metal catalyst residue.
- F. Metal orifice meter.
- G. Ati crib.
- H. Metal pump PA-base volatile and pressure gauge.
- I. Metal pump.
- J. Metal Reservoir.
- K. Diluter.
- L. Ati safe manometer.
- M. Diluter and safe manometer.
- N. Object bench and adjustment screws.
- O. Metal safe manometer.
- P. Metal float.
- Q. Alkaline.
- R. Ati catalyst residue.
- S. Catalyst.
- T. Best gas.
- U. Conqueror.
- V. Condensin Jenner.
- W. Mixer.
- X. Metal separator and nozzle.
- Y. Titrator.
- Z. Catalyst.

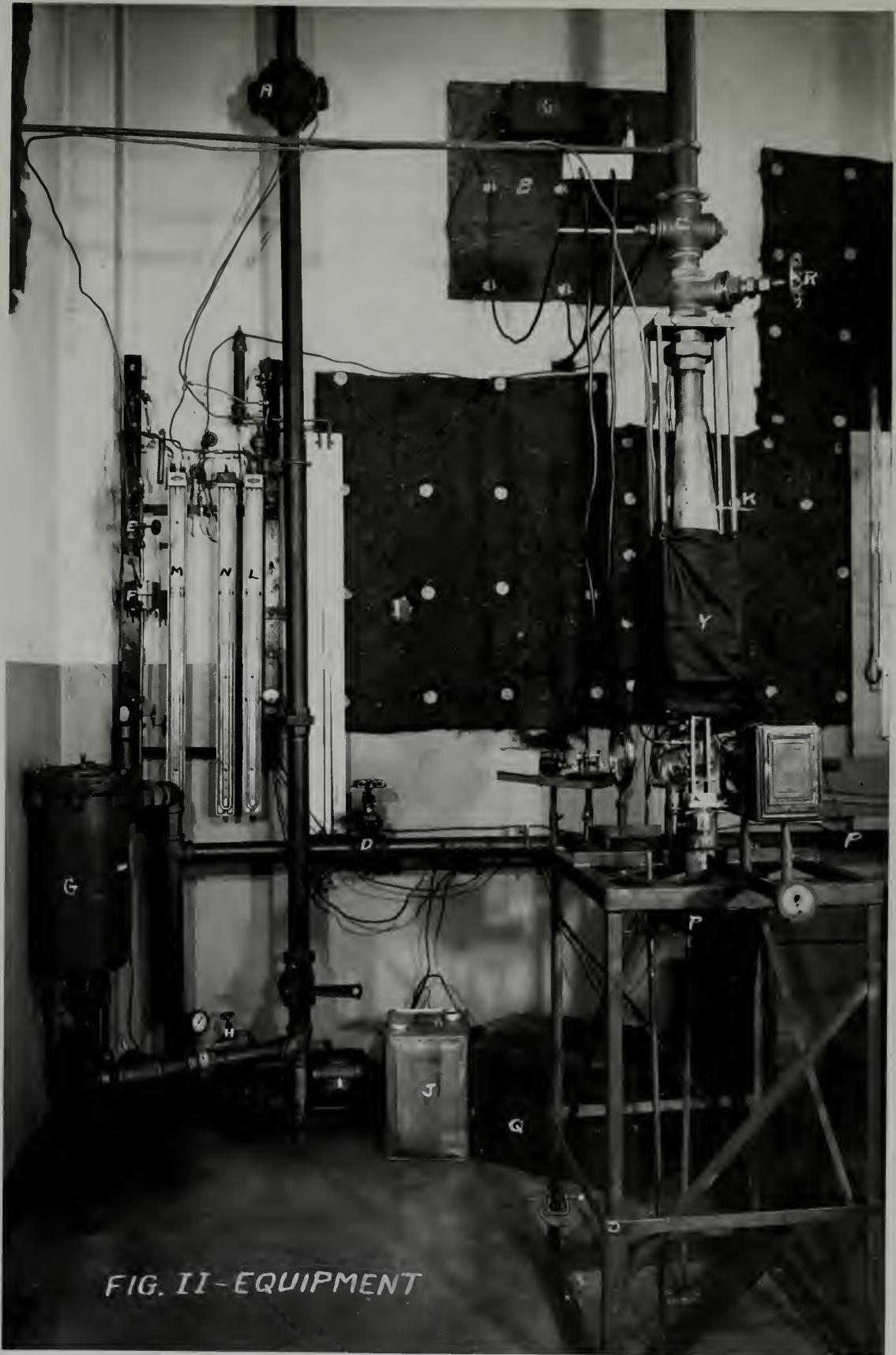


FIG. II-EQUIPMENT

FIG. III - CAMERA AND
LIGHTING



FIG.IV - FUEL NOZZLES



115 volt building power. This spark technique and the power pack design is fully described in (14). Previous measurements have shown the spark duration to be less than 0.25×10^{-7} seconds.

The light from the spark is directed by two five-inch condensing lenses and a 3 x 6 inch mirror into the camera through the chamber so that the spray is photographed in semi-silhouette. The light is diffused and centered by manipulation of the lenses.

The camera, spark gap, mirror and lenses are supported on a 24 x 24 inch bench with telescoping legs, which can be adjusted vertically by means of two screw-type jacks so that any part of the chamber may be photographed. The base is bolted rigidly to the floor.

A light-proof cloth cloaks the chamber, nearest condensing lens, and the camera lens so that the camera shutter may be opened, the condenser discharged, and the shutter closed, eliminating the necessity for spark-shutter synchronization.

Experimental Procedure

The oil spray was obtained with three types of fuel injection: downstream flow, perpendicular flow and upstream flow.

For downstream flow, the bent nozzle to be studied was secured in a tapped hole near the top of one metal wall, the chamber assembled and installed. The alignment of the nozzle in the plane of the adapter was checked when the nozzle

the same time, the government has been unable to meet its obligations to the people. The result is that the people have suffered greatly. The government has failed to provide sufficient food and clothing for the people. The people are starving and dying.

The government has also failed to provide sufficient medical care for the people. The people are sick and dying from various diseases. The government has failed to provide sufficient education for the people. The people are illiterate and ignorant. The government has failed to provide sufficient employment opportunities for the people. The people are unemployed and destitute.

The government has also failed to provide sufficient infrastructure for the people. The people are living in poverty and lack basic necessities such as clean water, electricity, and transportation. The government has failed to provide sufficient social services for the people. The people are suffering from poverty and lack of basic necessities such as clean water, electricity, and transportation.

The government has also failed to provide sufficient infrastructure for the people. The people are living in poverty and lack basic necessities such as clean water, electricity, and transportation. The government has failed to provide sufficient social services for the people. The people are suffering from poverty and lack of basic necessities such as clean water, electricity, and transportation.

Conclusion

In conclusion, the government has failed to meet its obligations to the people. The people are suffering from poverty and lack of basic necessities such as clean water, electricity, and transportation. The government has failed to provide sufficient social services for the people. The people are suffering from poverty and lack of basic necessities such as clean water, electricity, and transportation.

The government has also failed to provide sufficient employment opportunities for the people. The people are unemployed and destitute. The government has failed to provide sufficient medical care for the people. The people are sick and dying from various diseases. The government has failed to provide sufficient education for the people. The people are illiterate and ignorant. The government has failed to provide sufficient infrastructure for the people. The people are living in poverty and lack basic necessities such as clean water, electricity, and transportation.

and adapter were made (see Appendix D). The alignment in the line of sight of the camera was checked by opening a plugged hole in the opposite metal wall that was closest to the nozzle tip.

For perpendicular flow, disassembly of the chamber was not necessary and the nozzles could be inserted by merely screwing them into a tapped hole near the top until the forward face of the adapter was flush with the milled inner surface of the wall.

For upstream flow, the procedure was the same as for downstream flow except that the metal wall was reversed, top-to-bottom, with the nozzle pointing up into the chamber.

For each type of flow, and for each nozzle run at a specified condition of air and fuel rate, the procedure was as follows:

1. Camera and lenses were aligned and the bench was adjusted to proper height.
2. The air compressor was started and allowed to build up pressure until stable conditions existed in the surge tank with the by-pass open.
3. The fuel pump was started and pressure adjusted by internal by-pass to 90 psi.
4. The desired air rate was set by adjusting the by-pass.
5. The desired fuel rate was set by adjusting the fuel valve.
6. The light-proof cloth was adjusted around the chamber.

7. The shutter was opened, condenser discharged,
and shutter closed.

8. All manometers were read.

Each nozzle was photographed at a high and a low fuel rate and at a low, intermediate, and high air rate for each fuel rate.

For downstream flow, the spray envelope was photographed at each condition with reflected light from two Super Flood lamps placed 18 inches behind the camera lens and at the maximum angle permitted by the chamber walls. The exposure time was 2-4 seconds at f3.5.

негативні тенденції, більшість яких виходить з позитивної сфери життя. Барвінко вважає, що позитивні стосунки зі світом зумовлені, якщо вони зумовлені засобами. Це може відбутися як засобом застосуванням засобів, які використовують індивіди у певних ситуаціях, так і засобом, який використовується індивідами як засіб для впливу на інших членів групи або соціуму. Тому засобами можуть бути як позитивні, так і негативні. Важливо пам'ятати, що засобами вважають не тільки фізичні об'єкти, але і всі речі, які використовують індивіди для виконання певних функцій. Наприклад, якщо індивід використовує засіб для впливу на інших членів групи або соціуму, то це засіб вважається засобом. Але якщо індивід використовує засіб для виконання певної функції, то це засіб не є засобом, а є засібом для виконання певної функції. Також слід пам'ятати, що засобами вважають не тільки фізичні об'єкти, але і всі речі, які використовують індивіди для виконання певних функцій. Наприклад, якщо індивід використовує засіб для впливу на інших членів групи або соціуму, то це засіб вважається засобом. Але якщо індивід використовує засіб для виконання певної функції, то це засіб не є засобом, а є засібом для виконання певної функції.

RESULTS

The results are presented as a series of plates, Figures V through XXXIII, portraying the spray by two independent photographic techniques. The instantaneous pictures were taken by means of the spark-lighting apparatus while the spray envelopes shown were obtained by time exposure with reflected light.

Each figure represents the full series of nozzles, increasing in size from left to right, at one condition of air rate and fuel rate, and for one type of injection. The number beneath each picture refers to the experimental run listed in Appendix F. The plates are arranged as to type of injection and for each type, they are arranged in order of increasing air rate, and at each air rate, two plates are arranged in order of increasing fuel rate. Pictures of the spray envelope were obtained for downstream flow only because of the generally poor character of the spray for the other types of injection which would make time exposures of little constructive value.

For each individual photograph, a knowledge of what is shown is necessary to permit correct analysis. The magnification is approximately 2.8. The actual magnification can be obtained by measuring the nozzle tip in the photograph and comparing it with the actual diameter for that nozzle given in the appendix. The depth of focus is about 1.5 mm. and the center of focus is on the diameter of the fuel orifice or axis of the spray. The negatives were cut down for mounting but no vital information was lost since the nozzle tip was in the center of

CONTENTS

several years ago to witness a re-education and adjustment of

The first step in the process of creating a new model is to identify the key variables that are likely to influence the outcome. This involves conducting research and analysis to determine which factors are most important and how they interact with each other.

上

the 1990s, the number of people leaving the country increased significantly, particularly among young adults aged 15-24. This out-migration has been attributed to several factors, including rural-to-urban migration, rural depopulation, and economic globalization. The rural-to-urban migration has been driven by job opportunities in urban centers, where there is a higher standard of living and better access to education and healthcare. Rural depopulation, on the other hand, is due to a combination of factors, including agricultural decline, industrialization, and urbanization. The economic globalization has also contributed to the out-migration, as it has created new job opportunities in developing countries, particularly in the service sector. The government has implemented various policies to address this issue, including the promotion of agriculture, the development of infrastructure, and the promotion of tourism. However, the problem remains a significant challenge for the country, as it affects the rural economy and the overall development of the country.

the chamber in all cases and the chamber walls may be reconstructed knowing the magnification. In some photos, the chamber wall shows as a black strip to the right or left and was indicated where impingement was present. The nozzle tip is shown in the prints on the top for down stream, from the left for perpendicular injection and from below for upstream injection. Out-of-focus imperfections are unavoidable, particularly at low air velocities due to fuel impingement on the optical flats.

Fuel rates of 1.08 and 3.34 grams per second and air rates of 40, 80, and 180 grams per second were chosen bearing in mind that the change in air rate is logarithmic in character and that the intermediate range might be expected to prove of greatest interest. The metric system was used here to keep numbers large enough to handle, and weight rates were used because the metering was more feasible in terms of weight.

DISCUSSION OF RESULTS

There is a question as to the value of the photographs regarding their reproducibility. In all, 228 runs were made, mostly all concerned with downstream flow, and the best negative chosen for each condition. For the instantaneous pictures, no marked misrepresentation was noted in any case. However, to substantiate their value further, three pictures were taken in rapid succession for each nozzle at an air and fuel rate known to give acceptable atomization. Two of the three taken are shown in Figures XVII, XVIII, XIX, XX and XXI. They may be compared with the third, which was inserted in its proper place in the series, Figure X. The Spray Envelopes, however, are not so easily validated. The density of the negative is a function of the density and reflectability of the spray itself. At the spray cone edges, where drops are small and density is light, definition is not good in the negative and it is bettered in developing only at the expense of losing some of the edge and thus not exactly portraying the true cone. In printing negatives of varying density simultaneously, the loss of definition is constant, but the ones of lighter density suffer more in order to bring out the heavier ones. This is most readily illustrated in the pictures at low air velocities where spray density was quite light.

Two important features of the instantaneous photographs must be noted in order to understand what is actually recorded.

STRATEGIC GOVERNANCE

and the role of the board in the governance of the organization. This paper also highlights the need for the board to have a clear understanding of its role and responsibilities, and to work in partnership with management to achieve the organization's strategic objectives. The paper also discusses the importance of communication and collaboration between the board and management, and the need for the board to be accountable for its actions. The paper concludes by emphasizing the importance of the board in providing leadership and guidance to the organization, and the need for the board to be responsive to the needs of the organization and its stakeholders.

First, because the picture was not truly taken "instantaneously", though the exposure time is very small, there will be a greater ratio of large drops to small drops than actually exists, due to the fact that the smallest drops are accelerated faster and cannot be "stopped". Secondly, the exposure time limits the size of drop that can be "stopped". In order for a drop to be "stopped", it must not travel its own diameter during the time of exposure. Knowing the time of exposure to be less than 0.025 microseconds, it may be calculated that the spark will "stop" drops of size greater than 5 microns for an air velocity of 660 feet per second and 2 microns for an air velocity of 275 feet per second, and probably "stops" even smaller ones.

The nature of the equipment limits the accuracy with which conditions may be reproduced. Consequently, a representative value of fuel rate and air velocity was chosen for labelling each figure. This is an acceptable procedure for a qualitative investigation. The actual data and calculations for each run are given in Appendix F for reference.

Eastman Plus X Fine Grain film packs were used throughout, with an aperture of f 3.5. Negatives through Run 80 were developed in Eastman Microdol Developer, over-developed 100% to give maximum contrast and good grain for future enlargement. It was then realized that a more compact presentation of results would be desirable, obviating the use of enlargements, so all subsequent negatives were given normal development in Eastman D-11 Developer. It was also physically impossible to duplicate exactly the light intensity on the film when the lens

title, because it's not just for new products and services -
 but also for existing ones. This is very similar, since with
 a better ratio of time to value than previously
 possible, the same cashflow can be used twice
 instead of once, giving a much larger
 return. "Secondly", the response time
 limit is the one to add up to the
 "third". In other words,
 "second" is the first to leave the
 company, if the first is not
 able to make its money back.
 Considering the costs of
 development and marketing, it may be
 reasonable to set the
 limit at 12 months. This
 would give a
 profit of 25% per year
 and drop-off after
 12 months.

The fourth is the
 maximum limit for
 the number of employees
 that can be hired. Considering
 the cost of hiring
 and training, it is
 reasonable to set
 the limit at 12 months.
 This would give a
 profit of 25% per year
 and drop-off after
 12 months.

Finally, there is the
 maximum limit for
 the number of employees
 that can be hired
 and the cost of
 hiring and training
 is the same as the
 cost of developing
 and launching a
 new product or service.
 This would give a
 profit of 25% per year
 and drop-off after
 12 months.

arrangement was disturbed. For these reasons, the density of the instantaneous pictures was not constant in all negatives leading to non-uniform results in printing. Insufficient time prevented using a more suitable but more tedious technique of printing each negative to best results, stripping the prints in a plate and rephotographing the plate.

The following exceptions from standard conditions are noted:

1. Fig. VI - Run 79 - Nozzle tip just out of picture.
2. Fig. XXIII - Run 144 - Fuel rate 2.50 gms/sec. to prevent impingement.
3. Fig. XXV - Run 149 - Fuel rate 3.05 gms/sec. to prevent impingement.
4. Fig. XXIX - Run 91 - Tip of spray 4.00 inches above nozzle tip.
5. Fig. XXIX - Run 99 - Tip of spray 3.64 inches above nozzle tip.

It is apparent from a comparison of the Spray Envelope pictures with the instantaneous pictures, that the time exposure technique is incapable of telling the true story of atomization. In many instances, the time exposures give an illusion of a good mist formation, but the instantaneous pictures show incomplete atomization, often with fuel mass concentrations. This is easily explained by the fact that the negative receives many traces during exposure instead of recording a physical mass position. When the fuel becomes well atomized, the dispersion of drops causes a diffusion of the

to discuss and evaluate their role. Beginning now throughout
society there is a danger for one entity to dominate and
privilege, failing to listen equally or fairly to others.
This should not be a privilege given to any particular group
but rather a right given to everyone to have their
views heard by others and to be treated with respect and
the opinions of others must also be considered.

: Boston

Writing to his son - 27 July - 17.30H. I
of .000\am 02.5 after DAD - AM 00H - XXXX.0H .S

.transcription follows

of .000\am 20.3 after DAD - AM 00H - VXX.0H .C

.transcription follows

after 00.4 writing to DAD - 12 am - XXXX.0H .A

.ditto follows

after 00.5 writing to DAD - 00.00H - XXXX.0H .C

.ditto follows

equivalent value and the importance of merit should be re-empha-
-zed and that certain characteristics of the individual
-the value of which can be measured by objective criteria
-not by subjective criteria such as personal values. In conclusion
-the individual should be given the opportunity to demonstrate
-his worthiness and the merit of his work should be evaluated
-by his peers and not by himself. This is the best way to
-achieve recognition and to encourage further development
-and to maintain a sense of worth in one's own self-worth and
-one's own self-esteem.

light with the result that a fading is evident in pictures where atomization is fine and drops are well dispersed. This fading effect is small in comparison with the differences encountered in developing and printing, and, in fact, is largely dependent on them. Also, this fading effect is not uniform with increasing air or fuel rate because the film cannot differentiate between a concentration of small droplets and a solid mass concentration during long exposure. Another feature of the time exposure is that it represents the summation of positions occupied by the spray during the exposure with the consequence that spray fluctuations cause a false impression of spray volume and cone angle on the negative. It must be concluded that photographing the spray envelope with time exposure does not offer a picture valid enough for even the roughest qualitative analysis of the spray characteristics.

On the other hand, the instantaneous photographs lend themselves well to detailed analysis provided the air stream has not been disturbed sufficiently to disrupt formation of a good spray cone. An inspection of the figures indicates that Downstream flow lends itself best to analysis because of least interference from the nozzle. Only three spray characteristics can be studied with any degree of certainty: Drop Size, Dispersion, and Uniformity.

DROP SIZE: For velocities sufficient to produce acceptable atomization, no effect can be noted for increasing fuel rate or increasing orifice diameter at one air rate, and for

one type of flow. At low air velocities, the velocity of the fuel is a greater percentage of the air velocity than at high, with the consequence that the change in fuel velocity imposed by change of orifice diameter or increase of fuel rate has a more noticeable effect on the relative velocity of fuel to air, and a decrease in drop size is observed for increased nozzle size and decreased fuel rate. At high air velocities, the change in relative fuel to air velocity with change in fuel rate and nozzle size is so small that the effect on drop size is not noticeable. For one fuel rate and one nozzle size, increased air velocity has a marked effect on the decrease in drop size. As the type of injection is shifted from downstream, through perpendicular to upstream, the relative velocity of fuel to air becomes greater, other variables constant, with the result that drop size decreases. The effect is more noticeable with large nozzles than with small, which leads to the conclusion that the influence of type of injection on drop size as photographed is exaggerated by the fact that there is more physical interference from the large nozzle, causing more fuel to be pulled out of the spray along the nozzle. This amounts to an appreciable decrease in fuel being atomized.

DISPERSION: Dispersion decreases with an increase in air velocity for all types of injection, due to increased stability and increased resistance to distortion of streamlines as air velocity increases. It decreases with increased fuel rate for downstream flow, probably because of the greater stability of a more rapidly moving liquid column at the same air velocity. For perpendicular injection, the dispersion increases because

and the other is a national one. Now it is
clear that such a policy will be independent of the
national character and of the political and economic
situation. But if we consider the two main
problems of foreign policy, that is, the
protection of our country from external
aggression and the promotion of
international cooperation, then it is
obvious that the former is more important.
The latter, while it is also important,
is less so. It is a question of
the relations between
two countries, while the former
is a question of the whole world.
Therefore, the policy of
international cooperation must be
based on the principle of mutual
respect and equality. This principle
must be applied in all
relations between
countries, both in their
internal affairs and
in their external affairs.
The principle of
mutual respect and
equality must be
applied in all
relations between
countries, both in their
internal affairs and
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internal affairs and
in their external affairs.

the increase in fuel velocity, with increase in fuel rate and decrease in orifice size, serves only to shoot the fuel column farther across the air stream, affording more area upon which the air can work. For upstream injection, the increased fuel velocity shoots the fuel column farther upstream. The farther the fuel column goes, the more it loses its stability and becomes dispersed, thus presenting a greater area of impact to the onrushing air.

Increasing nozzle size increases dispersion for all types of injection, though the effect is not well illustrated for perpendicular injection. As nozzle size increases, the perimeter of the fuel column increases, providing more surface on which the air may act. For upstream injection, larger nozzles provide a greater area of impact to the velocity front.

UNIFORMITY: In atomization, the limit of drop size is one infinitely small, and this is approached asymptotically, with the force required to obtain it increasing in a like manner, i.e., an infinite shearing force being required to give an infinitely small drop size. When the atomizing force increases, fewer large drops will occur in relation to the number of small. Thus, with a general decrease in mean drop size, the decrease is at the expense of large drops being broken up. This amounts to saying that the variation of drop size from the mean is less with a decrease in mean drop size, and this variation is the definition of uniformity. This reasoning is confirmed by the photographs. Increased air rate gives better uniformity for all types of injection. Increased fuel rate

state level at economic growth. Policies have been proposed that would limit the ability of states to impose regulations that affect the environment. These policies include measures such as caps and trading programs, which limit the amount of emissions that can be emitted by individual companies. The idea behind these policies is to encourage companies to invest in cleaner technologies and reduce their impact on the environment. This has led to significant improvements in air quality and reduced greenhouse gas emissions.

The main argument put forward to support these policies is that they are necessary to combat climate change. Climate change is a global problem that requires international cooperation to solve. The Paris Agreement, signed by nearly all countries in 2015, aims to limit global warming to well below 2 degrees Celsius compared to pre-industrial levels. This requires significant reductions in greenhouse gas emissions from all sectors of the economy. The transition to a low-carbon economy will require investment in renewable energy sources like wind and solar power, as well as energy efficiency measures. It will also require changes in consumer behavior, such as reducing waste and conserving energy. The cost of this transition will be borne by society as a whole, but it is estimated that the benefits will far outweigh the costs in the long run. In addition, the transition to a low-carbon economy will create new jobs and opportunities for economic growth. It will also help to protect the environment and ensure a sustainable future for all.

decreases the uniformity. The effect of nozzle size is not marked except in upstream flow where the same illusion occurs as explained in the discussion of drop size regarding the amount of fuel drawn out of the column by the larger nozzle.

In line with these observations, an attempt was made to apply the formulation of Nukiyama and Tanisawa (15) in order to predict the effect of the variables on Mean Drop Size. These investigators tested a small nozzle, using liquid fuels injected into the throat of a venturi atomizer with air as the atomizing agent. From their tests they determined that:

$$D_m = \frac{585 \sqrt{\sigma}}{\sqrt{V\rho}} + 597 \left(\frac{\mu}{\sqrt{\rho\sigma}} \right)^{0.45} \left(\frac{1000 Q_f}{Q_a} \right)^{1.5} \quad [1]$$

where:

D_m = Volume-surface mean diameter in microns.

V = Relative velocity of air to liquid - meters/second.

σ = Surface tension of liquid - dynes/cm.

ρ = Density of liquid - grams/cc.

μ = Viscosity of liquid - dynes-sec./sq.cm.

Q_f = Volume rate of liquid - cc./sec.

Q_a = Volume rate of air - cc./sec.

They found no effect on drop size from changing the size of venturi, within small limits. Lewis and Edwards (17) have also shown that the equation gives good results for venturis of any size. In particular, they tested perpendicular injection from a small nozzle into the throat of a relatively large venturi. This constitutes point injection into a reasonably uniform air stream, and they found that equation (1) still held.

for all early stages in setting out. Application of measures
which will ensure all early work carried out quickly and
economically will go to reduction of cost of building up.
Early work will be given out to the firms best to whom
or whom can supply the required work earliest and only at
times of (2) available and amenable to modification of work
and work will be available for setting up building of
early work which can supply them from a distant place
so the firm involved engaged in work and oral agreement
that building work will cease if work is not done
[1]
$$\left(\frac{P_{00}}{P} \right)^{24.0} \left(\frac{M}{M_0} \right) 120 + \frac{2848}{V} = D_m$$

example:

amount of labour hire per hour = 10

hours/hire - hours of hire to complete work = V

hrs/hire - hours to complete work = D

hrs/hire - hours to finish = 9

hrs/hire - hours to complete = 12

hrs/hire - hours to start work = 20

hrs/hire - hrs to start work = 30

work and materials will start work on day last
and (2) available has been . similar time taken, it may be
assumed that current work being done on day one is
similar to previous work done , implying all work to
start previous to the first day of work there is no
difference in oral contract which constitutes part .
work there (1) available and work part work . unless the work is

TABLE I

For Diesel 011: $D_m = \frac{32220}{V} + 41.5 \left(\frac{1000 Q_f}{Q_a} \right)^{1.5}$

Fig.	Run No.	Nozzle	No.	Va	Vf	V	$\frac{3220}{V}$	Qf	Qa	$(\frac{1000 Q_f}{Q_a})^{1.5}$	D_m
								DOWNSTREAM			
VI	79		5	42.7	5.0	37.7	85.5	1.33	27400	.47	86.0
VI	77		1	45.8	.2	45.6	70.6	1.26	29400	.37	71.0
VIII	161		1	41.1	.7	40.4	79.8	3.95	26400	2.4	82.2
X	178		5	83.0	4.9	78.1	41.2	1.31	153600	.03	41.2
X	171		4	80.5	2.2	78.3	41.1	1.30	51900	.16	41.3
X	167		3	82.6	.82	81.8	39.4	1.28	53400	.15	39.6
X	152		2	82.6	.36	82.2	39.2	1.31	53400	.16	39.3
X	158		1	80.0	.24	79.8	40.4	1.31	51400	.16	40.6
XII	181		5	83.0	15.0	68.0	47.4	4.04	53500	.87	48.3
XII	39		4	86.5	7.0	79.5	40.5	4.10	55800	.84	41.3
XII	26		3	84.6	2.6	82.0	39.3	4.04	54600	.84	40.1
XII	51		2	87.1	1.1	86.0	37.5	3.93	56100	.75	38.3
XII	75		1	84.8	.7	84.1	38.3	4.03	54800	.84	39.1
XIV	182		5	199	5.1	194.1	16.6	1.29	128500	.04	16.6
XIV	157		1	201	.24	201.0	16.0	1.33	130000	.04	16.0
XVI	17		5	203	15.1	188.0	17.2	4.06	131000	.23	17.4
XVI	74		1	204	.73	203.3	15.9	4.03	131300	.23	16.1
PERPENDICULAR											
XXVI	145		5	196	4.8	196.0	16.4	1.30	120000	.04	16.4
XXVII	146		5	199	15.1	199.0	16.2	4.06	128500	.23	16.4
UPSTREAM											
XXXII	85		5	216	4.3	220.0	14.6	.87	139000	.01	14.6
XXXIII	86		5	202	15.0	217.0	14.8	4.04	130000	.23	15.0

Note: Nozzle size decreases from #1 to #5. Dimensions given in Appendix "D".

$$\text{Total Power Out: } P_{\text{out}} = \frac{A}{3550} + \pi J \cdot 2 \left(\frac{C_0}{J \cdot 3550} \right)$$

$\frac{C_0}{J \cdot 3550}$

Watts	A	J	$\frac{C_0}{J \cdot 3550}$
100	0.00	100	0.00
200	0.00	200	0.00
300	0.00	300	0.00
400	0.00	400	0.00
500	0.00	500	0.00
600	0.00	600	0.00
700	0.00	700	0.00
800	0.00	800	0.00
900	0.00	900	0.00
1000	0.00	1000	0.00
1100	0.00	1100	0.00
1200	0.00	1200	0.00
1300	0.00	1300	0.00
1400	0.00	1400	0.00
1500	0.00	1500	0.00
1600	0.00	1600	0.00
1700	0.00	1700	0.00
1800	0.00	1800	0.00
1900	0.00	1900	0.00
2000	0.00	2000	0.00
2100	0.00	2100	0.00
2200	0.00	2200	0.00
2300	0.00	2300	0.00
2400	0.00	2400	0.00
2500	0.00	2500	0.00
2600	0.00	2600	0.00
2700	0.00	2700	0.00
2800	0.00	2800	0.00
2900	0.00	2900	0.00
3000	0.00	3000	0.00
3100	0.00	3100	0.00
3200	0.00	3200	0.00
3300	0.00	3300	0.00
3400	0.00	3400	0.00
3500	0.00	3500	0.00
3600	0.00	3600	0.00
3700	0.00	3700	0.00
3800	0.00	3800	0.00
3900	0.00	3900	0.00
4000	0.00	4000	0.00
4100	0.00	4100	0.00
4200	0.00	4200	0.00
4300	0.00	4300	0.00
4400	0.00	4400	0.00
4500	0.00	4500	0.00
4600	0.00	4600	0.00
4700	0.00	4700	0.00
4800	0.00	4800	0.00
4900	0.00	4900	0.00
5000	0.00	5000	0.00
5100	0.00	5100	0.00
5200	0.00	5200	0.00
5300	0.00	5300	0.00
5400	0.00	5400	0.00
5500	0.00	5500	0.00
5600	0.00	5600	0.00
5700	0.00	5700	0.00
5800	0.00	5800	0.00
5900	0.00	5900	0.00
6000	0.00	6000	0.00
6100	0.00	6100	0.00
6200	0.00	6200	0.00
6300	0.00	6300	0.00
6400	0.00	6400	0.00
6500	0.00	6500	0.00
6600	0.00	6600	0.00
6700	0.00	6700	0.00
6800	0.00	6800	0.00
6900	0.00	6900	0.00
7000	0.00	7000	0.00
7100	0.00	7100	0.00
7200	0.00	7200	0.00
7300	0.00	7300	0.00
7400	0.00	7400	0.00
7500	0.00	7500	0.00
7600	0.00	7600	0.00
7700	0.00	7700	0.00
7800	0.00	7800	0.00
7900	0.00	7900	0.00
8000	0.00	8000	0.00
8100	0.00	8100	0.00
8200	0.00	8200	0.00
8300	0.00	8300	0.00
8400	0.00	8400	0.00
8500	0.00	8500	0.00
8600	0.00	8600	0.00
8700	0.00	8700	0.00
8800	0.00	8800	0.00
8900	0.00	8900	0.00
9000	0.00	9000	0.00
9100	0.00	9100	0.00
9200	0.00	9200	0.00
9300	0.00	9300	0.00
9400	0.00	9400	0.00
9500	0.00	9500	0.00
9600	0.00	9600	0.00
9700	0.00	9700	0.00
9800	0.00	9800	0.00
9900	0.00	9900	0.00
10000	0.00	10000	0.00

Note: $P_{\text{out}} = A \cdot J \cdot T + \frac{A}{3550} + \pi J \cdot 2 \left(\frac{C_0}{J \cdot 3550} \right)$

Table I includes the calculations for sufficient pertinent runs to provide a basis for correlation.

The conclusions drawn from this analysis generally agree with those observed in the photographs. The variables investigated in this thesis affect the formula in the following ways: (a) Increase of nozzle size decreases the fuel velocity, thus affecting the relative velocity V ; (b) Increased fuel rate increases the fuel velocity, thus affecting relative velocity, and increasing Q_f ; (c) Increased air rate increases the relative velocity V and increases Q_a ; (d) Type of injection affects relative velocity V - fuel and air velocities being subtracted for downstream, added for upstream, and fuel velocity being neglected for perpendicular injection. The general observation first made is that the change in mean drop size due to nozzle size, fuel rate and type of injection at air velocities sufficient to give acceptable atomization is of the same order of magnitude as the experimental error involved in this thesis. The predicted effect on mean drop size from equation (1) is most notable at low air velocity for nozzle size and fuel rate, and most apparent for type of injection at high fuel rates, as previously explained. The change in drop diameter at higher air velocities is sufficiently small, with all the studied variables except air velocity itself, to escape detection by macroscopic examination of the photographs. The variables are all significant at low air velocities, but this does not contribute much to the knowledge of atomization as regards its application to the proper combustion of fuels, since atomization is not acceptable. The

correlation does show that the formula is correct as to general trend, but its validity has been more comprehensively established by other investigators.

The photographs afford a good comparison of the types of injection and the advantages and disadvantages offered by each. The effects of each on the spray characteristics have been previously explained. A consideration of other features is also feasible. It is seen that streamlining that portion of the nozzle that extends into the air stream is desirable for downstream flow, and a definite necessity for the other types. The flow might be expected to be more asymmetrical for downstream injection than is indicated by the photographs, and probably would be in a less restricted gas duct where streamlines would have more freedom to distort laterally. Nozzle size in the range tested does not seem to be an important factor with downstream flow, but it is quite important with perpendicular and upstream injection. For the perpendicular type, the large nozzles form a definite low pressure area on the downstream side, although the tapered tip did prevent fuel from running back along the nozzle (a condition experienced by Robillard with the blunt tip). In upstream flow, general atomization was very poor because the fuel collected on all exposed portions of the nozzle and was blown off in large droplets. Also, from the combustion standpoint, it does not seem possible that a nozzle would stand up well with the flame enveloping it. In summary, perpendicular and upstream injection do not offer enough advantage in atomi-

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zation to counterbalance the inherent disadvantages due to interference of the nozzle. Perpendicular injection does offer the easiest means of nozzle replacement, however.

The instantaneous photographs, particularly those of downstream flow, illustrate nicely the mechanism of atomization and are in good agreement with the theories expounded by Castleman (8), Rayleigh (10), and Haenlein (18), discussed in Appendix "B". It is not the purpose of this thesis to elaborate on this agreement, but attention should be called to certain points pertaining to the effect of nozzle size.

At the same fuel rate and air rate, atomization starts sooner but takes longer for completion with the large nozzle than with the small. It starts sooner because of the greater relative velocity, and takes longer for completion because of the greater stability of a fuel column of greater diameter. The fuel column from the small nozzle shatters as soon as it starts to atomize. These facts are more evident at the lowest air velocity. At high air velocities, the effect is small but still noticeable.

The mechanics of atomization are illustrated by observing the principal action of surface tension at low air velocities and the combined action of surface tension and ligament formation by shearing action at high air velocities. No evidence of the action of turbulence in the fuel column can be observed because the highest Reynolds' Number encountered was 220.

Other observations made agree with the literature in that atomization occurs closer to the orifice with increasing air

of all subsequent material and considerations of noise
and vibration introduced by such activities do not go
beyond the limit of what can be done to correct them and
to prevent vital organs from being damaged by such material and
activities to maintain that which is necessary. Now when we
have made our conclusions as to what good is to be had and how
best to obtain it, (II) which are, (I) physical, (3) social or
of a kind like to those and so on etc. It is difficult to
tell us which would be best, which will give no annoyance
and which is best of maintaining hearing without creating
any pollution whatever, let the man who has to make up his mind
what he wants to do now for him to take into account the
different factors which are to consider when he
has to decide what to do. There are many factors which
will have to be considered when he makes up his mind
as to what to do. The first factor which he
will have to consider is the cost of the equipment
which will be required to achieve the desired result.
The second factor which he will have to consider is
the size of the room in which he has to work
and the third factor which he will have to
consider is the time required to achieve the
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velocity, and tend to agree with Scheubel and Sauter (1) in that ligaments cannot be observed above relative velocities of 10,000 - 12,000 cm/sec. It is further noted that atomization occurs closer to the orifice, with increasing orifice size.

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Writing addressed to Mr. Collyer of Messrs. Woods
Bankers dated 21st Sept. 1862, which includes evidence
of the amount of money advanced and paid before
the 1st instant to the amount of £ 100,000.

CONCLUSIONS

From the observations and discussion it may be concluded that:

1. Spark photography affords a good representation of the degree of atomization and general spray characteristics, and that the results so obtained are reproducible.
2. Correct analysis of the atomization of a fluid cannot be made from relatively long exposure pictures of the spray.
3. With increasing orifice diameter:
 - (a) No appreciable effect is noted on drop size at air velocities sufficient to give acceptable atomization. At low air velocities, drop size decreases.
 - (b) Dispersion increases.
 - (c) Uniformity not materially affected.
4. With increased air velocity:
 - (a) Drop size decreases.
 - (b) Dispersion decreases.
 - (c) Uniformity increases.
5. With increased fuel rate:
 - (a) No appreciable effect on drop size at air velocities sufficient to give acceptable atomization. At low air velocities, drop size increases.

QUESTION

- and as you can see from the diagram there is more
than one way to do this.
- Now let's look at another example. I
want to show you how to do this by using
the same technique, but this time we're
going to do it in a different way.
- So, consider this situation where
we want to find a solution to the equation
 $x^2 + 2x + 1 = 0$.
- What we can do is to factorise the
equation into two factors which are
 $(x+1)^2 = 0$.
- From this we can see that
 $x+1 = 0$, so
 $x = -1$.
- Therefore, the solution is
 $x = -1$.
- Now let's look at another example.
We want to solve the equation
 $x^2 - 4x + 4 = 0$.
- What we can do is to factorise the
equation into two factors which are
 $(x-2)^2 = 0$.
- From this we can see that
 $x-2 = 0$, so
 $x = 2$.
- Therefore, the solution is
 $x = 2$.
- Now let's look at another example.
We want to solve the equation
 $x^2 - 4x + 4 = 0$.
- What we can do is to factorise the
equation into two factors which are
 $(x-2)^2 = 0$.
- From this we can see that
 $x-2 = 0$, so
 $x = 2$.
- Therefore, the solution is
 $x = 2$.

- (b) Dispersion decreases for downstream injection, and increases for perpendicular and upstream injection.
- (c) Uniformity decreases.

6. For type of injection:

- (a) Spray characteristics are not materially affected.
- (b) Perpendicular and upstream injection have serious nozzle design problems, with large nozzles showing the greatest disadvantages.

7. Within the limits tested, air velocity was the only variable that materially affected the fineness of atomization.

8. From all considerations; downstream injection with large nozzles offers most to proper and complete atomization.

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RECOMMENDATIONS

1. An attempt be made with this apparatus to atomize Bunker "C" fuel oil under carefully controlled conditions to determine the character of atomization and what air velocities are necessary for acceptable spray formation.
2. An investigation into the effect of orifice perimeter/area ratio on atomization might prove of value.
3. With the chamber redesigned to permit good side lighting, and using a much shorter exposure time and smaller lens aperture, it might be possible to correlate quantitatively cone angle with nozzle size and other variables.
4. The effect of preheat on highly viscous fuels could be investigated on this equipment.
5. Specific nozzle designs could be analyzed with this apparatus. This is particularly true for attempts to improve perpendicular injection.
6. If the apparatus is to be used for further investigation, the chamber assembly could be further improved to prevent air leaks by assuring positive contact between glass and metal walls. This could be done by drilling countersunk holes in the glass every inch along its length next to both sides and using fine thread screws into tapped holes in the metal walls. A stop valve should also be placed in the exhaust line before it joins the by-pass to permit removal of the chamber without shutting off the air compressor. Also, a simple but efficient separator should be installed on the exhaust line if heavy liquids are to be used.

REFERENCES

the first time in the history of the world that a man has been able to do this. The reason is that he has been able to find a way to make the air move in such a way that it will blow him forward. This is what we call "flight".

Now, let us look at some of the ways in which people have tried to fly. One way is by using a large kite or a hot-air balloon. Another way is by using a propeller plane. Still another way is by using a rocket ship. All of these methods have their advantages and disadvantages. For example, a kite can only fly in a straight line, while a hot-air balloon can fly in any direction. A propeller plane can fly faster than a kite, but it requires more fuel. A rocket ship can fly very fast, but it is very expensive.

There are also many other ways to fly, such as using a glider, a paraglider, or a hang glider. These methods are less expensive than a rocket ship, but they require more skill and practice to use them safely.

In conclusion, flying is a difficult task, but it is also a very exciting one. It requires a lot of hard work and dedication, but the results are worth it. So if you ever get the chance to fly, don't miss it!

DOWNSTREAM INJECTION

INTRODUCTION

THESE PAPERS PERTAIN TO THE MARCH 1968 PROTESTS AT THE PROTESTANT THEOLOGICAL SEMINARY IN LEXINGTON, KENTUCKY. THE TIDE TURNED AGAINST THE SEMINARY'S BAPTIST LEADERSHIP AND FERVENT DEMANDS FOR REFORM AND DISCIPLINE BY CONSERVATIVE BAPTISTS. THE PAPERS ARE MOST QUITE CONCERNED WITH THE PROTESTANT THEOLOGICAL SEMINARY'S POSITION ON RACE, GENDER EQUALITY AND DISCRIMINATION IN EDUCATION. THE PAPERS ALSO DOCUMENT THE BAPTIST LEADERSHIP'S REACTION TO THE PROTESTANT THEOLOGICAL SEMINARY'S DECISION TO GRANT A BA HONORIS CIVITATIS DEGREES TO THE FIVE WOMEN WHO WERE DENIED A BA DEGREE DUE TO THEIR GENDER. THE PAPERS ALSO DOCUMENT THE BAPTIST LEADERSHIP'S REACTION TO THE PROTESTANT THEOLOGICAL SEMINARY'S DECISION TO GRANT A BA HONORIS CIVITATIS DEGREE TO THE FIVE WOMEN WHO WERE DENIED A BA DEGREE DUE TO THEIR GENDER.

MOTIONS TO LEGISLATE

AMENDMENT TO THE CONSTITUTION OF THE UNITED STATES

THESE PAPERS PERTAIN TO THE MARCH 1968 PROTESTS AT THE PROTESTANT THEOLOGICAL SEMINARY IN LEXINGTON, KENTUCKY. THE TIDE TURNED AGAINST THE SEMINARY'S BAPTIST LEADERSHIP AND FERVENT DEMANDS FOR REFORM AND DISCIPLINE BY CONSERVATIVE BAPTISTS. THE PAPERS ARE MOST QUITE CONCERNED WITH THE PROTESTANT THEOLOGICAL SEMINARY'S POSITION ON RACE, GENDER EQUALITY AND DISCRIMINATION IN EDUCATION. THE PAPERS ALSO DOCUMENT THE BAPTIST LEADERSHIP'S REACTION TO THE PROTESTANT THEOLOGICAL SEMINARY'S DECISION TO GRANT A BA HONORIS CIVITATIS DEGREE TO THE FIVE WOMEN WHO WERE DENIED A BA DEGREE DUE TO THEIR GENDER. THE PAPERS ALSO DOCUMENT THE BAPTIST LEADERSHIP'S REACTION TO THE PROTESTANT THEOLOGICAL SEMINARY'S DECISION TO GRANT A BA HONORIS CIVITATIS DEGREE TO THE FIVE WOMEN WHO WERE DENIED A BA DEGREE DUE TO THEIR GENDER.



211



228



203



197



190

FIG. V Fuel 1.08 gms./sec.
Air 140 ft./sec.



77



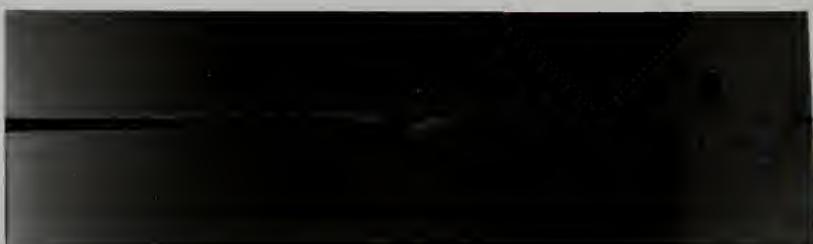
53



170



175



79

FIG. VI
Fuel ± 0.08 gms./sec.
Air 140 ft./sec.



212



206



204



198



191

FIG. VII
Fuel 3.34 gms./sec.
Air 140 ft./sec.

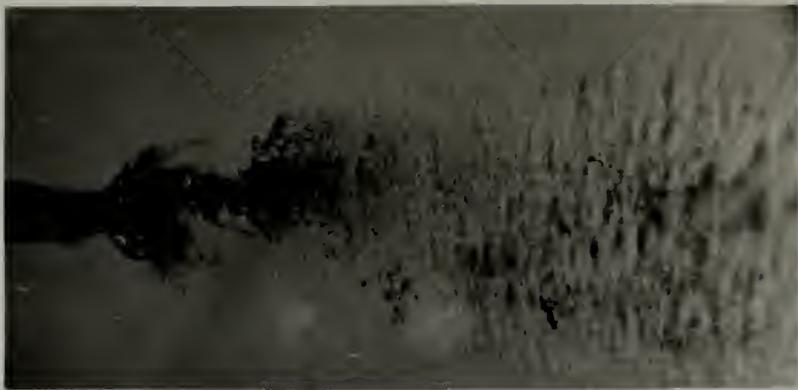


FIG. VIII
Fuel 3.34 gms./sec.
Air 140 ft./sec.



184



192



201



207



205

FIG. IX
Fuel 1.08 gms./sec.
Air 275 ft./sec.



FIG. X Fuel 1.00 gm.s./sec.
Air 2/5 ft./sec.



FIG. XI
Fuel 3.34 gms./sec.
Air 275 ft./sec.

75



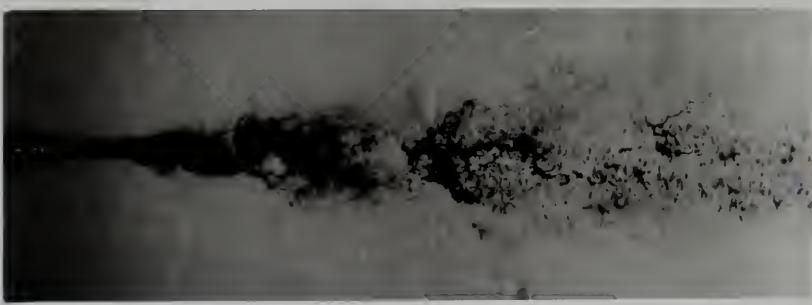
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26



39



181



FIG. KLI Kuei
Air $3 \cdot 34$ ft.³/sec.
Air 275 ft./sec.



215



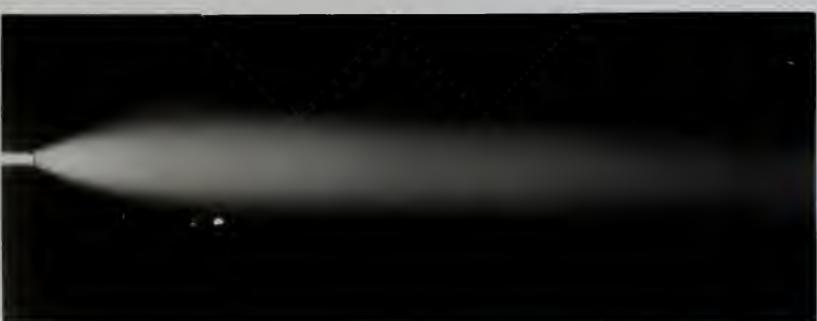
210



199



194



188

FIG. XIII Fuel 1.08 gms./sec.
Air 660 ft./sec.

157



155



34



174



162



FIG. XIV Fuel 1.08 gns./sec.
Air 660 ft./sec.

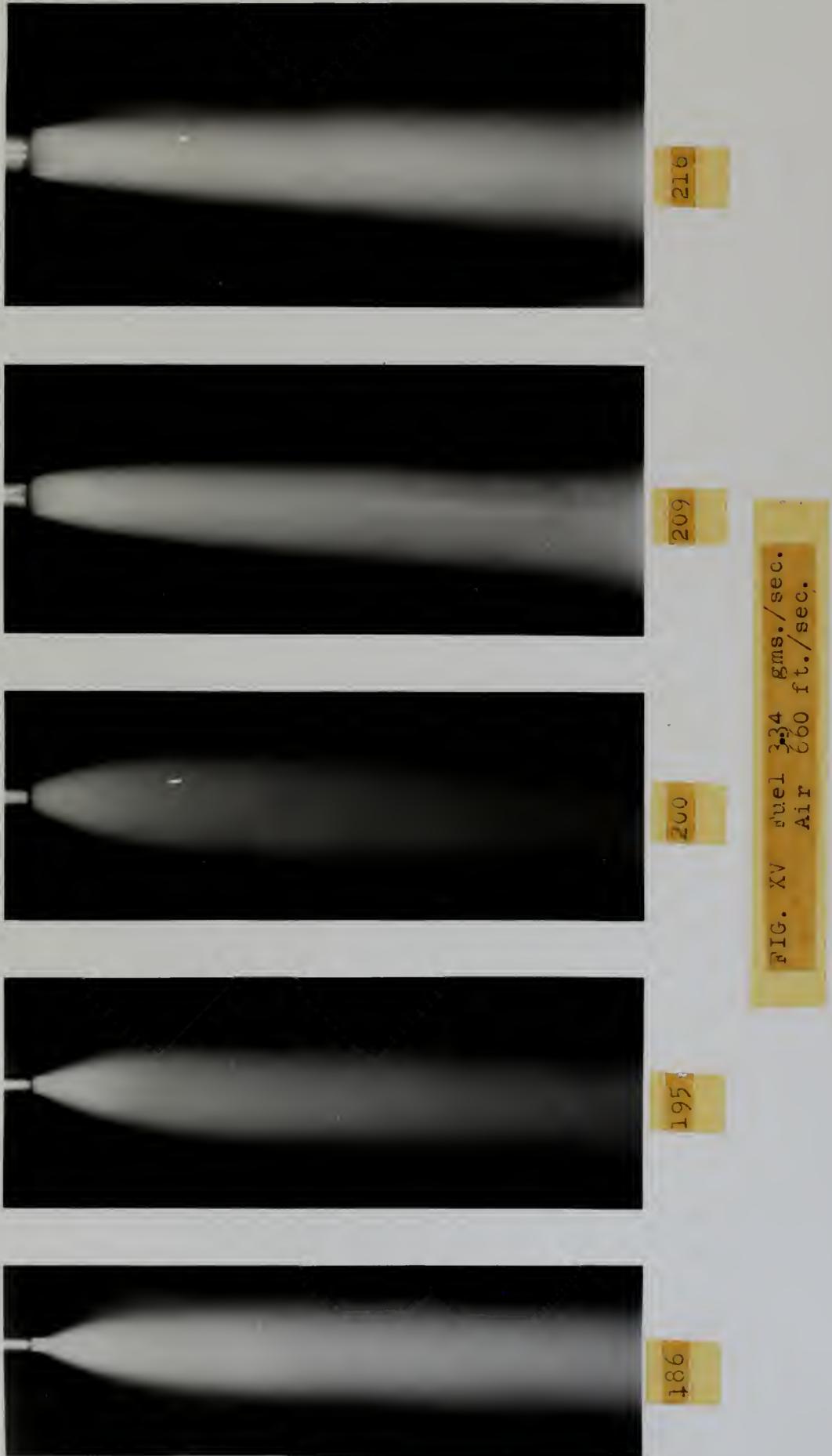


FIG. XV
Fuel 334 gms./sec.
Air 60 ft./sec.



FIG. XVI Fuel 3.34 gms./sec.
Air 660 ft./sec.



179

180

FIG. XVII Fuel 1.08 gms./sec.
Air 275 ft./sec.



172

173

FIG. XVIII Fuel 1.08 gms./sec.
Air 275 ft./sec.



168



169

FIG. XIX Fuel 1.08 gms./sec.
Air 275 ft./sec.



153



154

FIG. XX Fuel 1.08 gms./sec.
Air 275 ft./sec.



159



160

FIG. XXI Fuel 1.08gms./sec.
Air 275 ft./sec.

PERPENDICULAR INJECTION

SYNONYMICALLY IMPLICATIVE



125



131



137



143



150

FIG. XXII Fuel 1.08 g./sec.
Air 140 ft./sec.

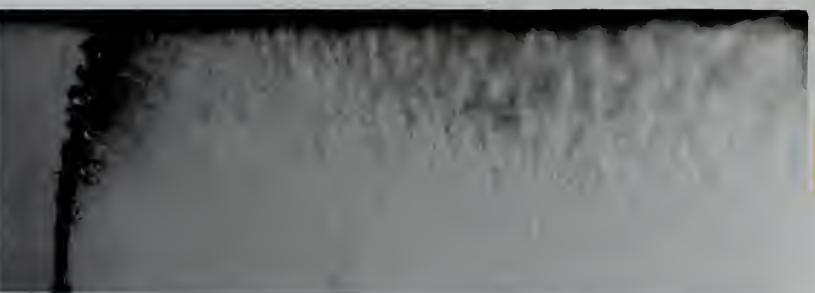


FIG. XXIII Fuel 3.34 gms./sec.
Air 140 ft/sec.



123



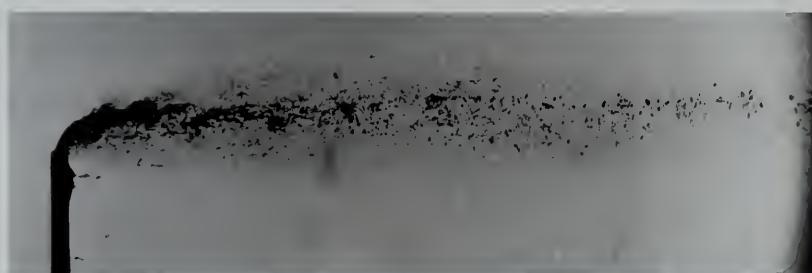
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135



141



148

FIG. XXIV Fuel 1.08 gms./sec.
Air 275 ft./sec.



FIG. XXV Fuel 3.34 gms./sec.
Air $2\frac{1}{2}$ ft./sec.

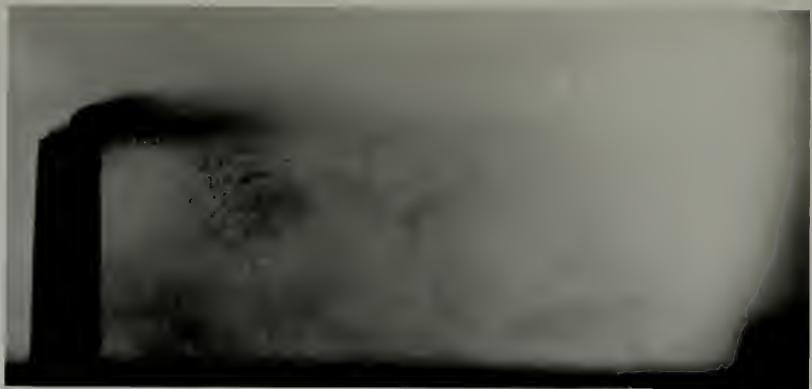


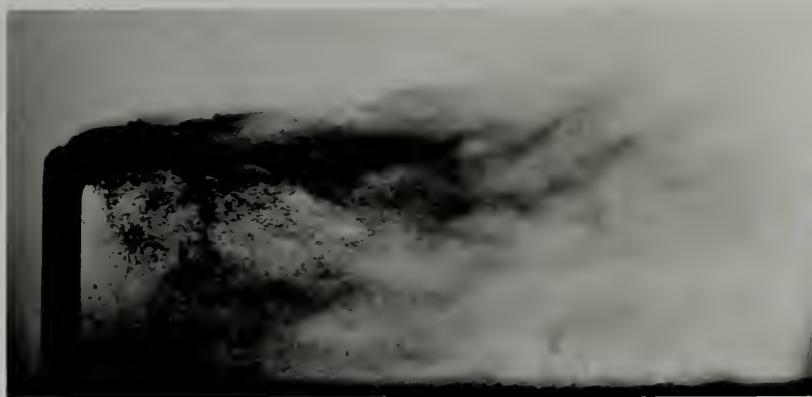
FIG. XXVI Fuel 1.0⁶ gms./sec.
Air 660 ft/sec.



122



128



134



140

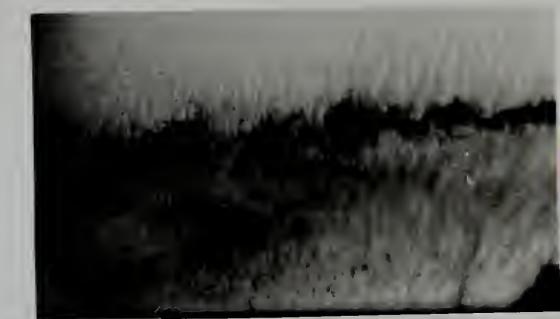


146

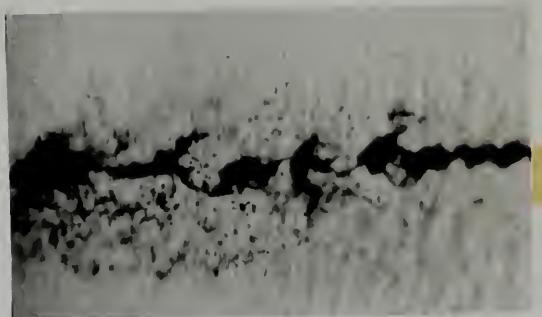
FIG. XXVII Fuel 3.34 gms./sec.
Air 600 ft./sec.

UPSTREAM INJECTION

HOITOLUOKKI MÄÄRÄTÖN



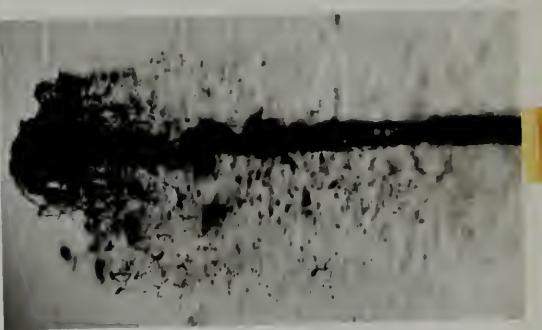
91



99



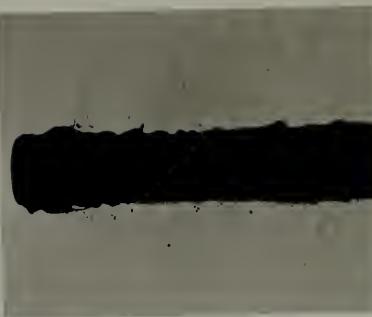
115



101



104



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117



105



98



92

FIG. XXIX. Fuel 3.34 gms./sec.
Air 140 ft./sec.

99

FIG. XXXI. Fuel 1.08 gms./sec.
Air 140 ft./sec.

91



97



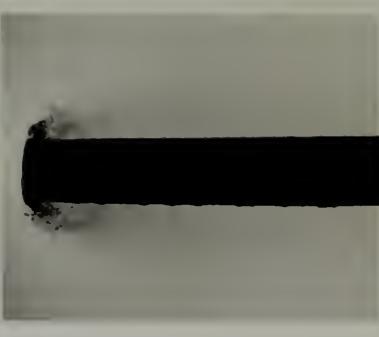
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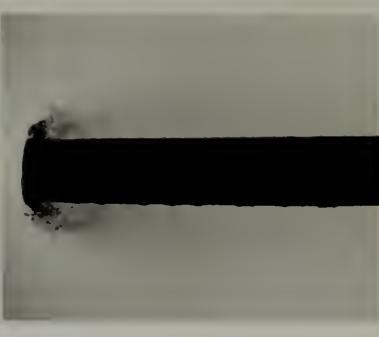
118



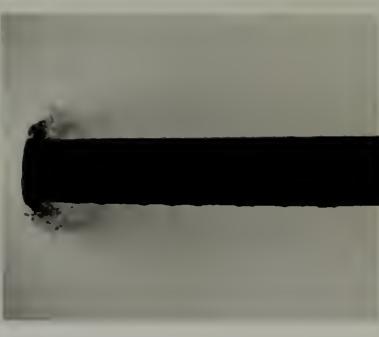
117



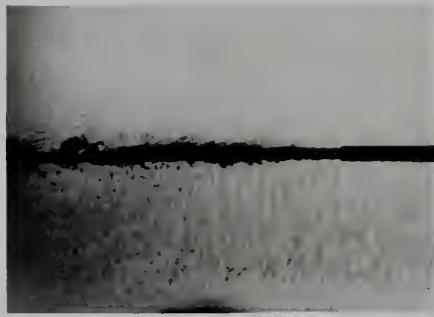
111



104



96



87



88

FIG. XXXI Fuel 3.34 gms./sec.
Air 275 ft./sec.

FIG. XXX Fuel 1.08 gms./sec.
Air 275 ft./sec.



120



119



110



109



107



94



108



80



85

FIG. XXXIII Fuel 3.34 gms./sec.
Air 660 ft./sec.

FIG. XXXII Fuel 1.08 gms./sec.
Air 660 ft./sec.

APPENDIX

XITOMELA

APPENDIX ASYMBOLS

- Ac - Chamber area - in.²
 Ai - Nozzle area, inside - in.²
 d_f - Density of fuel - 0.83 gms./cm.³
 Di - Nozzle diameter, inside - in.
 Do - Nozzle diameter, outside - in.
 ΔP_a - Differential air pressure - in. hg.
 Pc - Chamber pressure - in. hg., gage.
 Pca - Chamber pressure - psia.
 Pd - Diffuser outlet pressure - in. hg., gage.
 Pf - Fuel pump pressure - psi.
 ΔP_f - Differential fuel pressure - in. hg.
 Po - Static pressure downstream of air nozzle - in. hg., gage.
 Poa - Static pressure downstream of air nozzle - psia.
 R - Gas constant for air - 53.34 ft. lb./lb. °Fabs.
 Re - Reynolds' number.
 t_a - Air temperature before diffuser - °F.
 Ta - Air temperature before diffuser - °Fabs.
 Va - Air velocity in chamber - ft./sec.
 Vf - Fuel velocity at nozzle tip - ft./sec.
 Wa - Air weight rate - lb/min. or gms./sec., as indicated.
 Wf - Fuel weight rate - gms./sec.

VOCABULARYEXERCISES

	<u>EXERCISES</u>
\$.al -	upper tier - tv.
\$.ai -	lower tier, inside - tv.
£ .oo\,om -	level of 100 - 0.0 £ am, com
.in -	hostile giant, inside - tv.
Do -	hostile giant, outside - tv.
¥ tv -	littlest size of the business - tv. tv.
Bo -	upper business - tv. tv., eng.
Boo -	upper business - bus.
Boo -	littlest size business - tv. tv., eng.
Tv -	last sum business - bus.
Ma -	littlest last business - tv. tv., eng.
...an .nt -	size business division of the house - tv. tv.
.sing -	last division of the house - tv. tv.
.sing ^o .ip -	new company for it - 23.34 tv. ip, tip.
Boo -	heavy-duty, upper.
.tv ^o -	the same place littlest - tv.
.vca ^o .tv ^o -	the same place place littlest - tv.
.ooo\,tv -	the method in shopping - tv. ooo.
.tv ^o alioot -	last level as house tip - tv. ooo.
.ooo\,eng -	last review last - tv. ooo.

APPENDIX B

SUPPLEMENTARY INTRODUCTION

The atomization of liquids is important for many uses, such as spraying insecticides and paints, laying military smoke screens, and in drying and evaporation operations; but perhaps the most important use is in fuel burning power devices. In the latter it is essential that the fuel be finely atomized to permit intimate mixing of the fuel with as great a surface/volume ratio as possible, and that the fuel be mixed as rapidly as possible with the proper amount of air for combustion.

The characteristics most often used to describe a spray are:

1. Drop size - diameter of the individual particles in the spray.
2. Uniformity - deviation of the drop size from the mean.
3. Intensity - weight rate of flow of fluid per steradian.
4. Dispersion - Ratio of spray volume to liquid volume.
5. Distribution - Ratio of weight of air to fuel at any point in the spray.
6. Penetration - Farthest distance from the orifice along the axis of the spray reached by the spray.

LAUREL

INTRODUCTORY MATTER

Laurel is a genus of trees and shrubs belonging to the family of the Lauraceae. It is a large genus, containing about 100 species, distributed throughout the tropics and subtropics of both hemispheres. The name is derived from the Latin word *laurea*, which means laurel, and refers to the leaves of the tree, which are aromatic and have a strong fragrance. The leaves are evergreen, alternate, elliptical or lanceolate, and have serrated margins. The flowers are small, white, and fragrant, and are produced in clusters at the leaf axils. The fruit is a small, round, black drupe, containing a single seed. The wood of the tree is hard, durable, and has a fine grain, making it suitable for various purposes, such as furniture, paneling, and veneers. The bark is also used in medicine, particularly as a tonic and a stimulant. The leaves are used in perfumery and as a flavoring agent in cooking. The name "Laurel" is also used as a surname, and is derived from the Latin word *laureus*, which means laurel wreath.

7. Penetration rate - Velocity of the spray tip along its axis.
8. Cone angle - The total plane angle between the sides of the spray cone at its apex.

The physical variables affecting the spray characteristics are liquid nozzle geometry, spray container geometry, gas duct geometry, liquid characteristics and gas characteristics. Some theoretical considerations have been made to determine the effect of the above variables on the spray, but quantitative relations are lacking for want of sufficient generalized data.

The generally accepted theory of atomization is that proposed by Castleman (8), who assumes that atomization is the same for solid injection and air injection systems, depending only upon the relative velocity of the gas and liquid. His ligament theory is that droplets form as a consequence of small filaments of liquid being drawn out by the action of air on the main stream of the fuel jet. According to an earlier investigation by Rayleigh (10), the stability of a cylinder of liquid being drawn out and decreasing in diameter for any reason whatsoever decreases as the length of the cylinder is increased in comparison to the diameter of the cylinder. At the point where the length/diameter ratio becomes greater than the circumference of the cylinder, a decided instability is present and the action of surface tension is enough to cause the cylinder of liquid to collapse into droplets. At low air velocities drops are formed directly

the various parts of the organization like - Advertisement, Publicity etc.

There are also

some units - like Local units which perform the

functions of the Local units in the above.

The Central authority, State authority and Local authority

exist at the Central level, State level and Local level respectively.

These three levels have their own functions and responsibilities.

At the Central level, there is a Central Executive Committee, which consists of the General Secretary, Treasurer and General Secretary.

Some Committees like Finance Committee and Propaganda Committee are also present.

These Committees are responsible for the work of the Central authority.

At the State level, there is a State Executive Committee which consists of the State General Secretary, Treasurer and State General Secretary.

These Committees are responsible for the work of the State authority.

At the Local level, there is a Local Executive Committee which consists of the Local General Secretary, Treasurer and Local General Secretary.

These Committees are responsible for the work of the Local authority.

The Central authority has the power to control the State and Local authorities.

The State authority has the power to control the Local authority.

The Local authority has the power to control the Central and State authorities.

The Central authority has the power to control the State and Local authorities.

The State authority has the power to control the Local authority.

The Local authority has the power to control the Central and State authorities.

The Central authority has the power to control the State and Local authorities.

The State authority has the power to control the Local authority.

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The Central authority has the power to control the State and Local authorities.

The State authority has the power to control the Local authority.

The Local authority has the power to control the Central and State authorities.

from the jet by surface tension alone, at high velocities are formed by the combined action of ligament formation by the air and surface tension, while at high orifice Reynolds' numbers drop formation is further augmented by the turbulence of the liquid stream.

Haenlein (18) found that drop formation occurs by four separate mechanisms. At low relative velocity of liquid and air, the air does not appreciably affect the jet. Here the major factor in drop formation is the liquid surface tension, under the influence of which, rotationally symmetrical disturbances are set up in the column which increase until drops are formed. As air velocity increases, the amplitude of the disturbance increases, due to the high air velocity in the peaks and the low air velocity in the troughs of the liquid column. When the velocity is further increased, the initial disturbances become one-sided due to the augmented influence of the air on the column. The surface tension in this case retards wave formation since it tends to return the liquid column to its original form. At this point, the Castleman effect can be seen in liquids of low viscosity. Filaments are torn from the main stream and small drops are formed. With still further increase of velocity, filaments are formed closer and closer to the nozzle until all that can be seen is a cloud of droplets issuing directly from the orifice.

The generally accepted theory of atomization, then, is that at low air velocities drops are formed directly from the jet by surface tension alone; at high air velocities drops are formed by the combined action of ligament formation by the air and of surface tension; while at high orifice Reynolds' numbers drop formation is further augmented by the turbulence of the liquid stream.

and, according to town histories written well over a century ago, was the well known as the "old fountain" which was located in the center of the town. It was the first water source in the town and was used by all the early settlers. The water was clear and cold, and it was said to be good for health. The fountain was located in the middle of the town square, and it was a popular gathering place for the townspeople. The water was used for drinking, washing, and bathing. It was also used for irrigation of crops and for fire fighting. The fountain was a symbol of the town's history and culture, and it was a reminder of the town's past.

APPENDIX CEQUIPMENT DATA

Compressor:

"Ro-Twin" - Allis Chalmers Manufacturing Co.,
Milwaukee, Wisconsin.

Delivery - 533 cubic feet per minute at 100 psi
gage.

Speed - 700 RPM

Compressor Motor:

General Electric Induction Type.

220 v., 60 cycle, 3 phase, 180 amp., 75 H.P.

860 RPM

Fuel Pump:

"Generator" gear type.

Fuel Pump motor:

General Electric Split Phase Resistance

1/2 H.P., 110 v., 60 cycle, 7.5 amp., 1725 RPM.

Camera:

"Voightlander" f 4.5, 9 x 12 cm. film pack.

Lens: Wirsin, f 3.5, 7.5 cm. focal length.

Film: Eastman "Plus-X".

Spark Power Pack:

Rectifier Transformer: Sola Gas Tube Trans-
former, 115 volt input, 15,000 volt output,
825 v.a., 60 ma.

Filament Transformer: "Thordarsen Multivolt"
Electric Manufacturing Company, Chicago.
Type 1-11F61, 63 watt.

Condenser: .01 mfd.

DISCUSSIONATM TRAFFIC

Growth factors:

- "hot-spots" - ATM connection management QoS

- Leverages - ATM connection management QoS

- QoS - ATM connection management QoS

Connectivity factors:

- Greatest traffic migration area

- 500 km² at 60% of 3 Mbps, 190 Mbps, 70 Mbps- 800 km²- 1000 km²

- "hot-spots" exist along

- best route selection

- greatest possible utilization of available bandwidth

- ATM switch, ATM router, ATM bridge, ATM hub, ATM switch

- connection

- "hot-spots" exist along the backbone

- long distance links

- "hot-spots" exist along

- long distance links

- long distance links

- Japanese Governmental cooperation

- telephone company cooperation

- convergence of ATM

Rectifier Tube: Raytheon RKR-7Z.

Resistances: 5 megohm in each lead to condenser.

Spark Gap: $\frac{1}{4}$ " stainless steel rods with $\frac{1}{8}$ " gap.

Reception Date: May 2000 UN-7

Registration: 2nd floor of the main building

Bank Qd: "Santini" 2nd floor with "B" sign.

Address: 2nd floor of the main building

Phone: +962 6 533 0000 - 533 0001 - 533 0002

Address: 2nd floor of the main building

Phone: +962 6 533 0000 - 533 0001 - 533 0002

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Address: 2nd floor of the main building

Phone: +962 6 533 0000 - 533 0001 - 533 0002

APPENDIX DNOZZLE DATA

Each nozzle consists of a polished stainless steel tube tapered at the end and silver soldered to special brass adapters which screw into one of the metal walls, being held there by a nut and two lock washers, as shown in Figure IV. The other end of the adapters connects to a one-half inch brass fuel line. The nozzles were aligned in the adapters so that when the end of the adapter was flush with the metal wall, the nozzle tip was in the center of the chamber cross-section, and in the case of the bent nozzles, the bent portion was also aligned vertically, parallel to the chamber walls.

The nozzle tips were tapered to give a minimum interference between the air and fuel streams at the tip due to wall thickness. The taper was gradual, starting approximately one-half inch from the end, and the maximum taper of any one nozzle did not exceed $1\frac{1}{2}$ degrees, thereby assuring almost uni-directional flow of air along the nozzle at the taper.

No attempt, other than polishing, was made to streamline that part of the nozzles which lay across the air stream. In the case of the five nozzles bent for upstream and downstream injection, that portion of the nozzle which lay along the air stream was made sufficiently long to allow the disturbed air, caused by the cross-stream part of the nozzle, to regain its uni-directional flow once again before reaching the tip.

ANSWERANSWER

Many years ago I had a very bad cold, and my doctor told me to take a long walk every day. I did so, and soon recovered. This morning I got up early and took a walk in the park. When I came home, I found a note on the table which said "Take care of yourself". I was very surprised, because I had not written it. I looked around the room, but could not find any one who had written it. I then remembered that I had written a note to myself the day before, telling myself to take care of myself. I was very pleased to find that the note had been written by myself.

Many years ago, I had a very bad cold, and my doctor told me to take a long walk every day. I did so, and soon recovered. This morning I got up early and took a walk in the park. When I came home, I found a note on the table which said "Take care of yourself". I was very surprised, because I had not written it. I looked around the room, but could not find any one who had written it. I then remembered that I had written a note to myself the day before, telling myself to take care of myself. I was very pleased to find that the note had been written by myself.

Each tip was measured on a metallograph at a magnification of 10.3 to 1. The outside diameters before the taper were measured with a micrometer.

Nozzle	Gage	Diameter Outside at Tip	Diameter Inside at Tip	Wall Thickness at Tip	Diameter Outside before taper
1 Bent	10	0.1080"	0.1050"	0.0015"	0.1330"
1 Perp.	10	0.1100	0.1020	0.0040	0.1280
2 Bent	12	0.0910	0.0845	0.0033	0.1070
2 Perp.	12	0.0950	0.0860	0.0045	0.1030
3 Bent	15	0.0610	0.0550	0.0030	0.0710
3 Perp.	15	0.0650	0.0550	0.0050	0.0710
4 Bent	18	0.0400	0.0340	0.0030	0.0470
4 Perp.	18	0.0380	0.0350	0.0015	0.0460
5 Bent	20	0.0320	0.0230	0.0045	0.0340
5 Perp.	20	0.0320	0.0230	0.0045	0.0340

PROPERTIES OF U. S. NAVY DIESEL OIL

Flash point, closed cup, min.	150 °F
Pour point	0 °F
Cloud point	10 °F
Viscosity, Saybolt Seconds Universal	40
Water and sediment, max.	trace
Total sulphur, max.	1.00%
Carbon residue, on 10% bottoms, max.	0.20%
Ash, max.	0.01%
Corrosion at 212°F, copper strips	Passable
90% distillation temperature, max.	675 °F
Color, max.	5
Ignition quality, min. Centane number	50
Density, gms./cm. ³	0.83
Surface tension, dynes/cm.	25.0

24

-seitigen σ ja abzählen kann so bestimmen wir die möglichen

tests and avoided significant side effects. Let's go to next

With the members of the commission a meeting will be held.

THE JOURNAL OF CLIMATE AND APPLIED CLIMATE SCIENCE

APPENDIX ECALIBRATION OF MANOMETERSFuel Manometer

The fuel mass rate was measured with a fuel over mercury manometer across a .025 sharp edged orifice in standard half-inch brass tubing. Differential pressure in inches of hg. across the orifice was plotted against fuel rate in grams per second. The data for this curve, Figure XXXIV, was obtained by weighing the fuel accumulated in a tared beaker in a given amount of time.

<u>Measured Wt. Grams</u>	<u>Time of Run Seconds</u>	<u>Manometer In. of Hg.</u>	<u>Fuel Rate Gms./Sec.</u>
93.90	181.1	.98	.518
179.22	170.2	3.84	1.052
140.68	90.4	7.74	1.557
137.00	68.4	11.87	2.002
163.20	71.0	15.75	2.30
186.25	71.2	20.11	2.620
181.00	63.0	24.21	2.870
177.85	54.7	30.52	3.245
184.50	52.0	35.67	3.545

Air Mass Rate

The air rate was measured by a standard one-inch sharp-edged orifice. Mass rate calibrations were made for this orifice for air by Dr. R. S. Bevans of the M.I.T. Staff, and Figure XXXV shows curves taken from his data. Differential pressure across the orifice was measured in inches of mercury with an air over mercury manometer. The static pressure down-

五〇〇

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-TEN DAYO ISHTA A KIWI BOMBAKESHT EHT SOZT NADA ISHT ED
BOMBAKESHT NI SULFUR DODGE QTRM 250. A QUOTIO TAKEMAN VIO
TO ASKANTI NI CUMBERG LAKHNOVSKII . QUDUS MASTID HON-TING
EANTAE NI OSARI ISHTA TAKALAYA BESYOLQ EAW SOITIO EHT ASOTOK . BA
-DO EAW , VIXXIE BOMBAKESHT , PAVNO MIDS TOT NADA EHT . BACOSA PER
TAKALAYA BOMBAKESHT NI BOMBAKESHT EHT EAW QUDUS VD BOMBAK
-SHT TO JAHOMA NOVIG A NI

Amount in Rs.	Date of Recd. in Rs.	Rate of Interest per cent	Amount of Interest on Rs.
322.	62.	1.181	02.48
220.1	45.4	2.071	22.971
222.1	47.2	1.09	22.041
500.1	23.11	4.80	20.241
02.5	27.21	0.17	02.481
020.5	11.05	2.12	22.001
078.5	15.45	0.60	181.00
245.4	22.03	2.42	28.771
242.4	20.21	0.52	02.481

Agenda Soni-oso bishabu a yd berimbaun sun sifir ilu
sifit tol oban atan amolawilis ntar anali .colito dega
sun ,WABZ .7.1.2 add to agenda 13 .X .13 yd tol waditu
Lukmanullah .wadu sin marr neder nevano shudo VIII sifit
yebutan to sengon at berimbaun sun colito sit sacker tindas
tindas erabutu sifit sun .Tolongan tindas uyo tilu na diliw

stream from the orifice was measured with an open end mercury manometer in inches. The air temperature was measured at the entrance to the diffuser and the correction to the mass rate made as indicated on the figure.

Chamber Pressure

Because the chamber had to be removed frequently in order to change nozzles and clean the transparent walls, it was deemed impractical to install a permanent static pressure tap in the chamber for measuring chamber pressure. Instead, calibration curves (Figure XXXVI) were constructed between a permanent pressure tap in the 4" x 4" section at the outlet from the air diffuser and a temporary pressure tap replacing the fuel nozzle in the spray chamber. Two calibration curves were necessary for determining chamber pressure because the chamber exhaust piping was lengthened starting with Run 121, thereby influencing both the chamber pressure and the diffuser outlet pressure.

Original Chamber Exhaust Piping

<u>Diffuser pressure (In.Hg.)</u>	<u>Chamber pressure (In.Hg.)</u>
10.1	9.8
10.9	10.0
11.7	10.0
12.4	9.9
13.0	9.8
13.7	9.6
14.5	9.3
15.4	9.1
16.3	8.9
17.8	8.7
18.5	8.3
19.8	8.0
23.0	7.8

-the day made an ally between the two cities and their
businesses are interdependent and so on. This is the reason why
one of the causes of the separation was the
fact that the two cities were not able to
exist together.

Chamber of Commerce

Because the chamber had to be removed immediately to
it, "the Chamber of Commerce" became the "Chamber of Commerce". It
was decided that it would be better to have a separate
chamber for the chamber of commerce. This
is later, called "the Chamber of Commerce" (商会) were confirmed
to have a permanent presence for the "X" and "Y" areas.
This outcome from the different parts of a political
party involved the last name in the party's name.
Two
political parties were necessary for determining which
business people the chamber of commerce
should deal with from 1911, especially international ones like the
business and the other business.

Official Chamber of Commerce

<u>Official Chamber of Commerce (OCC)</u>	<u>Different Business (Different Industries)</u>
B.9	10.1
B.10	9.0
B.11	7.1
B.12	4.2
B.13	0.3
B.14	2.3
B.15	1.4
B.16	1.2
B.17	1.0
B.18	1.2
B.19	2.8
B.20	2.8
B.21	0.3

Modified Chamber Exhaust Piping

<u>Diffuser pressure (In.Hg.)</u>	<u>Chamber pressure (In.Hg.)</u>
7.4	7.0
8.1	7.2
9.0	7.3
9.8	7.3
10.5	7.3
11.3	7.2
12.3	7.1
13.0	6.9
14.2	6.6
15.4	6.4
16.8	6.1
19.4	5.8
22.8	5.9

Spark Timing

An attempt was made by Robillard to measure the duration of the spark and, consequently, the exposure time for the "instantaneous" photographs of the spray. He indicates that the exposure time is less than $.25 \times 10^{-7}$ seconds. No further attempt at physical measurement of the spark time was made by the authors, since it was felt that more accurate information than that given was not vital to a qualitative investigation.

Magnetic Dipole Moment

<u>(.M.H.D) Magnetic Dipole</u>	<u>(.M.M.)</u>	<u>Dipole Moment</u>
0.5		1.5
5.5		1.8
3.5		0.9
4.5		2.0
3.5		10.2
5.5		11.3
1.5		15.3
6.5		13.0
5.5		14.5
4.5		15.7
1.5		8.9
8.5		14.9
9.5		22.8

Time limit

The time limit was made by the addition of 10 seconds to the time taken for the "run" and the time taken for the "stop". The time limit was set at 10 x 25 = 250 seconds. No further attempts were made to improve the time limit.

The time limit was made by the addition of 10 seconds to the time taken for the "run" and the time taken for the "stop". The time limit was set at 10 x 25 = 250 seconds. No further attempts were made to improve the time limit.

FIGURE XXXIV
CALIBRATION CURVE OF 2000' MACH 0.655 AIRCRAFT FOR NAVY STANDARD DIESEL OIL

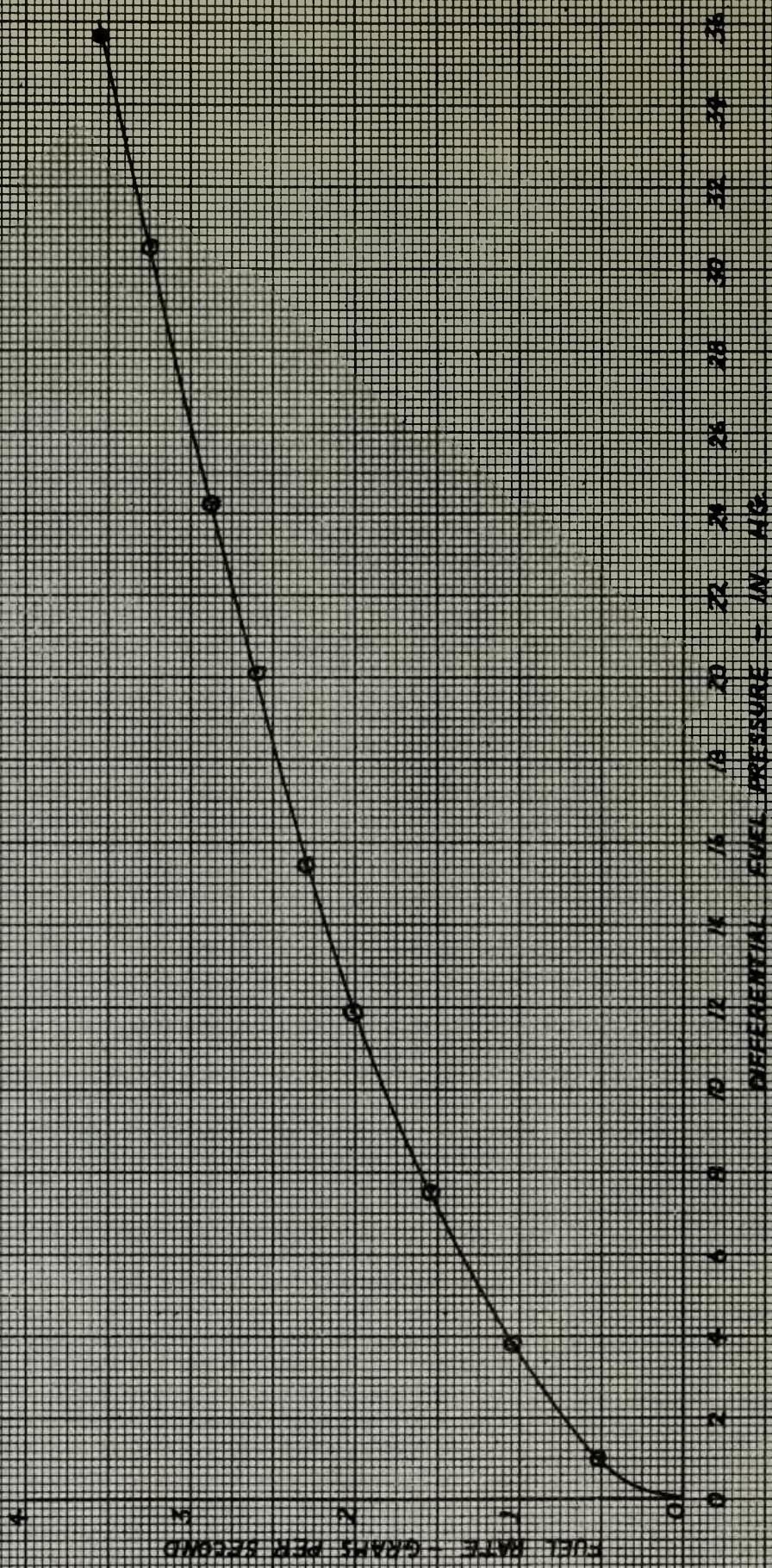
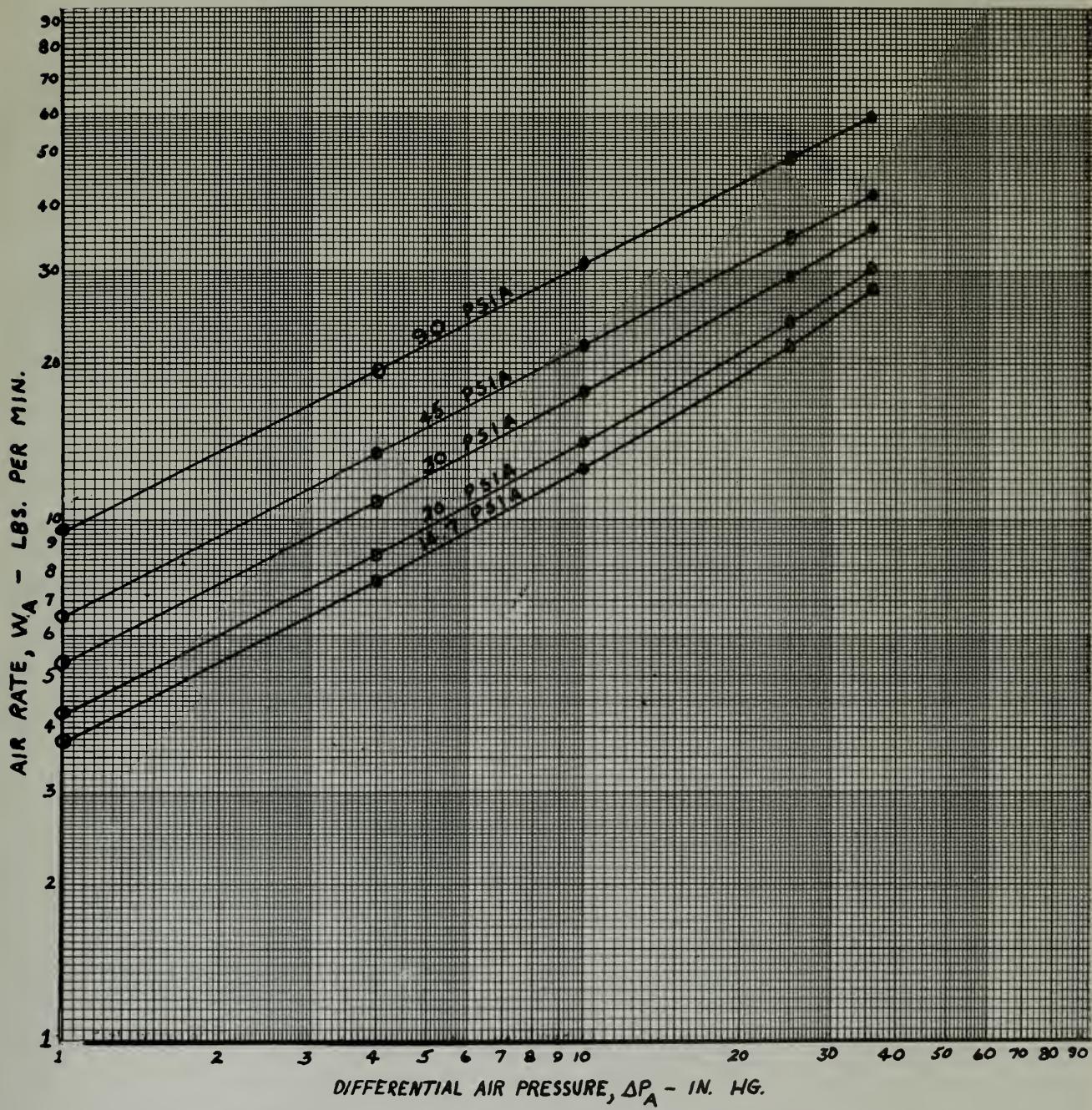
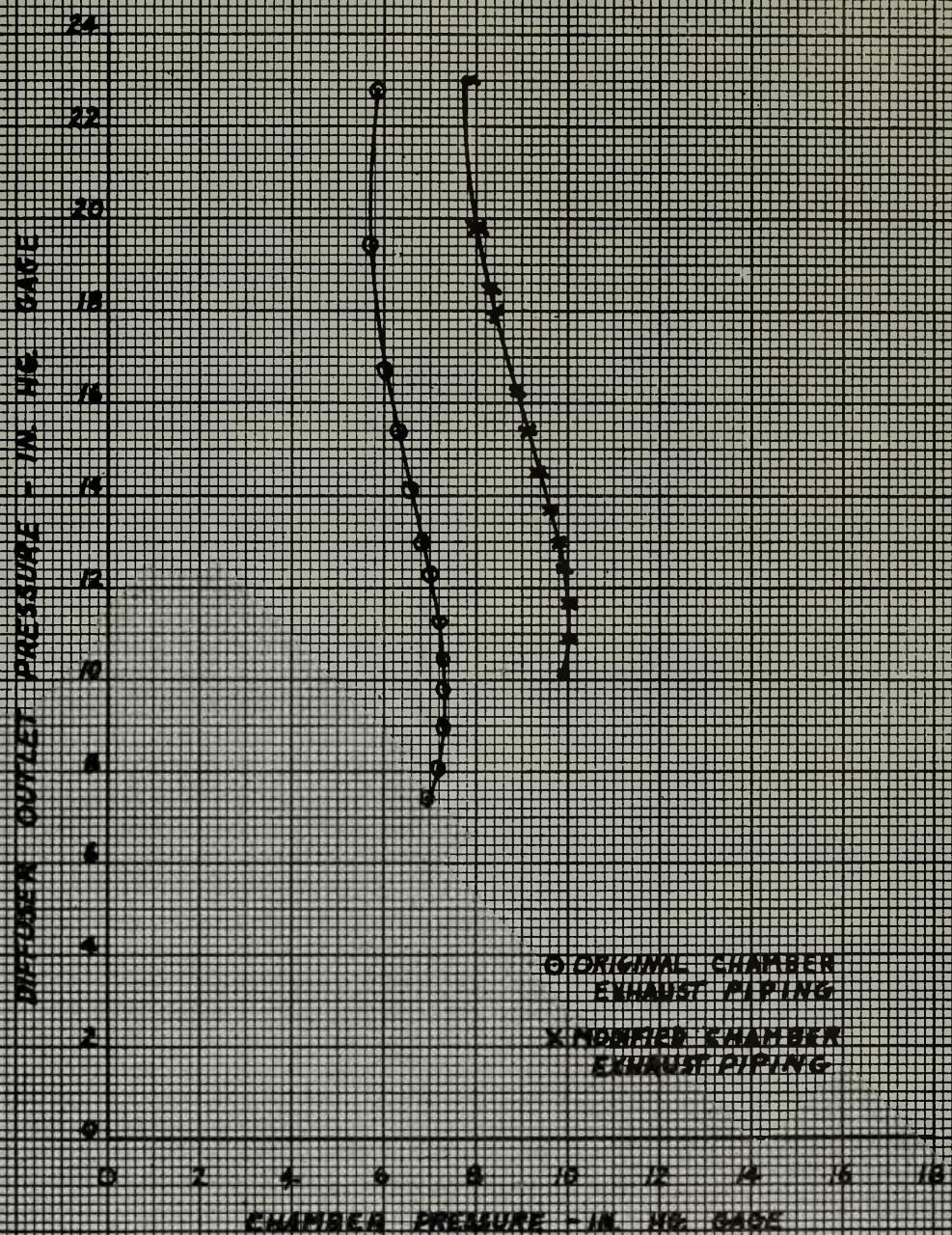


FIGURE XXXV
CALIBRATION CURVE FOR ONE INCH AIR ORIFICE FROM DATA OF R. S. BEVANS
STATIC PRESSURE DOWNSTREAM OF ORIFICE - AIR TEMPERATURE 75F*



*AIR RATE CORRECTED FOR TEMPERATURE = $W_A(1.06 - 0.0008t^{\circ}\text{F})$

FIGURE XXXVI
CHAMBER PRESSURE MANOMETER
CALIBRATION



APPENDIX F

DATA AND CALCULATIONS

EXPLANATION

MAP OF THE CULTIVATIONS

RUN	ΔP_a	ΔP_f	Po	in.hg. gage	Pd	in.hg. gage	Pc	in.hg. gage	Pea	Wa	Wf	Va	ft. sec.	Vf	ft. sec.
17	25.0	32.6	14.2	16.1	16.4	16.4	7.3	7.3	18.1	17.7	17.7	665	4.95	4.87	
25	25.5	32.2	14.6	16.4	8.9	9.9	7.8	7.8	17.9	18.2	18.3	673	8.7	8.7	
26	26.0	32.1	7.0	7.8	7.1	7.1	6.1	6.1	17.0	17.7	17.7	278	8.6	8.6	
29	25.5	1.7	6.6	6.7	16.1	16.1	18.7	18.7	21.6	18.3	18.3	145	2.8	2.8	
34	26.0	4.0	12.8	8.2	9.0	16.1	16.1	19.0	19.0	18.3	18.3	284	22.8	22.8	
39	25.2	6.2	33.2	32.2	11.9	16.1	20.5	21.6	17.7	17.7	17.7	660	3.5	3.5	
40	25.1	6.2	32.2	31.1	14.1	14.1	18.7	18.7	18.3	18.3	18.3	286	3.5	3.5	
50	25.0	6.2	30.8	30.8	8.8	9.0	18.3	18.6	18.0	18.2	18.2	147	1.1	1.1	
51	25.3	1.7	5.3	3.8	7.4	7.4	7.1	7.1	21.7	17.7	17.7	147	3.5	3.5	
54	25.0	1.7	31.0	31.0	8.0	7.8	7.8	7.8	19.1	18.3	18.3	278	2.4	2.4	
74	25.0	5.9	32.0	32.0	14.2	16.1	8.9	8.9	18.4	18.2	18.2	669	3.5	3.5	
75	25.0	5.9	32.0	32.0	3.8	7.5	7.5	7.4	18.2	18.1	18.1	150	0.7	0.7	
77	25.0	5.9	32.0	32.0	4.0	7.1	7.1	7.0	18.1	18.1	18.1	140	16.2	16.2	
79	25.0	5.9	32.0	32.0	4.0	7.0	7.0	7.0	18.1	18.1	18.1	140	49.0	49.0	
80	25.0	5.9	32.0	32.0	3.3	13.7	13.7	13.7	17.5	17.5	17.5	96	1.1	1.1	
85	27.4	3.3	32.3	32.3	3.8	9.8	9.8	9.8	16.7	16.7	16.7	191	3.5	3.5	
86	24.8	5.6	32.3	32.3	3.8	8.3	9.3	9.3	9.3	9.3	9.3	709	14.1	14.1	
87	24.6	5.6	32.3	32.3	3.2	7.6	8.6	8.6	8.9	8.9	8.9	661	49.2	49.2	
88	24.6	5.6	32.3	32.3	3.2	7.6	8.6	8.6	8.9	8.9	8.9	274	3.5	3.5	
91	25.2	3.3	31.6	31.6	3.2	7.8	8.4	8.4	19.5	19.5	19.5	197	15.4	15.4	
92	25.2	3.3	31.6	31.6	3.5	7.8	8.2	8.2	18.4	18.4	18.4	282	48.6	48.6	
94	25.2	3.3	31.0	31.0	3.8	13.6	13.6	13.6	21.4	21.4	21.4	198	22.0	22.0	
95	26.1	6.2	31.0	31.0	3.9	8.4	8.4	8.4	21.2	21.2	21.2	667	7.1	7.1	
96	26.1	6.2	32.0	32.0	3.8	8.1	9.2	9.2	18.7	18.7	18.7	282	7.2	7.2	
97	26.0	6.0	32.0	32.0	3.8	7.6	7.8	7.8	18.4	18.4	18.4	276	22.4	22.4	
98	26.1	6.2	32.0	32.0	3.8	7.6	7.8	7.8	18.3	18.3	18.3	149	7.1	7.1	
99	26.1	6.2	33.1	33.1	3.8	7.4	7.4	7.4	18.5	18.5	18.5	139	8.8	8.8	
101	26.1	6.2	33.1	33.1	4.0	7.4	7.4	7.4	18.7	18.7	18.7	295	2.8	2.8	

RUN	ΔP_{a}	ΔP_{f}	Po	Pd	in.hg. gage	in.hg. gage	Pc	in.hg. gage	Pca	Va	Wf	Vf	ft. sec.
	in.hg.	in.hg.											
172	6.1	4.1	10.7	11.7	10.0	19.9	19.6	79.9	1.09	266	7.3		
173	6.1	4.1	10.7	11.7	10.0	19.9	19.6	79.9	1.09	266	7.3		
174	26.0	4.1	17.0	20.1	8.0	25.1	18.6	189.8	1.09	665	7.3		
175	1.8	4.2	11.1	11.3	10.0	20.2	19.6	43.1	1.10	144	7.4		
176	1.7	3.2	10.3	10.7	10.0	19.8	19.6	41.0	3.41	157	22.9		
177	6.2	4.1	11.0	11.5	10.0	20.1	19.6	81.9	1.09	272	16.0		
178	6.2	4.0	11.0	11.5	10.0	20.1	19.6	81.9	1.08	272	15.9		
179	6.2	4.0	11.0	11.5	10.0	20.1	19.6	81.9	1.08	272	15.9		
180	6.2	4.0	11.0	11.5	10.0	20.1	19.6	81.9	1.08	272	15.9		
181	6.2	32.1	11.0	11.5	10.0	20.1	19.6	81.9	3.35	272	48.2		
182	25.7	5.9	16.4	19.7	8.0	22.8	18.6	186.0	1.07	653	15.7		
183	5.9	4.0	11.0	12.3	10.0	20.1	19.6	80.5	1.08	268	15.9		
184	6.0	32.2	11.1	12.4	9.9	20.2	19.6	81.2	3.36	270	49.4		
185	24.8	32.1	15.1	19.3	8.1	22.1	16.7	178.8	3.35	624	49.2		
186	25.0	4.0	15.7	20.1	8.0	22.4	18.6	182.1	1.08	640	15.9		
187	6.1	4.0	10.1	10.5	9.9	19.7	19.6	38.7	1.08	129	15.9		
188	25.0	4.0	10.1	10.5	10.3	9.9	20.3	19.6	38.7	1.08	129	49.2	
189	21.5	4.0	15.7	20.2	8.0	22.4	18.6	182.1	1.08	640	7.3		
190	1.5	32.1	10.1	10.5	9.9	20.3	19.6	82.0	3.36	273	22.6		
191	1.5	32.1	11.3	12.7	9.9	20.3	19.6	82.0	1.09	273	7.3		
192	6.2	4.1	11.3	12.3	10.0	20.2	19.6	82.0	3.36	273	7.3		
193	6.1	32.2	11.2	12.3	10.0	20.2	19.6	82.0	1.08	640	7.3		
194	25.0	4.0	15.7	20.2	8.0	22.4	18.6	182.1	1.08	640	22.4		
195	24.8	31.8	15.1	19.3	8.1	22.1	18.7	178.8	3.35	624	7.3		
196	1.7	4.1	11.0	11.3	10.0	20.1	19.6	41.6	1.09	139	22.4		
197	1.7	31.8	11.0	11.3	10.0	20.1	19.6	41.6	3.35	139	22.4		
198	1.7	31.8	11.0	11.3	10.0	20.1	19.6	41.6	1.09	618	2.8		
199	25.2	4.1	15.6	17.0	8.7	21.4	19.0	180.0	1.09	618	2.8		
200	24.9	32.0	15.5	16.7	8.8	20.4	19.0	177.8	3.34	610	3.6		
201	6.3	4.0	10.7	11.8	10.0	20.0	19.6	82.0	1.08	272	3.6		
202	6.2	32.0	11.3	12.7	9.9	20.3	19.6	82.0	3.34	272	2.7		
203	1.7	3.8	10.5	10.9	10.0	19.9	19.6	41.6	1.05	139	8.6		
204	1.7	31.6	10.5	10.9	10.0	19.9	19.6	41.6	3.32	139	8.6		
205	1.5	32.0	10.1	10.5	9.9	19.7	19.6	38.7	1.07	129	3.6		
206	1.5	4.2	12.2	12.7	9.9	20.7	19.6	82.0	1.10	273	1.2		

Year	Population	Area (sq km)	Density (per sq km)
1951	10,000	100	100
1956	12,000	100	120
1961	15,000	100	150
1966	18,000	100	180
1971	22,000	100	220
1976	26,000	100	260
1981	30,000	100	300
1986	35,000	100	350
1991	40,000	100	400
1996	45,000	100	450
2001	50,000	100	500
2006	55,000	100	550
2011	60,000	100	600
2016	65,000	100	650
2021	70,000	100	700
2026	75,000	100	750
2031	80,000	100	800
2036	85,000	100	850
2041	90,000	100	900
2046	95,000	100	950
2051	100,000	100	1000
2056	105,000	100	1050
2061	110,000	100	1100
2066	115,000	100	1150
2071	120,000	100	1200
2076	125,000	100	1250
2081	130,000	100	1300
2086	135,000	100	1350
2091	140,000	100	1400
2096	145,000	100	1450
2101	150,000	100	1500
2106	155,000	100	1550
2111	160,000	100	1600
2116	165,000	100	1650
2121	170,000	100	1700
2126	175,000	100	1750
2131	180,000	100	1800
2136	185,000	100	1850
2141	190,000	100	1900
2146	195,000	100	1950
2151	200,000	100	2000
2156	205,000	100	2050
2161	210,000	100	2100
2166	215,000	100	2150
2171	220,000	100	2200
2176	225,000	100	2250
2181	230,000	100	2300
2186	235,000	100	2350
2191	240,000	100	2400
2196	245,000	100	2450
2201	250,000	100	2500
2206	255,000	100	2550
2211	260,000	100	2600
2216	265,000	100	2650
2221	270,000	100	2700
2226	275,000	100	2750
2231	280,000	100	2800
2236	285,000	100	2850
2241	290,000	100	2900
2246	295,000	100	2950
2251	300,000	100	3000
2256	305,000	100	3050
2261	310,000	100	3100
2266	315,000	100	3150
2271	320,000	100	3200
2276	325,000	100	3250
2281	330,000	100	3300
2286	335,000	100	3350
2291	340,000	100	3400
2296	345,000	100	3450
2301	350,000	100	3500
2306	355,000	100	3550
2311	360,000	100	3600
2316	365,000	100	3650
2321	370,000	100	3700
2326	375,000	100	3750
2331	380,000	100	3800
2336	385,000	100	3850
2341	390,000	100	3900
2346	395,000	100	3950
2351	400,000	100	4000
2356	405,000	100	4050
2361	410,000	100	4100
2366	415,000	100	4150
2371	420,000	100	4200
2376	425,000	100	4250
2381	430,000	100	4300
2386	435,000	100	4350
2391	440,000	100	4400
2396	445,000	100	4450
2401	450,000	100	4500
2406	455,000	100	4550
2411	460,000	100	4600
2416	465,000	100	4650
2421	470,000	100	4700
2426	475,000	100	4750
2431	480,000	100	4800
2436	485,000	100	4850
2441	490,000	100	4900
2446	495,000	100	4950
2451	500,000	100	5000
2456	505,000	100	5050
2461	510,000	100	5100
2466	515,000	100	5150
2471	520,000	100	5200
2476	525,000	100	5250
2481	530,000	100	5300
2486	535,000	100	5350
2491	540,000	100	5400
2496	545,000	100	5450
2501	550,000	100	5500
2506	555,000	100	5550
2511	560,000	100	5600
2516	565,000	100	5650
2521	570,000	100	5700
2526	575,000	100	5750
2531	580,000	100	5800
2536	585,000	100	5850
2541	590,000	100	5900
2546	595,000	100	5950
2551	600,000	100	6000
2556	605,000	100	6050
2561	610,000	100	6100
2566	615,000	100	6150
2571	620,000	100	6200
2576	625,000	100	6250
2581	630,000	100	6300
2586	635,000	100	6350
2591	640,000	100	6400
2596	645,000	100	6450
2601	650,000	100	6500
2606	655,000	100	6550
2611	660,000	100	6600
2616	665,000	100	6650
2621	670,000	100	6700
2626	675,000	100	6750
2631	680,000	100	6800
2636	685,000	100	6850
2641	690,000	100	6900
2646	695,000	100	6950
2651	700,000	100	7000
2656	705,000	100	7050
2661	710,000	100	7100
2666	715,000	100	7150
2671	720,000	100	7200
2676	725,000	100	7250
2681	730,000	100	7300
2686	735,000	100	7350
2691	740,000	100	7400
2696	745,000	100	7450
2701	750,000	100	7500
2706	755,000	100	7550
2711	760,000	100	7600
2716	765,000	100	7650
2721	770,000	100	7700
2726	775,000	100	7750
2731	780,000	100	7800
2736	785,000	100	7850
2741	790,000	100	7900
2746	795,000	100	7950
2751	800,000	100	8000
2756	805,000	100	8050
2761	810,000	100	8100
2766	815,000	100	8150
2771	820,000	100	8200
2776	825,000	100	8250
2781	830,000	100	8300
2786	835,000	100	8350
2791	840,000	100	8400
2796	845,000	100	8450
2801	850,000	100	8500
2806	855,000	100	8550
2811	860,000	100	8600
2816	865,000	100	8650
2821	870,000	100	8700
2826	875,000	100	8750
2831	880,000	100	8800
2836	885,000	100	8850
2841	890,000	100	8900
2846	895,000	100	8950
2851	900,000	100	9000
2856	905,000	100	9050
2861	910,000	100	9100
2866	915,000	100	9150
2871	920,000	100	9200
2876	925,000	100	9250
2881	930,000	100	9300
2886	935,000	100	9350
2891	940,000	100	9400
2896	945,000	100	9450
2901	950,000	100	9500
2906	955,000	100	9550
2911	960,000	100	9600
2916	965,000	100	9650
2921	970,000	100	9700
2926	975,000	100	9750
2931	980,000	100	9800
2936	985,000	100	9850
2941	990,000	100	9900
2946	995,000	100	9950
2951	1,000,000	100	10000

<u>RUN</u>	<u>A Pa</u>	<u>Δ Pf</u>	<u>Po</u>	<u>Pd</u>	<u>in.hg.</u>	<u>in.hg.</u>	<u>Base</u>	<u>gage</u>	<u>psia</u>	<u>Pca</u>	<u>Va</u>	<u>Wf</u>	<u>Vf</u>	<u>ft.</u>	<u>ft.</u>	<u>sec.</u>	
208	6.0	31.8	11.7	12.7	9.9	20.5	19.6	80.5	3.53	268	3.6						
209	25.7	32.3	15.8	19.2	8.1	22.5	18.7	186.0	3.36	650	3.6						
210	24.6	4.0	15.1	16.6	8.8	21.2	19.0	178.8	1.08	614	1.2						
211	1.6	4.1	10.3	10.4	9.9	19.8	19.6	39.4	1.09	131	0.8						
212	1.5	32.1	10.1	10.3	9.9	19.7	19.6	38.7	3.55	129	2.4						
214	5.8	32.2	12.5	12.7	9.9	20.9	19.6	80.5	3.36	268	2.4						
215	24.8	4.0	15.1	19.3	8.1	22.1	18.7	178.8	1.08	624	0.8						
216	25.0	32.1	15.7	20.2	8.0	22.4	18.6	182.1	3.35	640	2.4						
220	25.3	4.0	15.6	19.1	8.1	22.4	18.7	186.0	1.08	650	6.9						
223	1.7	4.1	10.5	10.9	10.0	19.9	19.6	41.6	1.09	139	1.2						

APPENDIX GSAMPLE CALCULATIONS

Run 180 - Nozzle 5 Downstream with modified chamber exhaust piping.

Calculate: (1) Fuel weight rate, (2) fuel velocity, (3) air weight rate, and (4) air velocity.

Assume: (1) Compressible, steady state air flow in the constant area chamber. This assumption is valid for the maximum Mach number encountered, approximately 0.6.

(2) The temperature of the air preceding the air diffuser constant and equal to the temperature of the air in the chamber. The variation in temperature preceding the diffuser in all runs was no greater than four degrees and the maximum temperature difference between it and the chamber temperature was 10°F , this maximum occurring only at the highest air rate. To simplify tedious calculations, a mean temperature of 95°F was used for all runs. The maximum error in air weight rate by this assumption was 2% at the highest air rate, less for lower air rates. Since the use of Figure XXXV gave an error of approximately 5%, this assumption was justified.

ANNUAL REPORTSUMMARY STATEMENT

For 1930 - Report & Information with regard to expenses
bills.

This is (3) "Review Test" (2) "Test Review Test" (1) "Test
Review Test" and (4) "Test Review Test".
The (1) "Compliance" section is the
concluding statement of the
for the maximum mark number indicated, approxi-
mately 0.0.

(5) The characteristic of the publications are the
different contents and the composition of the
group is not the same. The publications
are now in the different parts of the
country and the different members
of the group are not gathered
in one place. The publications
are not published by the group
but by individual members only.¹⁰⁰ The
number of subscribers is not
the same as the number of
members, a mean percentage
of 25% was given for
the total number of the members
and the number of the publications
was not known at the time. Since the
XXX gave an order to "abolish it", this is
supposed to be the reason.

ANSWER AND DISCUSSIONS
(Cont'd)

Given: $t_a = 95^{\circ}\text{F}$ $T_a = 555^{\circ}\text{F}$ abs.

$P_f = 90$ psi.

$\Delta P_f = 4.0$ in. hg.

$\Delta P_a = 6.2$ in. hg.

$P_d = 11.5$ in. hg. gage

$P_o = 11.0$ in. hg. gage $P_{oa} = 20.1$ psia.

$d_f = 0.83$ gms./cm.³

$D_i = 0.023$ in. $A_i = 4.155 \times 10^{-4}$ in.² for
nozzle 5 Downstream

$A_c = 1.0$ in.²

Solution: (1) With $\Delta P_f = 4.0$, enter curve, Figure XXXIV,
read $W_f = 1.08$ gms./sec.

$$(2) V_f = \frac{W_f}{A_i d_f}$$

$$= \frac{1.08 \text{ gms./sec.}}{4.155 \times 10^{-4} \text{ in.}^2 \quad 0.83 \frac{\text{gms}}{\text{cm.}^3} \quad 6.45 \frac{\text{cm.}^2}{\text{in.}^2} \quad 30.48 \frac{\text{cm.}}{\text{ft.}}}$$

$$= 15.9 \text{ ft./sec.}$$

(3) With $\Delta P_a = 6.2$ and $P_{oa} = 20.1$ psia, enter
curve, Figure XXXV, read $W_a = 11.0$ lb./min.
 W_a (corrected for temperature)

$$= W_a (1.06 - 0.0008 t_a^{\circ}\text{F})$$

$$= 11.0 (1.06 - 0.008 \times 95)$$

$$= 10.81 \text{ lb./min.}$$

$$= \frac{10.81 \text{ lb./min} \quad 453.6 \text{ gms./lb.}}{60 \text{ sec./min.}}$$

$$= 81.9 \text{ gms./sec.}$$

(cont'd)

$$\text{Gross: } \text{P} = 250 \text{ kg} = 250 \text{ kg per sq m}$$

$$\text{P} = 30 \text{ kN}$$

$$\Delta P = 0.4 \text{ kN}$$

$$\Delta P = 0.5 \text{ kN}$$

$$\Delta = 11.2 \text{ m. per sec}$$

$$T_0 = 10 \text{ s. for } 0.1 \text{ kN}$$

$$g = 9.81 \text{ m/sec}^2$$

$$Df = 0.053 \text{ m. } \frac{\Delta}{\text{max deflection}}$$

$$\Delta = 0.1 \text{ m}$$

Position: (1) At first deflection, $\Delta = 0.4 \text{ m}$, outer centre, $T_0 = 10 \text{ s}$

$$.001 \times 20.1 = 20.1 \text{ rad/sec}$$

$$\frac{\frac{M}{2}}{\frac{EI}{L}} = \omega \quad (2)$$

$$.001 \times 20.1 =$$

$$\frac{.001 \times 20.1}{.001 \times 20.1} \times 10^{-4} \times 20.1 =$$

$$.001 \times 20.1 =$$

$$.001 \times 20.1 = 20.1 \text{ rad/sec } \Delta = 20.1 \text{ rad/sec } (3)$$

$$.001 \times 20.1 = 20.1 \text{ rad/sec, ready for eqn (2)}$$

as (corresponding to deflection)

$$(T_0^2 \times 800.0 - 0.1) M =$$

$$(20 \times 800.0 - 0.1) 0.1 =$$

$$.001 \times 20.1 =$$

$$\frac{.001 \times 20.1 \times 10.0}{.001 \times 20.1} =$$

$$.001 \times 20.1 =$$

SAMPLE CALCULATIONS
(Cont'd)

(4) With $P_d = 11.5$, enter curve, Figure XXXVI,
modified chamber exhaust piping, read
 $P_c = 10.0$ in. hg. gage, $P_{ca} = 19.6$ psia.

Then $V_a = \frac{W_a R T_a}{P_{ca} A_c}$ where R is the gas
constant for air =
53.34 ft. lb./lb. F abs.

$$= \frac{81.9 \frac{\text{gms.}}{\text{sec.}} \quad 53.34 \frac{\text{ft.lb.}}{\text{lb.Fabs.}} \quad 555 \text{ F abs.}}{19.6 \frac{\text{lb.}}{\text{in.}^2} \quad 1.0 \text{ in.}^2 \quad 453.6 \frac{\text{gms.}}{\text{lb.}}} \\ = 272 \text{ ft./sec.}$$

SOURCE CALCULATIONS
(Confidential)

WTPB = 1000 cu m/day (A)

Water treatment plant efficiency = 90%

Efficiency of pump = 0.90 = 0.90 cu m/day

Efficiency of motor = 0.90 = 0.90 cu m/day

Efficiency of pump = 0.90 = 0.90 cu m/day

$$\frac{1000 \text{ cu m/day}}{\frac{0.90}{0.90} \times 0.90 \text{ cu m/day}} = 1111 \text{ cu m/day}$$

$$1111 \text{ cu m/day} = 1111 \text{ m}^3/\text{day}$$

APPENDIX HLITERATURE CITATIONS

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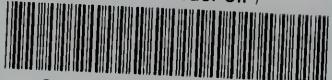
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