NATIONAL BUREAU OF STANDARDS REPORT

2864

MODIFICATION OF STANDARD ARMY GASOLINE LANTERN

by

Selden D. Cole
Paul R. Achenbach

Report to
Office of The Quartermaster General
Department of the Army

NBS

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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- Office of Basic Instrumentation
- Office of Weights and Measures.

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To
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MODIFICATION OF STANDARD ARMY GASOLINE LANTERN

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Abstract

The mantle-holder assemblies of several standard Army gasoline lanterns were modified by inserting a metal spider between the mantle-holder and its supporting tube. These spiders consisted of a central target to break up the jet of liquid fuel discharged from the generator orifice during lighting operations, and three supporting arms. They were designed to reduce mantle breakage which had been found to be a serious problem in the use of these lanterns. The tests showed that the spiders were effective in reducing mantle breakage, but that their use decreased the luminosity of the standard lantern considerably. Reaming out the mantle-holder and its supporting tube to provide a free area 25% greater than the original unmodified mantle-holder resulted in significantly greater luminosities than were observed for the original lantern at all tank pressures. The generator temperatures were found to be practically identical before and after modification.

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1. INTRODUCTION

Standard Lantern Adaptation

In compliance with a request of the Office of The Quartermaster General, tests were made of a standard gasoline lantern, as made by the Coleman Company, to determine the operating characteristics at normal ambient temperature after the mantle-holder assembly had undergone a modification intended to prevent excess mantle breakage.

2. TEST EQUIPMENT

Three lanterns were used in the mantle breakage test and one lantern was used for comparisons of luminosity. Fig. 0 is a photograph of a typical standard lantern.

The gasoline tanks of the three lanterns used to study mantle breakage were connected in parallel to a high pressure air line so that the same pressure could be maintained on each of the three tanks. A pressure regulator in the common air supply line was used to adjust the tank pressure to the desired values. One lantern was tested as delivered by the manufacturer; the other two lanterns were modified only with respect to the interior of the mantle-holders. One of the two modified lanterns was equipped with a 1/32" thick spider and the other with a 1/16" thick spider. The size and shape of the spiders and their location in the mantle-holder are shown in Fig. 1. The spider shown in Fig. 1 obstructed 33.2% of the free area of the 5/16" orifice in the original mantle-holder. After reaming out the mantle-holder to a diameter of 13/32" the spider obstructed 24.7% of the area. The free area of the modified mantle-holder with the spider in place, as shown in Fig. 1, is 27.2% greater than the area of the original 5/16" orifice without the spider.

All temperatures were measured with 30 gage copper-constantan thermocouples except those on the lantern generator where 36 gage copper-constantan thermocouples were used. Pressures were measured with a three-inch Bourdon gage graduated from 0 to 60 psi.

Luminosity was measured with a General Electric Lumenometer graduated in foot-candles from 0 to 100 and from 0 to 1000. New generators were used for all tests and the gasoline was purchased to conform to Federal Specification VV-G-109 for Unleaded Gasoline.

3. TEST PROCEDURE

To observe the effect of the spiders on mantle breakage, new mantles were affixed to the three lanterns and burned off as per instructions. At a predetermined pressure, the lanterns were lighted one at a time and allowed to burn for several minutes after which they were turned off and cooled down to room temperature. With the lanterns cold, the valve was opened to lighting position until liquid gasoline dropped from the mantle and appeared on the generator. At this time the valve was closed and time given for the gasoline to evaporate. This procedure was followed with each lantern two to three times between operations of actually lighting the mantle.

In the luminosity tests the candlepower was measured with the glass globe and hood in place as in actual use. The glass was meticulously cleaned and put in place only after the mantle was burning with full illumination. Temperatures on the generator were measured in three places, as indicated on the generator outline in Fig. 3, by wrapping the fine gage thermocouple wire around the generator tube and binding the junctions down with lengths of glass thread.

The lantern was first lighted with a tank pressure of about 25 psi so as to obtain a bulbous shape to the new mantle. The lantern was turned off and allowed to cool to room temperature and the pressure reduced to zero.

With the 1/32" spider in place, the lantern was lighted with 5 psi pressure on the tank. After the generator temperature ceased to rise, readings were recorded every 10 minutes of the room temperature, the three temperature stations on the generator and the luminosity of the lantern. At the completion of each set of readings the pressure on the tank was increased 5 psi until a maximum of 40 psi had been reached. After completion of the tests with the 1/32 inch spider the lantern was turned off and allowed to cool to room temperature. The 1/32" spider was carefully removed from the mantle-holding assembly so that the mantle was not damaged in any way. The lantern was assembled as a standard lantern without the spider using the same mantle, and the same procedure was followed as described above. Then, as before, the lantern was turned off and allowed to cool to room temperature at which time the 1/16" spider was carefully placed in position so as not to damage the mantle. The same procedure of recording temperatures and luminosities and increasing the pressure by 5 psi every ten minutes to a maximum pressure of 40 psi was followed.

Check runs were made using new mantles in conjunction with the 1/32", 1/16" spiders and without the spiders.

The diameter of the orifice in the mantle-holding tip was increased from 5/16" to 13/32" by reaming it out, and the tube connecting the mantle-holding tip to the generator was bored out to 27/64" for a depth of 1/4". With the 1/32" spider installed as shown in lower part of Fig. 1, the routine testing procedure followed of increasing pressure on the tank every ten minutes after recording room temperature, generator temperature and luminosity was repeated.

4. TEST RESULTS

In the breakage testing of mantles, each lantern was operated as a standard lantern, or as modified lantern with the 1/32" spider or with the 1/16" spider in the mantle tip. During the series of tests the two spiders were used in each of the three test specimens and each of the three lanterns was operated as a standard lantern a part of the time. During the series of tests each mantle-holder assembly, with or without a spider, was subjected to the normal operation of lighting a cold lantern twenty-four times as described in the Test Procedure. The 24 lighting operations were distributed among the three test specimens in each case. The mantle was actually lighted during only about one-fourth of the 24 operations.

Under these conditions each mantle tip assembly was subjected to the same flow of gasoline from the same orifices. With the standard lantern assembly, eight new mantles were required in twenty-four lighting operations. A new mantle was installed when the netting of the old one was so damaged that the luminosity was severely affected. This was apparent when a hole greater than 1/4 inch had developed in the netting of the mantle. With the

1/16" and 1/32" spiders in the mantle-holder assembly, no mantle had to be replaced because of damage from lantern lighting operations. When the spiders were changed from one lantern to another, a new mantle was installed because of damage caused by handling.

Fig. 2 is a comparison of the luminosities of the lantern with four different mantle tip assemblies for the same range of tank pressure. The curves indicate that the luminosity of the standard lantern drops off rapidly with increase in pressure above 15 psig when either the 1/16" or 1/32" spider is being used, as compared to the standard lantern without the spiders. When the mantle-holding tip and 1/4" of the supporting pipe are enlarged in conjunction with a spider, as in Fig. 1, the luminosity was significantly higher at all tank pressures than for the standard lantern.

Fig. 3 shows the temperatures obtained at three stations on the generator during these tests. The temperatures were measured at the stations indicated on the outline of the generator in Fig. 3. For all practical purposes, the temperature curves for each station are the same for the four different mantle tip assemblies.

5. CONCLUSIONS

The use of a spider in a mantle tip assembly of a standard lantern definitely reduces the possibility of mantle breakage but also definitely reduces the luminosity of the lantern for tank pressures above 15 psig, whereas the same spider used in a mantle tip assembly that has been enlarged increases the luminosity well above that for the original lantern. This conclusion is clearly indicated by Fig. 2 and 3 for the spider and mantle tip dimensions given in Fig. 1. However, not enough work has been done with other spider and tip dimensions to be sure that the optimum combination has been used.

The effectiveness of a spider in reducing mantle breakage is attributed to breaking up of the stream of liquid gasoline that is released on first opening of the valve of a cold lantern. The liquid stream under pressure ruptures the netting of the mantle when it hits it directly, whereas a spider breaks up the stream into larger drops of gasoline that drop onto the mantle individually but without force enough to break the netting.

The success of the spider in preventing mantle breakage is believed to be dependent on having the generator orifice centered in the mantle-holder assembly with sufficient precision that the jet of gasoline leaving the orifice will strike the 1/8-in target in the center of the spider. This degree of precision apparently existed in all of the lanterns used for these tests.

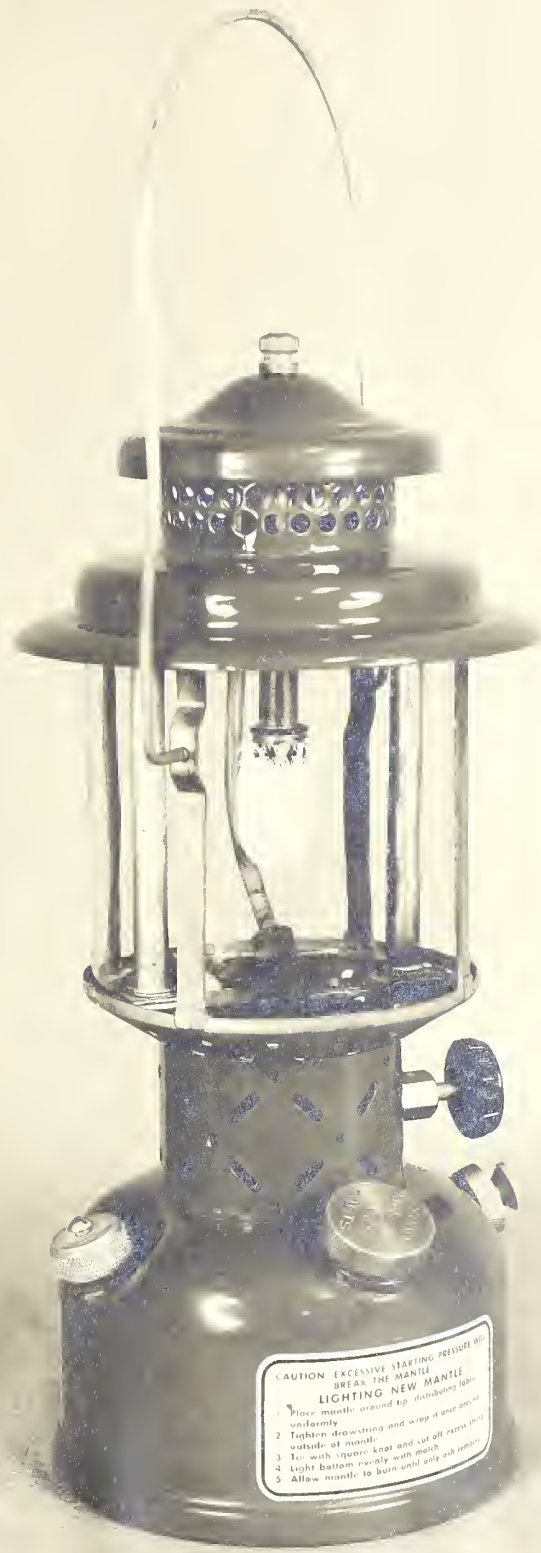
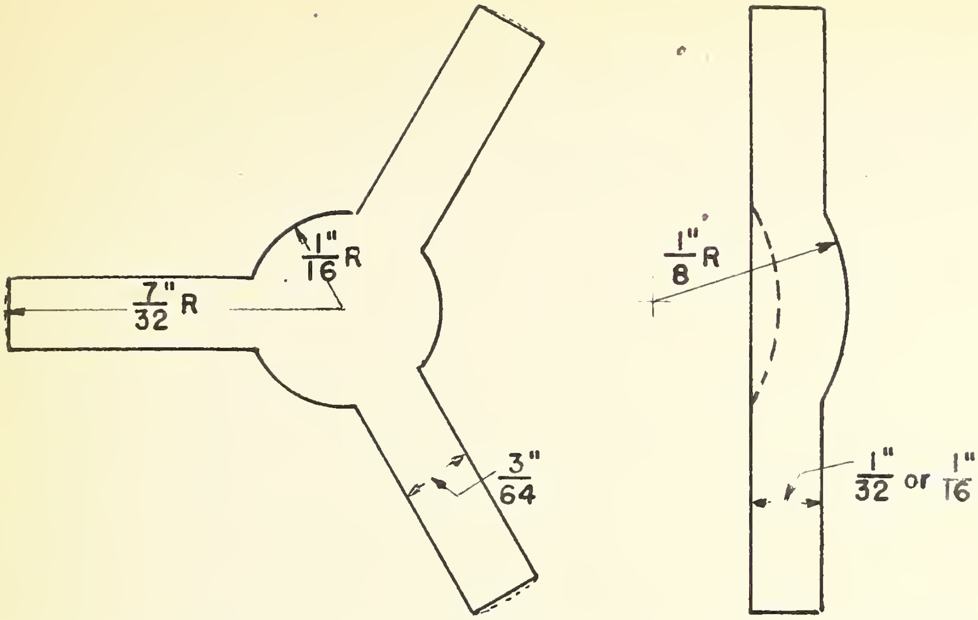
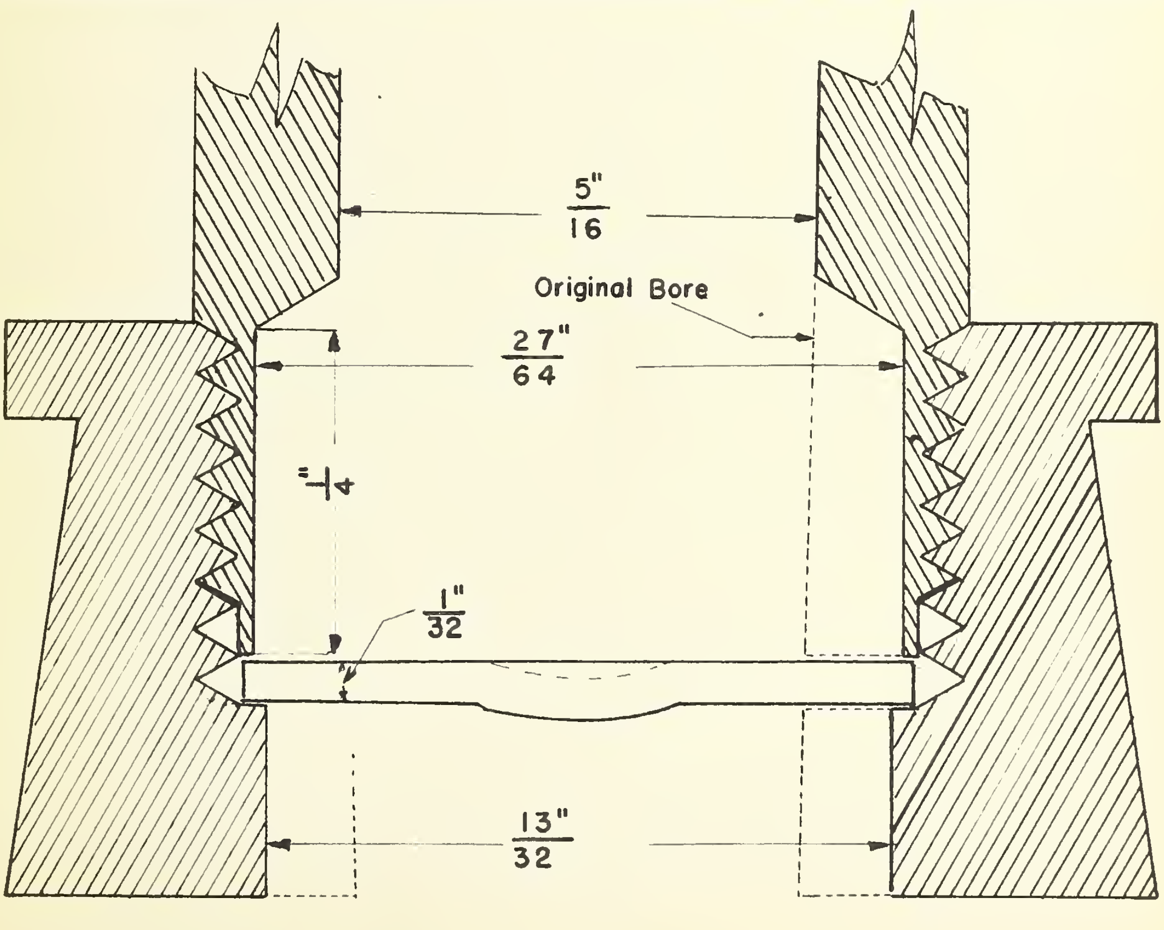

CAUTION EXCESSIVE STARTING PRESSURE WILL BREAK THE MANTLE
LIGHTING NEW MANTLE
1 Place mantle around tip distributing fabric uniformly
2 Tighten drawstring and wrap it once around outside of mantle
3 Tie with square knot and cut off excess string
4 Light bottom evenly with match
5 Allow mantle to burn until only ash remains

Fig. 0

SPIDER





ADAPTATION OF MANTLE HOLDING ASSEMBLY

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FIG. 1

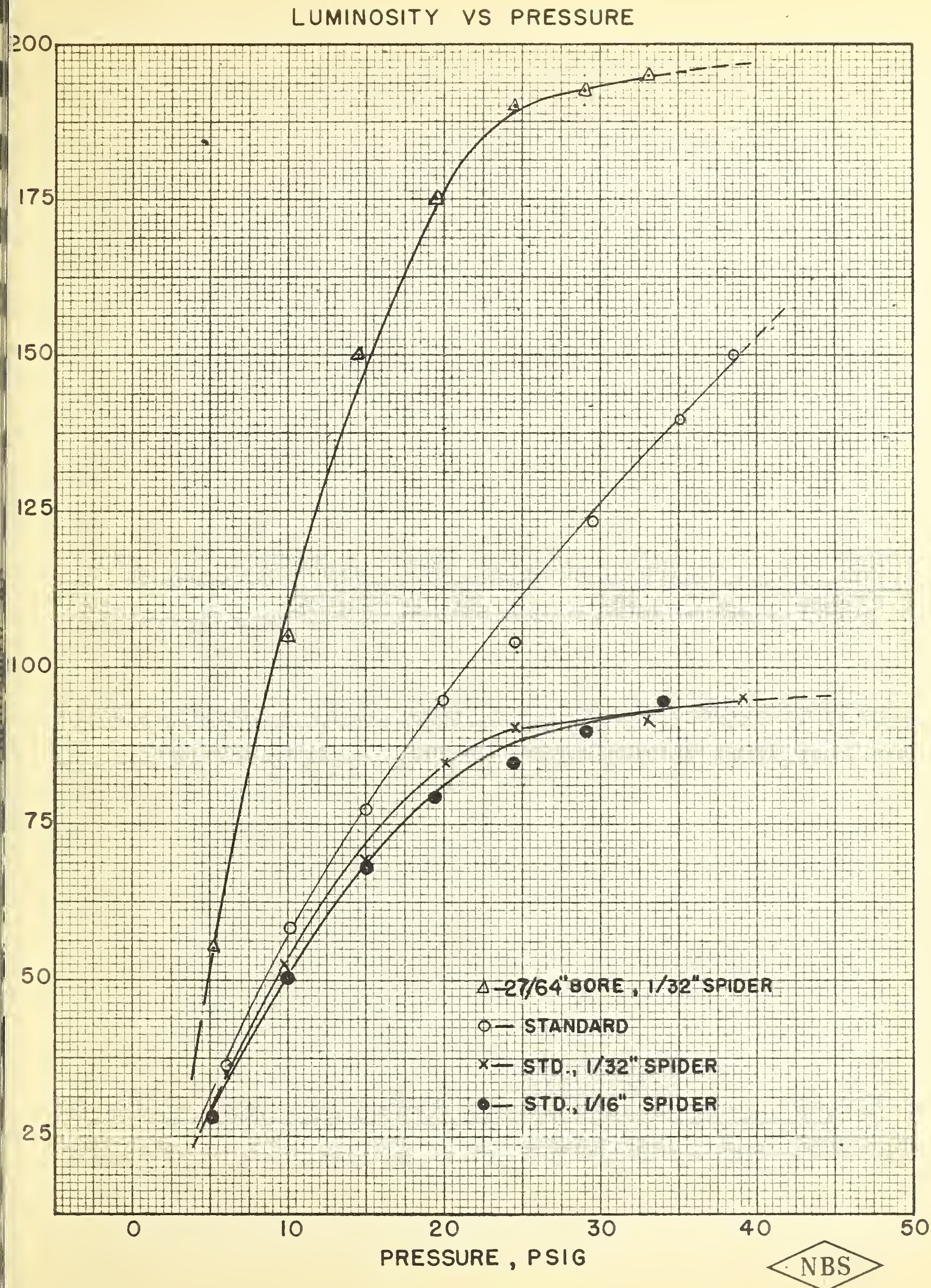
LUMINOSITY VS PRESSURE
200
175
150
125
100
75
50
25
0
10
20
30
40
50
PRESSURE , PSIG
△— 27/64" BORE , 1/32" SPIDER
○— STANDARD
×— STD., 1/32" SPIDER
●— STD., 1/16" SPIDER
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FIG. 2

GENERATOR TEMPERATURE VS PRESSURE

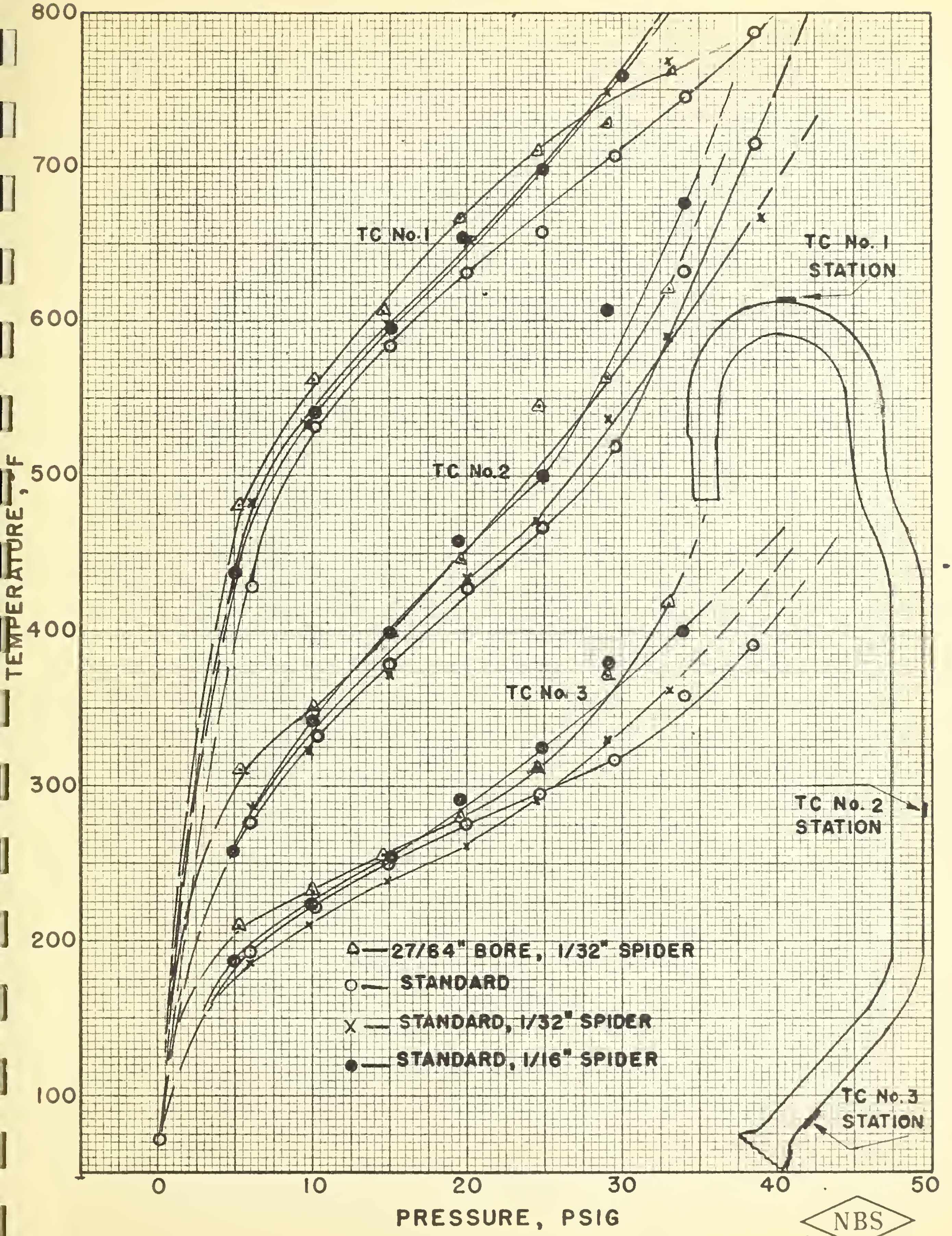

FIG. 3

THE NATIONAL BUREAU OF STANDARDS

Functions and Activities

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1901, as amended by Congress in Public Law 619, 1950. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to Government Agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. A major portion of the Bureau's work is performed for other Government Agencies, particularly the Department of Defense and the Atomic Energy Commission. The scope of activities is suggested by the listing of divisions and sections on the inside of the front cover.

Reports and Publications

The results of the Bureau's work take the form of either actual equipment and devices or published papers and reports. Reports are issued to the sponsoring agency of a particular project or program. Published papers appear either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau itself publishes three monthly periodicals, available from the Government Printing Office: The Journal of Research, which presents complete papers reporting technical investigations; the Technical News Bulletin, which presents summary and preliminary reports on work in progress; and Basic Radio Propagation Predictions, which provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: The Applied Mathematics Series, Circulars, Handbooks, Building Materials and Structures Reports, and Miscellaneous Publications.

Information on the Bureau's publications can be found in NBS Circular 460, Publications of the National Bureau of Standards ($1.00). Information on calibration services and fees can be found in NBS Circular 483, Testing by the National Bureau of Standards (25 cents). Both are available from the Government Printing Office. Inquiries regarding the Bureau's reports and publications should be addressed to the Office of Scientific Publications, National Bureau of Standards, Washington 25, D. C.

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