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INTER-OFFICE MEMORANDUM

GM

DATE 20 January 1945

TO: Dr. G. B. Kistiakowsky

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FROM Capt. J. O. Ackerman *A3*

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LANL Classification Group
P. Lang 6-5-98

SUBJECT: Viscosity of Composition B-2

1. At your request, a summary of the very small amount of information available at this time regarding factors controlling pourability of Composition B-2 have been assembled.
2. As yet, we have been unable to secure a reliable knowledge of the factors which must be controlled in the manufacture of Composition B-2 to secure most satisfactory castings. This occurs because of lack of knowledge of the manufacturing processes and the degree of control which the manufacturer can maintain, plus the fact that because of limited facilities and materials we have not as yet traced out the effect of the several variables.
3. It appears at this time, however, the Composition B must be controlled to some high degree by the manufacturer. To be of ideal quality, it is probable that two explosive mixtures of different properties will be necessary. These are:

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- a. A low viscosity slurry which can be poured at very low temperatures into small and intricate molds. The viscosity of this mixture must be low, but on the other hand, should contain particles of sizes which will not segregate readily within the half hour or one hour cooling time for small castings.
- b. For large castings with a cross-section of size which requires four to ten hours cooling time, it is possible that processes which may give best castings will not be vitally affected by the workability or viscosity of the slurry. It is more likely that grit size and percentage of RDX should be such that little segregation can occur. There now appears to be a possibility that it will be desirable to have a mix with considerably more than 60% RDX to increase the power of the explosive, as well as to improve casting properties. This statement is conjectural, however.

4. Recently, viscosity tests have been conducted by Reisberg at S-site with the modified Stormer viscometer. These tests have shown that a good bit of variation occurs from box to box in any given lot of Composition B. The tests have been extended to include viscosity tests of mixtures of good and poor lots of explosives. The results were gratifying in that they showed that the mixtures of half-and-half of two materials, the resulting mixture showed viscosity properties approaching those of the less viscous material. Following this work, Reisberg has taken a series of photomicrographs of RDX particles extracted from several batches of Composition B. Preliminary analyses have been made of the particle size distributions, shown by these pictures. The method used by him in the study is given below:

METHOD:

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Approximately 5 gms. of Composition B was placed in a 150cc beaker. About

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SUBJECT: Viscosity of Composition B-2 (Cont'd)

25-30cc of chloroform was added and the beaker agitated until an appreciable layer of RDX formed. Approximately 15cc of chloroform was poured into a crystallization dish (17cm. diam.). To this, about 10cc of the RDX suspension (stirred vigorously) was added and the particles allowed to settle. The dish was gently transferred to the microscope stage and the particles observed through the $CHCl_3$ layer.

For photomicrographs: A photo of a stage micrometer was taken under the same conditions as are the particles. This was to be used as a measuring device.

10X objective

$\frac{1}{2}$ sec. exposure with 6V microscope lamp of highest intensity (adjusted by means of sub-stage condenser).

5. Attached hereto are 10 photographs taken during this study. Also attached is Fig. 1, which shows particle size distribution curves taken from several photomicrographs. In examining these curves, one must note that the particle size distribution is based on the number of particles counted and not weight. In this respect the curves do not parallel standard practise. The curves are noteworthy, however, in that the correlation is good in showing that the smaller particle sizes are of greatest importance in varying the apparent viscosity. The larger sizes, apparently, are of lesser importance, but would permit loading a melt without serious increase in the viscosity.

6. It is impossible to write a good specification without greater knowledge of the factors affecting pourability and without a knowledge of the manufactured processes. However, if one were to hazard a guess on a specification which would assist in the pouring of small castings, it would be as follows:

- a. A slurry should be cast in pellets at any convenient composition, at or above 60% RDX. This slurry should be such that when TNT is added to reduce the composition to 60% RDX, the viscosity should be 10 poise ¹⁵ poise at 90°C. (This is probably 9 seconds or less on the Holston viscosimeter).

If the composition is delivered by the manufacturer with an RDX content greater than 60% to assist in manufacturing, it must be uniform enough so that when mixed with TNT to a fixed percentage of RDX, it will give uniform workability for all portions of the lot. This is necessary so that small castings made at different times will match each other in composition.

- b. On the basis of the limited particle size determinations, Fig. 2 has been prepared. This figure shows the band enveloping curves of particle size from the studies of materials which have proved acceptable in viscosity studies and in casting room pouring. In the portion of the curve for

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TO: Dr. Kistiakowsky

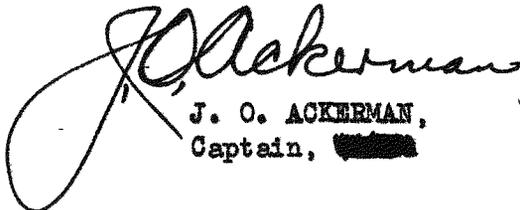
FROM Capt. Ackerman

SUBJECT: Viscosity of Composition B-2 (Cont'd)

small particle size, only one line is shown. This line is to be considered the maximum curve. The short vertical lines below the curve indicate only that the very fine grist probably can not be eliminated completely.

7. It is possible that an extended study of particle size effects not only on the explosive mixtures, but also from the standpoint of experience of other industries would lead to definite information on the effect of grist size on desirable properties of the slurry. Although indications of work to date are that a small increase in the fine fraction is extremely detrimental, there probably is a critical point beyond which this would not be true. For example, Baratol-2, which contains only micropulverized material of a low mean diameter, is not only extremely pourable, but shows practically no segregation in moderate size castings. The difference between these results and those with the graded material with a reasonably large percentage of extreme fines is probably not incompatible if all factors were known.

8. It appears that it will be desirable to determine as soon as possible what form further work at S-site should take, and how this can be correlated with work at Bruceton and Holston. It would be desirable if S-site can secure RDX in several grist sizes, typical of standard manufacture. These fractions then can be combined in a series of proportions to develop curves of properties. If this is practicable, it would be desirable to secure fractions which limit or eliminate the fine grist paralleling, if possible, the sizes that can be produced commercially by Holston. This is particularly important as a reduction in fines appears most desirable as a method of improving the viscosity and pourability. If special RDX is obtained from Holston, we should receive information on its preparation and chances of securing uniformity in a manufactured lot containing them.


J. O. ACKERMAN,
Captain, 

cc: Lt. Hopper
Mr. Popham

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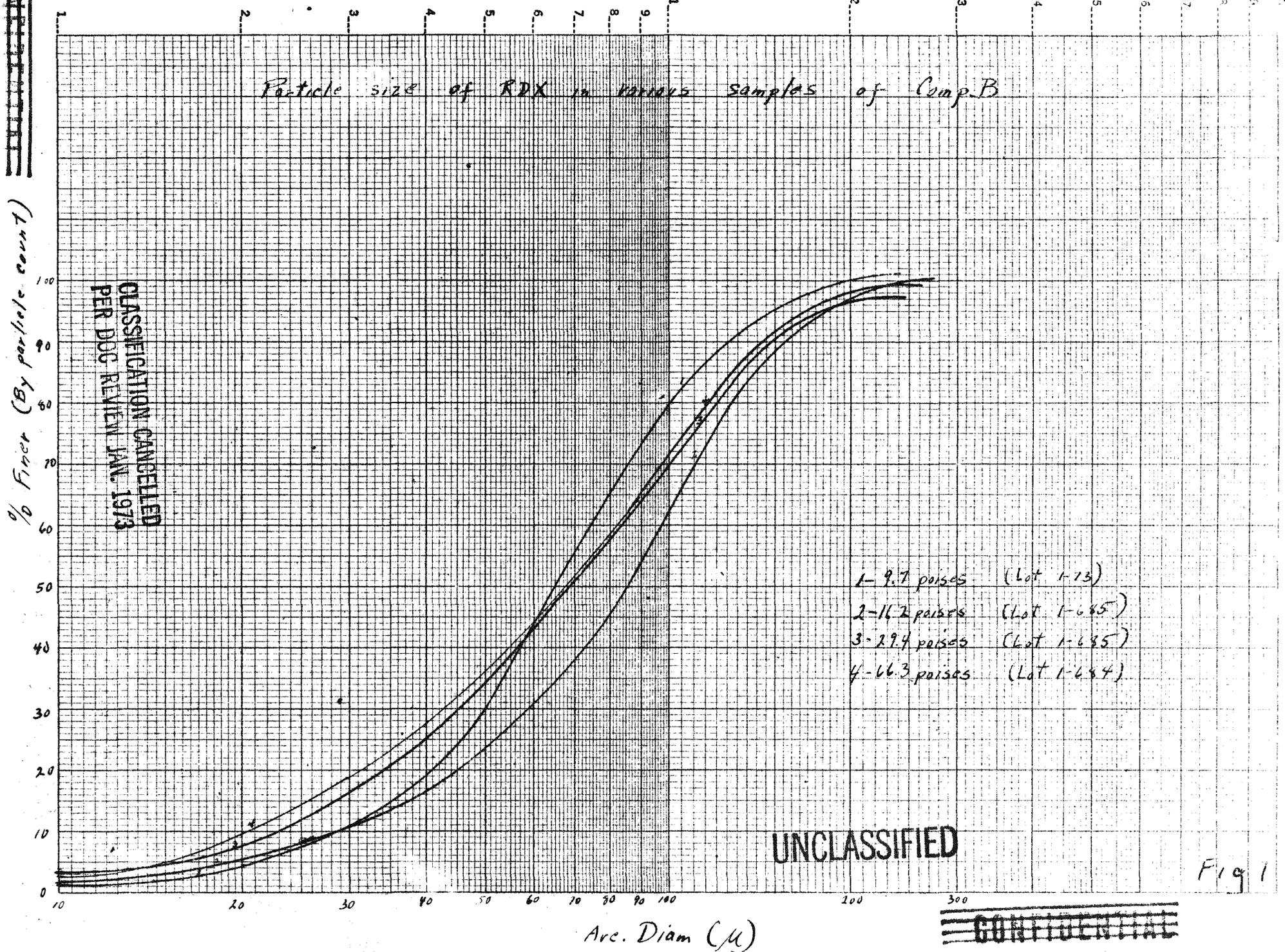
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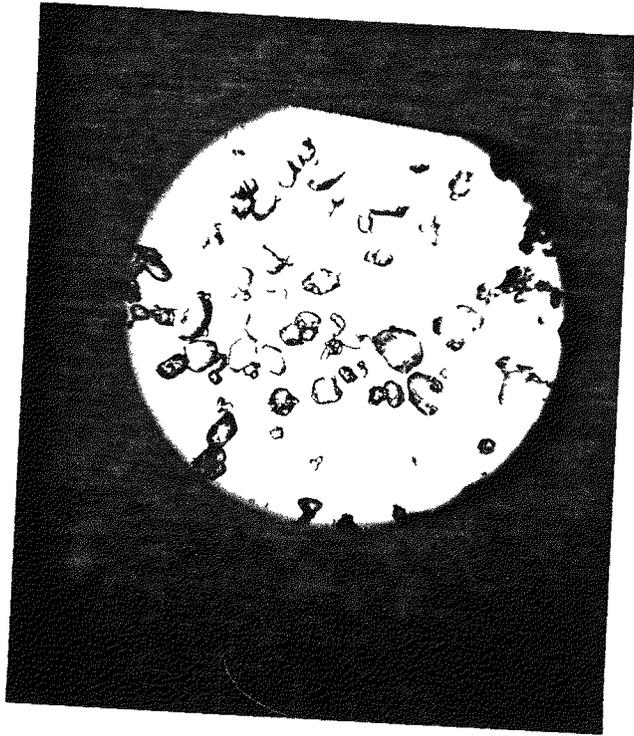
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Particle size of RDX in various samples of Comp. B

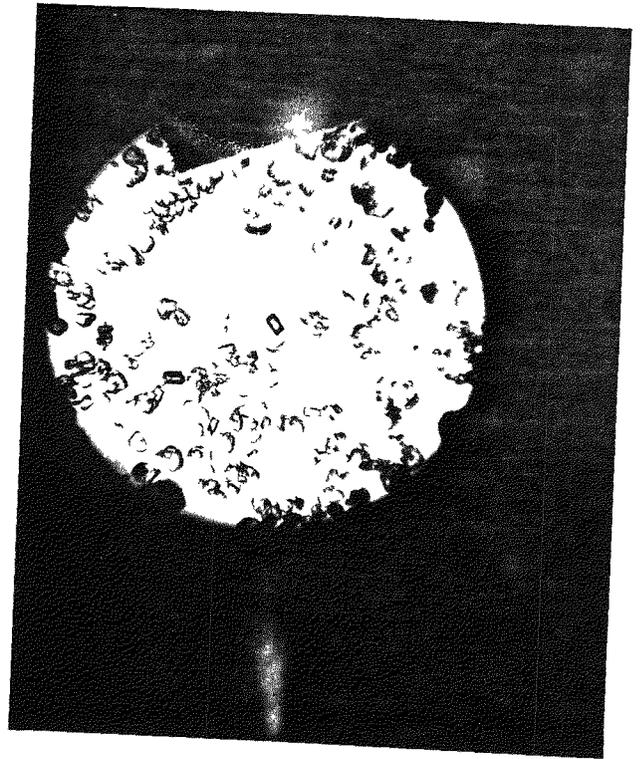


Lot 1-73

Lot 1-04 Batch 9-2362



9.74 pieces



73.8 pieces

Blend 1:1 parts
Lot 1-044 b 9-2362
Lot 1-73

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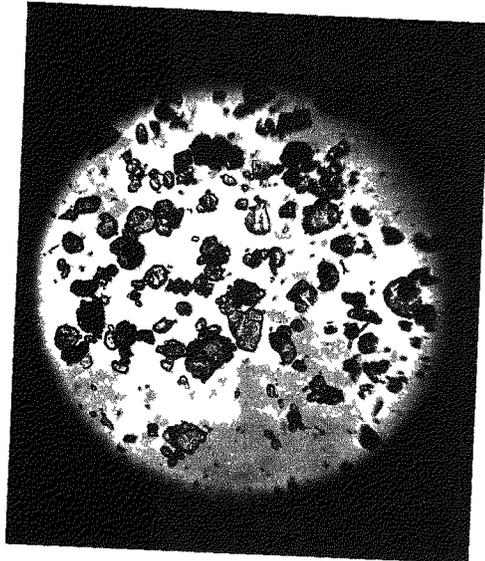
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15.4 pieces

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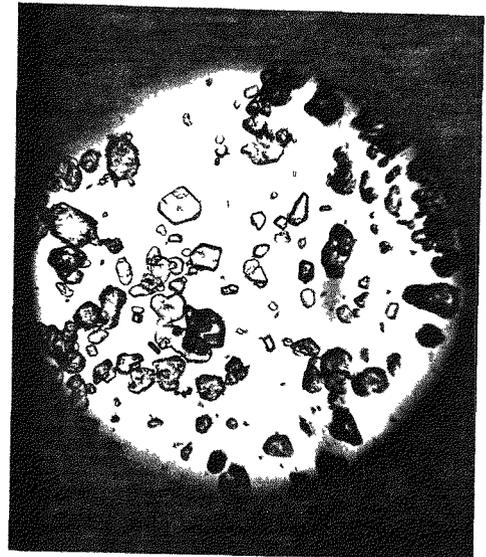
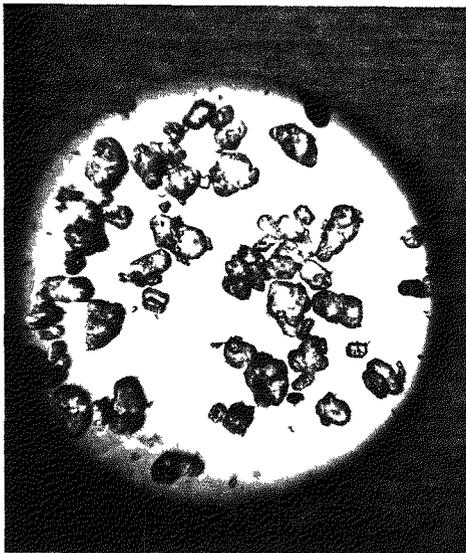
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Lot 1-685 b 4-10

blend 1 part

Lot 1-684 b 9-2353
-ST 1-685 b 4-43610



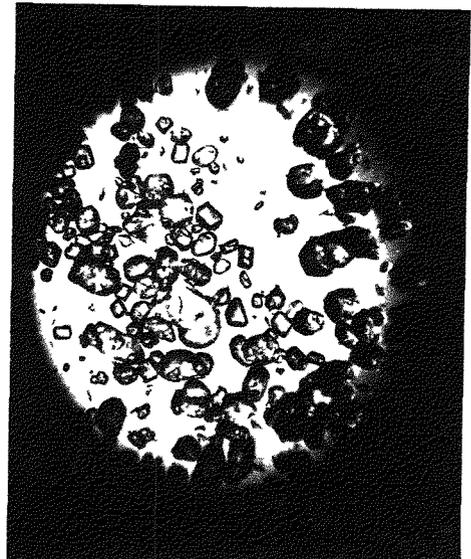
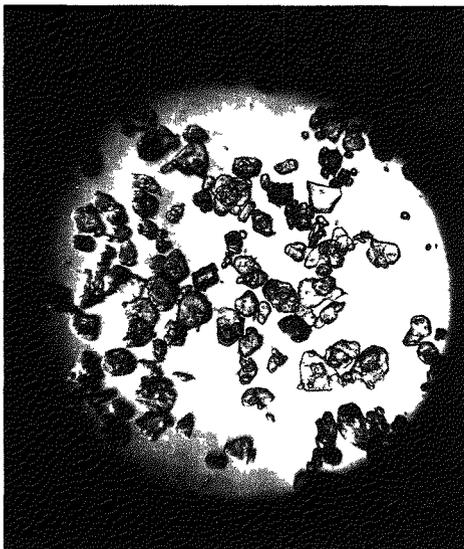
16.2 poises

28.4 poises

Lot 1-684 b 9-2353

Lot 1-685 b 4-43610

Melt agitated for 1 hr.

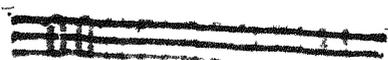


0
0
0
0
1
1
1
2
2

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63.25 poises

29.4 poises



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Lot 2785

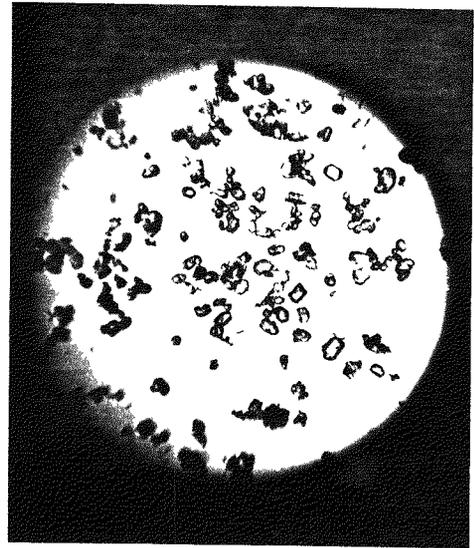
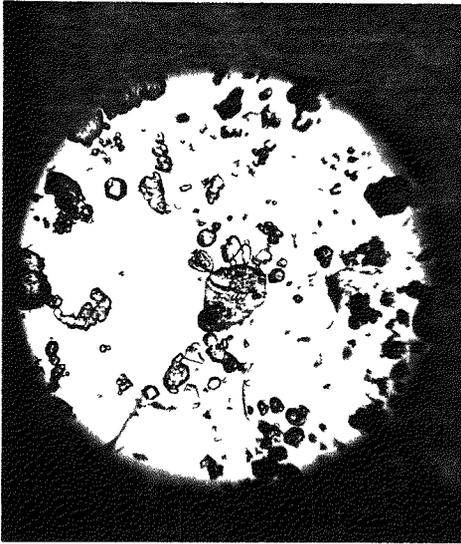
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Blena

1:1 parts

Lot 1-684 to 9-2302

Lot 2785 to 3-14473



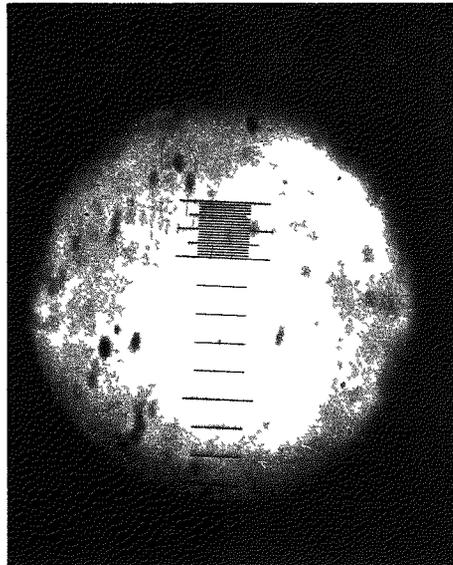
11.75 parts

21.0 parts

Stage Micrometer

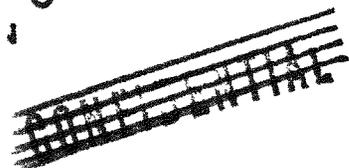
0.01 mm.

0.10 mm.



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