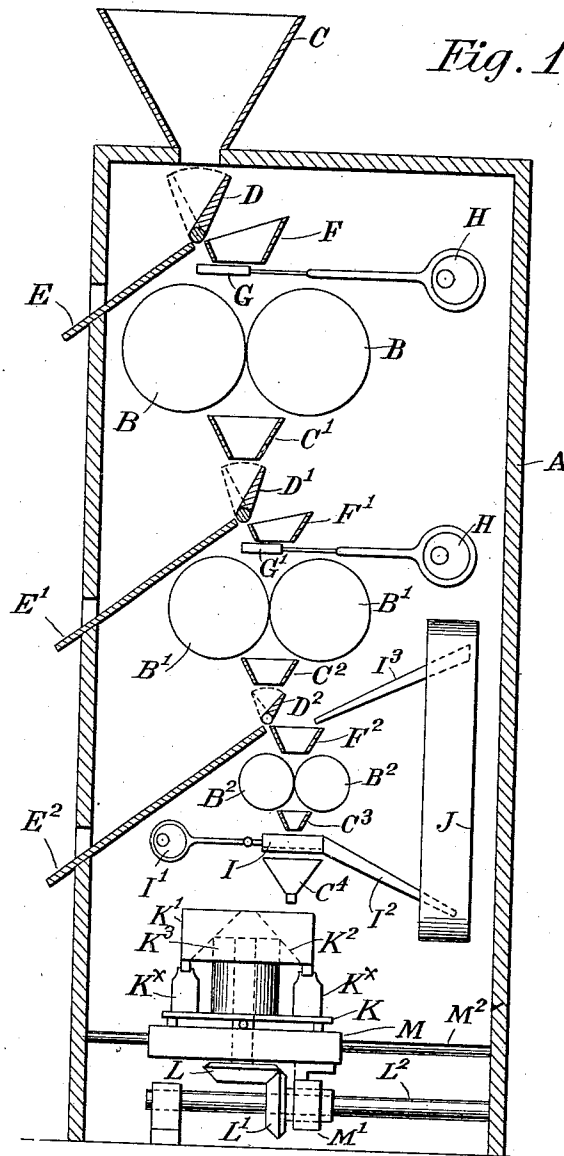


1,062,636.

2 SHEETS--SHEET 1.



Witnesses:
Wm Bohleber
G P Johnson

Arthur S. Clift ^{Inventor}
By his Attorneys
Kerr Page Cooper & Hayward

A. S. CLIFT.
 PLANT OR APPARATUS FOR THE SAMPLING OF ORES.
 APPLICATION FILED DEC. 3, 1912.

1,062,636.

Patented May 27, 1913.
 2 SHEETS—SHEET 2.

Fig. 2

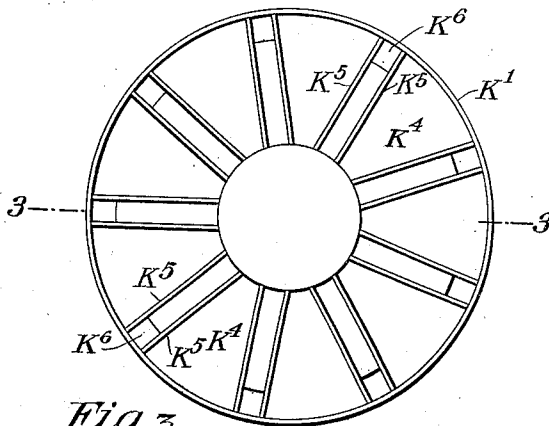


Fig. 3

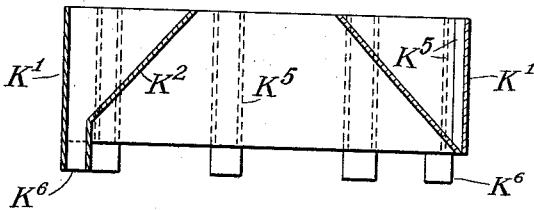


Fig. 4

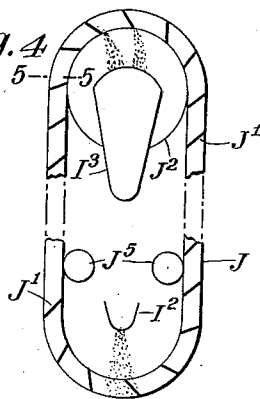


Fig. 5

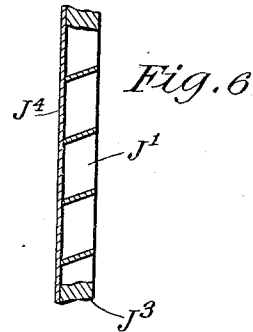
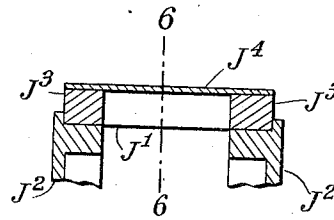
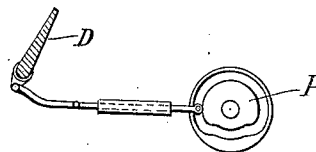


Fig. 7



Witnesses:
Wm. Rohleber
W. P. Johnson

Inventor
Arthur S. Clift
 By *his Attorney*
Harry Page Cooper & Hayward

UNITED STATES PATENT OFFICE.

ARTHUR STEBBINS CLIFT, OF LONDON, ENGLAND.

PLANT OR APPARATUS FOR THE SAMPLING OF ORES.

1,062,636.

Specification of Letters Patent.

Patented May 27, 1913.

Application filed December 3, 1912. Serial No. 734,664.

To all whom it may concern:

Be it known that I, ARTHUR STEBBINS CLIFT, a citizen of the United States, residing at London, England, have invented certain new and useful Improvements in Plants or Apparatus for the Sampling of Ores, of which the following is a full, clear, and exact description.

This invention has reference to a plant or apparatus for the sampling of ores and for like purposes.

It is well known that the usual method of selling ores is by analysis, and in order to correctly determine the analysis showing the contents of the ore, it is necessary to obtain a small representative sample of the whole of a cargo or other parcel of ore which is to be sold, or the contents of which it is desirable for any other purpose to correctly ascertain. This was formerly almost universally done, and is still done in many places, by taking small quantities at intervals, say for example one skip in every 20 or one truck load in every 20 from a ship or train, piling these individual quantities up together and then dividing the pile up and shoveling two quarters away, dividing again and shoveling two quarters away etc. Then when the quantity is reduced to a certain extent in this manner, the ore is broken through a crusher or rolls between each operation of quartering so that finally the resultant sample is a comparatively very small one of finely ground material which is then put into suitable cases or sample bottles, sealed by buyers' and sellers' representatives and sent to the chemists for analysis, and upon the chemists' determination the value of the cargo or other quantity of ore is based. This hand method has several disadvantages. It involves a great amount of labor, and it also gives an opportunity for dishonest laborers or manipulators to falsify the result by skilfully discarding or throwing into the sample the particular quarters which by eye they can see are the richest, or by otherwise introducing, especially in the final operation, foreign material in the form of dust or otherwise. The dishonest enrichment of ore samples in this manner is known in the trade as "salting", and it is obviously easier to "salt" a sample when it is frequently handled by hand than if the operation were performed by an automatic plant or machine where the operations are entirely automatic,

and where neither the ore nor the sample can be touched during the operation by anyone.

To obviate the disadvantages of hand sampling various arrangements have been proposed generally comprising crushers, rolls and grinding mills acting on the ore in stages, some suitable automatic sampler or dividing machine being employed at each stage to cut out and reject a certain percentage of the ore while allowing the remainder to pass on to the crushing or grinding machine of the next stage and so on. In this manner by successive cuts and intermediate crushing or grinding a resultant small finely ground sample is finally obtained, which emerges from the last machine and enters a small sample case or chest, from which it is filled by hand into the requisite number of sample bottles for the chemists. Such methods are a great improvement over the old method of manipulating entirely by hand, but still have the disadvantage that owing to the plant consisting of a considerable number of separate machines, it becomes large and costly, and is further complicated by requiring a great number of belts or gears for driving the different machines. It is also generally necessary with such arrangements to have complicated forms of chutes or conveyers for conveying the ore from one machine to another and these on account of the abrasive and often corrosive nature of different ores, are subject to rapid wear. A further great disadvantage is that the actual filling of the sample bottles is performed by hand, so that at this most vital stage of the process (where salting is of course easiest) the operation is still done by hand.

Now the object of this invention is to provide a machine which shall avoid the above mentioned disadvantages, and which shall contain in itself a compact assembly of all of the elements necessary for accomplishing various successive grindings and divisions of the ore and finally discharging the sample by means of a suitable device direct into the sample bottles so obviating the hand-filling of the latter.

To this end the apparatus may comprise a series of superposed pairs or sets of rolls, grinders or the like each pair or set of which may correspond to one stage of the sampling. Beneath each set of rolls or equiva-

lent devices may be arranged a guiding device or deflector for cutting or dividing the stream of ore, which device automatically changes its position at intervals whose duration corresponds to the proportion of material which is to be retained for the next stage of the sampling. Thus if one-fifth (that is twenty per cent.) is to be retained, the deflectors will be for one-fifth of the time in such a position that they deflect the material to a hopper, bin or other suitable receptacle for feeding the next set of rolls. The discharge outlets of the hoppers or bins may be controlled by any convenient devices, such as slides, delivery screws or the like, so that the contents (received in the one-fifth interval just mentioned) will only be discharged by the time the next lot is received. In other words the delivery from each hopper or receptacle is positively regulated so that it is practically perfectly continuous or uniform although the filling of the receptacle is intermittent. From the last set of rolls the now finely ground material may pass on to a sifter which rejects any coarse particles while the fine material passes to a device which delivers it regularly to a set of sample bottles and fills them automatically. The rejected coarse particles however, instead of being cast aside, may be continuously returned by a suitable conveyer to the rolls to be again further crushed, so that they ultimately find their way to the bottles with the rest of the samples, thus further insuring that the latter are properly representative of the original material.

The bottle-filling portion of the apparatus is adapted to fill the whole of the sample bottles (for example nine) gradually and practically simultaneously. Means may also be provided whereby the rate of filling can be varied or adjusted so that the filling of the bottles will be just properly completed by the time the sampling operation is finished, that is to say by the time the whole of the lot of material which is being sampled, has been acted on by the apparatus.

The apparatus may be so constructed that it can be totally inclosed, transparent windows being provided in the casing at intervals if desired so that the ore passing through the apparatus may be observed, without its being possible however to touch it by hand.

In order that the invention may be clearly understood and readily carried into effect reference will now be had to the accompanying diagrammatic drawings in which:—

Figure 1 is a general view mainly in vertical section showing the general arrangement of the parts in one example of the improved sampler. Fig. 2 is a detail view in plan of a distributing device hereinafter referred to for guiding the samples into the bottles. Fig. 3 is a vertical section thereof,

on the line 3—3 of Fig. 2. Fig. 4 illustrates a convenient arrangement of belt-elevator hereinafter referred to. Fig. 5 is a detail cross section to a larger scale, on the line 5—5 of Fig. 4. Fig. 6 is a detail vertical section on the line 6—6 of Fig. 5. Fig. 7 is a detail view of a deflector and its operating device.

According to the example illustrated the sampling machine or apparatus comprises a suitable frame or casing A containing the several sets of rolls B, B¹, B² arranged one above the other and driven by any ordinary or suitable gear (not shown) in the well known manner. The ore to be sampled enters a hopper C at the top of the machine. At the outlet of this hopper is a hinged vane or deflector plate D which is reciprocated from side to side automatically by any convenient means, such as that hereinafter referred to, so as when in the dotted position to deliver (say 20 per cent.) of the time into a hopper like receptacle F which in turn delivers it to the first pair of rolls B. During the remaining 80 per cent. of the time of each throw, or to and fro stroke, of the deflector, the latter is in the full line position and serves to reject the ore by throwing it on to a chute E which discharges it from the machine. The portion of the ore entering the first set of rolls is thus one-fifth or twenty per cent. of that which first enters the hopper C. This portion is crushed by the rollers B to a certain size and then passes into another hopper C¹ and from thence past another reversible vane or deflector D¹ which like the deflector D rejects 80 per cent. of it down a side chute E¹, whereas the remaining 20 per cent., while the deflector is in the dotted position falls into another hopper-like receptacle F¹ whence it is delivered continuously to the second set of rolls B¹ and so on, according to the number of sets of rolls employed. Thus in the present example each deflector reduces to one-fifth the quantity of the material to be acted on by the next set of rolls, and hence while the rollers B act on a fifth of the whole of the material fed into the top hopper C, the rollers B¹ have to act only on a twenty fifth thereof, while the next set of rollers will act only on a hundred and twenty fifth part, and so on. Consequently by passing through the successive rolls, hoppers and vanes, the ore is successively crushed finer and finer and at each stage of the crushing a definite portion is rejected by the vanes or deflectors D D¹. These latter are operated for example by a cam P, Fig. 7, or other suitable mechanism which may be actuated by one of the moving shafts of the ordinary gear (not shown) for driving the rolls.

The proportion of ore rejected by the vanes D D¹, in the manner indicated obvi-

ously depends upon the percentage of the duration of their stroke (assumed in this case to be 80 per cent. thereof) during which they occupy the full line position. Hence by varying the relative timing, they can be caused to guide any desired proportion of the streams of ore to the next receptacles for the succeeding pairs of rolls. For instance if they are only in the dotted position for a tenth of their stroke, they will only deliver ten per cent. of the ore-stream to the next rolls.

Suitable ore-feeders or controlling devices are arranged at the mouths of the hoppers or receptacles F F^1 , each of these devices consisting say of a fairly rapidly reciprocating slide or plate G worked by an eccentric arrangement H which may have a variable throw or be combined with other means for adjusting the stroke of the slide plate G . The ore entering the receptacle F or F^1 falls on the plate G and is pushed over the edge thereof, a small proportion at a time, at each reciprocation in the known manner, thus keeping the stream of ore which passes through the rolls and vanes regular and uniform or practically so. Such an arrangement is employed because it is necessary, if the sample lot is to be truly representative, that the stream of ore which is cut or deflected by the vanes D D^1 should be an approximately uniform stream.

The deflectors D , D^1 , D^2 , should all move together or simultaneously from one extreme position to the other, for which purpose any suitable means may be employed for operating the cams P , Fig. 7, in unison.

After the bulk of the sample lot has been sufficiently reduced as above described, it is finally passed through another arrangement of hoppers or funnels and deflectors C^2 D^2 F^2 to a pair of fine crushing rolls B^2 (or a suitable grinding mill) built near the bottom of the apparatus. The discharge from these rolls or grinding mills falls through a funnel or hopper C^3 on to a small shaking sieve I worked from a cam I^1 , and having meshes of the size which it is desirable the particles of the sample shall be when they enter the sample bottles. The fine ore which passes through this shaking sieve falls into a small hopper or funnel C^4 placed beneath the sieve and is thence discharged in a small stream on to the top of a suitably designed bottle filler such as hereinafter described. The portion of ore which is too coarse to pass through the sieve is discharged therefrom at the side by the shaking motion, into a guide-chute or nozzle I^2 and is led to a suitably designed band or other form of elevator J which drops it into a second guide chute I^3 (see also Fig. 4) whereby it is again discharged into the grinding mill or fine crushing rolls B^2 . In this manner all of the sample can be finally crushed or

ground so that it may pass through the shaking sieve and ultimately is discharged into the bottle filling portion of the apparatus. This comprises a revolving plate or table K upon the surface of which the required number of bottles K^x to be filled for example nine, are placed in a circle. Over the top of the circle of bottles is arranged an annular distributor or hopper of thin sheet or cast metal. The outer wall K^1 of this distributor may be either cylindrical as shown or be conical, while the bottom K^2 thereof is in the form of a cone thus giving the interior the appearance of a channel or V-shape or wedge-shape in cross-section. The hollow or conical bottom of the distributor is arranged to rest on a central supporting block K^3 from which it can be readily lifted by hand.

The annular channel or trough inside the distributor K is divided (see Figs. 2 and 3) transversely or rather, radially, into compartments or cells K^4 by hollow partitions each of which may consist of a pair of parallel and approximately radial walls K^5 separated from one another by a narrow space forming a radial pocket or chute open at the top but closed at the bottom by the inclined surface of the cone K^2 . At the lower corner of each chute near the circumference of the distributor, is an outlet nozzle or orifice K^6 beneath which is placed one of the sample bottles K^x each pocket or chute serving to fill one of these bottles. Thus as the distributor revolves, a fraction of the stream of finely ground material falling from the aforesaid funnel will pass into the said vertical spaces or chutes and thence into the sample bottles, whereas the rest generally forming the larger part of the material, will be collected in the intervening cells or compartments. These latter are preferably made of a size such that they will not be more than filled by the time the bottles themselves are filled even if only a small proportion of the fine material passes into the said bottles. The rate of filling of the bottles can be arranged so that it occupies just the time of one complete sampling operation, or say for instance one hour, after which the distributor is taken out and emptied, ready for a fresh sampling operation.

To effect the adjustment of the rate of filling, means are provided whereby the revolving chutes can be caused to cut the ore stream at different distances from the center of the distributor, and thus the proportion or fraction of the ore transferred to the bottles can be varied as desired. Thus if the ore stream falls near the center a considerable proportion of it will pass into the narrow radial pockets formed by K^5 and thence to the bottles, while if it falls near the circumference the bulk of it will fall

into the intervening cells K^4 (owing to their greater angular extent) and be retained therein instead of going into the bottles.

To permit of the adjustment of the rate of filling the bottles, and also for convenience for instance in removing and replacing the bottles and emptying the distributor for a fresh sampling operation, the mechanism for supporting and rotating the plate or table K may be so arranged that the said plate and the rest of the filling device may be slid sidewise. To this end it may be driven by a pair of bevel pinions L L^1 the latter of which is capable of sliding endwise on a driving spindle L^2 with which it is suitably connected for that purpose. The boss or sleeve of the pinion L^1 may be fitted in a bracket or bearing M^1 connected with a sliding table M carrying the bottle filling device. This table may be provided at each side with slides M^2 and the rotating plate K of the device should be capable of turning freely upon it. The spindle of the pinion L passes up freely through the sliding table M and the rotating plate K is made fast to it. By this means the table M , and with it the rotating plate K and the rest of the bottle filling device, may be moved sidewise more or less as required, without interfering with the driving action through the bevel gears L L^1 (which move sidewise with the filling device) and the spindle L^2 . Thus the filling device may easily be set to revolve so that the stream of ore from the discharge of the fine-crushing rolls or grinding-mill falls either nearer the center of the revolving annular hopper or nearer the periphery or at any intermediate point which may be desired. As above indicated, if the stream of ore falls near the periphery, a relatively less portion of the ore stream will enter the pockets or chutes K^2 and find its way into the bottles, than if the stream falls near the center of the revolving annular hopper. The whole bottle-filling mechanism, therefore, can be easily so adjusted that the bottles will be filled to the desired height during each sampling operation, or will receive a sufficient quantity of ore to permit of the chemist making a proper analysis.

The elevator J (see Figs. 4, 5 and 6) may conveniently consist of an endless belt carrying inclined internal slots or pockets J^1 . It may be arranged to run on narrow flanged pulleys J^2 at each side leaving a free space between them. The edges J^3 of the belt which bear on the pulleys are made of thick material, such as rubber, between which the internal slots J^1 extend, a backing or thin web J^4 being provided to form the outer surface of the belt. The material fed in from the side by the lower chute I^2 , falls into the pockets or spaces between the slots and the web J^4 and is carried upward there-

in and at the top is tipped into the upper chute I^3 to be returned to the rollers B^2 as above stated. At its lower end the belt may be kept in an open loop ready to receive the material, by means of suitable guides, such as jockey pulley J^5 .

All those parts or elements of the apparatus which require to be actuated may be driven by gears or belts, either direct or through intermediate shafts from the main driving shaft of the machine, thus rendering the machine compact and self-contained. Moreover all parts subject to the abrasive or corrosive actions of the ore are inexpensive and easy to renew.

It will be readily understood that the apparatus may be of very considerable size, sufficient to enable a considerable amount of ore (say for instance) a lot of 20 tons per hour to be passed through the top hopper C .

I claim:

1. In an ore sampling machine, the combination with pairs of rolls arranged in sequence, of containers for charges of material, deflectors intermediate to the containers and rolls, and means for controlling the position of the deflectors whereby a definite proportion of the charge in each container is passed to the appropriate rolls and the remainder diverted from the machine, as set forth.

2. In an ore sampling machine, the combination with pairs of rolls arranged in sequence, of containers for charges of material, intermittently operated deflectors intermediate to the containers and rolls for passing a definite proportion of the charge in each container to the appropriate rolls, and means for delivering the proportional charges continuously to said rolls, as set forth.

3. In an ore sampling machine, the combination with pairs of rolls arranged in sequence, of containers for charges of material, deflectors for passing a definite proportion of the charge in each container to the appropriate rolls, and means for delivering the product of the last pair of rolls of the series into a series of bottles, and means for varying the rate of such delivery whereby the filling of the bottles may be timed to coincide with the completion of the sampling operation, as set forth.

4. In a machine of the kind described, the combination with a series of rolls and co-operating mechanism for sampling and reducing the material, of a revolving distributor having radial chutes and adjustable with respect to the point of delivery for the material from the last rolls of the series, whereby the filling of receptacles of material deposited in the chutes may be timed to coincide with the completion of the sampling operation, as set forth.

5. In a sampling machine of the kind de-

scribed, the combination with a series of rolls and coöperating mechanism for sampling and reducing the material, of a vibrating screen for receiving the material from the last of the series of rolls, a chute for the coarser particles intercepted by the screen, and a conveyer for returning said particles to a pair of rolls for regrinding, as set forth.

10 6. In an ore sampling machine, the combination with a plurality of crushing or reducing mechanisms arranged in sequence, containers for the charges of material to be delivered to each reducing mechanism, 15 means intermediate to each container and its appropriate reducing mechanism for deter-

mining the proportion of the charge which passes thereto, receptacles for receiving such proportional charges, and means for feeding the material from said receptacles continuously to the reducing mechanism, whereby the whole of the material to be sampled is subdivided by steps into the necessary amount for the finished samples, and at the same time gradually reduced to the required 25 fineness, as set forth.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

ARTHUR STEBBINS CLIFT.

Witnesses:

O. J. WORTH,
CARL R. LOOP.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."