IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

MAR 7 - 1952

AEC-725/2

Dr. Phillip L. Merritt, Assistant Director
Division of Raw Materials
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Please make the following corrections in your copies of TEI-217, "Wagon-drill sampling by U. S. Geological Survey".

Page	Line	Change	To
6	5	10,000	7,000
9	9	10,000	7,000
10	7	10,000	7,000
10	10	$150.00	$135.00
10	10	1 - 1/2¢	$ 0.0193
11	7	$ 1.50	$ 1.93
11	10	$ 89.48	$ 89.91

Sincerely yours,

O.E. McKelvey

for W. H. Bradley
Chief Geologist

Corrections made
3-12-52
LA H

Copy to: Recipients of TEI-217

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

FEB 28 1952

AEC - 646/2

Dr. Phillip L. Merritt, Assistant Director
Division of Raw Materials
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Transmitted herewith for your information and distribution are 6 copies of Trace Elements Investigations Report 217, "Wagon-drill sampling by U. S. Geological Survey," by Wm. P. Huleatt, February 1952.

This report describes the sampling equipment that we are using for our wagon-drilling program on the Colorado Plateau and elsewhere. It will be of interest to persons engaged in sampling of dry-hole drilling.

This report is intended for publication in the Engineering and Mining Journal. We are asking Mr. Hosted, by a copy of this letter, whether the Commission has any objection, on grounds of security, to such publication.

Sincerely yours,

W H Bradley

W. H. Bradley
Chief Geologist

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UNCLASSIFIED

Geology - Mineralogy

This document consists of 11 pages,
plus 2 figures.
Series A

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

WAGON-DRILL SAMPLING

BY U. S. GEOLOGICAL SURVEY*

By

Wm. F. Hulcott

February 1952

Trace Elements Investigations Report 217

This preliminary report is distributed without editorial and technical review for conformity with official standards and nomenclature. It is not for public inspection or quotation.

*This report concerns work done in part on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission

USGS - TEI Report 217

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WAGON-DRILL SAMPLING BY U. S. GEOLOGICAL SURVEY

By Wm. P. Huleatt

ABSTRACT

For a number of years the Geological Survey has employed core drilling as a means of obtaining samples of underground formations for use in exploring and evaluating mineral deposits. During 1951, however, experiments with less expensive methods showed that, for analytical purposes, wagon-drill cuttings could be used as effectively as cores, provided a practical method were devised for recovering them in suitable form. The recent development of such a method has made it possible, in places where the depth of drilling does not exceed 125 feet, to supplant thousands of feet of core drilling by wagon drilling which is much faster and which can be done at approximately one-third the cost of the former method. This report describes the sampler and discusses performance, maintenance, and operating costs.

INTRODUCTION

For a number of years the Geological Survey in part on behalf of the U. S. Atomic Energy Commission, has employed core drilling as a means of obtaining samples of underground formations for use in exploring and evaluating mineral deposits. During 1951, however, experiments with less expensive methods showed that, for analytical purposes, wagon-drill cuttings could be used as effectively as cores, provided a practical method were devised for recovering them in suitable form. The recent development of such a method has made it possible, in places where the depth of drilling does not exceed 125 feet, to supplant thousands of feet of core drilling by wagon drilling which is much faster and which can be done at approximately one-third the cost of the former method.

The wagon drill is of the pneumatically-driven percussion type, using sectional drill rods and mounted on some form of mobile carrier such as a truck or caterpillar treads. For accurate sampling the drill is operated without water and the dry cuttings are blown from the mouth of the hole by compressed air while the drilling is in progress. The recovery of representative samples under these conditions requires the use of special equipment and adequate precautions must be taken to prevent dust losses and contamination.

In certain types of deposits the ore minerals are soft and friable, and the chopping action of the drill bit reduces them to dust while the harder gangue minerals emerge from the hole as coarser fragments up to 1/4 inch in diameter. In other types of deposits the reverse may be true. In both cases it is evident that if accurate results are to be expected the dust must not be allowed to escape.

Wagon-drill samples are more easily contaminated than are cores. In drilling for evaluation purposes it is the custom to collect individual samples from each increment of depth. As the cuttings rise to the surface they become contaminated to a certain extent by particles dislodged from the upper walls of the hole. This can be remedied by the use of casing but when used in connection with wagon drilling, the procedure is costly and involves complications. As the amount of contamination from this source usually is not overly serious, casing usually is considered unnecessary. The necessity remains, however, to prevent contamination of one sample by another in any equipment used to collect the samples at the surface, and such equipment should be so designed that all of the parts are either self-cleaning or readily accessible for manual cleaning between samples.

Other desirable characteristics are simplicity of design, mobility, and economy of operation.

The machine shown in the photograph was designed and built by the Survey in accordance with the above requirements and gave highly satisfactory results during the sampling of ~~10,000~~ 7,000 feet of 2-inch hole under normal operating conditions.

DESCRIPTION

The sampler consists essentially of a combined suction fan and dust precipitator driven by a gasoline engine and provided with the necessary fixtures for collecting coarse and fine drill cuttings in suitable containers. Auxiliary equipment includes a set of pneumatic-tired wheels and tow bar which can be quickly attached for greater mobility, and a 20-foot length of 3/8-inch air hose and nozzle which is connected to the wagon-drill compressor for use in cleaning the apparatus.

The suction fan (A) (fig. 1) is a standard Type D, Size 5 Rotoclone manufactured by the American Air Filter Company of Louisville, Ky. It consists of a rotating spiral-bladed fan encased in a snailshell housing provided with a tangential outlet through which the solids are expelled by centrifugal force. The fan is driven at 4,000 r.p.m. by a 4 hp. air-cooled gasoline engine (J) using a double V-belt drive and draws approximately 500 cu. ft. of air per minute. The glass jar (C), which serves as a receptacle for the drill cuttings, is held in air-tight contact with the hopper (B) by means of a spring-actuated platform (F, H, E) and can be released by pressure on the handle (G).

In operation the slotted collecting hood (M) (fig. 2) is connected to the fan by means of 10 feet of 4-inch flexible metal tubing (D) and placed over the drill hole. A 1-gallon glass jar (C) is set under the hopper (B),

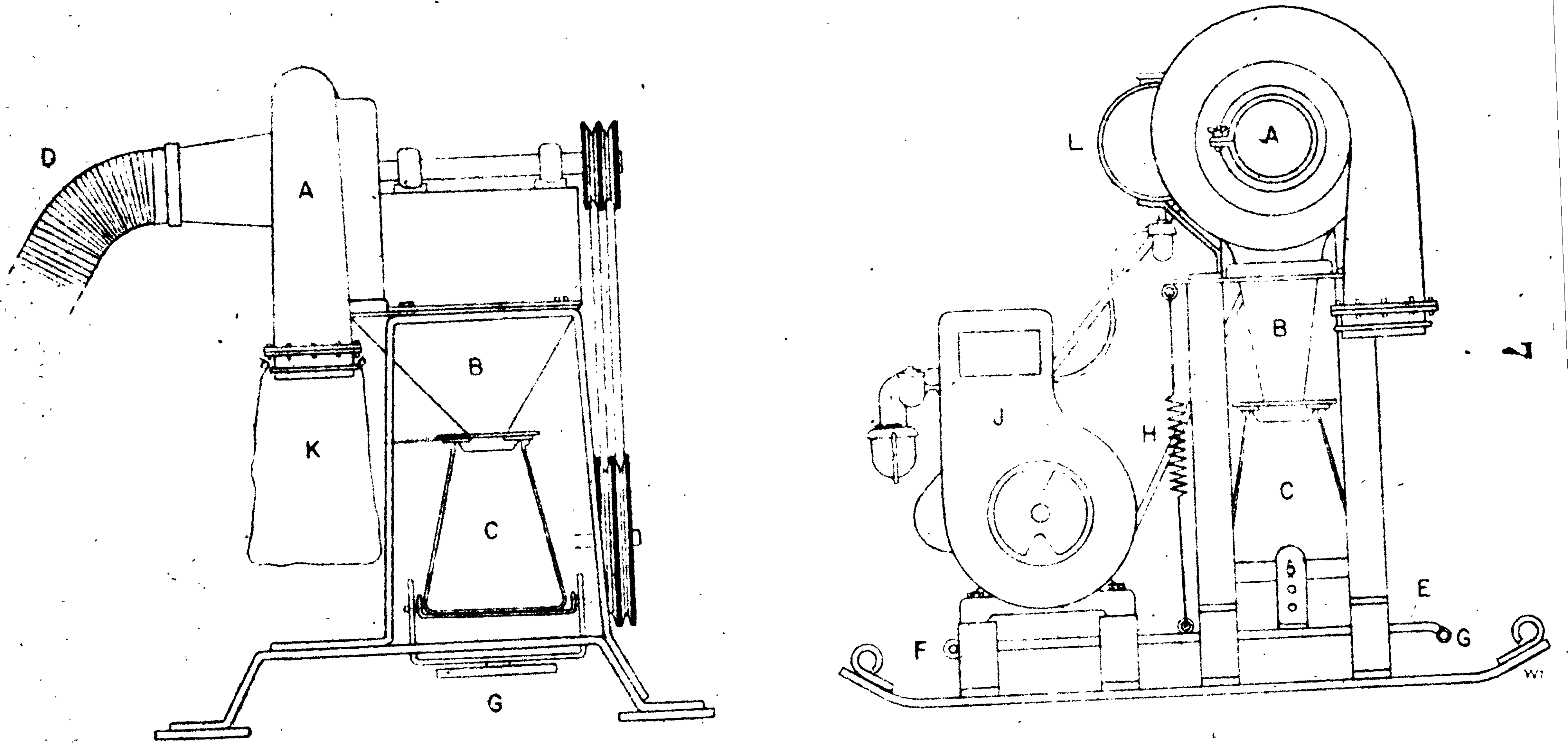

FIGURE I

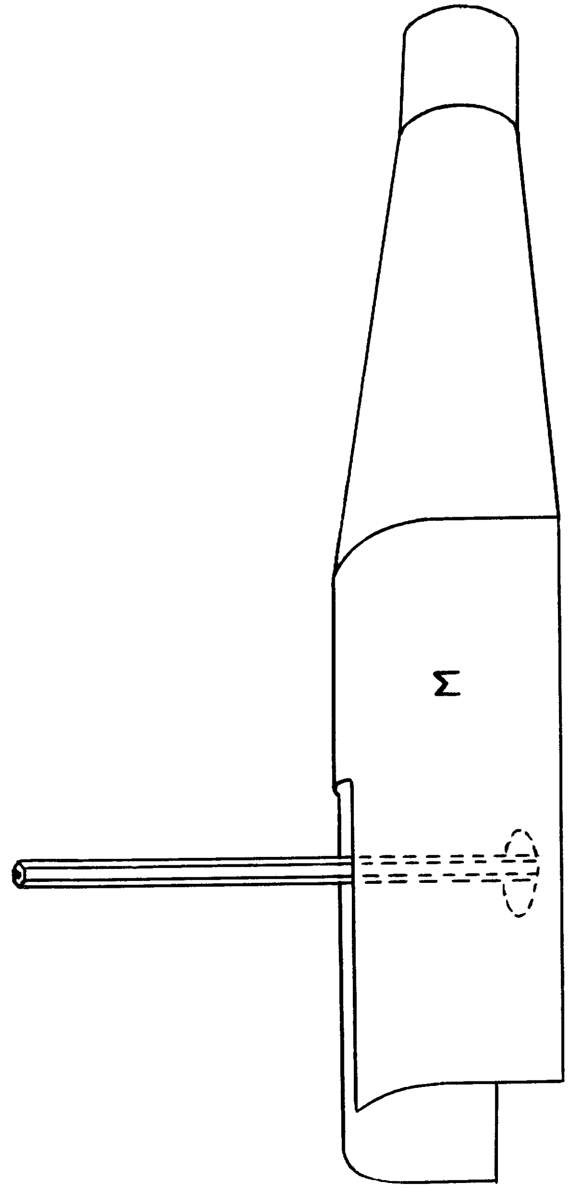

FIGURE 2

a porous cotton sample sack (K) is attached to the fan discharge by means of a special clamp, and the fan is started before the drilling begins. The drill cuttings are drawn into the fan by suction and discharged through the hopper into the jar which, being made of glass, permits visible inspection of the material as it comes from the hole. A small amount of dust passes through the fan and is caught in the bag. When the desired length of hole has been drilled, the material in the jar is emptied into the sack which is then labelled and sent to the laboratory.

PERFORMANCE

As a test, the machine was used to sample ~~10,000~~ 7,000 feet of 2-inch holes drilled in sandstone and shale. Individual samples represented 3 feet of hole each and weighed approximately 9 pounds. Of this amount, about 3 ounces of dust was collected in the cloth sack and the remainder of the sample in the glass jar.

Owing to irregularities in the walls of the holes and the uncertain amount of compaction of the rock in place, it was virtually impossible, without resorting to elaborate procedures, accurately to determine the exact percentage of cuttings recovered; but observation during the drilling and weight comparisons with cores obtained from the same types of rock indicated that the recovery was 96 percent or better. It is interesting to note in this connection that the losses inherent in the two drilling methods do not have the same significance. In wagon drilling the loss is evenly distributed throughout the length of hole drilled and although 100 percent of the drillings are not recovered, each increment of hole, however small it may be, is represented in the sample.

On the other hand, a 90-percent recovery in core drilling means that no core at all was obtained from 10 percent of the drilled footage, and the depths at which the losses occur is often hard to determine. Such breaks in the record may be filled to a certain extent by the substitution of drill sludges but they are seldom regarded as satisfactory.

MAINTENANCE

The cost of maintaining the machine in operating condition is low chiefly due to the fact that, excluding the motor, the only moving parts subject to wear are the fan rotor, shaft bearings, and drive belts. After sampling 7,000 ~~10,000~~ feet of hole it was found necessary to replace the rotor, shaft bearings and one section of the fan housing, and the gasoline engine was in need of minor repairs. The total cost of reconditioning was slightly under $135.00 $0.0193 ~~$150.00 or 1-1/2¢~~ per foot.

OPERATING COSTS

The current average contract cost for core drilling AX holes (1-1/8-inch diameter core) to depths of 125 feet or less is approximately $2.50 per foot as compared to $0.75 per foot for wagon drilling. The faster rate of wagon drilling (130 ft. as against 30 ft. per 8 hours) makes possible an additional saving in samplers' wages. On the other hand, wagon-drill sampling is more expensive in some respects than coring. Because of fluctuating prices the following data are only approximate but they may be considered sufficiently significant for the purpose of comparison. The original cost of the sampling machine (approximately $500.00) is not included.

Comparative costs based on 100 feet of hole

Item	Core drilling	Wagon drilling
Drilling:	$250.00	$75.00
Sampler's pay @ $1.25 per hour:	33.33	7.69
Core boxes @ $2.75 ea.:	5.50	
Sample sacks @ $13.50 per 100:		4.59
Sampling machine, maintenance:		~~1.50~~ 1.93
Sampling machine, gas & oil:		.70
Shipment of samples, see below.		
Total per 100 ft. of hole:	$288.83	~~$89.48~~ 89.91

The weight of 100 feet of boxed core is 148 lbs. as compared to 34 sacks of wagon drill cuttings which weigh 306 lbs.