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JANUARY 15, 1945

OF THE LOS ALAMOS PROJECT

PROGRESS REPORT NUMBER SIX OF THE GADGET PHYSICS DIVISION

This document contains 62 pages

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difficult to make measurements with an external detector, and for this material as possible from the internal assembly. It is, of course, used externally. It seems to be important to eliminate as much extraneous that a fairly good prediction could be made when a long counter was and internal piston chamber and external long counters. It was found with extrapolations to the critical mass using external Geiger counters rather pronounced may upon its position. Some experience was also obtained caused asymmetries which made the effect of added material depend in a material was added. Introduction of detecting chambers near the core was encountered due to changing experimental conditions when additional In the course of these critical mass experiments, some difficulty was understood of the hydride is far from complete.

disagreement between experimental and theoretical results indicates that a 5.05 kg of 25 as critical mass when the core was surrounded by Cd. The 6.03% WC predicted 5.1, observed 7.5. A further observation on BeO gave follows: BeO predicted 2.1 kg 25, observed 3.2; U predicted 3.8, observed slightly for the effect of the extraneous material on the assembly are calculated. The results which for the case of U and WC must be decreased is found that the observed results are considerably higher than those by Group G-1. Criticality has been reached now in BeO, U, and WC and it further assemblies of U^{235} usine U and WC tampons have been made

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collapse until an x-ray shot is made. The effect of the x-ray flash is still seen possible to obtain magnetic records which can show the complete detection equipment from the pickup effects from the x-ray tubes, and it is now considerable progress has been made in shielding the magnets and to consist in the early stages of a well defined series of laminae. and the observation of the detonation waves, considerable structure of the jets can be observed and when well formed, can definitely be seen to be hollow inside. Intercession of the detonation waves, considerable structure of the jets can proceed directly against each other above the plate. For ordinary waves expectancies there is definite evidence for jets formed when the detonation at two points above a thin steel plate. In contradistinction to some previous detail in the structure of the jets formed by detonating a slab of explosive recent photographic work by group G-2 has shown considerable assembly has gone above critical for prompt neutrons.

The instantaneous intensity is quite large. This is the first time that an absorption. Since the length of time of the burst is 5 to 10 milliseconds, added, and drops of considerable intensity (10^{11} to 10^{12} neutrons) were between stations, was longer than had been expected. More material was first drops gave very small effects indicating that the mean time to avoid effects from delayed gamma rays, and a very thin tamper was used dropping through a rather thinly tampered ${}^{70}\text{Fe}$ assembly. Graphite was used graphite tamper, ${}^{70}\text{Fe}$ (75 per cent concentration) and more graphite was neutrona were made on January 13. A large consisting of a sandwich of the first drops which produced a chain reaction with prompt purpose fairly large sources are needed.

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Some further measurements have been made by Group G on the study of small lenses. And the results previously reported which were in contradiction with other methods of detection appear to be erroneous. Present results indicate agreement with the other measurements and that the most accurate results can be obtained with small loops of wire in which the circuit is made when two pins are connected by contacts. There appears, however, to be no advantage in this method over the direct electrical method for this work, and in the future very little work of this type is contemplated.

Considerable progress has been made with these small loops in the transmission of a signal from the inside of a hollow sphere. The method is to transmit a signal from a loop as oriented that the compensating odd currents in the sphere would pass across the crack between the two hemispheres. It is found that with as much insulation as is furnished by a sheet of paper between the hemispheres more than 10 per cent of the energy has been made to obtain the signal from the inside of a copper sphere in which the hemispheres are separated by $\frac{1}{8}$ in. of tetrolite. While the test has been made to obtain the signal from the inside of a copper sphere by a sheet of paper between the hemispheres more than 10 per cent of the energy is transmitted out from the sphere in a static test. One dynamo by a sheet of paper between the hemispheres more than 10 per cent of the energy is transmitted out from the sphere in a static test. One dynamo

suppliy has been introduced which gives greater stability to the discriminator scales so that all new units will work with fast pulses. A regulated The Electronics Group, G-4, has revised the standard laboratory base line. This break in the curve is not clearly understood at present. Large increase in negative voltage immediately after the curve crosses the These all show breaks in the rise of the voltage curve and a very

the inner surface of the shell.

This break is interpreted as due to the reflection of the shock wave from

(15)
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X-ray shock opposite the detonation point.

X-ray immediately following collapse corresponds to the jet observed in the X-ray photographs of Group X-1 make it seem probable that the large negative comparison of the single point detonations with

(16)
JULY

have been obtained.

month, and magnetic records which are quite free from interference effects. The site at Pajarito Canyon has been operating during the past month at present cannot be obtained in any other way for a full share. method of obtaining information about the implosion in its later stages development of small circuits to fit inside the spheres will provide a reasonable well matched as to shock velocity in some cases and that the signal is transmitted. We believe that the conductive material can perhaps record is not completely understood, it is quite apparent that an appreciable

~~CONFIDENTIAL~~ SERIOUS THESE DIFFICULTIES MAY BE.

better conditions of alignment will be necessary before it is clear how low energy tracks. Further experiments at higher intensity and under tracks in the region representing the tamper. There are also numerous with gold core. These show, due to the low intensity, a great scarcity of

LOW INTENSITY were obtained on January 15 with a [REDACTED] STEEL MOCK-UP

The first pictures taken with the betatron operating at very 20E

the cloud chamber was begun on December 22 and is now complete. Patented in order to get the contractor off the site. Installation work on electrical installation to the members of the group than had been anticipated. Expected completion date, and it was necessary to leave a larger amount of construction work on K Site dragged out considerably past the

the point where it gives 40 R/mn.

After replacement, it has taken some time to work the instrument back to cutters were encountered with the injector which then had to be replaced.

After the start of construction. After a few days of operation, diffi- December and the instrument was in operation approximately two weeks

Installation of the betatron by Group G-5 was begun about mid-

in the study of insulation.

Testing equipment of various degrees of resolution for use in experiments electronics group continues to be in the development and construction of this window has been built. A considerable fraction of the work of the repair of various health instruments, and a portable alpha counter with applications. There has been considerable work in the development and

~~CONFIDENTIAL~~
[REDACTED]
reliability of the results. A modulation scheme for the proportional

observing the Ra Ia shot which should increase the accuracy and the

A number of improvements are being made in the equipment for

[REDACTED]
metall meter to determine the effect of absorption by the H.E.

shot using a small amount of Ra Ia from the same shipment was made without

electrode detectors can be used to increase the simultaneity. A further

It is planned to postpone further hollow sphere shots until

14-19
204

shipment No. 3 and an almost solid sphere.

A second shot was made December 14 by Group G-6 using Ra Ia

appears can give measurements accurate to somewhere better than 1/10 msec.
is a photographic method using the cameras developed by G-11 which it
accuracy of the measurement of the detonators. Most promising of these
several methods have been under investigation to improve the
the difficulties have been traced to characteristics of the explosive.
these have been made with great care in the local shops, and here again
show a considerable improvement. Most of the mechanical assemblies for
The results with spark detonators filled with lead azide also
mention work.

now being made to get electro detonators into general use in the experi-
Strong efforts are

[REDACTED] [REDACTED]
failures have been observed.

overcome. From 1200 detonators tried at 5600 volts and 0.5 μ F/det. no
of the detonator. It is now believed that these difficulties have been
but that these difficulties were caused by erratic mechanical behavior
encountered were primarily due to insufficient control of the explosive,
both wire and spark detonators. It now appears that the difficulties
a very considerable improvement in the simultaneity and reliability of
Tests carried out by Group G-7 during the last month indicate
intensity by observation of the second harmonic of the applied frequency.

characteristics of the counter then permit measurement of the radiation
the D.C. voltage applied to the proportional counter. The non-linear
counter has been proposed which would superimpose a high frequency voltage on

in connection with the development of the initiator. In the meantime, the group G-10 has made plans for a new firing site in Santa Cruz.

160
165

the quality of the results.

better charges, and an investigation is being made in an effort to improve obtained on this scale are much poorer than have been obtained with

The records

16
160

of hemispheres accelerated by cast charges.

A number of experiments have been carried out to study the motion

lateral by a group of lenses.

study of single lenses and in the study of the acceleration of a metal plate with great rapidity. It is now planned to use this method both in the study of these lenses, and the measurements can be carried out and analyzed

behind the zenith by 1.0 microns. The method seems to work very well in

For the 2115G lens, they find that a point 70° from the axis lags

which may eventually be achieved.

since it is likely that this may determine the degree of simultaneity studies will be made to determine the over-all time lag in the detonator

in the study of electric detonators. It has been possible to produce an
The rotating pyramid cameras have been modified slightly to use
definition of photographic studies.

suscept. Use of this equipment should greatly increase the accuracy and
efficiency. And experiments are now in progress to use a jet
a pulse of 0.1 msec wide, the usual explosive light source does not give
make static tests at frequencies of 0.2, 0.35 and 1.0 megacycles. Using
The Kerr cell pulsing equipment has been used by Group G-11 to

incorporated together with comments in the G-10 group report.
of the designs now being considered has been prepared by Sherr and is
collapse cavity and do not initially fill the whole volume. A summary
being proposed introduce a symmetry which is different from that of the
after severe impact. In order to overcome this, some of the designs now
is a very difficult one, and sandwiches of materials remain as such even
drawn. It seems, however, that the problem of mixing materials in impact
preliminary tests made on several initiators, no conclusions can as yet be
While a number of interesting phenomena have been observed and

on test initiators with the 20 mm gun,
the action of an initiator might have been. Shots have also been fired
can be made with recovery of sufficient material in order to ascertain what
shots have thus been made in an attempt to find out how severe an impulse
of X and G detonations that operate suitable firing sites. A number of
Group has requested shots to be fired for them by various other parts

R. F. Bacheg

of Group X-2.

Some further development work has been started to obtain higher speed photography of cathode ray oscilloscope traces. Various tests have been made in the development and design of equipment for the field tests

target which moves at 4×10^5 cm/sec. and gives a resolving time of somewhat better than 10⁻⁷ sec.

the order of 8 kg of 25. It must be pointed out that this extrapolation is quite in error near critical. Extrapolation indicates the critical mass is probably it has not been seen near critical. D. Fe and Pb Tamper. About 5 kg of 25 in a form of UH_{10} in these tamper

is 2nd with 7.5 kg.

of UH_{10} in the TC tamper is in the order of $\frac{7}{5}$ kg of 25. Criticality was reached on temper, a series of measurements were made. These indicated that the critical mass C. MC. Using the BP₃ chamber covered with Cd wrapped paraffin outside the

ments will be continued.

that the critical mass in Tu seems to be about the same as that in MC. These measure into the Tu tamper, and this amount was sub-critical. At the moment, it can be said a value of the critical mass in this tamper. About 5.3 kg of 25 UH_{10} has been put

B. Tuballoy. Some difficulty in the work previously reported gave too low

that without cadmium, is about 1.65.

which the iron would ordinarily absorb. The ratio of critical mass with cadmium, to this correction will not be large since the cadmium absorbs many of the neutrons made to this value for the critical mass, because of the iron in the structure, but critical with about 5.5 kg of 25 in the form of UH_{10} (72%). Some correction must be

A. B60. An assembly of which the core was surrounded by cadmium was made

25 is now available to reach criticality in both Tu and MC.

placed on the use of the detector outside of the tamper. It is believed that enough means made with detectors in tampers are not trustworthy. Emphasis is now being measurements in heavy tampers (Tu, Fa, MC, Pb) indicate that the measure-

I. Determination of Critical Size of Hydride Assemblies - Whole Group

January 22, 1945

GROUP G-1 - O. R. Fritsch, Group Leader

yet been analyzed. No radiation which would affect human health was observed between successive pulses in 1 to 2 microseconds. Various records were taken which have not yet been analyzed. The position of the control rod, it seems that the average time between the ^{10}H rise by about .001 degree C in one of these pulses. From the way this burst (10¹¹ - 10¹² neutrons estimated) were obtained the same evening. The temperature of was dropped throughout. More ^{10}H was added during the day and strong bursts indicated that the system was indeed supercritical for prompt neutrons when the sun 18th, in the small hours of the morning, small bursts of radiation were observed which delay was caused by various snags in the recording equipment. However, on January some of the parts were delivered from the shop a few days later and further

5. Drop Experiment - Whole Group.

Construction of this equipment in C shop is continuing.

4. Power Hydride - Field, Slotin

3. Safety Tests Outside Cage - No progress.

2. Safety Tests at Cage in Amounts of Active Material - No progress.

curacy, as that having a $7 \times 7\frac{1}{2}$ " outer dimension.

section of 6×6 " and $\frac{1}{4} \times \frac{1}{4}$ " inner hole required the same, within experimental accuracy, as that having a $7 \times 7\frac{1}{2}$ " outer dimension. A more elongated assembly of outside cross-grossmately cubic shape without hole. A more elongated assembly of outside cross-section of 6×6 " and $\frac{1}{4} \times \frac{1}{4}$ ", required about 55% more material for criticality than an $7 \times 7\frac{1}{2}$ " and inner hole $\frac{1}{4} \times \frac{1}{4}$ ", respectively. An assembly with an outer cross section of $7 \times 7\frac{1}{2}$ " the center of the core of hydride. Several assemblies were made in which a $\frac{1}{4} \times \frac{1}{4}$ " square hole was made throughout the center of the core of hydride. An assembly with an outer cross section of $7 \times 7\frac{1}{2}$ "

one required about 10% more active material to reach criticality.

pared with an approximately cubic one ($5\frac{1}{2} \times 5\frac{1}{2} \times 4\frac{1}{2}$ ") with the result that the last

F. Shape Factor. A rather flat assembly ($7 \times 7\frac{1}{2} \times 2\frac{1}{2}$) in 360 was com-

Graphite, No ^{10}H has been put in this paper since the last report.

are made critical.

To continue this experiment with UH_{10} in MC and UH_{10} in Tu, as soon as chose assemblies
This indicates that the UH_{10} -BeO assembly was about 5 nsec. It is planned
critically. The prompt period observed was a little greater than 500 microseconds.

This experiment has been done with UH_{10} and BeO at about $1\frac{1}{2}$ below prompt

10. Ross Experiment - Baker, Neeson

The assumption that it is due to thermal neutrons difference is from the temper.
was found to disappear if Cd was placed between the core and tamper, which confuses
The sharp rise in fission density near the edge of the BeO-tampered UH_{10} core

9. Neutron Distribution Inside Hydride Assembly

nsec.

above assembly of 1.2 crits, would have had an e-foldage time of about 80
BeO, the above assembly of 1.2 crits. As obtained from the Ross experiment with UH_{10} and
prompt. Making use of the τ . As obtained from the Ross experiment with UH_{10} and
indicated that this assembly was about 7% supercritical on delay or about 6% on
about the activity of 1.2 crits of UH_{10} in BeO tamper. The amount of boron required
plastically filled by Jetter's group. Some of these plastic blocks have been used to com-
large boron lead bricks were changed. The request for boron plastic blocks was com-
Because of the failure of the large die in Sigma Blade, the request for

7. Feynman-Boron Experiment - Baker, Daghlian, Fritsch, Holloway

satisfactory performance.

Some of this equipment was used in the Drop Experiment (#5) and showed

6. Detecting Equipment for Strong Neutron Pulses - Hugheas, Oborne.

about one week. After that we plan to do some more drop experiments.

The UH_{10} are then taken out and will be used for other measurements for

electroscope at a distance of 30 feet was completely discharged by one burst.

which 5 ft concrete wall, but near the system the dosage was appreciable; a neutron beam

plate.

number in a reproducible manner as the wave becomes more normally incident on the evidence of the multiple spall in $1/4$ " plates. The spalls develop and increase in angles (90° to 25°) of impact of the detonation wave on the metal plate, giving pictures of $1/4$ " plates with varying booster separations, i.e., differing

spacings for the latter band observed in the pictures of $1/8$ " plates. Actual samples of the spall laminae. However, an edge spall effect is probably observed in $1/4$ " plates are real; in fact, careful recovery in sandblast has revealed testinal observation. There is now abundant evidence that the multiple spalls observed by $1/8$ " plates were real. (Such spalls were in disagreement with results obtained by

multiple spalling observed in slab shots with $1/4$ " plates, and single spalls observed in $1/4$ " plates and spalls. Experiments have been made to determine whether the mul-

ticrondenitometers is out of action until a new amplifier (now covered) is delivered. In the meantime it is out of action until a new amplifier (now covered) is delivered to the meters appear from shot to shot. Further analysis is impeded because one of the cameras close limitations of impulses but unequalled differences in the measured di-

photographs were obtained for comparison with impulses. The models appear to be very good. In the meantime, the models were loaned to Gresson's group and some X-ray

sections.

In an essential part. The installation of an ionization chamber was undertaken by Allen tube. It was concluded that a monitor for the X-ray filtered intensity at every shot satiation of the impulse models, and trouble were traced ultimately to a bad X-ray

1.2 - Spares. Very promising results were obtained on the attempted standardiza-

1. X-RAY Photographs: Tammper Studies - Tuok (in charge), Crocker, White, Gaird

January 18, 1945

GROUP G-2 - L. G. Harris, Group Leader

have to be reduced in scale.

plane lenses charges was more damage than anticipated. Consequently, the charges were

1.4 -- Shockwave Fronts. Preliminary experiments showed that the blast from the

are unchanged by the cork.

pressing spall. However, the photographs indicate that the jet and spall phenomena cork might be expected to have appreciable effect in blunting such a spike, and suppression of a thin spike, ahead of the reaction zone in the detonation wave, such a layer of

If observed spall phenomena be attributed primarily to the intrusion.

1/8" cork was interposed between the HE and the metal.

Experiments have also been made with conventional slab geometry, in which

action.

whole, the X-ray pictures tend to indicate an origin for these jets in the HE inter-

of the plate adjacent to the HE interaction, and no spalls anywhere else. On the

of (b) are not yet complete, but there appear very well defined spalls in the region

at the base of the jet. A correlation with Koski's pictures is in progress. Results

probably accounts for the appearance, in some of Koski's pictures, of secondary lobes

the later spall is larger than the initial spall, i.e., at the tip of the jet, and

further, a spall structure can clearly be distinguished in the jets at 90°. In which

jet was obtained for $\theta = 37^\circ$, in which the spall structure can be resolved,

in the HE), which increases in size as it becomes smaller. A large and extremely ten-

aceous jet was obtained for $\theta = 90^\circ$ (waves measured based on

action of the HE. Results of (a) show a clear jet when $\theta = 90^\circ$ (waves measured based on

to eliminate all shock interaction in the metal, while preserving unchanged the intri-

front and plate as just mentioned), and (b) with a tetryl Comp. 5 lens system designed

with varying separation of the boosters (i.e., with angle of between detonation wave

to study the mechanism of jet production, slab experiments were made (

measured. Both the box and the batteries will serve to increase the signal to pick up recordings. A copper box to surround the picking coil, charge, and field coil is being tested. It is hoped to attain an 80 Gauss field which presents battery storage capacity.

Additional storage batteries are being tested to provide a larger storage which reduces the resistance in the circuit and thereby make it effective.

It is decided to the $1/4$ " steel walls and ceiling because the proper bonding is obtained in this. #3 is inadequate principally because the sheet metal on floor is showed no essential improvement in pickup. From these tests it is supposed that further tests made with the wire sealed off from blade. #3 by copper sheet,

(b) The wire pickup is sensitive to coil orientation and location, and to the peak magnetic signal using a 15 Gauss field.

Peak pickup with the best coil orientation is approximately equal to the leads to tube through the single large hole in the wall of blade. #3, the position of X-ray tube and leads. With the tube in the wire and with the peak magnetic signal near the wire and when near the nose of blade. #3 and wires to

position of the X-ray tube in blade. #3 has been tried. Comparisons to date are made showing coil near the wire and when near the nose of blade. #3 and wires to show if separation have been made. In particular, various positions and orientations of

C.1. "Intermittent action. Further studies to eliminate picking caused by the X-ray

C.2. "Central shock, no progress,

C.1. "Wire noise, no progress,

C.1. "Induced - noise (in charge), x/u resistors

X-ray tube. We hope that this disturbance will be reduced when the sample filter has been removed in reducing the disturbance caused by the impulsive generator operating the sample filter has been installed in slide #5. Considerable trouble has been experienced in taking ion chamber and amplifier for the photographic studies of alpha particles between the measured dosage and the operation of the counters. To some correlation between the measured dosage and the operation of the counters. Preliminary results indicate an absorption of Pb has been tested at P-btte. A new ion chamber and amplifier having sufficient sensitivity to allow operation wavelengths.

It was usually operated behind $\frac{1}{8}$ " or more of Pb and more sensitive to much shorter wavelength than the chamber was most sensitive to the longer wavelength whereas the counter only absorber in the X-ray beam was the end of the chamber which was of $\frac{1}{8}$ " brass. Particular ion chamber was filled with argon to a pressure of about 100 lbs/in². The nearer the X-ray tube and the number of counters fired by the same X-ray pulse. There little correlation if any between the readings of the ion chamber dosimeter installed 3.3 -- Integrating Ionization Chambers. It was discovered that there was very X-rays.

3.2 -- 1-mm Counters. No progress. These counters have not yet been tested at all after the output networks had been modified. The counters operated satisfactorily with the new gate circuit run to a safe value. The counters operated satisfactorily with the new gate circuit run to a safe value. The counters operated satisfactorily with the new gate circuit run to a safe value. The large current due to the displacement current through the 50μF condensers at the output of the peak currents passing between the counter bell and central tube. This large current frequently received at 2-state numerous counters blow up as a result of large 3.1 -- 5-mm Counters. When the 5-mm counters were placed by the filament fate 3.0. Counter and Ion Chamber Levelement - Allen (in charge), Hudson, 1/3 Schuster,

checked roughly by determining the percentage fitting of the counters for various po-

The effect of the elypha and beta collimators on X-ray intensity has been

the $\frac{1}{2}$ " wide slot in the permanent steel front of the cross.

cross as well as in the front of the cross where undestred X-rays may enter through

tional lead is being installed inside the forward part of the flat sides of the ste

have been shown to penetrate the steel body of the detector post. Therefore, addi-

4.2 -- Static Scattering and Counting Studies. X-rays in appreciable quantity

stalled.

The power supply for the indicator thyrotrans has been removed from it-

voltage.

already a person at the detector post can possibly turn off both the gate and base

dangerous to personnel. Therefore, an interlock device has been built and installed

The new gate supply, being a low impedance device of high voltage, is very

structure of the new networks for more counters to proceed.

of the counter assembly and the lower half in the bottom of the detector post. Con-

counters, the networks have been divided with the upper half now mounted on the back

about 6 feet from the counters to the networks. Accordingly, for the eight test

action between parallel wires having thin insulation and which are closely spaced to

the counters to the networks. In addition there was found to be objectionable inter-

was found to cause insulation breakdown between the necessary small wires connecting

The voltage surge resulting when a counter becomes conducting upon firing,

counters have been used at one time.

been installed at P-beta and is operating satisfactorily, although, so far, only the

4.1 -- Counters and Electronic Circuits. The permanent ignition gate circuit has

T/3 Westcott, T/5 Henderson

4. Counting Isolation and Separation - Metallica (in charge), Hartow, Willcox,

Implosion model tests were made in cooperation with Grefecon's section of group X-1, comparing a new and a used (826 flashes total, $156 > 400$ KV) tube each at 1/8 inch steel was about the same for the new tube at 360 KV as for the old tube at 360 and at 400 KV. Intensity (average of 20 flashes) through 5 inches of dural plate

Implosion model tests were made in cooperation with Grefecon's section of parts.

Conference was held with Westinghouse personnel concerning progress on tube development. Report of the conference was prepared and distributed to interested parties.

A tube which has passed its useful life was cast in a block of paraffin and fractured, pick-up and other non-x-ray use. This device will prolong the useful life installed in the war, P-Site, to be used as surge generator load for all testing of the normal intensity through 1/2" steel (see section I-2 of this report).

One new tube was installed in the P-Site war and found to give only 50% of

netic focusing studies were received.

the past month. 18 new "standard" tubes are on hand. 4 experimental tubes for mag-

5.1 -- X-Ray Tubes. Five tubes were consumed in the work of the project during

5. X-Ray Equipment - Guykendall (in charge), Finlayson, Wengenass, T/4 Whitmore, T/3 Ritter, T/3 Burdett, T/5 Pettit, T/4 Kluberg, T/4 Price last month.

4.3 -- Detector Post. A new removable iron front part of the cross has been made from a single piece of steel plate to replace the part broken by the explosion of

and counter studies.

4. Collimator or the Theoretical Division is now assembling in the scattering ring from the collimators of incomplete collimation. This is probably not serious. either side of maximum intensity remains about half the peak value indicating scatter stations of the counter assembly. A sharp maximum is found but the intensity on

able for further shock wave tests.

ture of 7% by volume of T02 bonded in polyethylene would have an X-ray absorption rate

From calculations and tests of sample mixtures it was determined that a mi-

otherwise good shot.

target. No evidence of increased density because of shock wave was seen in four

and to time the flash of X-rays within a microsecond after the projectile hits the

5.3 -- 20-mm Gun. The X-ray triggering circuit has been modified so as to flash

tubes.

capacity and voltage than now in use, and probably beyond the limit of the X-ray

time. These will permit construction of an oil-immersed surge generator of greater

A shipment of ten 100 KV, 0.04 mfd, condensers is expected in about a week

occurred. This general design shall be used in future generators for 400 KV or more.

house condensers was constructed and tested at 480 KV. No spark-over difficulties

5.2 -- Surge Generators and Timers. An oil-immersed arrangement of nine Westing

and its replacement necessitated installation of a new oil container.

The X-ray tube in the gun program reached the end of its high intensity life

vious tubes.

when sealed by about 100 flashes, emit intensity approximately the same as the pre-

Recently the tubes at Anchorage have "played out" and new ones installed which

less than that emitted by the tubes in service at Anchorage at that time.

However, the maximum intensity obtained in these tests at 360 KV was about 20 to 40%

an increase of intensity of about 50%, which agrees with the ion chamber results.

samples of the model photographs it is estimated that the use of 400 KV resulted in

more than twice as great for the new tube as for the used tube. From

400 KV, and was 75% greater at 400 KV. The spread of intensity of the individual

original wooden doors that were damaged in early explosive tests.

Heavy, all steel doors have been installed in Bldgs. #3 and 4 to replace the

6. General Facilities at P-Site - Crocker (in charge)

approximately 2000 amperes. This work has been done in cooperation with Kteneke. The peak current to the surge circuit. Rough calibration shows the peak current to plates of an oscilloscope. Preliminary curves show a lag of 2 to 5 microseconds in placing a resistor in the surge circuit. The voltage across this resistor is fed through a cable directly to the low 5 Mc. The voltage across this resistor is negative a resistance of 0.095 ohms and negligible inductance effect being placed in series in the surge circuit. The latest design is a 1/5" length of #¹⁴ wire having a constantan wire having a resistance of 0.095 ohms and negligible inductance effect been made.

Small resistors consisting of short straight lengths of resistance wire have been made. Preliminary measurements of the voltage required to establish the tube current. Preliminary measurements of the voltage required to establish the tube cathode structure which is believed to be the source of electrons forming the separate excitation (perhaps by an auxiliary Marx Generator) of the metallic arc in discussions have been held concerning the advantages and feasibility of

7000 gauss is more than ample. Retires of the Theoretical Division is assessing in the analysis of the magnetic focusing problems. He has concluded that a field strength at the cathode of nettle focusing is under way. The same coil and pulley arrangement as above will be used.

"vergent" focusing is under way. The same coil and pulley arrangement as above will be being experienced in obtaining current in the coil. Design of a ferrromagnetic core to insert within the hollow anode for "con- would design to give 4000 gauss field strength at center. The design of the coil and current pulsating equipment were taken over from group X-1A and at present trouble around an x-ray tube has been constructed, for "parallel" focusing. A coil has been

5.4 -- Magnetic focusing. An oil case large enough to hold a "bully" coil

(b) (5) DEC

Electrostatic shelving of Bldg. #3 has been improved with copper flues and hems have been installed in front of Bldgs. #3 and 4 to prevent fingers and fingers without slipping on snow and ice.

Hems have been installed in front of Bldgs. #3 and 4 to prevent fingers and fingers without slipping on snow and ice.

A system of ridge poles has been fabricated and installed. This permits a sharp covering of the counter post area and allows work in inclement weather.

The transformer taps have been changed to increase to normal the general supply voltage at the site.

A reinforced, one piece cover for the battery machine (used in magnetic studs) has been fabricated.

Yielded the following data:

sequent tests with pulse loops on charges of more uniform TNT density non-uniformities of density in the direction of the discrepancy. Sub-examination of the tampering data on these lens-charges revealed large examination results reported last month appear to be in error.

A. Timing results reported last month appear to be in error.

16/3/4

Rosen

301

and one charge have been assembled.

A new attenuator experiment has been designed and the equipment

2. Attenuation and HE Conductivity Experiments. Rosen
been designed and put into operation.

C. Standard calibration coil for absolute calibrations has
out has been placed in the electronics shop.

B. An order for a newly designed plan-prismoidal initiator core
records with new and old equipment are in agreement.

A. New equipment installed and in operation. Simultaneous

1. Instrumentation. All.

Section 2.

Section 2 - Crutet (Section Leader), Foss, Frankenfel, Kline,
Hobday, Kratz, Lanesman, Leiblich, Peterson,
Shank, Stark, Werner, Young, Major, Miller,
Stone, Feder, Herhey, Davison.

Personal: Section 2 - Fowler (Section Leader), Clancy, Daly, Miller,
Rosen, Smith, Thompsoon.

January 19, 1945

GROUP C-3 - G. M. Hillian, Group Leader

approximately 10 per cent of the pulse loop signal amplitude can be
detected) and tests in the field with a "primacord switch" indicate that
A. Starts. Tests in the laboratory (with a thyatron "triggering

11. Tamper attenuation measurements of pulse loop signals. Fowler, Rosen
and Thompson.

C. See paragraph 11.

circuits may be used in combination with metal pin contacts.
B. Preliminary results (1 shot) indicate that pulse loop circi-

of arrival of a detonation wave at a given position.

A. Pulse circuits have been developed to indicate the time

10. Pulse circuits. Fowler, Rosen and Thompson.

Results not yet ready to report.

B. Implosion of solid tubaloy spheres. Fowler and Sampson.

7. Explosive shots. No progress.

2158.

* This shot at low density deviates from other shots. It may be a

Lens	Method	Angle between pole and edge	Density of TNT	No. of shots	Pole and edge	3d between	Notes
2158	Pin Loops	~ 76°	0.81	1	1.1	1.1	None,
2156	"	"	0.89	1	1.3	1.0	
2156	"	"	0.89	1	1.3	1.2	
2156	"	"	0.89	1	1.3	1.2	
2156	"	"	0.89	1	1.3	1.2	
2156	"	"	0.89	1	1.3	1.2	
2156	"	"	0.89	1	1.3	1.2	
2156	"	"	0.89	1	1.3	1.2	

All orders will be placed through him and he will follow them up. There
Shanks will spend as much time as necessary to make all pictures.
to see that the necessary shots are fired on schedule.
site which will be on call at all times to give their highest priority
Frankel is permanent of a permanent firing crew for the medium
work at the small site will be concentrated on precipitation measurements.
small firing site and the part of Gamma Lab assigned to our section. The
an office of Pajarijo Lab and shop, is now also responsible for the
Some slight changes in responsibility have been made. Rates,
FIREARMS

2. Organization.

Second is discussed.

Slow explosive with a detonation velocity of less than 3600 meters per
thine about symmetry by the magnetic method are mentioned. Work with a
[redacted] [redacted]
experiments indicating the possibility of determining some-

1. Summary.

Section 2.

This too unique to the study of inside tamper eruptions.

C. Thought has been given to various schemes for applying

been made but the scope trace is somewhat ambiguous.

HRB

B. Dynamic. One shot of

HRB

tion factor is approximately the same with 100 and 200 KC sine wave sig-
of which are separated by thin insulation (paper or tape). This attenua-
detected outside of copper tamper, the two halves

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██████████

area as seen along the field.

expect, since the magnet record depends primarily on the projected weakly in the parallel detonations; the difference is what one would which comes out opposite to the detonation point. This fact appears can be correlated with a jet observed by Green in X-ray photographs. There is a larger negative knot immediately following the collapse; this on a line perpendicular or parallel to the field. In the former case, characteristic difference depending on whether the detonation point is magnetic record. In the case of 1-point detonation, there is a very

19

Again, some evidence of asymmetry could be seen on the

██████████

does not return to the base line in a smooth manner.

to the expansion of the sphere after the implosion, it always jagged and a single point, the negative voltage part of the curve, corresponding jagged as breakup of the sphere occurs. When the detonation was made at It then crosses the baseline a second time and becomes

A.

3. Experimental work.

Experiments, today, Klein and Werner, have been added.

records during the explosion appears to be partly due to interference

irregularity of the

detained on the first two.

Fair records were

D. RLA etc shots.

mixing of the static with copper.

There is evidence of poor symmetry or bad

voltage curve at about 2 msec. intervals after the start of the implosion.

These both show 2 steps in the rise of the

This also shows the break in the rise of the curve.

detonation is more pronounced.

that the break in the voltage curve during the initial stage of the in-

These records are similar to the preceding except

indicating that the detonation had been asymmetric.

After this shot, the field coil was found pushed 6 feet to the side.

inner surface of the shell. One of them shows a very irregular rise.

This may be interpreted as the reflection of the shock wave from the curve during the rise at about 3 msec. A few the start of the implosion.

They all show a break in the voltage

B.

tion in this case was made parallel to the magnetic field. No signal
was about as bad as usual.

(b) 2
3

F. Pick-up coil axis perpendicular to the magnetic field.

was about as bad as usual.

be determined with fair accuracy. In the third case, the interference
difference was appreciably less and the start of the implosion could
be prepared with about $1/8$ " of paraffin on the outside. In two cases, the
interference was about equally bad. Three torped charges were
prepared with about $1/4$ " of Comp. C. on the outside. As proposed by Mr. Marley,
the interference was about equally bad. Three torped charges were prepared
not be determined on the records. Three torped charges were prepared
was so bad in each case that the start of the implosion of copper could
not be determined on the records.

Interference during the explosion of the charge

E. Torpedo.

DE 153,

which was dependent on the primacord.

Made the shot similar to a one-point detonation and spoiled the timing
detonate before the explosion wave reached it through the primacord. This
cap or of Louise ausstieg the bottom penetration of the charge to
air almost vertically. Possibly a tetryl pellet was hit by a fragment of
weighing 550 grams lying on the ground. Indicating it was blown in the
soop. Another peculiarity of this shot was the finding of a fragment
expected as only the last part of the record was obtained on the solid.
The third charge detonated at least 50 usec. before it was

waves from neighboring detonation points.

from the HE and partly due to successive shocks from the interaction of

H. Slow explosion. All incendiary has measured the detonation

up of the sphere.

zero at about 6 msec.; this is probably connected with the breaking residual gas pressure. In two other cases the voltage dropped to shock wave acceleration, and the latter as the acceleration by the then remains nearly constant. The first part can be explained as a which point there is a sharp change of slope to a smaller value, which voltage curve shows a rapidly increasing rise up to about 6 msec., at the magnetic field and 2 with it perpendicular to the magnetic field, the 6 shots, 4 of which were made with the detonation line parallel to the

In

G. Exploding spheres.

solid state this was done only visually. Generated. This probably is due to imperfect orientation of the pick-up in a line parallel to the axis of the pick-up coil, some voltage was picked-up coil axis was perpendicular to the field and the detonation was the coil axis and the magnets rigid. In one experiment when the magnetic field and the same point detonation was perpendicular to both a similar result was obtained when the coil axis perpendicular to the one-half as great as was obtained with the coil in the regular position. The time when the sphere was expanding, a slight was observed about above background was observed during the implosion. However, during

Further experiments await evaluation by largely of the hazard involved.

Velocity m/sec.	Density of 50-50 mixture g/cm ³	Inside diam. mm	Outside contact area mm ²	Length of cylinder mm	Method of detonation
3580	1.50 g/cm ³	14.1	1-1/2"	1.56	Pentolite 1 in. shot
3630	1.50 g/cm ³	14.35	1-1/2"	1.56	Pentolite 1 in. shot
3680	1.50 g/cm ³	14.68	3/4"	1.60	Pentolite 1 in. shot
3720	1.50 g/cm ³	14.85	3/4"	1.65	Pentolite 1 in. shot
3760	1.50 g/cm ³	15.60	3/4"	1.67	Pentolite 1 in. shot
3800	1.50 g/cm ³	16.60	3/4"	1.69	Pentolite 1 in. shot
3840	1.50 g/cm ³	17.60	3/4"	1.71	Pentolite 1 in. shot
3880	1.50 g/cm ³	18.60	3/4"	1.73	Pentolite 1 in. shot
3920	1.50 g/cm ³	19.60	3/4"	1.75	Pentolite 1 in. shot
3960	1.50 g/cm ³	20.60	3/4"	1.77	Pentolite 1 in. shot
4000	1.50 g/cm ³	21.60	3/4"	1.79	Pentolite 1 in. shot

Following velocities were measured:

to research a high density in each case so that it would not scatter. The
attempt by weight. Detonator was sampled by hand and an attempt was made
velocities of a mixture of 50 per cent TNT and 50 per cent red mercury to
followed by weight. Detonator was sampled by hand and an attempt was made

1. Construction
100 pieces of equipment were constructed in this period. 64 pieces of equipment were repaired.

2. Scalers and discriminators - Higginbotham, Sands

The standard laboratory scalers have been revised. They now have a regulated supply, giving high stability to the discriminators. The discriminator and all new units will work on fast pulses. The discriminator dial is calibrated to read 0-100 volts. Unless otherwise specified, these are designed for positive input. The output for a counting rate meter described below. The Model 200 Scale of 64 uses 2 GSN7 scalers and 4 GSL7. The Model 300 Scale of 256 has two additional GSL7 stages.

The power throughout has been reduced and the life and stability should be corrected for 1000 to 200,000 counts per min. Accuracy 5%.

The Model 400 scaler contains an R.F. power supply, 1500 v, for G.M. tubes. This uses 6SL7 units and has a regulated power supply. It can be purchased with a F.E. register mounted on the panel.

A portable counting rate meter for use with the above has been designed. It will be useful for quick counts or for running preliminary bias curves. Eight ranges are provided for 1000 to 200,000 counts per min. Accuracy 5%.

The Model 500 scaler and discriminator is designed for applications requiring very high resolving time. A discriminator consisting of 2 GAG7s feeds an inverter which goes to a fast scale of 8 made with GAK5 and 6AL5 tubes. This is designed to feed to a Model 200 or Model 300 scaler. Resolving time is less than 1 microsec.

GRCP G-4 - W. A. Higginbotham, Group Leader

ments of multiple events occurring within the time interval can be made.

microseconds duration each. The sweeps are vertically displaced so that accurate measure-

A multiple sweep scope which presents 20 consecutive sweeps of 5, 10, or 25

X-1B Multiple Sweep Scope - Whitham

thereof.

is used to start several different cameras and provide timing pulses for calibration

An elaborate synchronization and timing outfit has been constructed. It is de-

O-2 Timing Equipment - Hurffman

mixer has been supplied to combine all 64 signals for presentation on another scope.

markers are provided. Each two will be used for the observation of 16 timing pins.

driven from one high voltage supply and one delayable fast sweep. Two microsec

A quadrupole scope assembly has been built for Russell. All four scopes are

11. Scopes - Tritarion

compact unit to be mounted on the wall which will operate warning lights.

A safety circuit has been developed for monitoring the air at Omega. It is a

hand counters are now in operation and another set is about to be delivered.

10 of the G.M. sets have been checked, repaired, and delivered to Hempermann.

20 Plutons and 30 G.M. sets have been received from Chicago. All the Plutons and

minutes, and it can detect approximately 25 alphas per minute.

or scale of 16. It is mounted on a hand cart. The background is $\frac{1}{2}$ count per

proportional counter at atmospheric pressure, 4 stage linear amplifier, head-pulses

investigating tables, etc., for contamination. It consists of a thin window methane

A portable alpha counter, battery operated, non-microporous has been built for

10. Health Instruments - Watts

X-2C Iniator - Tritterton

- 27 -

A "yes - no" iniatormer is completed and under test. It is supposed to determine whether or not all detonators fire within a given time interval. The time interval the test unit is 4 microseconds, but this interval can be made anything desired.

The chamber itself is functioning satisfactorily, but some difficulties are now being had in making completely reproducible and reliable light installation was begun on December 22 and is now complete.

3. Cloud Chamber

under construction and will be completed in about two days. For locking the betatron injector into the rest of the time sequence are compared to an expected output of about 50. The special timing controls relatively. The maximum output so far obtained is approximately 30 R/min. beginning of installation, but the betatron is not yet running X-rays were first obtained approximately two weeks after the

4. Betatron

in Buildings 2 and 3. It is located the betatron installation, and rather poor floor construction dislocated the betatron installation, otherwise the construction job was fairly satisfactory except for a few items including an incorrectly located I-beam, which intercomm circuits; otherwise the construction job was fairly satisfactory with plughed water lines, incorrectly constructed DC circuits, and wrong installation of the betatron. Considerable difficulty was experienced was nevertheless begun on December 22, a week after the beginning of installing to be done by our own men. Installation of the cloud chamber completed date, December 22, which left a great deal of electrical equipment. The contractor was unable to meet his last

5. Construction

January 13, 1945

GROUP G-5 - S. E. Heddlemyer, Group Leader

tested and so far satisfy the specifications, but it will be at least

Plans for doing this are well under way; the magnet coils are now being
defined by using a magnetic field to pull up the low energy particles.

so that one could expect to obtain a very great improvement in

enough very low energy scattered tracks traversing the image laterally
to observe the core. The photographs indicate, however, that there are

X-ray beam and the mockup were out of line so that it was not possible

single pulse on completion of the cloud chamber expansion. Both the

steel mockup with gold core, with the betatron synchronized to give a

A few cloud chamber photographs have been taken of a

5. Experimental Results

group and tested with pyramidal using the fast sweep.

above. A 16 channel plan circuit has been constructed by the electronics

complete, except for the injector timing circuits mounted

4. Electron Gun Assembly

jet penetration than is the betatron.

is subjected to considerably greater hazard from possible fragmentation or
explosion purposes. This was thought necessary as the cloud chamber

third complete set of cloud chamber parts has been constructed for
which will produce a flux density of 1800 gauss. (See 5 below.) A

cloud chamber setup is being constructed, including an air solenoid
for repeating this performance has not been found. A second complete

for several months without a single failure, but the exact procedure
sources. One of the first sources made has been functioning reliably

prolonged H.E. shots may be fired before the end of January.
tests to establish empirical criteria for analyzing the data. A few
at the site. The immediate future program calls for extensive modeling
a month before the new cloud chamber-assembly can be installed

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DOE P(3)

January 15th, 1945

GROUP G-6 - B. Rossi, Group Leader

REF 513

2. Improvements in the experimental methods for RA La tests

- A. Installation of new scopes and cameras
- B. Installation of new calibrator
- C. Addition of synchronous time marks on the RA La records
- D. Investigation of a photoelectric circuit for the determination of the time of detonation of the HE. Preliminary tests have shown that the detection of the light evolution may provide an accuracy in timing of the order of 1/2 microsecond.
- E. Investigation of explosive switches to cut off the loan current shortly after the occurrence of the minimum transmission.
- F. Replacements of expendable primaries by cathodes as expected, from contact potentials.
- Preliminary tests indicate that good timing in the operation of the switches can be obtained. However, serious troubles seem to arise.
- G. Installation of test equipment to the noise level. With appropriate shielding the selective followers. Tests show that this can be done without increasing F. Replacements of expendable primaries by cathodes as expected, from contact potentials.
- H. Installation of new calibrator
- I. Addition of synchronous time marks on the RA La records
- J. Investigation of a photoelectric circuit for the determination of the time of detonation of the HE. Preliminary tests have shown that the detection of the light evolution may provide an accuracy in timing of the order of 1/2 microsecond.
- K. Installation of new scopes and cameras
- L. Investigation of new calibrator
- M. Addition of synchronous time marks on the RA La records
- N. Installation of a photoelectric circuit for the determination of the time of detonation of the HE. Preliminary tests have shown that the detection of the light evolution may provide an accuracy in timing of the order of 1/2 microsecond.
- O. Installation of new scopes and cameras
- P. Replacements of expendable primaries by cathodes as expected, from contact potentials.
- Q. Installation of new calibrator
- R. Installation of new scopes and cameras
- S. Installation of new calibrator
- T. Installation of new scopes and cameras
- U. Installation of new calibrator
- V. Installation of new scopes and cameras
- W. Installation of new calibrator
- X. Installation of new scopes and cameras
- Y. Installation of new calibrator
- Z. Installation of new scopes and cameras

Fatibank, Kleszenic

B. Magneto detection in Bayo Site

Staub, Chromey, Levine

A. RA Ia Detection equipment in Bayo Site

C. Personnel

Production continued according to requests.

D. Geiger Muller counters

will be reported by Group G-1.

Measurements have been carried out with the 10⁰. The results

E. Relaxation time of nearly critical masses

tained 100 times bigger than the material background.

I G of radium near a pair of chambers, a second harmonic signal was ob-

served. Only static tests have been carried out so far. With a

moderately connected with the positive ion current and to simplify the

over the one used at present is that it is supposed to eliminate the

of the instantaneous radiation intensity. The advantage of this scheme

second harmonic can be separated by filter circuits and used as a measure

account of the non-linear relation between current and voltage. This

frequency appears in the current flowing through the leak restorer on

present and has multivibrator occurs the second harmonic of the applied

quency voltage on top of an appropriate D. C. voltage. When radiation is

of this scheme consists in applying to a proportional counter a high fre-

G. Proportional counter modulation scheme. The principle is

that up is not worse than with the previous set up.

(including H.E., source transfer devices, etc.)

C. Preparation of shots in Bayo Site

Harpert, Hartig, Komloch

E. Design and construction of new electronic circuits

Ditven, Lenz, Fredericka, Kisee

D. Construction of expendable electronic equiment

F. Development, Construction and testing of ion chamber

H. Evaluation of data

Koontz, Hall

G. Static absorption measurements

Hoodman, Delandau, Powers, Volpe, Lustiger

I. Proprietary counter modulation scheme

Koontz, Hall, with the collaboration of Rane and

Elmore of G-1

J. Time scale experiment

Merson, Labarge (in collaboration with G-1)

K. Construction of G-11 counter

E. Staub, R. Healy

[REDACTED]

[REDACTED]

3. Switches

Preliminary results on pressurizing lead aside show an increase in sensitivity to spark initiation. Experiments have been carried to 10,000 psi. At high pressures, the detonators can be fired with 50 μF at 3000 volts. Preliminary results on pressurizing wire detonator timing resulted in simultaneous which compare favorably with wire detonator timing.

Changes in explosive train and assembly method have

2. Spark Detonators

Only
not fire.

Eighteen pairs exhibited simultaneous detonation characteristics greater than could be accounted for by uncertainty of measurement. PETN which steves through 100 mesh on to 200 mesh has been adopted as a tentative standard. A 3/16" length of pressed PETN has been adopted as standard cap loading. Detonators have been found to exhibit better energy vs detonation time characteristics when the PETN is pressed to a few hundred psi. 500 psi is tentatively proposed for standard. At pressures above 1200 psi the detonators will

1. Wire Detonators

No failures have occurred in more than 1200 of the new commercial detonators

January 26, 1945

GROUT G-7 - L. W. Alvarrez, Group Leader

- A.** Wire detonator assemblies to us from Cal Tech have reached approximately 30 per day, with promise of achieving 1000 per day in one to two weeks.
- B.** Spark detonator shipments to Hercules from Cal Tech have reached approximately 150 per day. None have been received here from Hercules.
- C.** The production section of group G-7 can load and prepare 200 detonators per day. Their eventual capacity is expected to be 400 per day.
- D.** Detonator currents can be measured by placing a small loop of wire near a cathode ray tube and observing the magnetic deflection of the beam.
- E.** Marks on stainles steel can be read to $\pm .002"$.

- A.** Some improvements have been made!
- B.** One problem which has to be solved is the shorting of condensers after firing, due to significant switch research.
- C.** In detonators and measurement technique have been made, there is no possibility of unit improvement.
- D.** Measurments
- E.** to cut down magnetic interference in R-LA and magnetic shorts.

After two months of assistance in wire detonator development, this section is a setting up to detonate charges at four field sites. First priority is the RE-La, to gether with associated experimental shots.

RG-54-AU coax cable has been adopted as standard. Inductance is .09 μ H per

foot. Large quantities are available.

7. Wire

6. Field Service

the ordinary way. The root mean square timing error observed was

ends of the primocord, the primocord them going to a tetryl booster in
Half of these shots were set up with small tetryl pellets pressed in the
cord. Timing was accomplished by putting pins in these final primocords.
Each of these six primocords detonated a tetryl booster and a final prime.
Branches. Initial primocord split into six primocords by tetryl boosters.
Series of timing experiments were made of 1-6 primocord

9. Simultaneity of Detonation

in the high resistence method.

general character as with the low resistence method have been observed
nearest to the other plate of the condenser. Distortions of the same
of the metal constituents the surface of the moving plate which was
of a hundredth of a volt were recorded. These appeared to be characteristic
potential difference was applied to the condenser. Signals of the order
denser records led to an investigation of the signals received when no
The distortions described previously in low resistence con-

2. Condenser Microphone

(of the order of 100 lbs.) and further development work is under way.
not yet been possible to obtain good clear records with large charges
method, and the results are reported below under separate numbers. It has
most of the useful data obtained in the group is obtained by means of this
The method is now in good shape for use with small charges.

1. Straight Connects

January 17, 1945

GROUP G-8 - D. Francis. Group Leader

10. Impulse Hemispheres

(519 38)

appreciable variable error.

With those of Græsan one concludes that the boosters do not add an
error to those errors since these measurements are in reasonable agreement
about $1\frac{1}{4}$ " of primboard contribute

time interval recorded by them does not necessarily give the time it
since the two contacts are made in different ways, the
lower surface of the plate.
shortening of a pin (separated from the plate by less than 1 mil) to the
arrival of the shock wave at the bottom surface was recorded by the
of a 1/2 mil Cu foil to the steel plate through 1 mil polyethylene tape.
wave at the top surface of the steel plate was recorded by the shortening
thicknesses between 1/8" and 1" were used. The arrival of the detonation
to give reasonably reproducible results. Steel plates 1/4" x 1/4" and of
of the shock velocity in steel that were tried, the following were found
of the several experimental arrangements for the measurement

13. Velocity of Shock Waves in Metals
of the lens lens behind a point on the axis by 0.1 or 0.2 inches.
contact times below the plate it appears that a point 1" from the axis
above 1" and 2" of pentolite to accelerate 1/8" steel plates. From the
several shots were made with the 1 C1 30 Z contact lenses

of lens lens behind a point at center of lens by 1.0 ± 0.1 inches
Tiree 2 L 15G lenses were tested. A point 70° from center

12. Lens Testing With Timer

Lens and the $1/8"$ steel plate. Excellent agreement between the two shots

Two shots were fired with $2"$ of pentolite between the

In the time measurements was less than ± 0.1 msec.

Motion of the plate (10 mm.) and was 1.8 mm/sec . The probable error motion of the plate (10 mm.) and was 1.8 mm/sec . The probable error

acceleration. Then the velocity remained constant during the observed

in this region. During the first millisecond there was considerable about 1.2 mm/sec , but it was difficult to know where to draw the curve

the base of the lens and the plate. The initial velocity was apparently

velocity of a $1/8"$ steel plate when $1"$ of pentolite was placed between

CL 30 Z lens was measured: Four shots were fired to measure the

The velocity impeded to $1/8"$ steel plate using the

the first cm of motion of the plate.

accelerated by $2=1/2" dia \times 3"$ pentolite cylinder was 0.92 km/sec . over

A. The velocity observed for $1/2"$ thick steel plates

II. Velocity of Plates, Radius Effect and jets

observed with further shots.

velocity with thicknesses of plate. The reality of this variation is being

$5.9 \pm 0.2 \text{ km/sec}$. So there seems to be some indication of a change of

of $5.4 \pm 0.2 \text{ km/sec}$, but using $1/8"$ and $1"$ plate data one obtains

using data obtained from $1/8"$ plates and $1/2"$ plates one gets a value

correct velocity was assumed to be given by $(1/2 - 1/8) / [t(1/2) - t(1/8)]$.

constants for an $1/8"$ plate and $t(1/2)$ that for a $1/2"$ plate. Then the

following way. If $t(1/8)$ was the time interval observed between the two

attempt to avoid this difficulty the velocities were computed in the

would take a shock wave to traverse the plate. Consequently, in an

curves obtained when 1" penetolite was used were 0.9 and 1.8 msec.
of the plate was observed. The corresponding displacements for the
constant within the experimental error for all the time that the motion
at the time the plate started to move. Their displacement remained
3/16" radius for the 1/2" penetolite were 1.4 and 2.7 msec. respectively
portion of the plate at the 1" and 1-1/2" radius from the curve for the
displacement of the distance time curves for the
1/2" penetolite charge, and about 1.4 mm/msec. for the 3" penetolite.
various positions of the pins. It averaged about 0.94 mm/msec. for the
impacted to the plate was nearly the same (within 4 per cent) for the
radius, four at 1" radius, and four at 1-1/2" radius. The velocity
from the plate. Four were placed near the center on a circle of 3/16"
placed under the 1/8" steel plate at distances varying from zero to 10 mm
was inserted. The pellets were of 7/8" diameter. Twelve pins were
tetroyl pellet over which was placed a ring pellet into which the primacord
were detonated at the center of one cylindrical surface by a solid
The penetolite charges were cylindrical 3-3/4" in diameter. The charges
to 1/8" plates by penetolite 1/2 and 1 inch high have been measured.
B. Radius Effect. The curvature and velocity impacted
2.6 mm/msec.
observed motion of the plate (to 13.5 mm). This final velocity was
seconds, and the velocity then remained constant for the remaining
1.5 mm/msec. There was considerable acceleration during the first three
was obtained. For this arrangement the initial velocity was about

respective at the time the plate began to move, and also remained
nearly constant.

C. Jet Detection. A preliminary shot has been fired to show
that the velocity of a jet can be measured by bending the pipe so that
they are parallel to the plate. It is planned to fire more shots to
detect jets with this arrangement.

tion, etc.

- metrical" initiator will be tested for mechanical action, activity larger
5. If sufficiently deep and pure layers of polonium can be deposited, a "geo-
4. No progress on the cold wedge "topological" idea.

ting using 20 mm impacts.

3. Design development on the recoil type of mechanical initiator is progres-
with dummies.

2. Two types of "gun" initiators have been made and await recovery success-
studied. No conclusions as yet.

1. Numerous granular systems have been tried under gun impact and section
B. Design of Alpha-Neutron Sources - Serduke, Sherr

3. A report from the pile irradiation of SB is expected in a few days.
more effective than La in producing neutrons from Be.

- earths, has an energy in the neighborhood of 2 Mev and is considerably
emitter among the fragments other than La. This emitter is among the
2. Dodson has verified the existence of a long-lived, high-energy gamma
for measurement.

1. Three targets have been received from DTV and committed to Sege's group
A. Supply of Hadiocetyl - Sherr

I. Initiators

as follows:

- The members of G-10 have been principally concerned with the plans for in-
stallations at Sandia Canyon. Developments in our investigations may be summarized

January 20, 1945

GROUP G-10 - C. L. Critchfield, Group Leader

and obtaining high purity he suggested be done by Monsanto. Since the high density in his group. The investigations of platinum high surface density, multilayered rods or, base, the study of alloys and the calorimetric measurement Dodson is underway. Several concentric researches on polonium have been suggested to Dod

posed by Commander Goranson in Sandia using the 3" gun.

been agreed upon by Captain Parsons and Commander Birch that this work is A. Three shots at Anchors of Wood's design are inconclusive as to method. It

IV. Equations of State - Goranson

No further developments

III. Pressure Gauges

C. A sample of compressed fully tubaloy is under study in Wetman's group. B. No calculations are available as yet on the levitated core implosion.

others.

A. Fowler has made one shot on solid tubaloy and expects to follow up soon a

II. Gadget Design

on piezo measurements were inconclusive.

3. The electronic equipment is promised for February first. Tests at anch now stored awaiting firing.

2. Thirty-one win on the tantalum balls gave only about 5 mc each. These covery are being tried. The anchor recovery pit is being repeated.

1. Various charge thicknesses, numbers of initiation points and methods of C. Testing Techniques - Sampson, Goranson

the crushing of bars and disks of beryllium coated with activity.

6. Several other ideas of the breakable food class are being studied, notably

(c) b(2)

asymmetrical implications.

tion is simple, and the testing should be directed toward discovering the effects of
No shielding is required in this initiator. The radioca-

I. Omega Initiator

A. Group A Initiators

Broadly speaking our designs can be divided into two Groups: Group A con-
sists of initiators requiring good or very good symmetry of impulse. Group E ini-
tiators do not require symmetry, but will work even with Good asymmetry. We shall con-
sider fabrication problems, efficiency of operation, and required testing problems.

V. Initiator Designs

been prepared by Harry Sherr. This is presented below.

A brief discussion of the present status of inside initiators designs has

Mr. Thomas.

was agreed to postpone the other two problems until they can be discussed when
problem is at present being attacked by Monanito at the request of the Director, the

2. Gamma Initiator

TWO ADDITIONAL POINTS ARE OF INTEREST.

3. Multi-gam Initiator

4. Wedge Initiator

strategent as with the previous sources.

With a safety factor of 5 or more, the symmetry requirements may not be as

high levels with cylindrical shots.

desirable to perform tests with the design at low levels and to study the effect at
satellite, but the results at high charges may be different. It would therefore
tests at low charge levels may be

truly informative. The fabrication should be straightforward.

The multilocation in this source can be effected

extext.

The fabrication is straightforward, avoiding the plating difficulties to a large extent.

6. Iron Maiden Initiator

Fabrication very difficult.

This requirement makes the

5. Grapenuts Initiator

been suggested.

The chief characteristic of this group of sources is that they are supposed to operate when they are stuck regardless of symmetry. A number of mechanisms have

B. Group B. Initiators

as a Group B initiator.

The fabrication would be very difficult. The symmetry requirements would be high for the particular action postulated, but the source may work with poor symmetry

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The mechanisms whereby these initiators are activated are

C. Disconnection of Group B Initiators

The fabrication is straightforward.

proof against asymmetry.

The ideas contained in the disk initiator can be extended to make it more fool-

B. Cube Initiator (Little Joe)

reasonable symmetry. The fabrication is simplest for this case.

A single disk may require

7. Disk Initiator

would require about 10 times the masking required to make the above source work.

An alternative method would be to use disks of a hypothetical foil alloy. This

There appear to be three criteria which should be satisfied.

2. Photographic service = Thomson, Service Manager
The darkroom load is approximately constant (step of 1)
Apparatus for the high-speed motion-picture study includes
has been sent to Klinegan.
2. X-ray test instrument = Britaxmer
The darkroom load is approximately constant (step of 1)
The present prospects are that apparatus for all the
approved experiments will be laboratory tested in sample time, with the
following possible exceptions:
(6) Following spectrograph for 10² seconds (Geiger, Bifano).
To test our solution of the difficult problem of obtaining a smoothly
varying film velocity in the ratio of 1000 to 1, we must wait the
arrival of a hydraulic transmission in February.
(12) Camera for close-in shock (Benjamin). The success of
this unit depends upon the behavior of a pressure switch which has been
built, but not tested for lack of a firing site.
(14) Camera for air-motion study (Economou, Bifano). Ex-
periments are in progress on a line light source of proper duration for
3. Shutter mechanism: The Kerr cell pulsing device has

GROUP G-12 = J. E. Koch, Group Leader

object distance of about 3 meters with a focal length of 35". The slit cameras for Koski which were designed to yield stereo pictures at an angle have been made of one of the two new lever-focus lenses.

6. Armored still cameras

resilience law failures.

such expedients as prefiguring, hyper sensitization, and intensification of increasing the speed at which traces can be photographed, with the aid of met from stock. A research program is commencing with the objective of All prospective demands for these cameras are now being

5. Cathode-ray oscilloscope cameras - York

are now expected next week.

The rotors that were expected from the shop last month

C. Alvaras dove system

is under construction.

A production program on new rotating-mirror cameras

resolving time which appears to be considerably better than 10^{-7} seconds.

yielded images moving about 4×10^5 centimeters per second, with a

borrowed from Hoffmann for Logren's use in stimulated studies. As a new 2" superstructure used with the eccentric head.

pyramidal rotor is in routine operation at 5×10^3 cps for Hoffmann.

4. Camera production and delivery. A 1/2" transistor

components are in progress with a jet source.

standard EE candle-light source has not yet yielded satisfactory density.

2.0 megacycles, out at the chosen gate width of 0.1 microseconds, the

yielded a series of pictures on a static test object at 0.2, 0.33, and

plated without any major difficulties.

undertaken at the request of Pennay. Indicate that the work can be com-

pleted with a high-speed drop study.

Preliminary exposures on a high-speed water drop study.

A. High-speed water drop study - Whalen

10. Special Record Photography

distance of about 70 feet.

cameras designed for use with lenses of 47-1/2" focal length at an object

from this source, we have started the manufacture of three more lenses

the basis of these tests and Koski's expectation of enhancing the film

density, but the density for reflection pictures is not yet perfect. On

film of about F:30. Shadow pictures with HE sandals show considerable

for the record shutter reduces the speed of the camera to an acceptable