Y-6

# BLAST CLEANING MEDIUM PROVING MACHINE

Report by:

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## SUBJECT

The subject as assigned is one of a new Shot Testing Machine. In order to explain the Shot Testing Machine, it should be considered that the testing machine is not for the testing of shot only but for testing the standards of all abrasives used in blasting as manufactured today.

The blasting operation is recognized as the projection of some sort of medium against the surface of the items to be cleaned. This is only an application of the operation which was carried out in the early cleaning of castings when it was largely done by the use of a hammer and chisel, rubbing with a grinding wheel or pounding with some instrument to clean the surface. Another method of cleaning consisted of placing the object in a tumbling barrel and placing some sort of medium such as hard iron or other gritty, grinding or hammering materials with them, and continuously pounding them against the surface of the part to be cleaned. The entire process of cleaning was largely dependent on some sort of a hammering or pounding operation to break loose any foreign materials from the surface. In later years, air, steam or gas or some other gasious medium under pressure with an abrasive was used in the cleaning operation. To some extent liquids, with abrasives, are now used to remove foreign materials from the surface of the work being cleaned.

## HISTORY OF ABRASIVE TESTING METHODS

So far as is known, the first testing of metal blasting materials was done only by some of the larger buyers. The material furnished was of the metallic type known as metal sand, a white iron material which is made by atomizing molten cast iron and chilling

until it becomes a white iron. This white iron is not to any extent standardized, with the exception that is is largely made from melting cast iron scrap which has a reasonable limit of variation. The results in chemical analysis, hardness factors, and crushing strength were the observations recognized as test in considering what was the standard material to be purchased.

There was considerable agitation about 12 years ago for some kind of test which could be standardized to give data on impact resistance of this material and measure the deformation or breakdown of the material under impact conditions. As a result, there were developed by different shot manufacturers, centrifugal testing machines to measure, largely for their own observations and for exhibit to some customers, what 'life' could be expected from the use of these materials in a blasting way.

About 1945 considerable agitation was developed largely through the SAE channels for the standardization of some method for observing the value of materials used for blasting operations. After a great deal of discussion, it was generally accepted that some sort of an impact machine, as nearly as possible duplicating the operation in actual practice, would be the correct and proper type machine for the proving of blasting materials".

The term 'Testing' is somewhat of a misnomer. This type of an operation should be known as shot 'proving'. Equipment designed for this type of an operation should be known as "Blast Cleaning Medium Proving Equipment.

Several machines were devised by blast cleaning equipment manufacturers adopting the general principle of material passing through a breakdown operation somewhat similar to that obtained in the actual blast cleaning operation. Any such equipment which has been developed is largely manual and it is a very laborious job to

take a sample of high resistance material, which, in order to breakdown to a percentage generally accepted as a stage of measuring the value, requires a great many thousands of passes through the machine to obtain reliable statistics.

## REQUIREMENTS FOR BLASTING MEDIUM PROVING EQUIPMENT

Analyzing what is required in a proving machine both for speed and accuracy, a number of points are outlined to be considered in devising or constructing such equipment. These points are as follows:

1) The Proving Equipment must produce an effect which compares with that experienced in actual blasting operations.
2) The Proving Equipment must produce accurate data.
3) The Proving Equipment must be practical.
4) It must be rugged.
5) The proving operation must be done rapidly.
6) It must hold a large enough sample to obtain uniform and accurate results.
7) It must be simple to operate.
8) The equipment must not require labor outside of charging and discharging.
9) It must be used in a small space.
10) The equipment must be portable.
11) It must be quiet in operation.
12) Any parts must be easily replaced and inspected.
13) The machine assembly must be easily dismounted.
14) The machine must be dustless.

In answer to the above factors, equipment has been built for proving the value of blast cleaning materials. A standardized

sample of 500 grams has been adopted largely because screening equipment is used to which this size sample is easily adaptable. The sample size is based largely upon the cubical content which is calculated as approximately 7 cu. in., because if different classes of blasting materials are to be measured, the relative specific gravity of these different materials makes it necessary to measure them in a volume way rather in a weight way. For metallic material 500 grams is a standardized sample.

The machine is so built to test accurately all classes of materials such as shot, grit, garnet, sand, aluminum oxide, corncobs, apricot pits or any type material used for blasting operations and give a determination of breakdown value as used in blasting practice.

## CONDITIONS SURROUNDING STANDARD SPECIFICATIONS FOR BLASTING MATERIAL

It has been interesting to observe that material which is now so universally used as a blast cleaning medium should almost compare to patent medicine considering the knowledge the customer has on what he is actually buying. Before a means of measuring materials thoroughly for all characteristics was devised, there was no understanding of what certain products would do and what could be expected from them for blasting purposes.

## STANDARDIZATION OF METHODS FOR OBSERVATION

There is no accepted standard method for charting the results obtained from testing. It has been accepted to some extent that if a sample of homogeneous material such as a size of shot or grit is placed in a breakdown machine, observations can be made upon a sample and the amount of loss of material beyond a certain screening

analysis shall be observed by taking steps in the breakdown operation [illegible] a chart can be plotted until 55% of the material has been dissipated below a certain screen analysis.

It is generally accepted that all material is considered as dissipated that will pass thru an .011 screen opening because practice in the field has shown that in order to make a separation between sand and other materials which are removed from the article being cleaned that all material below this is normally exhausted into the dust collector or other disposal equipment.

EXHIBIT NUMBER 1

This is an assembly view of the Blast Cleaning Medium Proving Machine.

EXHIBIT NUMBER 2

This is a sectional view of the machine. It has a beater head which is a 12" diameter wheel corresponding to ordinary blasting machine wheels driven at a speed of 200 feet per second, peripheral velocity because this has been approximately an accepted standard velocity used in cleaning operations. This machine is built to answer as nearly as possible all specifications on what is required in a blasting medium proving machine. It has a revolving drum which contains an anvil and a lifting device to automatically feed the material through the machine positively and constantly at a certain specified rate and the drum is driven by separate power at a velocity of 25 rpm which feeds the material through at the rate of 25 times every minute and removes the broken material to the dust bag.

On this machine there has been devised an additional motor driven fan as a dust collector to pick up dust. It is not

55% loss. The abscissa or base of the chart only shows figures in a relative way. These figures show that some materials offered approximate '1' on this chart of resistance to breakdown, whereas other materials grade all the way to 'plus 18'.

EXHIBIT NUMBER 4

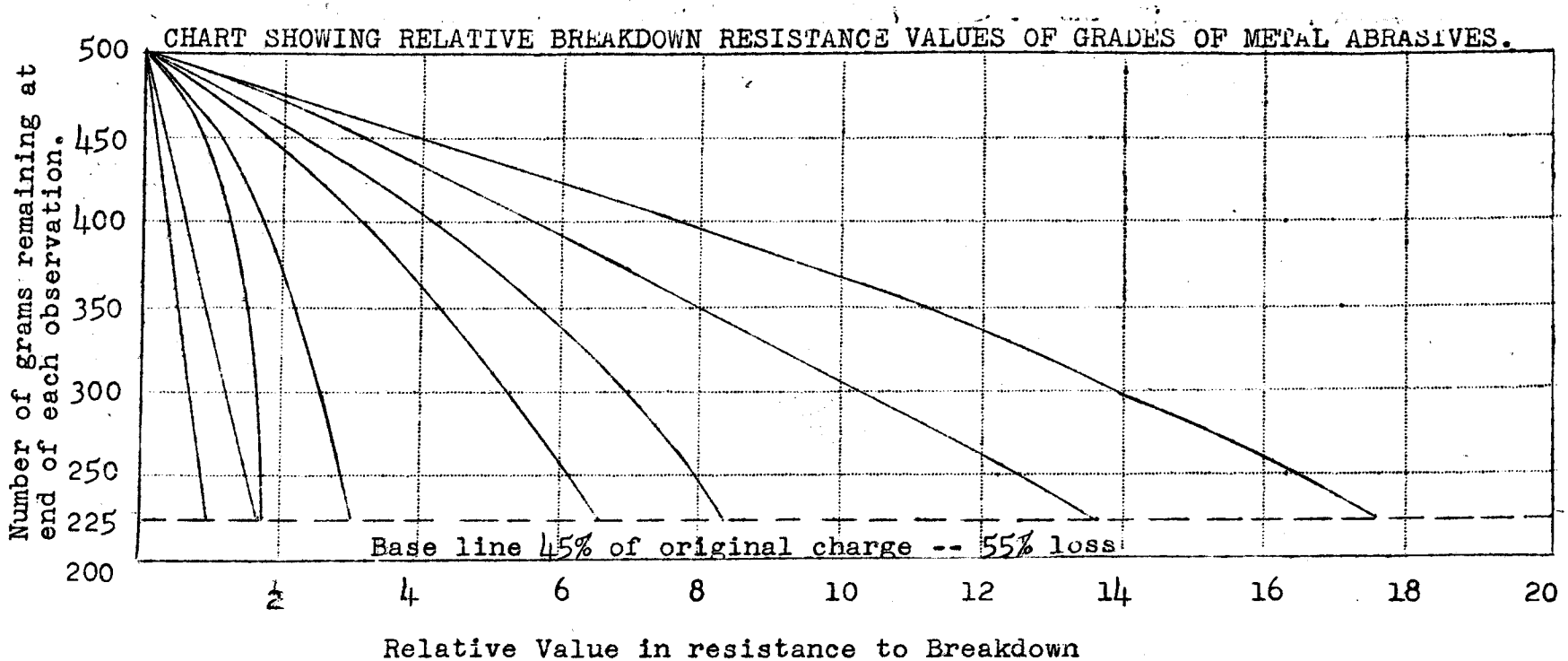
This exhibit shows the wide variation there is in hard iron materials as manufactured and offered to the trade. This is using a similar 500 gram sample as the ordinate and relative value figures for the abcissa.

EXHIBIT NUMBER 5

Using the same type of an ordinate to show the amount of material which is used in making a determination, charts are plotted to show the relative value of the homogeneous or uniform material both size-wise and analytical-wise. A homogeneous material screened to a similar size both in crushed form known as grit and spherical form known as shot have been used. Values of resistance to breakdown have been plotted and no appreciable difference in life value is shown. There is a slight difference in the early part of the operation but as the operation continues, there is no discernable difference.

EXHIBIT NUMBER 6

There is a great deal of controversy on the value of material size-wise. Exhibited here is a breakdown of material known as hard iron material and breakdown of steel showing there is no appreciable difference in the life depending upon the size of the material charged into the machine.




All material below an .010 screen removed.

These materials are all Standard SAE Sizes.

This chart is on the basis of an original sample of 500 grams.

## COMPOUNDED MATERIAL

The value of any material which is a compound can be measured by testing the compounded materials using the proportion there is of each in this compound and plotting a chart from the resistance of these elements.

When the correct figures on what is in the compound are not available, the material must be run through the testing machine to the extent of the number of passes that is necessary to completely exhaust or breakdown all of the higher grade product.

## TEST TO COMPLETE EXHAUSTION

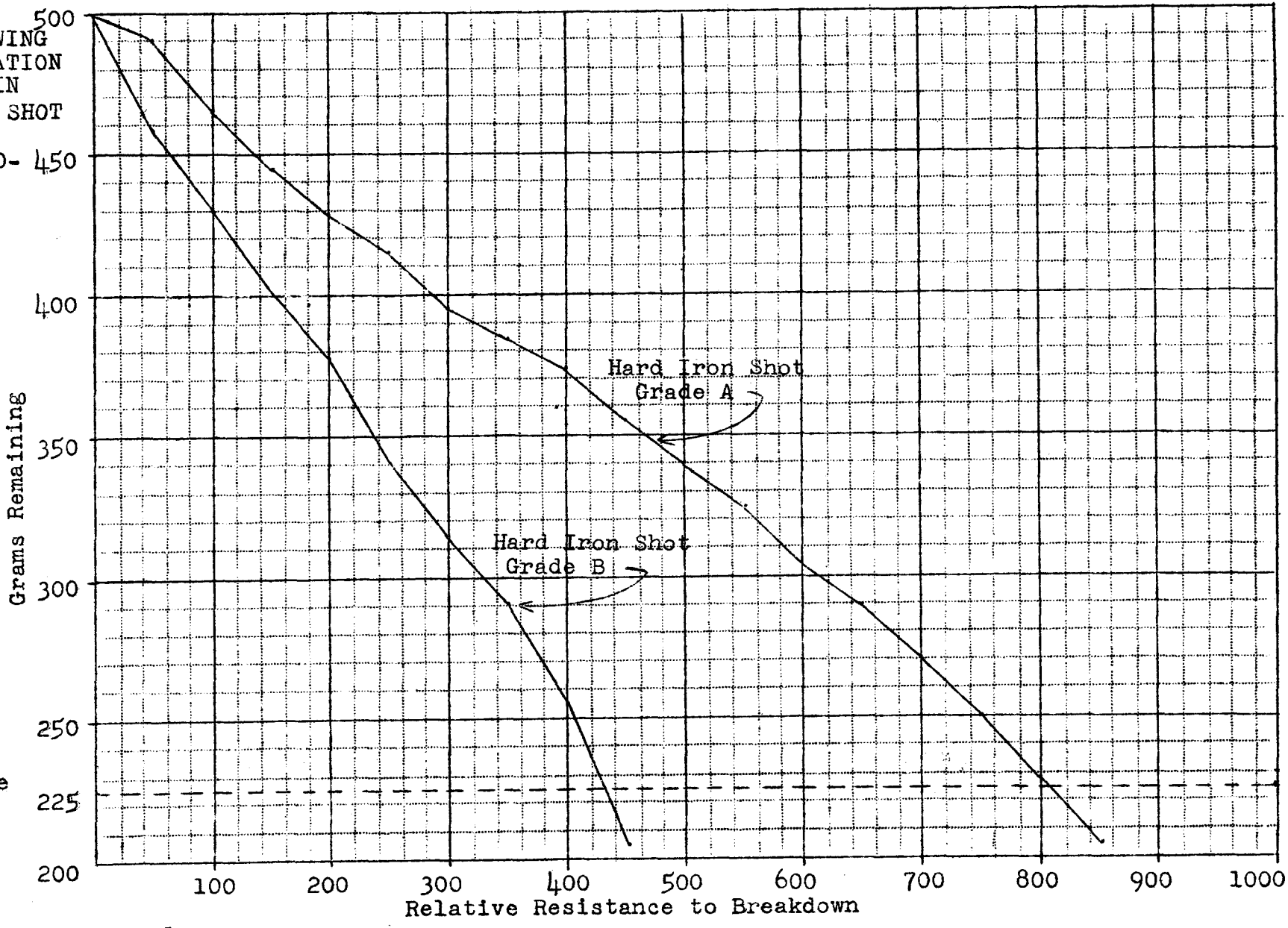
In order to make correct determinations on any class of material, whether it be compound or homogeneous, and obtain the actual resistance to breakdown or to give the correct data on measuring the amount of material to be added to the testing machine at all times in order to keep the testing machine in operation, the following method of measuring must be followed;

First, segregate a sample of a minimum of 1500 or more grams. Place 500 grams of this in a testing machine and run to a time or period until not to exceed ten percent of original 500 grams of material has been dissipated. Then, after removing and weighing the material which is left, add enough new material to get the machine up to the original charge because this duplicates the operation in a commercial blasting machine. Continue this until 1000 or more grams are used by the addition method, measuring the number of passes or breakdown cycles the material resisted during this period. Then, use the average amount added for each 100 cycles for the last 500 grams.

EXHIBIT NUMBER 7

This is a chart plotted on the use of 1500 gram samples of different types of material to show the average amount of consumption per 100 cycle for the last 500 grams added. This shows a correct picture of the actual amount of consumption in the machine when the levels are maintained anywhere between 90 and 100 percent of the original charge although more time is required for the test, it is an accurate method of measuring the values of the material.

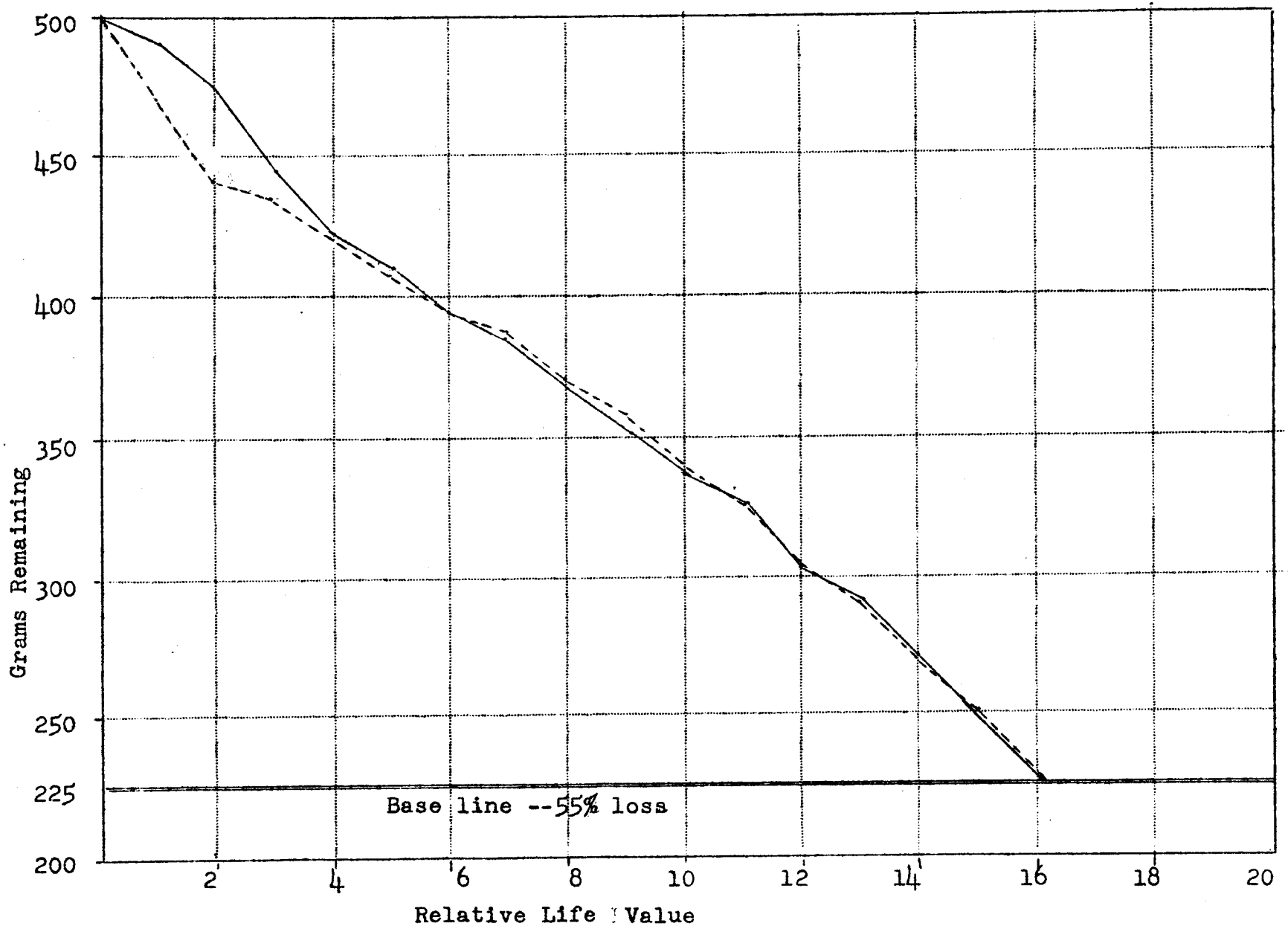
CHART SHOWING WIDE VARIATION EXISTING IN CAST IRON SHOT AS BEING OFFERED TO-DAY.




Basis: 500 Gram Sample

Exhibit #4

VALUE OF SHOT AND GRIT COMPARED




Cast iron Shot _____
Cast Iron Grit - - - - - -

Exhibit #5

CHART SHOWING THERE IS NO APPRECIABLE DIFFERENCE IN LIFE OF MATERIALS SIZE-WISE.

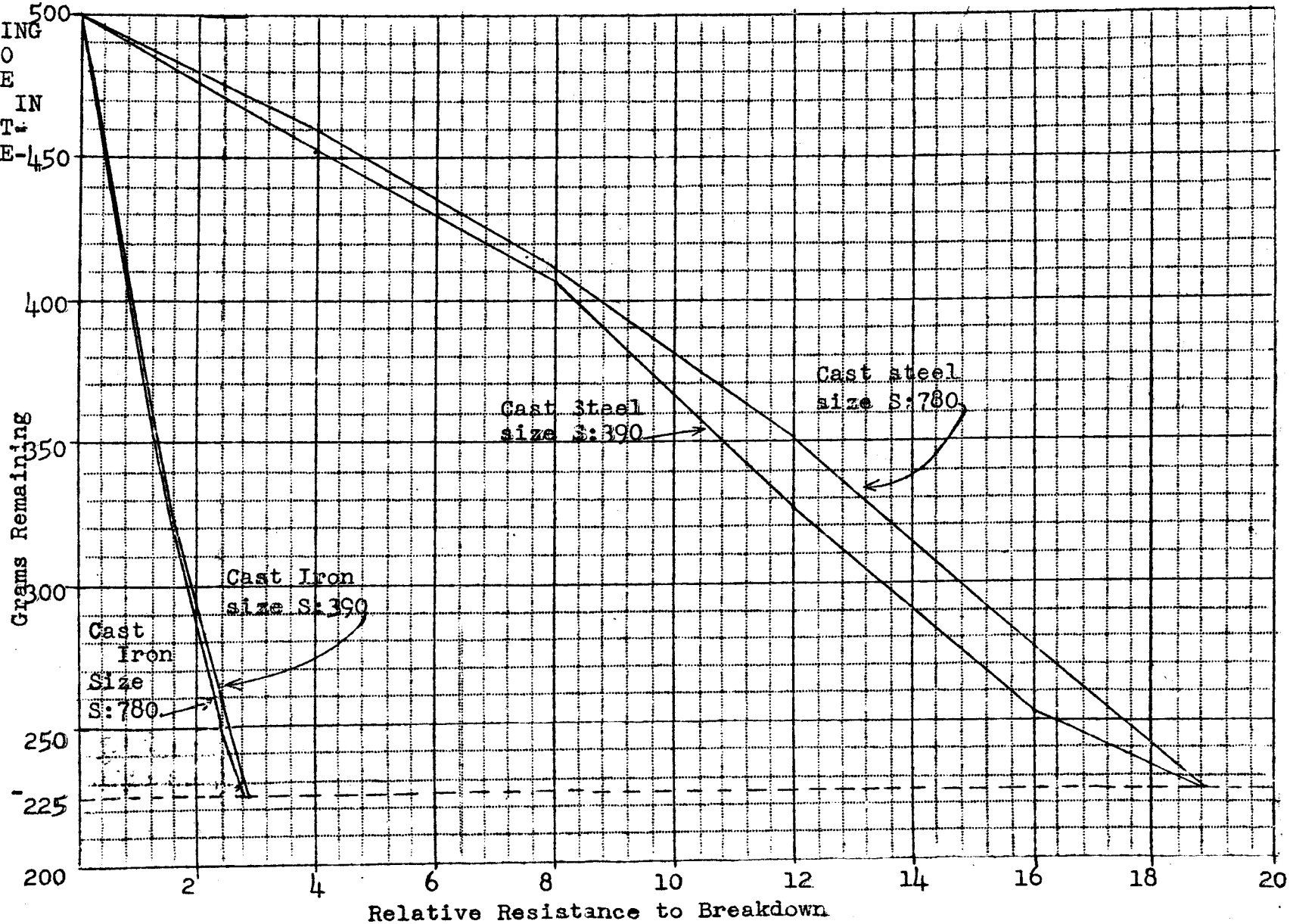



Exhibit #6

Standard Breakdown Test - 1500 Gram Sample. Material added each 10% reduction. Average reduction each 100 Passes. % of Total Charge. Based on last 500 Grams Added.

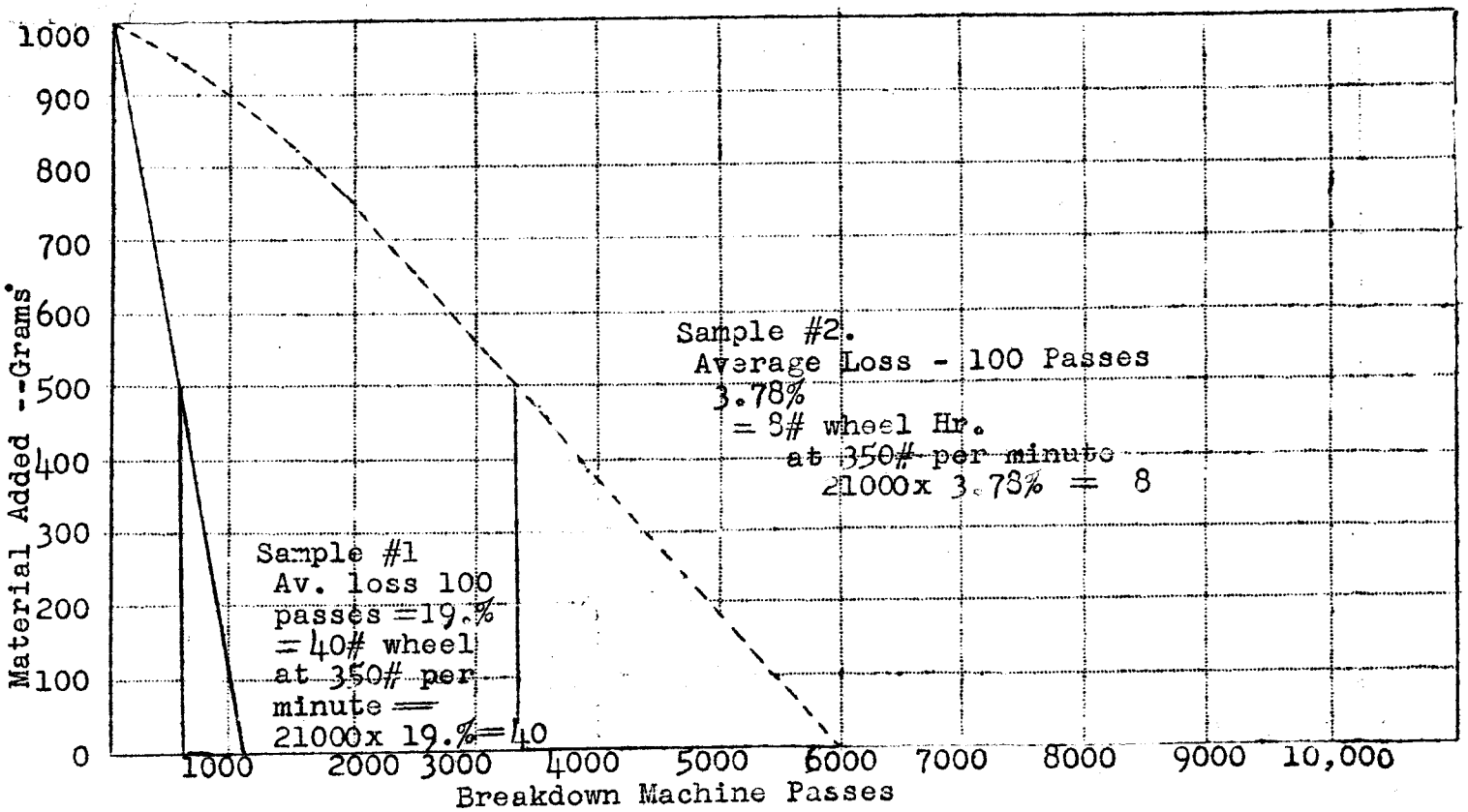



Exhibit #7