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December 18, 1947

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ATOMIC ENERGY COMMISSION

Secret

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MEMORANDUM FOR INFORMATION

TEST PROGRAM FIRING SEQUENCE

Note by the Acting General Manager

1. Attached is a letter from the Director of the Los Alamos Laboratory on the subject of test program weapon types and firing sequence. It is circulated for the information of the Commissioners.

2. Copies of this letter and proposal will be furnished the General Advisory Committee and the Military Liaison Committee for their information.

3. A meeting will be held on December 29 and 30 in Chicago between the General Advisory Committee, representatives of the Los Alamos Laboratory, members of the Commission staff, and a representative of the Military Liaison Committee for the purpose of reviewing this proposal together with various previous recommendations. Firm recommendations will be made to you as to types and firing sequence immediately thereafter.

4. A previous draft study by the Los Alamos Laboratory was circulated for the information of the Commission on November 24, 1947.

12-18-47

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW
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2ND REVIEW DATE: 05/02/02
3RD REVIEW DATE: 05/02/02
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19TH REVIEW DATE: 05/02/02
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By Authority of the U. S. Atomic Energy Commission
Per: *Gen. Macomber* Date *12-22-47*
Document No. *LX-93-14B*

UNIVERSITY OF CALIFORNIA
Los Alamos Scientific Laboratory
(Contract W-7405-Eng-36)
P. O. Box 1663
Los Alamos, New Mexico

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By Authority of the U. S. Atomic Energy Commission
Per: *John Newburger* Date *12-29-47*
Document No. *LX-77-772-14B*

In reply refer to: LAB-DIR-40

December 5, 1947

Mr. Carroll L. Wilson
General Manager, AEC
1901 Constitution Ave.
Washington, D. C.

Via: Manager, Santa Fe Directed Operations

Subject: Pacific Proving Ground Program

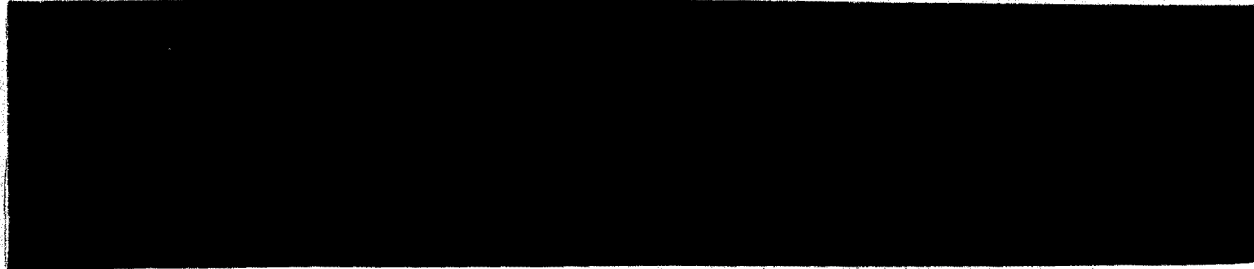
Dear Mr. Wilson:

Attached herewith is the proposal of the Los Alamos Laboratory for the order and character of weapons to be tested in the forthcoming Pacific Proving Ground Program. While it is not possible at this time to present the detailed and final specifications for certain of the types proposed, nevertheless the general nature of their proposed nuclear characteristics can be given.

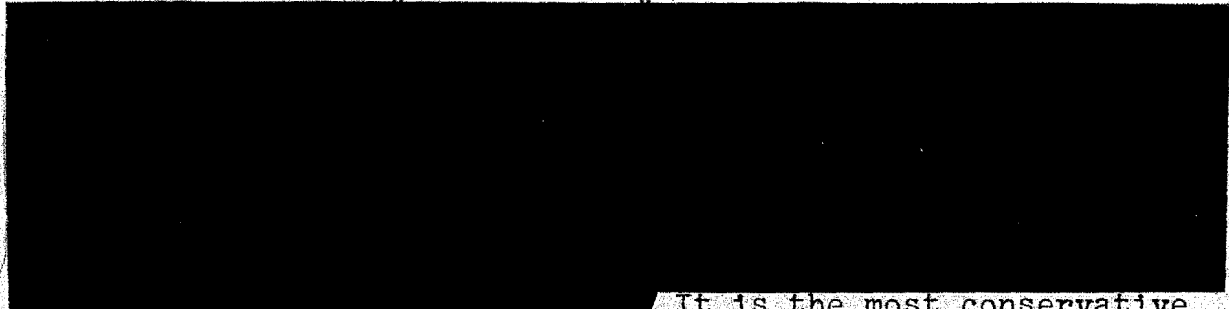
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BY AUTHORITY OF *D. P. Dickson*
BY *Wm. Lynch* DATE *2-2-59*



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It is the most conservative model from a design point of view of all the above.

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The various alternative programs presented in the event of "success" or "failure" have been considered by the Laboratory from the point of view of endeavoring to maximize the position of the country both in bomb fundamental physics, and in present (or near future) stockpile position. We have placed more emphasis upon understanding the behavior of nuclear explosions, and less emphasis upon certain practical details such as the minimum usable initiator strength. The latter point is covered, however, in the event that no "failures" occur by the proposal to include in the final shot two factors of interest:

1. A U-235 weapon with a smaller amount of active material which will give us very useful design information, and
2. An initiator of the present minimum acceptable strength.

We are led to this position by the fact that no atomic weapon has yet been detonated with other than the strongest available initiator, and by the belief that our present lower limit, in which we have full confidence, should, nevertheless, have a practical test.

We shall plan upon this program for the Sandstone Operation unless specific instructions are received to the contrary. Such instructions, in view of the time scale involved, can probably only involve changes in firing order of weapons now designed, or nearing final design, and for proper planning, must be received before January 15, 1948. It is quite impossible to incorporate any major design change in this test even if such instructions were received immediately.

Yours truly,

/s/ N. E. Bradbury

Director

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By Authority of the U. S. Atomic Energy Commission

Per: Dr. McClellan Date 12-22-47

Document No. XXV-11-777-74B

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TEST PROGRAM FIRING SEQUENCE

December 5, 1947

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By Authority of the U. S. Atomic Energy Commission

Per: Henry Newburger Date 12-29-47

Document No. XXV-11-777-74B

I. General Considerations

Any test plan must achieve to the maximum degree possible the objectives of the test. These are two fold:

- (a) to improve the short range military position of the nation through testing models which may rapidly become stockpile items, and
- (b) to improve the longer range military position by obtaining such information from the behavior of particular models that better and more efficient weapons may be designed.

Wherever possible, both objectives should be attained to the fullest extent, but in a clear case of conflict it is assumed that (a) takes precedence over (b).

It may be recalled (a) that the significant past development of atomic weapons was the FM method of assembly, and (b) that the phenomena involved in this weapon are so complex that it was considered necessary to test this model, whereas the gun weapon was used without test. The success of Trinity and subsequent detonations therefore clearly indicated that the direction of weapon improvement would be along the line of the FM model. However, the test of one model is obviously insufficient basis for a program of weapon development, especially since the phenomena occurring in that particular model are not completely understood. One can neither be confident of improved designs of weapons employing the same material (Pu) as the Trinity bomb, nor of FM models employing other material (U-235), without additional tests.

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BY AUTHORITY OF G. P. Beckman
BY W. J. ... DATE 2-2-59

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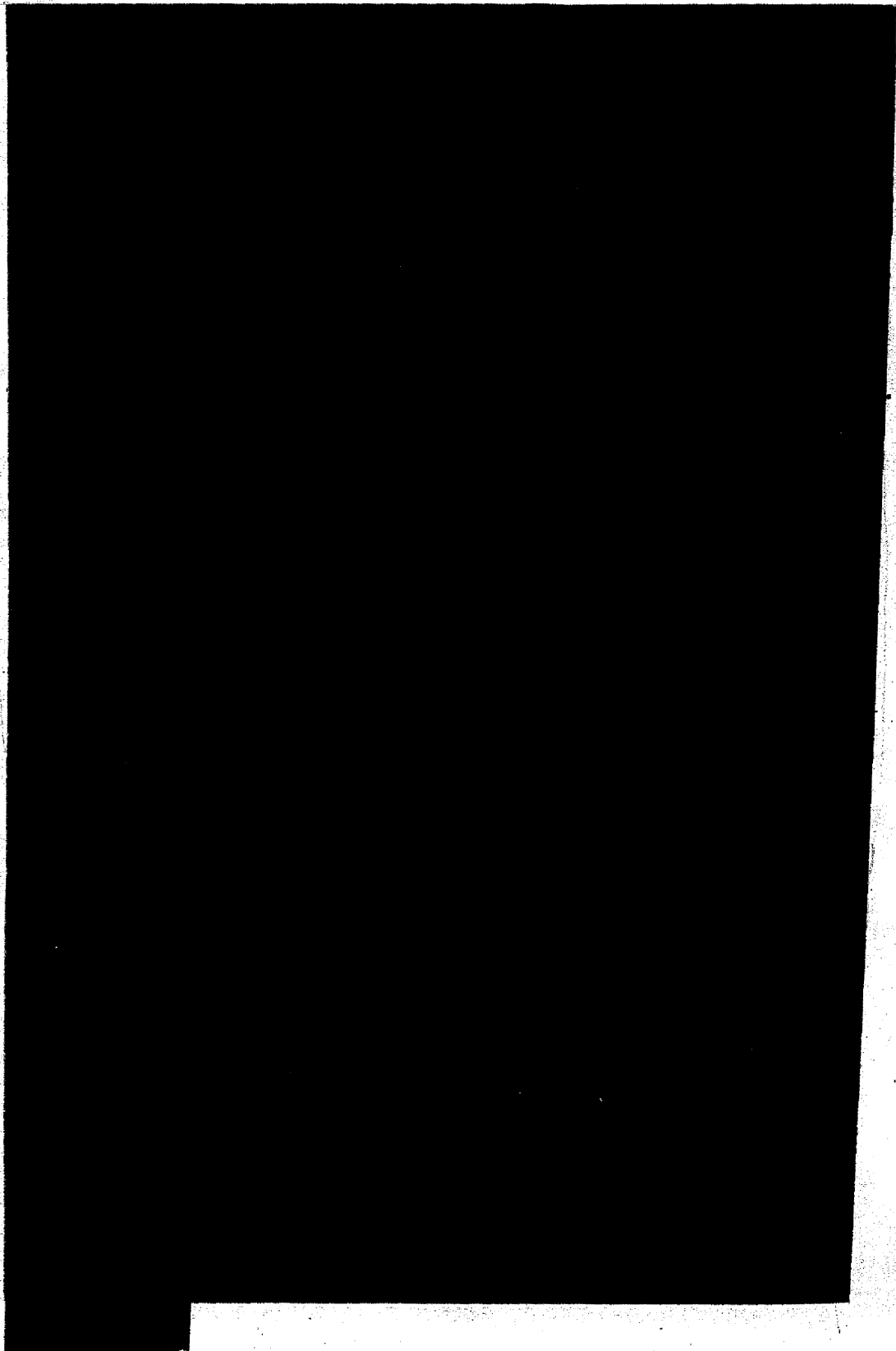
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As the result of the work of the Los Alamos Laboratory and from considerations of production and stockpile, information on the following items is of utmost importance to the development of atomic weapons.



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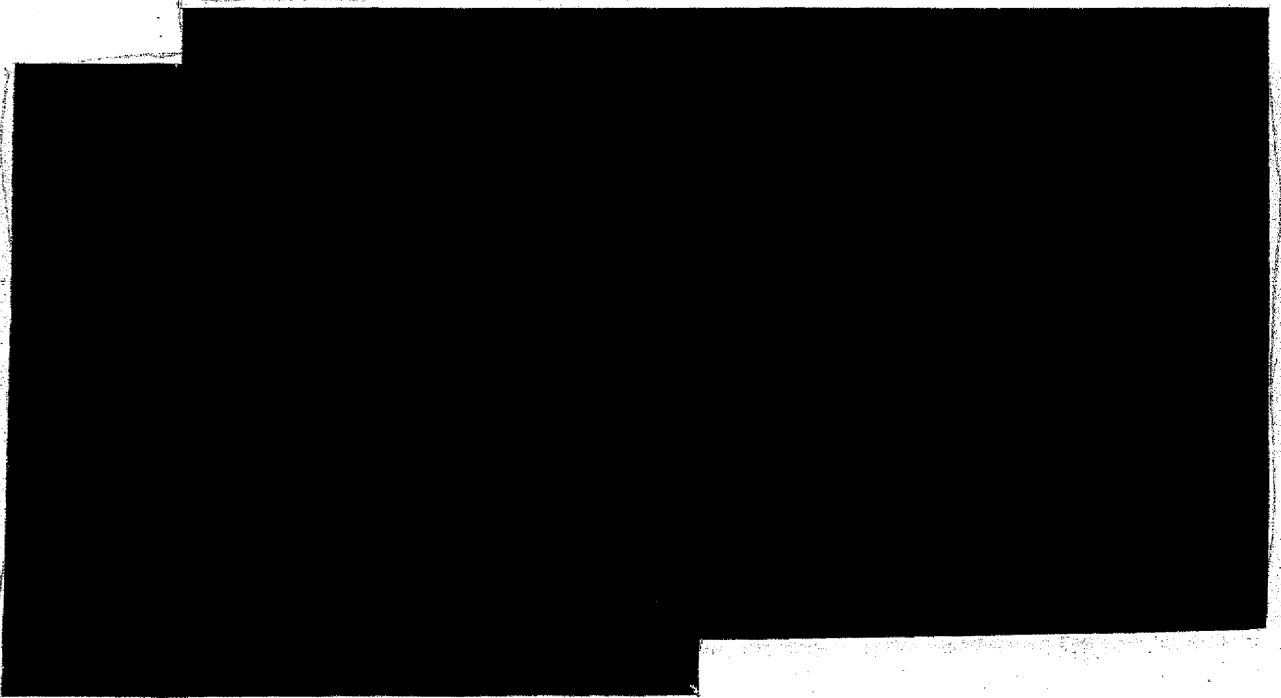
With only one model of each type, which would therefore rigorously give only one point on a behavior curve, six shots would be required (including one repeat for an initiator test), unless some combinations of the six items are possible. Certain combinations are possible, at sacrifice of definiteness, but it will be shown by the detailed considerations of the specific plan that the minimum number of shots is three, each one of which has to be "good" in a sense to be defined. When it is realized that atomic weapons are subject to fluctuations in behavior beyond human control, even a three-shot program appears thin. A test plan involving a small number of shots has to ignore such statistical considerations and rely on a degree of compensation provided by the fact that an unfavorable fluctuation, resulting in low yield, can still yield behavior information, especially from other measured quantities such as alpha, the rate of rise of the reaction rate. In fact, this is generally true regardless of the cause of a low yield and emphasizes that

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the test program is a series of experiments on weapon types rather than simply a confirmation or disproof of behavior predicted from the performance of the first FM type.



Finally, considerations of production indicate that it would be very desirable, if possible, to investigate the effect of a decrease in the permissible lower limit of initiator strength. It is agreed, however, that fissionable material is more valuable than initiator material; therefore, tests relative to utilization of the former take precedence.

II. Specific Plan

These considerations, amplified in detail below and restricted by the 3-shot limitation, lead to the plan of Figure 1. The last line, "Stockpile Position", gives an approximate picture of the types of weapons on which information suitable for a decision as to stockpile types would exist as the result of any combination of "good" or "bad" criteria of the diagram. Such a picture is approximate at this time, because all of the measurements will not be available for consideration until after the test. A firing sequence plan for field operation cannot be based on so detailed evaluation of all results on one shot before the next, as can a subsequent evaluation of

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factors affecting a stockpile program.

In order to establish a reasonable method of determining the sequence to follow in the field, a relatively simple criterion of "good" or "bad" has been agreed upon:

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In reaching a conclusion for the "goodness" of a particular shot, the Scientific Director shall weigh the results of each measurement according to his judgment of the accuracy and thus obtain a weighted average of available results.

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III. Detailed Considerations

Certain general remarks can be made in regard to the plan of Figure 1.

[REDACTED]

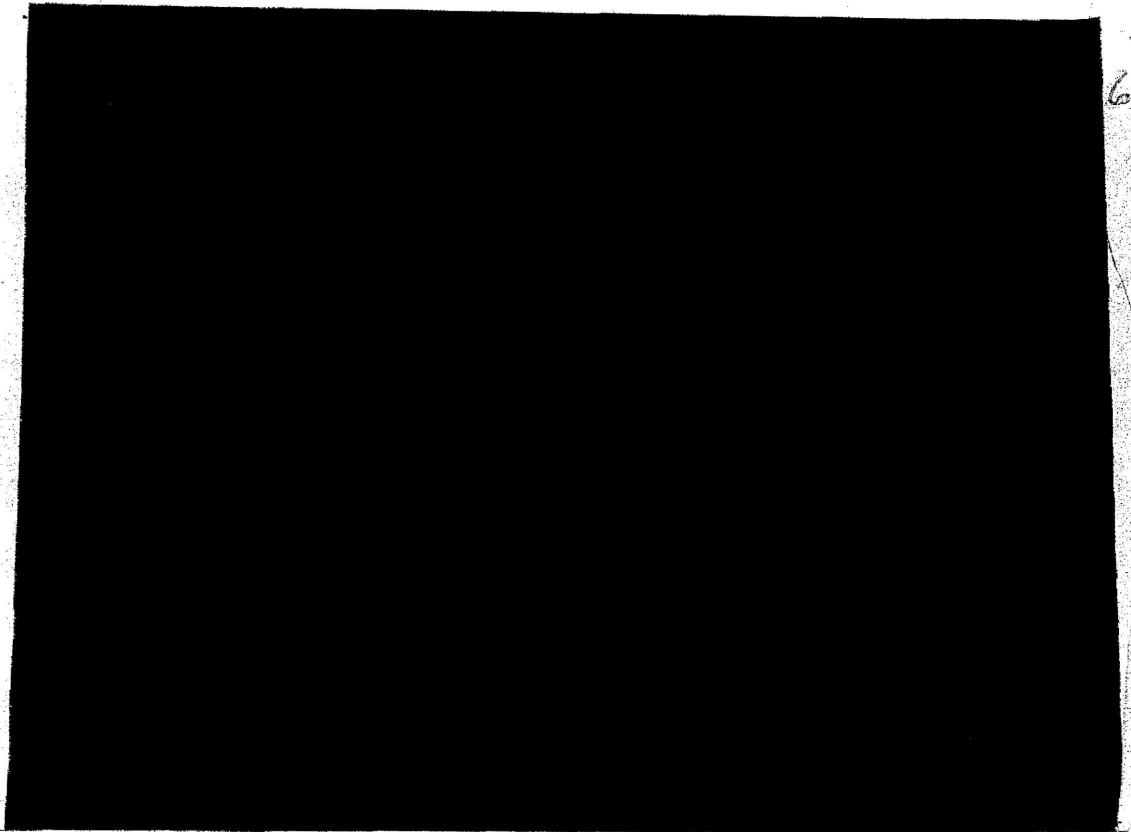
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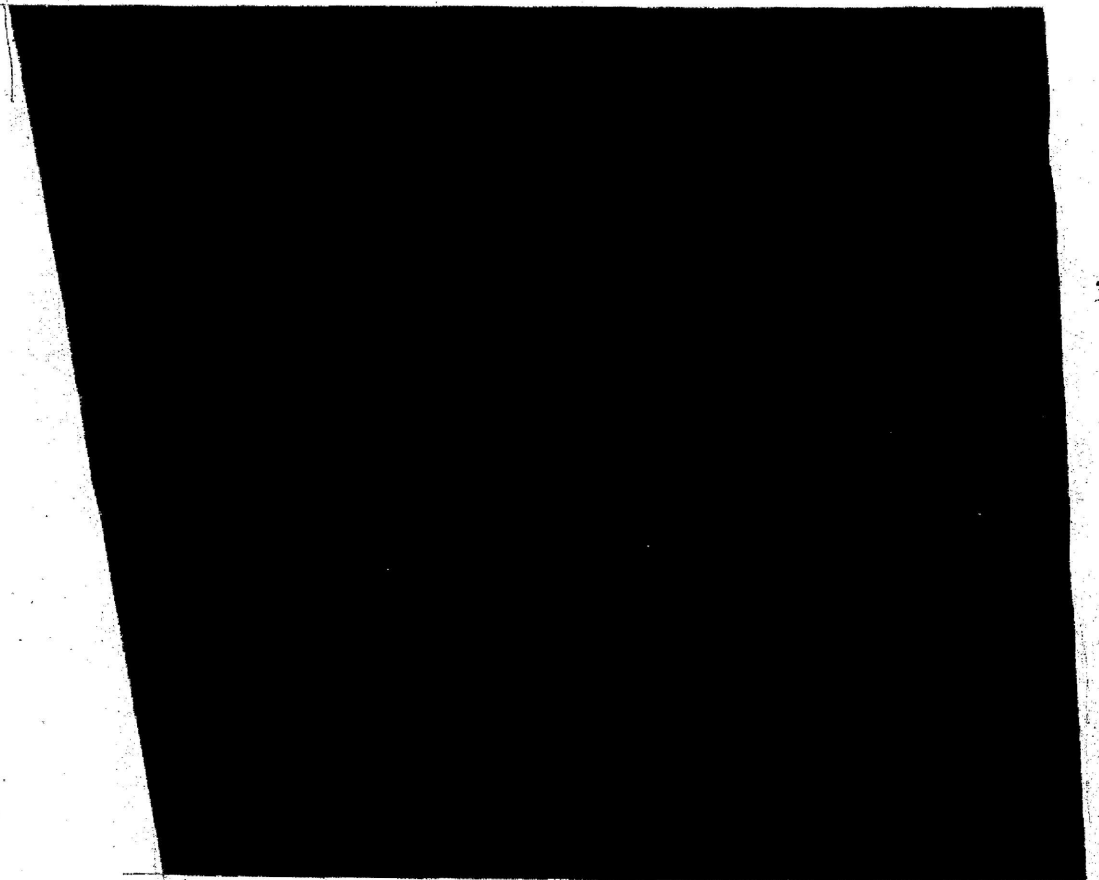
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In order to follow particular paths of Figure 1, the four possible sequences are listed as A, B, C, D. For example, A sequence moves to the left at the branch-point following each shot, indicated as Shot #1 good; Shot #2A good; Shot #3A.



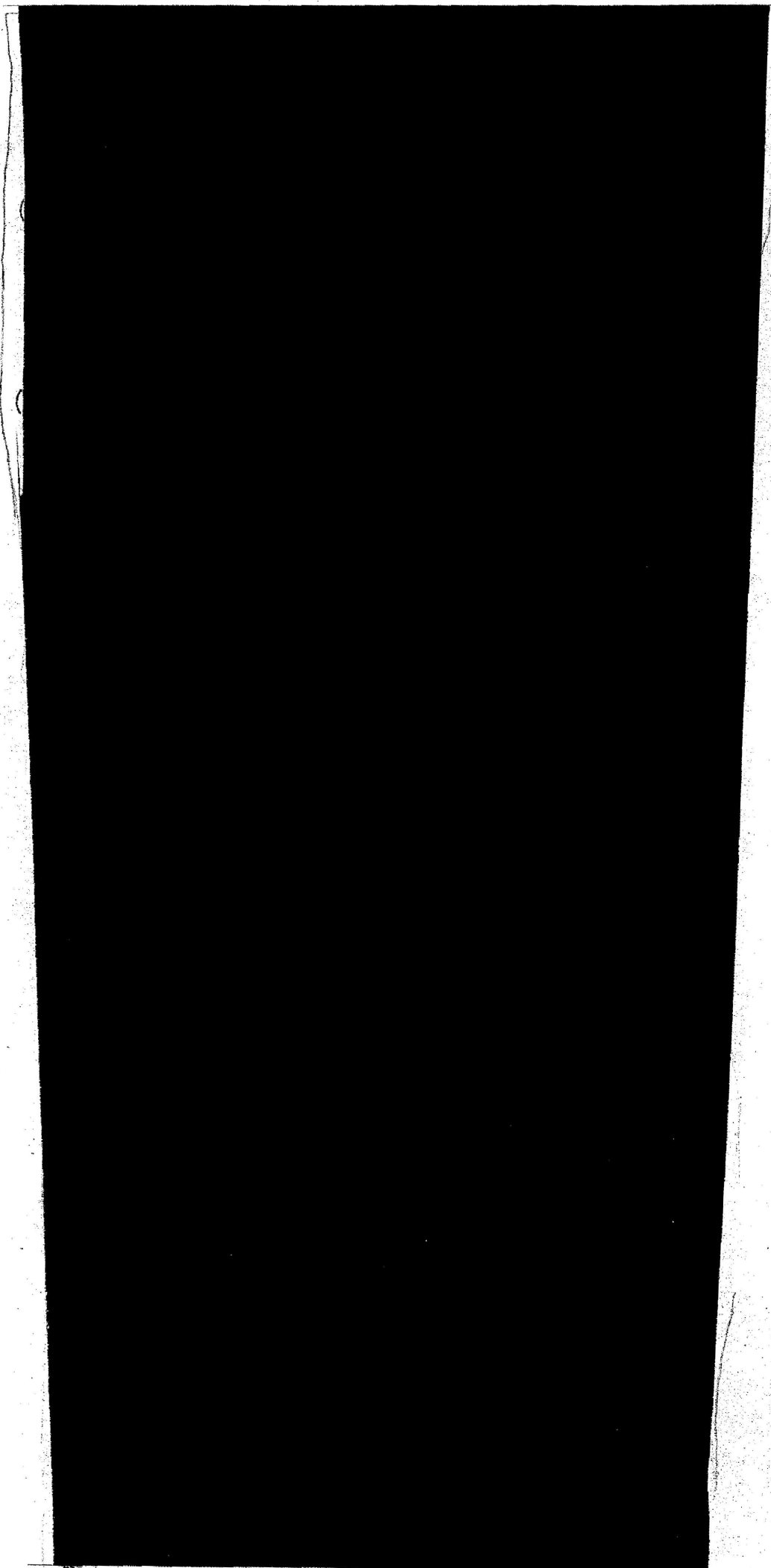
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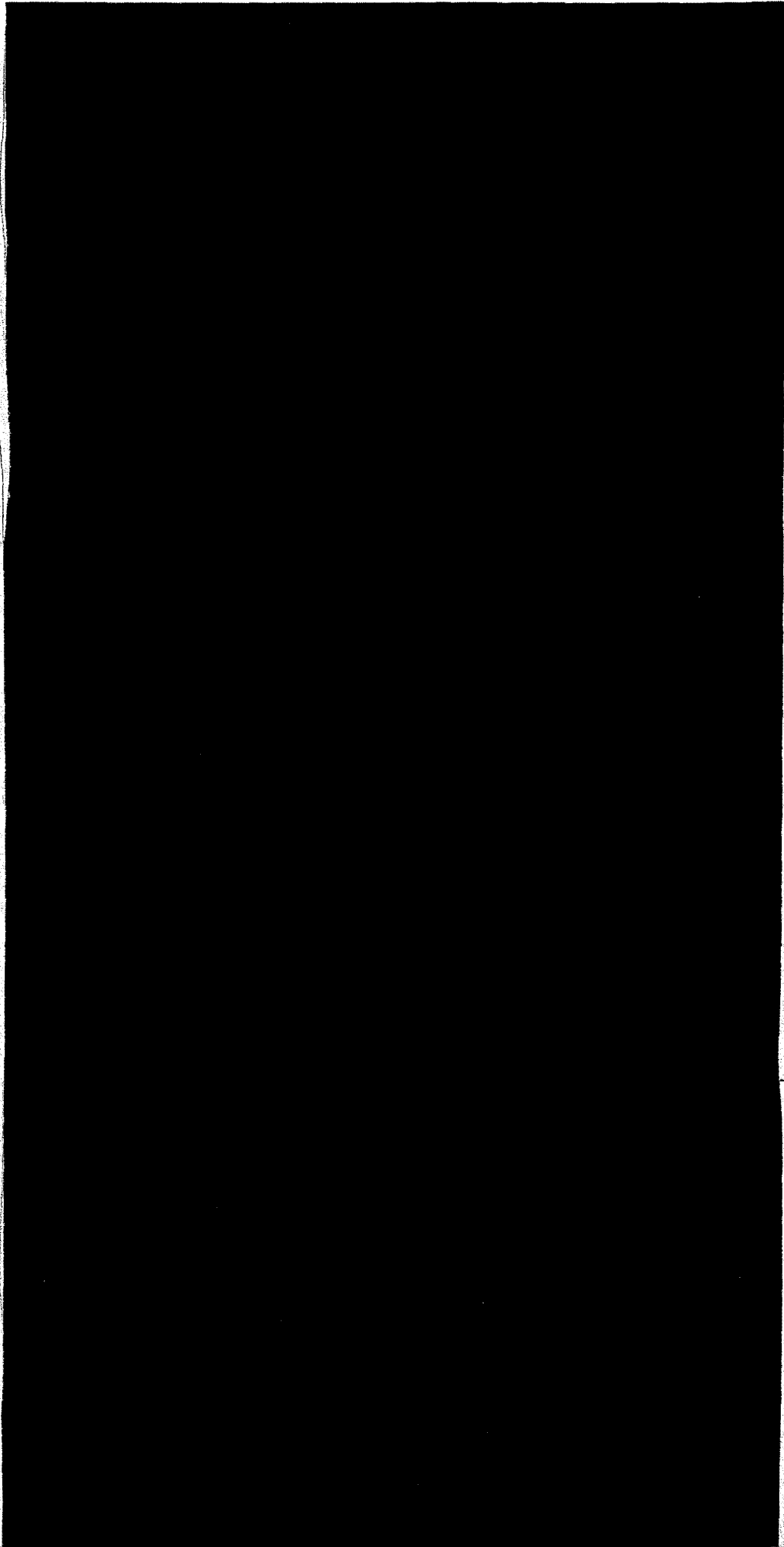


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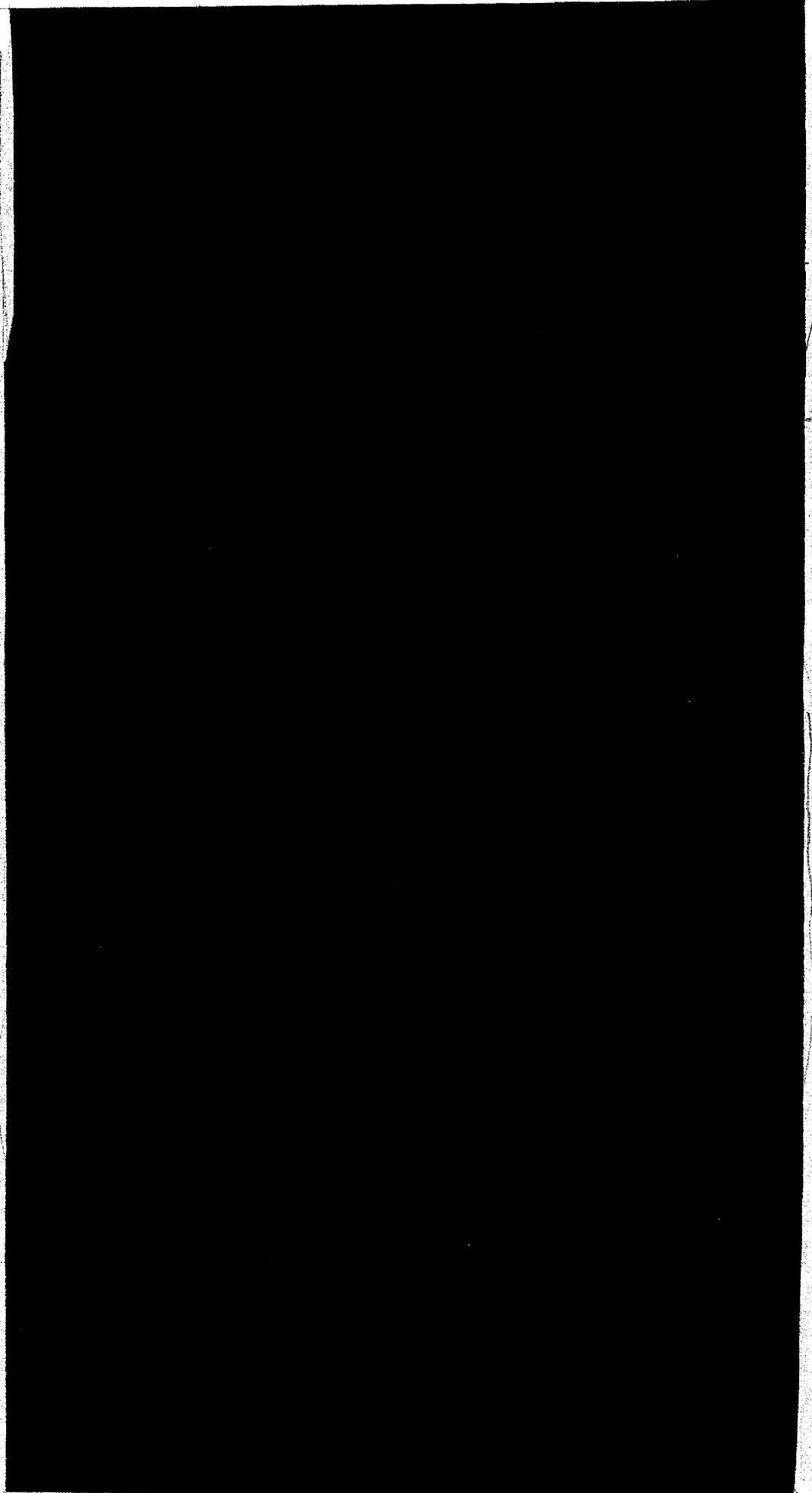
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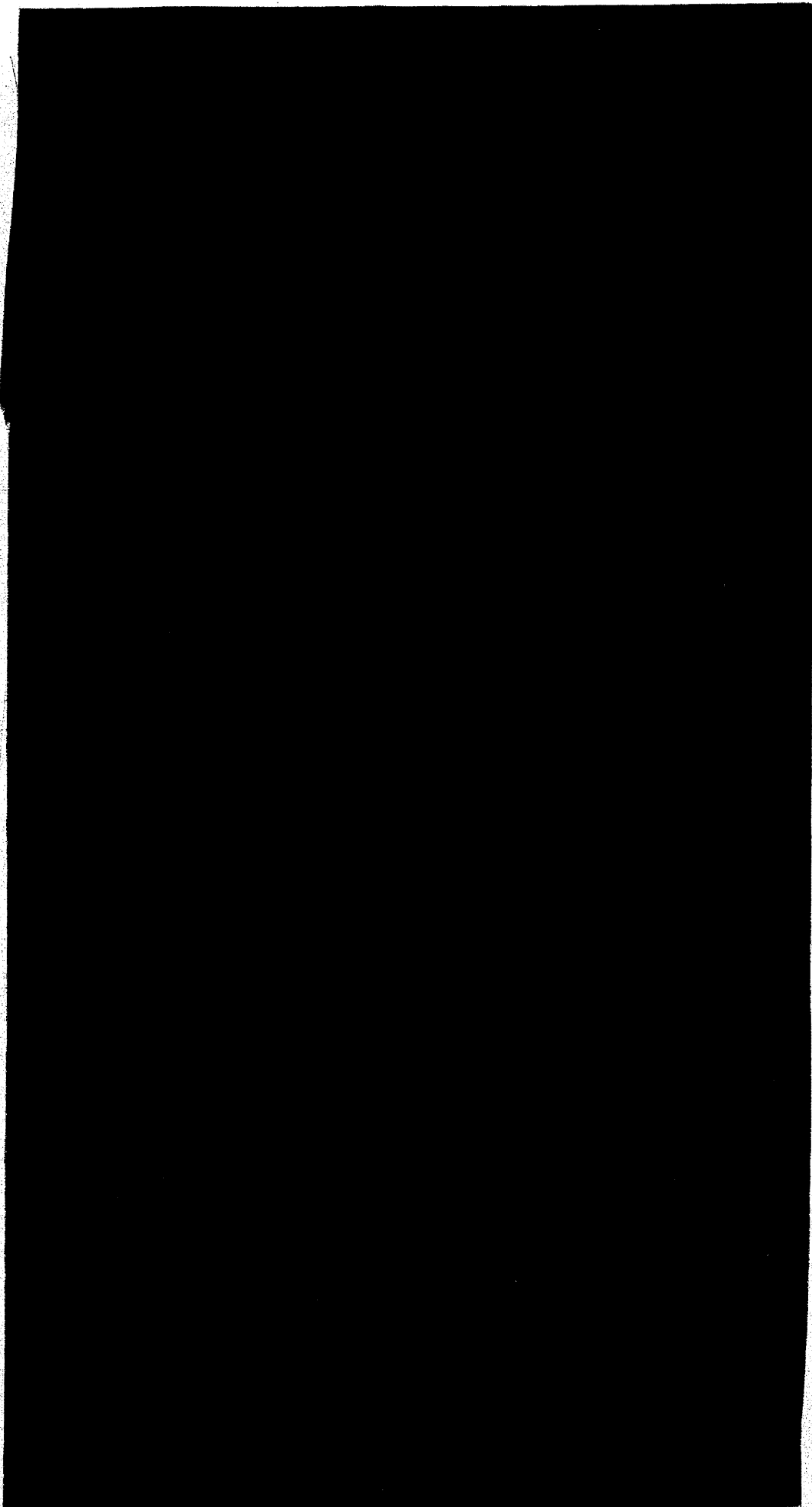


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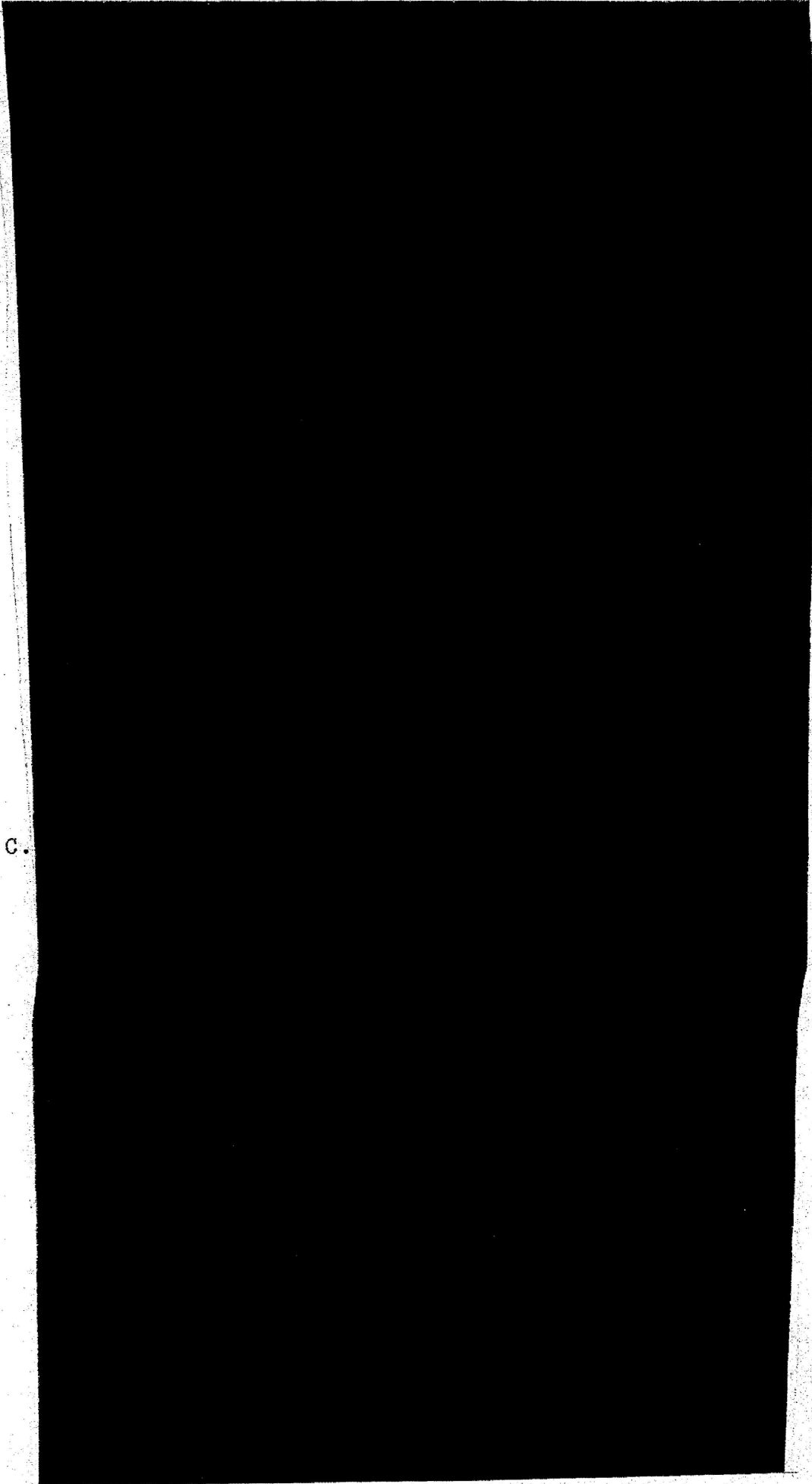


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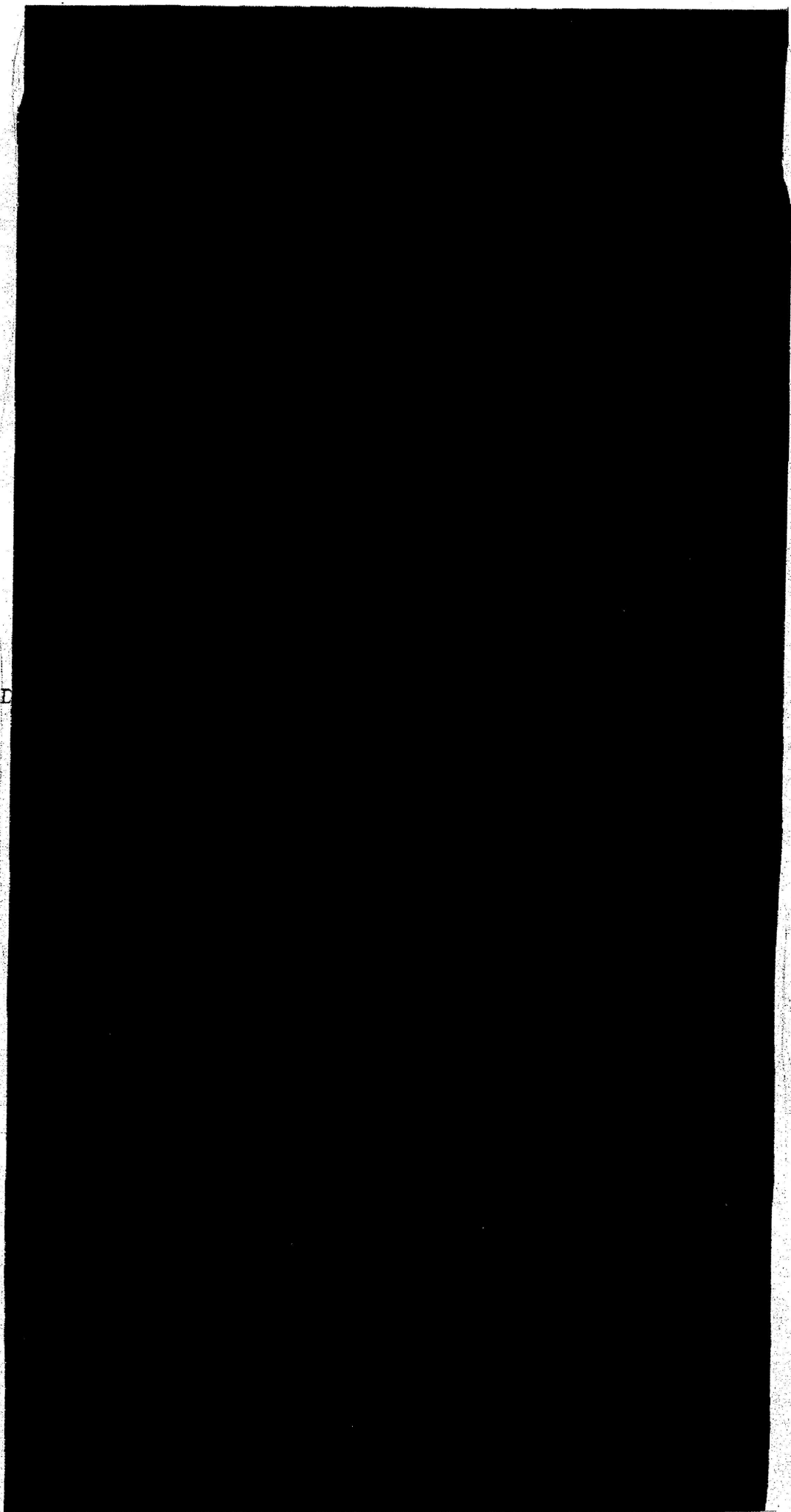
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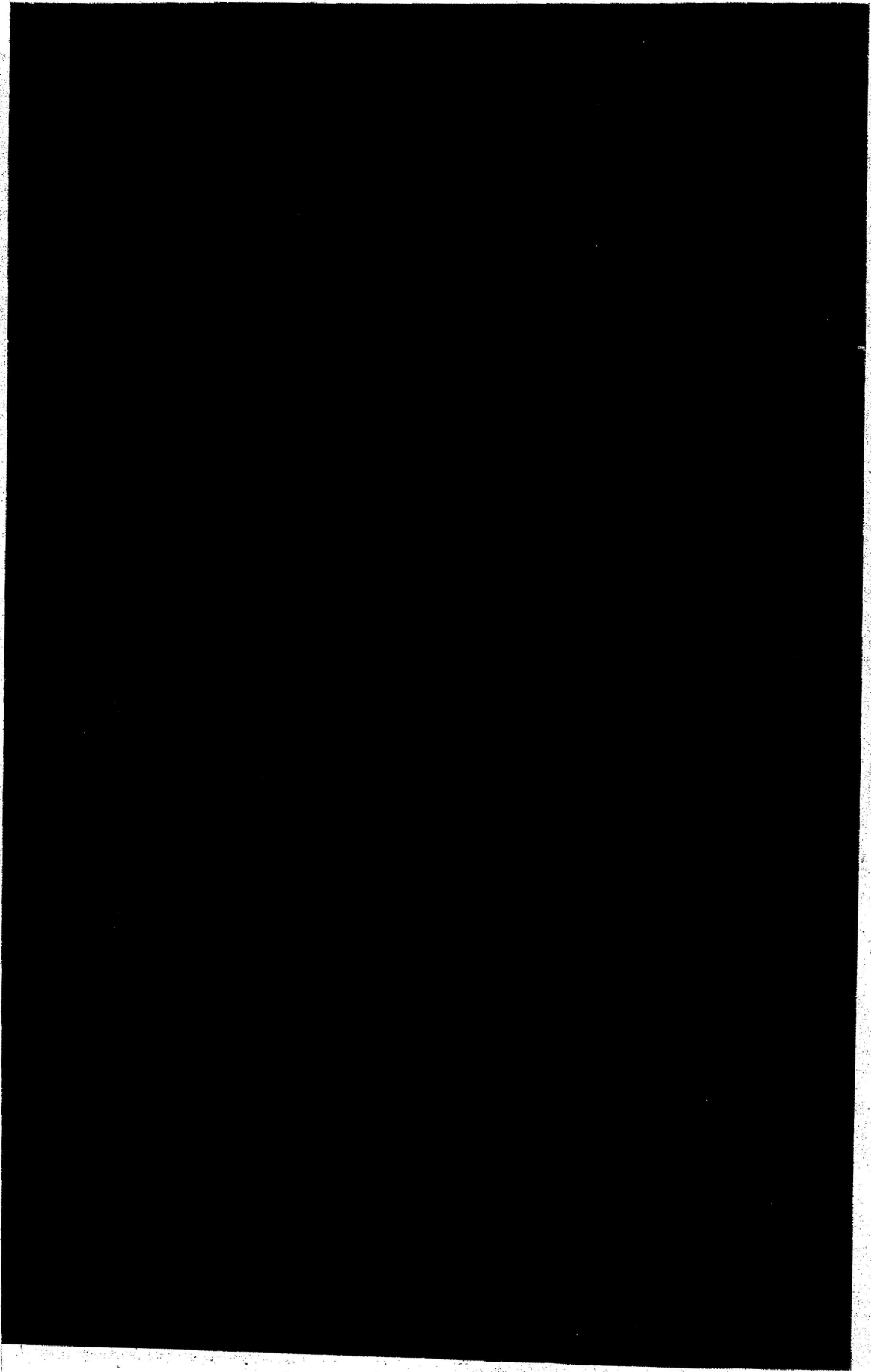
IV. Conclusion

The plan of Figure 1 represents the best compromise in view of the need to determine value of possible stockpile models, design information for future developments, and effect of initiator from only three detonations. The plan has the additional very definite advantage that no shot is determined by the outcome of the shot immediately preceding it. This allows time for the analysis of substantial amounts of data and considered judgment in determining the model to be used for the third shot.

No reconsideration of this plan should be permitted after it is adopted as an operational procedure and the Test Organization has started procurement and plans on this basis.

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By D.M. tsa Date 7/27/08

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