A-84-019
46-17

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INTER-OFFICE MEMORANDUM

GMK

DATE 7 August 1944

TO: Dr. Kistiakowsky

FROM: Captain Ackerman

SUBJECT: Suggestion for Firing Test.

1. I have been intending to speak to you for some time about a seemingly possible method for improving the implosion effect but have been unable to do so because your time has been so fully occupied. For this reason, the essential points are given below.

2. The small number of photographs and specimens which I have seen from implosion tests of cylinders and spheres has indicated that the folding and lack of uniform displacement of the central mass has resulted largely from lack of uniformity in the time at which the shock surface between detonation waves from two adjacent detonators intersects the curved inner surface and the fact that the interaction produces a jet which, occurring after the beginning of the implosion, causes a later high concentration impact on the central body.

3. About the middle of June, I discussed the subject with Dr. Neddermeyer. At that time, I brought the point that an air gap of varying thickness immediately adjacent to the interior body could probably cause a time delay which would compensate for the greater length of time necessary for detonation wave to reach points on the inner surface farther removed from the detonator. This would permit the development of more uniform timing and uniform distribution of pressure on the cylindrical or spherical surface. At that time, I believed that variations in this air gap and its shape could be used to remove the jet effect. The general layout of this scheme is shown on the print attached at Fig. 1. I am now inclined to believe this method would not suffice. For the purpose intended in this case, the air gap would be primarily a delay with the thickness of the gap proportioned to the time delay necessary.

4. Consideration of the Munroe effect as originally discovered rather than as now applied in cavity charges indicates that the effect may result from other factors than focusing. For example, if the bottom of the explosive is engraved, the metal sheet is also engraved in mirror image. Likewise, if the bottom of the explosive is embossed, the metal plate is also embossed. In the case of embossed marking, the [illegible] of an opening in the explosive is largely lost in the flat areas between the markings. Since the embossing occurs on the metal plate in spite of this, it seems probable that some action other than focusing occurs and that this action is probably the result of the compression of air in the air gap. Incidentally, tests made here with a uniform thickness of air gap around a central pipe show considerable delay but little change in symmetry.

5. The various pictures that I have seen of implosions show that the jet which forms is probably very detrimental to uniform implosion. Several of Koski's pictures, particularly those taken recently with cavities produced artificially in the castings adjacent to the pipe show the increased effect of a cavity. If a cavity can be used to produce a jet concentration, it seems probable that a designed cavity would be used to produce an opposite effect. Therefore, it may be possible to resolve the jet into a plain wave or by the introduction of another jet of proper size, timing and location, to neutralize the objectionable jet. For this reason, I believe it might be possible to introduce a cavity in the charge with

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Form 25

TO: Dr. Kistiakowsky

FROM:

SUBJECT:

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the apex near the pipe in such a manner that a counter-jet could be directed outward into the explosive. A tentative location and shape of cavity is shown in Fig. 2. Certain features of this cavity would require study as the timing may not be such as to produce the desired effect. However, if this counter-jet could assist in neutralizing the detrimental jet until after the implosion is complete, combination of the cavity with the variable air-gap type of cavity intended to produce uniformity in the positive pressure region might materially improve the uniformity of collapse. Although the cavity type of counter-jet would remove some of the explosive force from the interior cylinder or sphere, it would still permit developments of high pressures surrounding the mass which would come into play later during the implosion to give a holding effect.

6. Since it does not appear possible to make the counter-jet of great force because of the unfavorable angle at which the blast wave enters the cavity, it might be desirable to minimize the jet against which it must operate or to delay the formation of the undesirable jet until a time late in the implosion. It appears that this could be done by removing some of the explosive which contributes little to the implosion. Possibly this explosive could be replaced by a heavy inert material like lead, but I understand tests of this nature with wood have been ineffective. Since the presence of more explosive contributes to the ultimate pressures on the interior, it would seem possible to follow the idea which you have suggested recently in discussing lenses. You suggested the use, in the outer area of the charge, of explosive material with a rate of detonation much lower than that of the explosive used in producing the implosion. By this method and with the counter jet it would seem possible to reduce the undesirable lack of uniform pressure on the cylinder, without eliminating the high pressure holding effect which would be developed by the use of large quantities of explosive. The scheme is shown on Fig. 3.

7. I do not believe that the thoughts herein would lead to a very good solution to the implosion problem as the efficiency of the total explosive mass is materially reduced when compared with that which can be secured by lenses. However, since tests could be made very simply, particularly using sectional cylinders now under construction for Koski, the thought is offered for your consideration.

J. O. ACKERMAN
Capt., CE

JOA:mw
Incl:
3 prints.

cc: Dr. Neddermeyer

[redacted] CANCELLED
PER DOC. REVIEW JAN. 1973

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A-84-019
46-17

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Air Gap

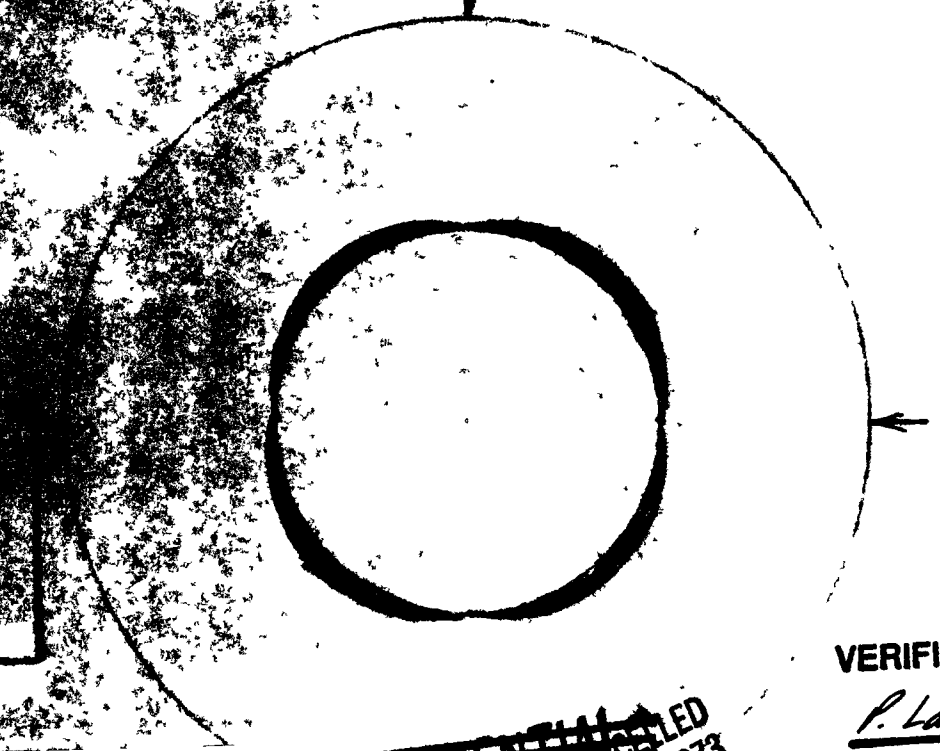

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Fig. 1.

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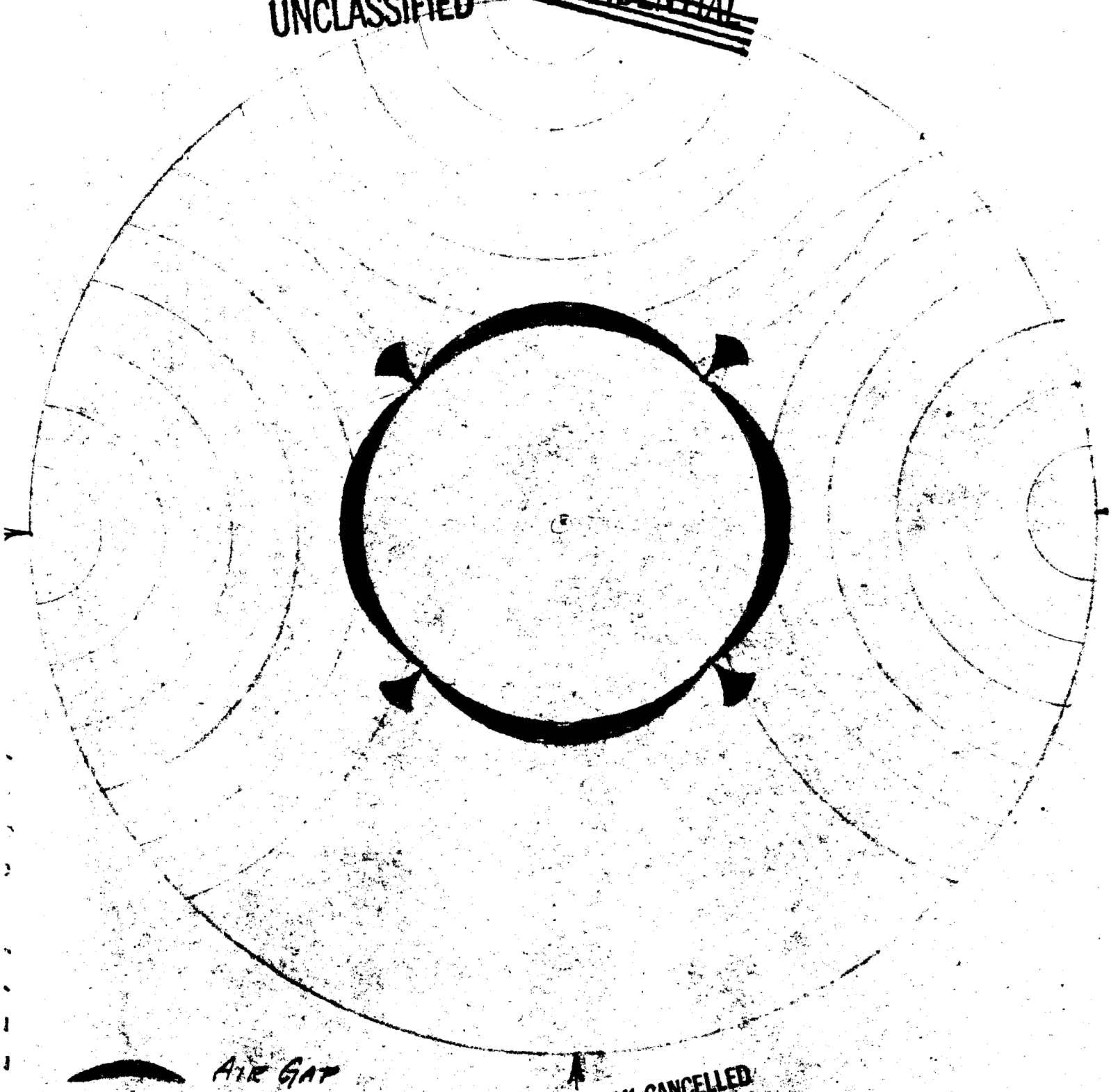

Fig. 2

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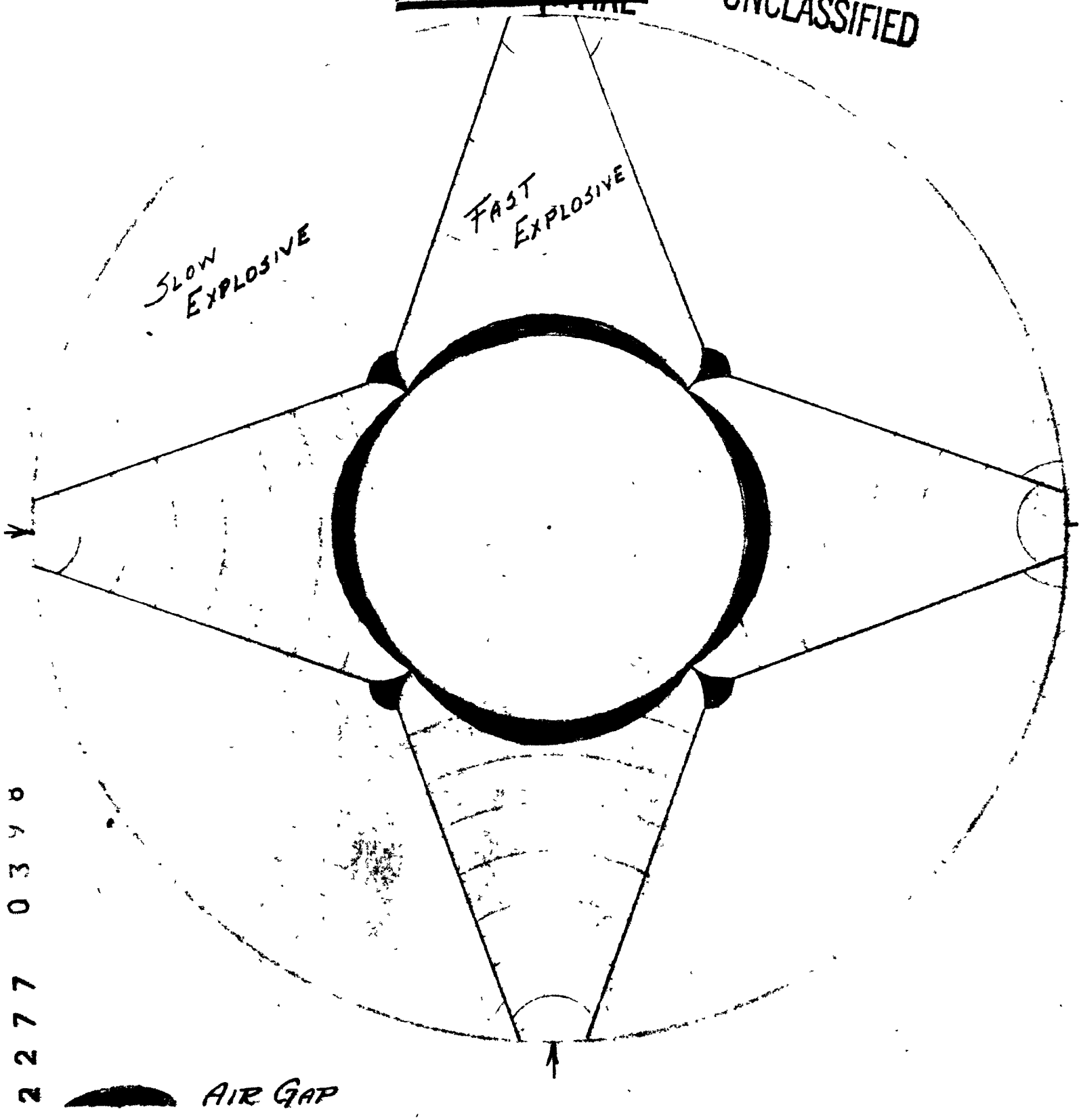

FIG. 3.

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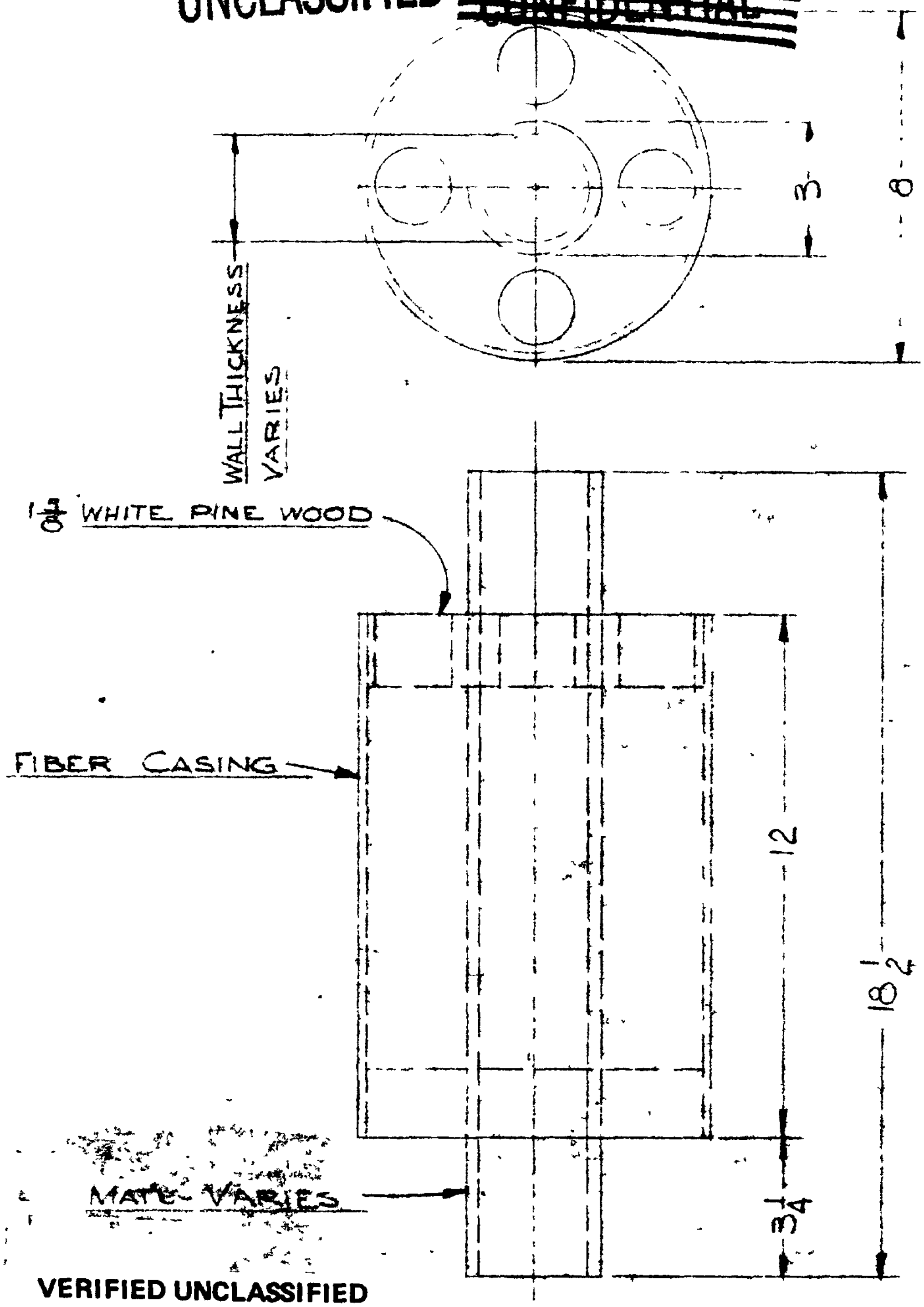

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[signature]

PART NAME	
MOLD-TYPE-AR	
SCALE 1/4"=1"	DRAWING NO
SHTS 1	A-16
SHT # 1	

SKETCH BY TODD
DRAWN BY H. PA DATE 7-3
APPROVED

CLASSIFICATION CANCELLED
PER DOC REVIEW JAN. 1973

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