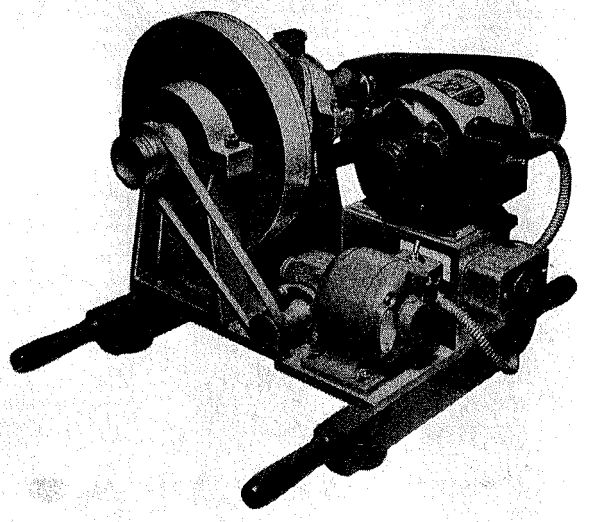
1955
Budget -
Shot Peening

buying engineered abrasives

1955008



j. f. ervin
abrasive industries
111 south division street
ann arbor, michigan

BUYING ENGINEERED ABRASIVES

Blast cleaning represents an impressively large part of today's cost of production. Selection of the correct abrasive can mean the difference between profit and loss. Until the advent of steel shot, the purchaser, using the price of scrap iron as an index, placed his order on a competitive "first cost" basis. All cast iron abrasives were the same and the original cost was the only consideration. Today, the first cost of an abrasive is relatively unimportant. An ever increasing range of cleaning problems and improvements in blast cleaning equipment have made cleaning performance and longevity of the abrasive of first consideration. The S.A.E. has done much in recent years to minimize the cost of the analysis necessary to select the correct abrasive. They have standardized size specifications, worked toward material standards, and are now working on a program to establish standards for selection of the correct abrasive for the individual job requirements.

In past years the purchaser bought an abrasive and put it into his machines for a "Production test". By such "Buy and Try" methods he eventually arrived at a material for the job. Such methods were costly and the results always questionable. The latest and most efficient method for the selection of the correct abrasive is to:

1. Thoroughly analyze the equipment, the product to be cleaned ,and the operating personnel.
2. Establish a good system of record keeping for the present operation. Accumulate records of the cost of operation with the abrasive currently being used in the equipment. Preserve these records for future comparison.
3. Consult one or more abrasive manufacturers for their opinions and recommendations.

4. Conduct comparison tests in the purchaser's plant with the aid of an approved shot testing machine such as the Ervin Test Machine.

5. Correlate these test figures with present production records to determine the effect that loss from carry-out and equipment leakage will have upon the cost of the new abrasive.

6. Purchase enough of the newly selected abrasive to enable the production personnel to observe the effectiveness and economy for an adequate period of time.

7. Make a careful comparison of equipment maintenance costs.

Careful and intelligent use of an approved test machine, such as the Ervin Testing Machine, in the initial steps will materially reduce the chances of purchasing an abrasive that will not economically and efficiently do the job.

The Ervin Test Machine was developed in the Ervin Laboratories for use in quality control in the manufacture of stee labrasives. It is used and distributed by the Alloy Metal Abrasive Company and the Standard Abrasive Company. The Machine has been sold for use in Sweden. Several of the larger manufacturers in the United States use the machine for the quality control of incoming shipments of abrasives. The machine has been used by other laboratories in abrasive research projects.

The machine is a portable machine, occupying less than three cubic feet of space, and weighing about one hundred fifty pounds.

The Ervin Test Machine very nearly duplicates production cleaning conditions. The only factor not duplicated is the loss from carry out in castings and leakage of the production equipment. However, the results of tests conducted in the machine may be applied to previous records

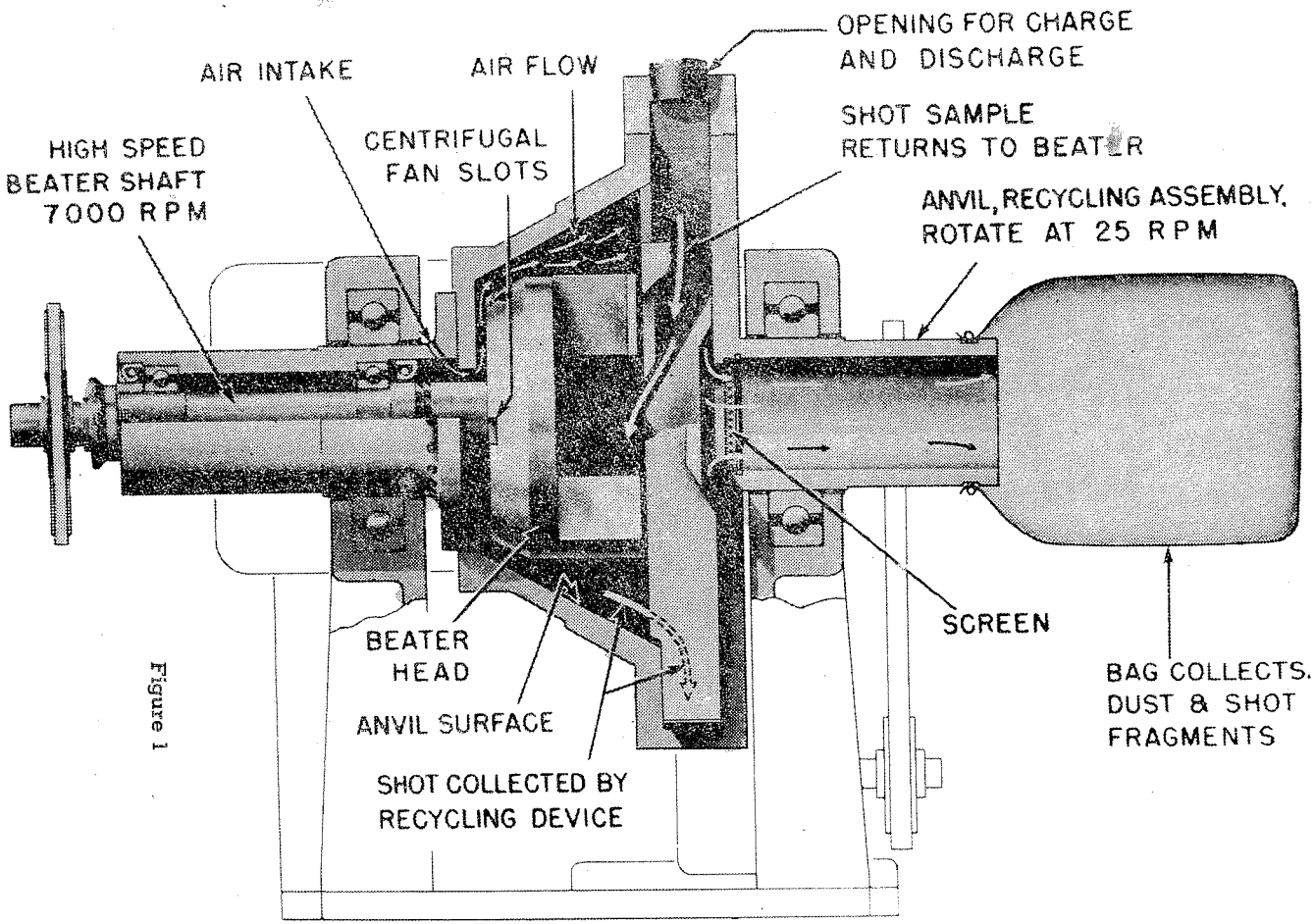

OPENING FOR CHARGE
AND DISCHARGE
AIR INTAKE
AIR FLOW
SHOT SAMPLE
RETURNS TO BEATER
HIGH SPEED
BEATER SHAFT
7000 RPM
CENTRIFUGAL
FAN SLOTS
ANVIL, RECYCLING ASSEMBLY,
ROTATE AT 25 RPM
SCREEN
BEATER
HEAD
ANVIL SURFACE
SHOT COLLECTED BY
RECYCLING DEVICE
BAG COLLECTS.
DUST & SHOT
FRAGMENTS

Figure 1

of the operating equipment with amazingly accurate results. The machine propels the abrasive against an anvil at approximately two hundred feet per second. The abrasive is returned to the throwing wheel by an automatic recycling device until it is worn or broken down fine enough to be exhausted from the machine by the dust collection system. Thus the machine duplicates production equipment; the same rate of propulsion, the abrasive fired against a casting, automatic recycling, and an air-dust removal system.

Physically, the machine consists of a throwing wheel or beater, revolving at the rate of seven thousand revolutions per minute on a shaft about which there is revolving an anvil and recycling device at a rate of twenty-five revolutions per minute. As indicated in the cross sectional view (fig. 1), air is taken in through the opening behind the propelling wheel and circulated by the force of the revolving blades through the cleaning chamber. The air finally escapes with its accumulation of dust through the center of the shaft into the attached dust collection bag. The high speed shaft, operating the throwing wheel, is belt driven by one half horse power, one hundred ten volt electric motor. The anvil-recycling device is belt driven by a one eighth horse power motor, geared down. The machine operates from any full power one hundred ten volt electric light outlet.

The operation of the machine is extremely simple. The abrasive is charged into the machine through the opening on the rim of the drum of the recycling device (fig. 1) and opening stoppered with a rubber plug. The motor operating the high speed shaft is started and allowed to get up to full speed. The motor operating the recycling device is then started. The operation of this motor starts the flow of abrasive through the machine and actuates the counting device. Upon completion of the desired number of passes through the machine for the abrasive being tested, the machine is stopped by reversing the above procedure. Stop the slow speed shaft which is cycling the material through the machines. After it has stopped turning, shut off the

motor driving the high speed shaft. The material may be removed through the same opening through which it was originally charged into the machine.

The conducting, observing, and recording of an abrasive comparison test in the Ervin Test Machine is fully as simple and efficient as is the design of the machine. An exact amount of abrasive, by weight or volume, is measured out and charged into the machine. (Ordinarily 100 grams or twenty-five cubic centimeters.) After each one hundred or two hundred passes through the machine (according to the material being tested and the method used) the abrasive is removed from the machine and measured to determine the amount that has been consumed (worn out). For easy reference the results can easily be plotted on simple graph paper as a line or curve of the "breakdown rate" of the abrasive. The information thus secured can then be substituted in a simple formula with the information concerning the loss by carry-out etc. (Secured from records concerning the operation of the present abrasive in the production equipment.) In this manner, the purchaser can readily prove for himself, without the expense of production testing, whether the abrasive being tested is the one that he should purchase.

There are three standard methods currently accepted for the comparison testing of abrasives.

1. The Quality Control Test (A short test)
2. The 55% Comparison Test (For ordinary abrasives)
3. The Stabilized Loss Test (For steel abrasives)

The Quality Control Test is used by plants having their own test machine to assure the quality of abrasives being purchased. A sample of the material being purchased is run in the test machine and the rate of breakdown plotted on a graph. As additional shipments arrive, samples are selected at random and run in the machine just long enough for the quality control man to be satisfied that the trend of the curve depicting the rate of breakdown for the material is the same as the original. (Naturally, this can be

accomplished without a graph; using only the figures.) Ordinarily, one or two hundred passes through the machine are sufficient to test ordinary types of abrasive as the rate of breakdown for such materials is rapid and constant. In the case of steel abrasives, it is ordinarily necessary to run the material up to five hundred passes. This, because of the trenmendously longer life of the steel.

The 55% Comparison Test, used principally to test the short lived ordinary abrasives is conducted as follows:

1. Accumulate approximately one half pound of abrasive by removing a small sample from each of several containers selected at random.
2. Mix the samples well and quarter either by hand or by use of a sample splitter until the desired amount needed for the test is secured.
3. The recommended amount is one hundred grams or twenty-five cubic centimeters. It should be screened so that all of the abrasive passes through the top screen and remains on the control screen. Example: SAE 460 shot should all pass through a U.S. Standard Screen with an opening of .055 inches and remain on top of a screen with an opening of .0469 inches. This, after the material has been shaken in the screen set up for at least four minutes.
4. The material is charged into the machine and run for a set number of passes through the machine. (Usually one hundred or two hundred passes, depending upon the test and the abrasive.)
5. At the end of the set number of passes, the material is removed and measured to determine the amount of material used. This is accomplished by screening the material over the original control screen (in this case the .0469) and a series of alternate smaller screens. The material remaining on each screen is weighed or measured and recorded.
6. The material is then returned to the machine and the process repeated again until, by weight or vol-

ume, 45% of the original sample remains above the .011 screen. The .011 screen is the one ordinarily used to determine the dividing line between useful abrasive and that which is no longer of any abrasive value. A screen of a different sized opening can be used if the same screen is used in all tests being compared.

The Stabilized Loss Test was devised when it was definitely established that steel abrasives did not break down at a rapid and standard rate. Steel abrasives tend to offer greater resistance to wear and breakdown near the end of the life cycle than do the ordinary materials. It is, then, necessary to consider the entire life span of the steel abrasive if complicated formulas are to be avoided.

The test is conducted in the same manner as the 55% Comparison Test except that as the material is measured, an amount of abrasive equal to that expended is replaced in the machine. Example: If at the end of the first hundred or two hundred passes it is found that five per cent of the material has been expended, five per cent of new material is added to the sample before it is replaced in the machine.

The cycle is continued, as in the 55% Comparison Test, until the average loss of material each time the machine is stopped is stabilized in relation to the amount maintained in the machine. Thus, it is easy to determine the percentage of the abrasive consumed each time the abrasive is passed through the machine.

EXAMPLE:	Charge in machine	100 grams
	Number of passes thru machine	100 passes
	Loss of material below a specific screen (.011)	22 grams
	Average amount in machine	89 grams
	Loss per 100 passes	22 grams
	Percentage of loss equals	22/89 or 25—%

This is equal to approximately ¼% per pass through the machine.

As previously mentioned, it is possible to substitute this figure (the result of the test machine analysis of the material) in a simple formula to determine the amount of abrasive consumed per wheel hour. Then, by applying the machine-history loss factor, determine the cost of using the abrasive in question without a production test.

The formula is simply derived. If the machine is a somewhat standard machine, it will throw three hundred pounds of abrasive per minute at a velocity of two hundred feet per second. In an hour the wheel of the machine will have thrown eighteen thousand pounds of abrasive. If the loss is one quarter of one per cent per pass, the consumption per wheel hour will be equal to the percentage of loss per pass times the amount of abrasive thrown:

A = The percentage of loss of abrasive per pass.

B = Amount of abrasive thrown by a wheel in an hour.

The formula: A x B = Pounds of abrasive consumed per wheel hour.

From the Stabilized Loss Test:

A = ¼%

B = 18,000 pounds

.0025 x 18,000 = Pounds per wheel hour

$$\frac{25 \times 18{,}000}{10{,}000} = 45 \text{ pounds of abrasive per wheel hour}$$

NOTE: This is for an ordinary abrasive.

From this computation an easily remembered and used formula is derived:

A is allowed to equal the percentage of loss per 100 passes.

B is allowed to equal the amount of abrasive thrown per wheel hour.

Then: $\frac{A \times B}{10{,}000}$ = Pounds of abrasive consumed per wheel hour.

Substitution of figures taken from tests using steel readily show the amazing difference in the amount of abrasive consumed per wheel hour compared to ordinary abrasives.

EXAMPLE: (For Steel Abrasive)
B = 18,000 pounds of abrasive thrown
A = 4% per hundred passes
Formula: $\frac{A \times B}{10{,}000}$ = Pounds of abrasive consumed.

By substitution:

$$\frac{4 \times 18{,}000}{10{,}000} = 7.2$$ pounds of abrasive consumed per wheel hour.

(This compared to 45 pounds per wheel hour for ordinary abrasive)

Applying the cost of abrasive to these figures it is readily apparent that original cost cost bears little relationship to the actual worth of the material.

EXAMPLE: If the ordinary abrasive costs $100.00 per ton or 5c per pound, the cost of operation per wheel hour (not considering loss) will be 5c x 45 pounds or $2.25.

If the cost of steel abrasive is $200.00 per ton or 10c per pound, the cost of operation is 10c x 7.2 pounds or 72c per wheel hour.

While this gives a good comparison as to the actual worth of the abrasive, the picture changes considerably when the "loss factor" is taken into consideration. The "loss factor" is the amount of abrasive lost through carry-out in the cavities of castings and through leakage in the machine and the separation system. Even a well maintained, efficiently operated machine will lose a certain percentage of the material used. The average one wheel machine has been found to lose, in most cases, about 5 pounds of abrasive per wheel hour. Therefore, if this loss is taken into consideration, the picture looks something like this:

If the cast iron abrasive costs $100.00 per ton or 5c per pound; the consumption is 45 pounds per wheel hour and the loss is 5 pounds per wheel hour, the cost per wheel hour will be 5c x 50 pounds or $2.50. If the cost of steel abrasive is $200.00 per ton or 10c per pound; the consumption is 7.2 pounds per wheel hour and the loss is 5 pounds per wheel hour, the cost per wheel hour will be 10c x 12.0 pounds or $1.22.

In the same manner, the cost of the freight from various points of shipment can be figured in to give a final complete picture of the comparative cost of one abrasive in relationship to another.

Another use to which the Ervin Test Machine may be put is the testing of the efficiency of the equipment. The pounds of abrasive used per hour may be figured from the production records and the abrasive being used tested according to the Stabilized Loss Method. The difference between the production figures and the stabilized loss test figures will be the amount of abrasive being carried out in castings and lost through leakage in the machine and the separation system. Unless the efficiency factor for the equipment is pretty well known, it is always good to make such a test at the beginning of an abrasive investigation.

Thus, the Ervin Laboratories have developed a tool, in the Ervin Test Machine, that makes possible the accurate analysis and selection of abrasives. It enables the purchaser to reduce the process of purchasing abrasives to a science and, at the same time, it eliminates much of the expensive production testing that has been necessary in the past.

The Ervin Industries make the Ervin Test Machines available for use of the customers and prospective customers of the Standard Abrasive Company and of the Alloy Metal Abrasive Company without charge.