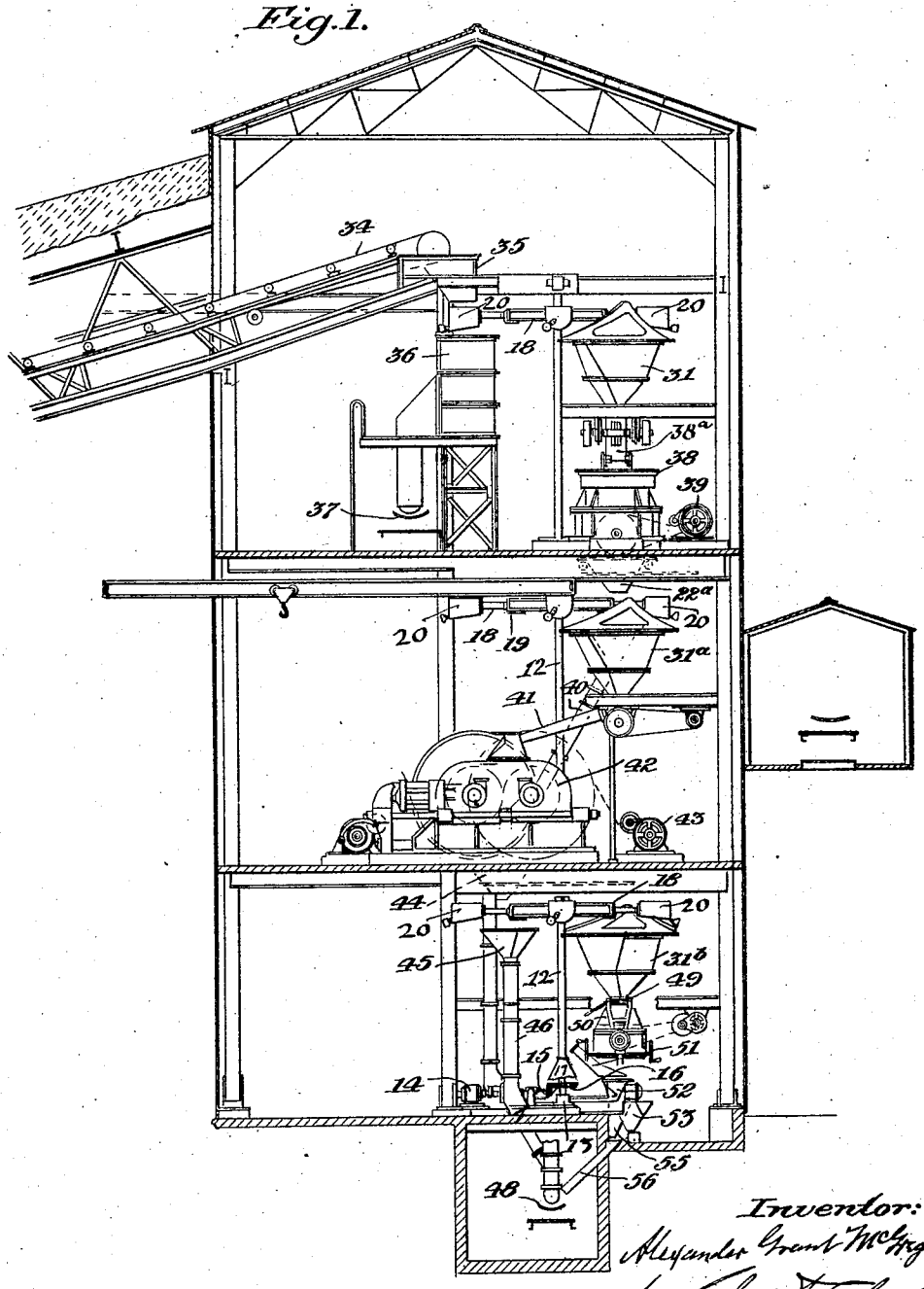
July 6, 1926. 1,591,092

A. G. McGREGOR

SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 1

Fig. 1.



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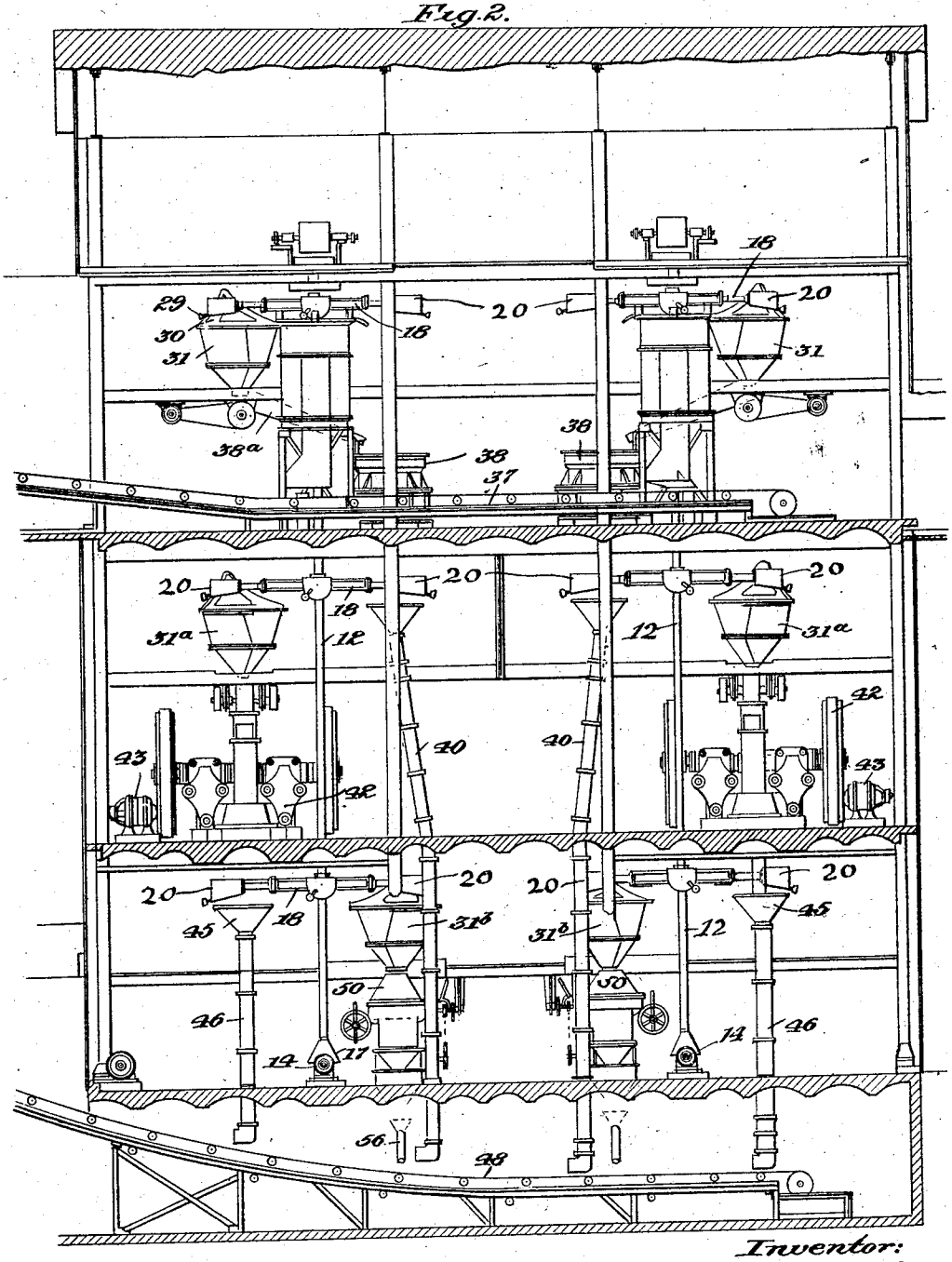
July 6, 1926. 1,591,092

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SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 2

Fig. 2.



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July 6, 1926. 1,591,092

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SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 3

Fig. 3.

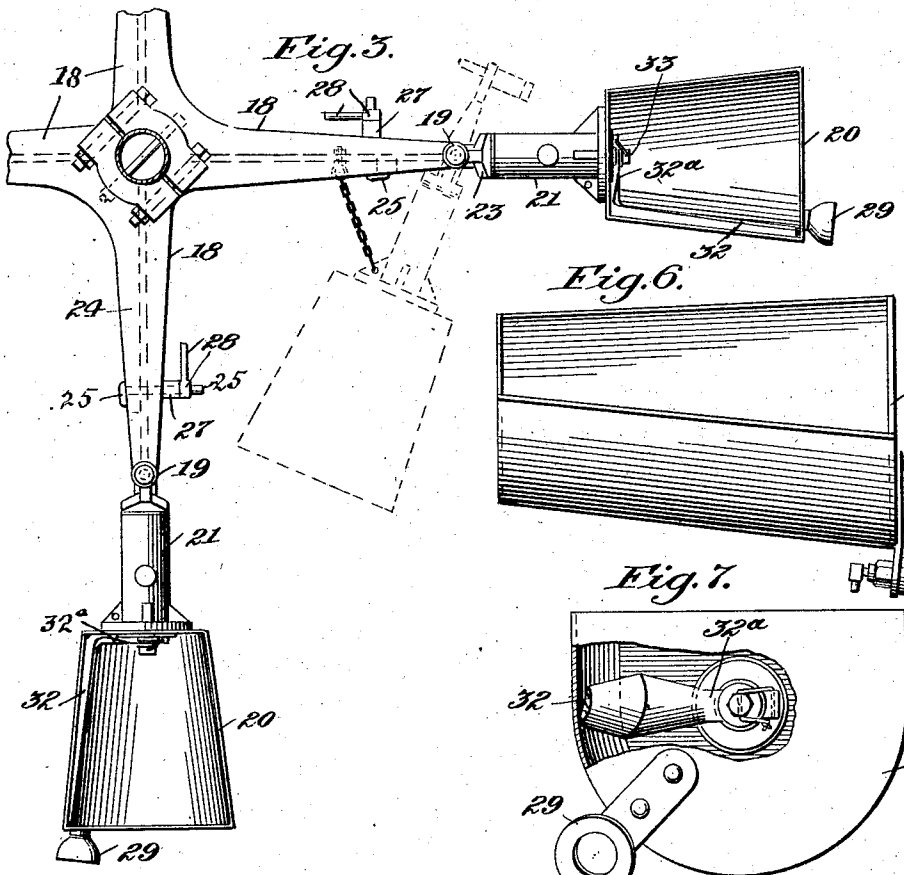


Fig. 6.

Fig. 7.

Fig. 4.

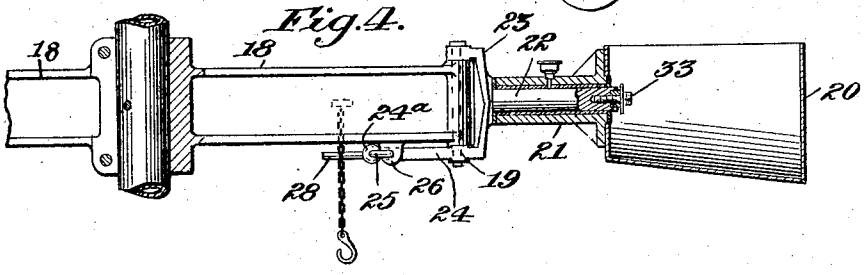
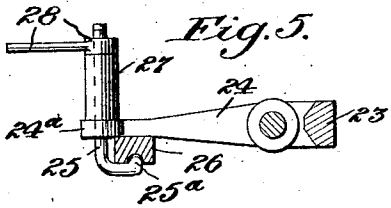


Fig. 5.



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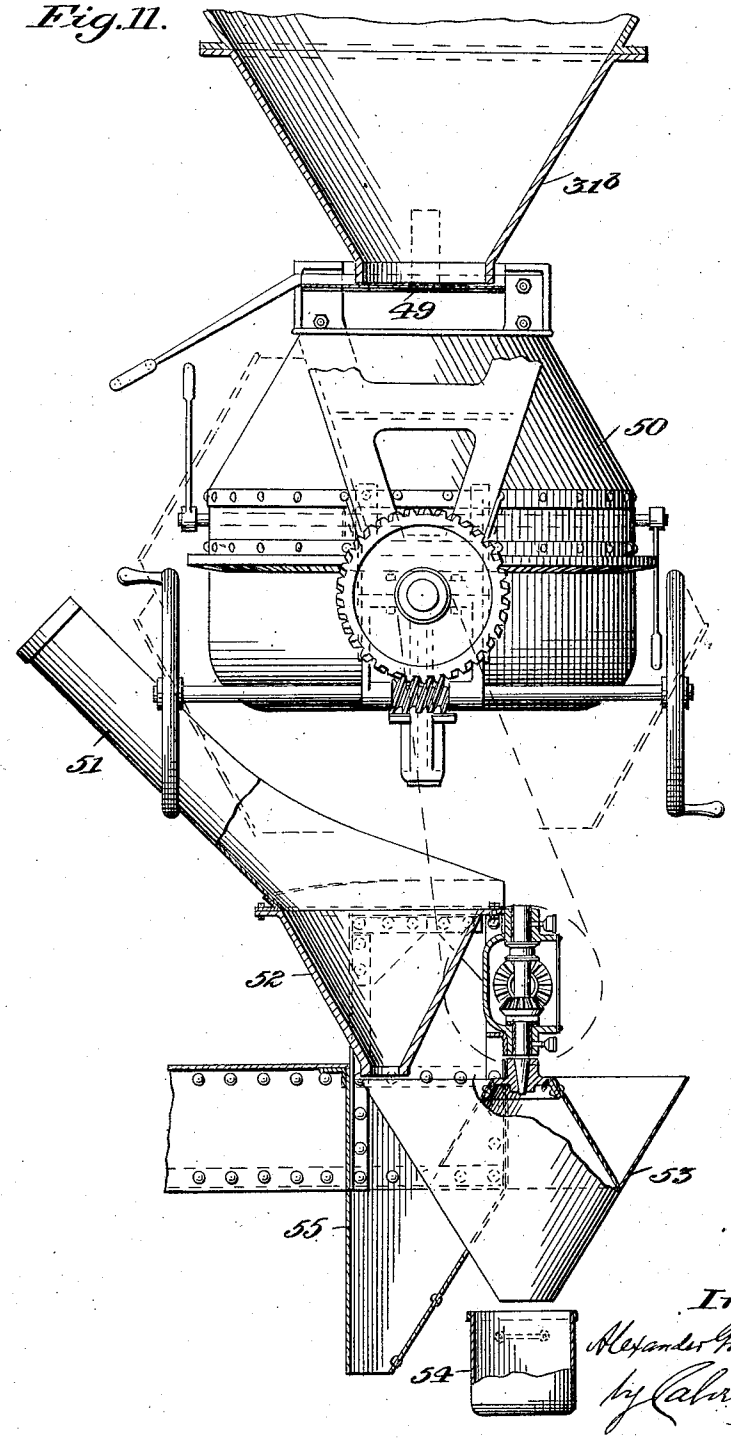
July 6, 1926. 1,591,092

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SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 5

Fig. 11.



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SAMPLING APPARATUS

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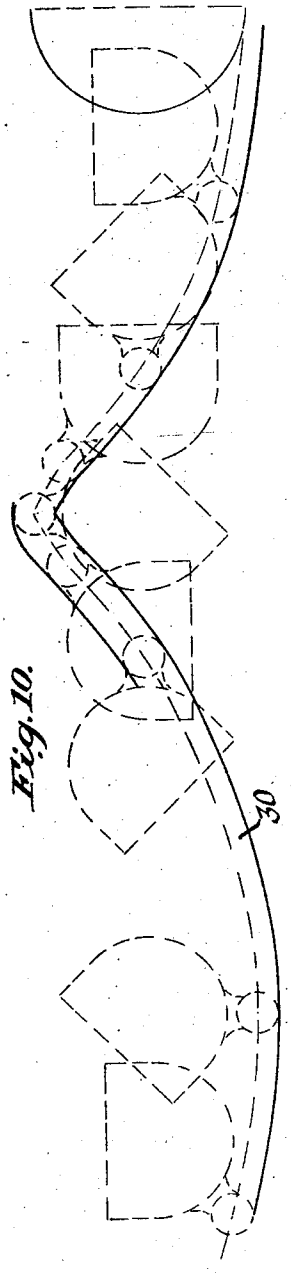


Fig. 10.

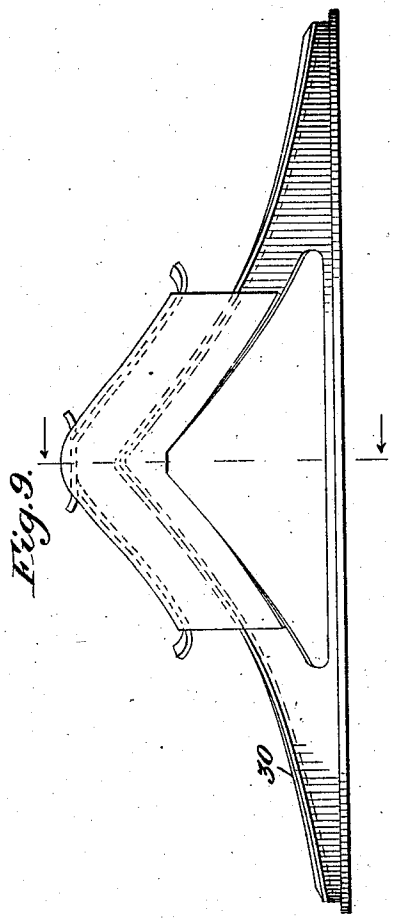


Fig. 9.

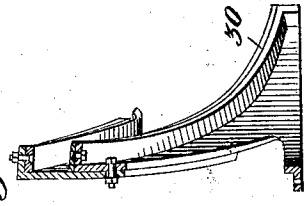


Fig. 9a.

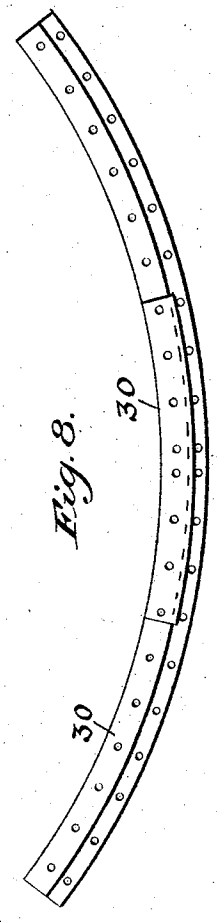


Fig. 8.

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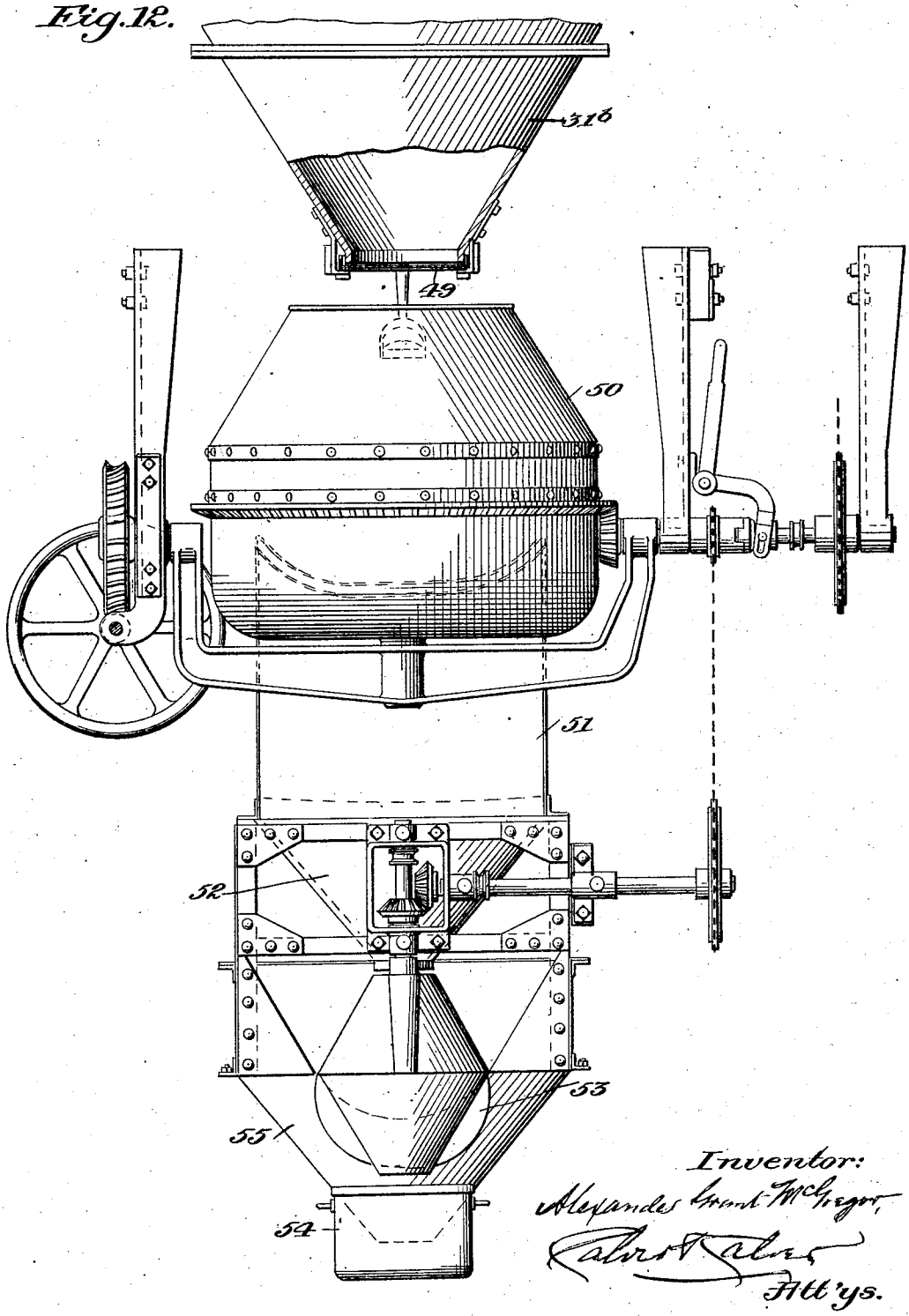
July 6, 1926. 1,591,092

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SAMPLING APPARATUS

Filed April 19, 1924 6 Sheets-Sheet 6

Fig. 12.



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Patented July 6, 1926. 1,591,092

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT McGREGOR, OF WARREN, ARIZONA.

SAMPLING APPARATUS.

Application filed April 19, 1924. Serial No. 707,628.

This invention relates to an apparatus or machine for sampling ores, or the like, which will work more conveniently and to better advantage than the sampling machines at present in use in ore mills.

In an ordinary ore sampling mill, such as are now generally in use, a ten or twenty per cent sample of the coarse ore delivered to the mill is taken at the top of the mill in some such sampler as the Brunton, Vezin, Snider, etc. The ore is crushed in a subsequent crushing machine and another sample is taken of the ore discharged from the crushing machine. A second sample is further crushed by a second crushing machine. A third sample is taken of the ore discharged from the latter machine, and this is delivered to a third crushing machine. A sample is taken of the product from the third crushing machine and is usually delivered to a sample safe or hopper.

In such a mill each sampler cuts an approximately definite percentage of the material fed to it, and no change can be made in the percentage taken by the sampler without installing a different sampler, which is not practical in ordinary mill operation, and is not resorted to.

Such samplers as those suggested have slots or openings in the periphery of the sampler for collecting the sample. In order to get an accurate sample it is necessary that the sampler collect a uniform section through the stream of ore flowing to it, and this requires that the slots or openings in the sampler be large enough so that the coarsest material coming to it will not be prevented from passing through and so that a proper amount of coarse material will pass into the sampler. In usual practice the width of the sample opening must be several times the diameter of the coarsest ore fed to it. As the diameter of the usual sampler of the type suggested is not greater than about 60 inches, it results that, in order to get a proper opening for coarse ore, the width of the opening amounts to usually about ten per cent of the circumference described by the sample slot. Oftentimes it is twenty per cent. It is necessary to crush the sample finer before taking the next sample, and with large amounts of ore per lot, and with this large proportion of sample a great amount of crushing is required in the sampling mill.

Oftentimes in order to cut down the amount of crushing in the sampling mill, the sample opening is made narrower than it should be for accurate results and for getting a proper proportion of coarse ore. Very often the coarse ore will not analyze the same as the fine. In an ordinary sampling mill the several samplers require their own drives which increases the number of belts and pulleys on each floor. The present mechanical ore samplers in use, such as those mentioned, will not operate on sticky ores, such as flotation concentrates.

One purpose of my invention is to enable the percentage of sample to be varied from time to time. On large lots of ores it is not necessary to cut as big a percentage as on small lots. Another object is to get a small percentage sample of coarse ore and yet have sufficient width of bucket in order to get an accurate sample. I accomplish this by having a sample bucket with a comparatively wide open top, and which is caused to travel on a much larger circle than is common in samplers of the types hereinbefore referred to. A further object is to cut samples on the various floors of a sampling mill with a self-contained machine having only one drive.

In the accompanying drawings Fig. 1 is an endwise elevation of a sampling mill having several floors fitted with a preferred form of sampling and reducing apparatus. Fig. 2 is a sidewise elevation of the same, showing the sampling and reducing apparatus in duplicate. Figs. 3, 4, 5, 6 and 7 are detail views of sampling buckets, their carrying arms and attached parts. Fig. 8 is a detail plan view, and Fig. 9 a detail elevation of the bucket-turning cam-ridge. Fig. 10 is a diagrammatic view illustrating the turning movement of a sampling bucket. Figs. 11 and 12 are enlarged detail views of the Jaeger dumping mixer and the Vezin sampler shown in Figs. 1 and 2.

Referring to the drawings, 12 denotes a vertical shaft having a stepped bearing at 13 at its lower end and having suitable bearings in the several floors of the mill. The shaft 12 is driven from a motor 14, the motor shaft carrying a bevel pinion 15 meshing with a bevel gear 16 rigidly connected with the shaft 13 and protected by a safety housing 17.

In the preferred form of the invention il-

lustrated in the drawings, the shaft 12 carries several sets of arms 18 to each of which is attached, preferably by a knuckle joint pivot 19, a rotatably mounted sampling bucket 20, each sampling bucket being connected with a sleeve 21 mounted on a journal rod 22 preferably formed integral with a yoke 23 forming part of the knuckle joint pivot 19. The yoke 23 has, integral therewith, an inwardly extending arm 24 through the inner end 24^a of which passes a locking pin 25 having a bent-over end part 25^a arranged to enter a recess in the outer face of a lug 26 on the arm 18, so as to hold the said arm in working position; but when it is desired to throw a bucket out of working position the locking pin 25, passing through a sleeve 27 on said arm, may, by a proper manipulation of a handled locking nut 28, be loosened and withdrawn so that the pivotally mounted bucket may be displaced from or moved out of working position, as shown in dotted lines in Fig. 3.

Each bucket 20 is provided with a cam roll 29 arranged to engage a curved cam ridge 30 mounted on a sample hopper 31, 31^a and 31^b, so that as the shaft rotates, carrying the buckets 20 around with it, each bucket, when it arrives over a sample hopper, will, by engagement of the cam roll 29 with the said cam ridge 30, be turned upside down so as to empty its contents into a sample hopper.

To insure a proper discharge of the samples from the sampling buckets, particularly if the material being sampled is of a sticky nature, the sampling buckets are each furnished with a bayonet-shaped scraper or cutter 32, the inner portion of the shank 32^a of said scraper or cutter being approximately at a right angle to the body 32. The shank 32^a is secured by an attaching screw 33 to a journal rod 22 on which a sleeve 21, rigidly connected with a sampling bucket 20, is mounted for turning movements, and with which journal rod the scraper or cutter 32, 32^a is rigidly connected, so that as the sampling bucket is turned upside down to discharge its contents the said scraper or cutter will remain stationary and will thus assist in clearing the said bucket of its contents.

The ore to be sampled is discharged from a conveyor 34 into a hopper or chute 35 at the top of the mill and beneath which hopper or chute the sampling buckets 20 are carried at intervals. In the form of the invention herein illustrated there are four arms 18 in each set, each arm carrying a sampling bucket 20, these sampling buckets cutting at intervals through the stream of material being discharged from the hopper or chute 35.

If, however, it be desired to take a lesser percentage of sample material from the stream of crushed ore or other material being discharged from the hopper or chute 35 than would be taken if all four of the sampling buckets of each set were in operation, one or more of said sampling buckets may be thrown out of operation by loosening it from its supporting attachment to an arm 18, and displacing it from working position, as indicated by dotted lines in Fig. 3.

That portion of the stream of material being discharged from the chute or hopper 35 which is not carried away by the sampling buckets 20, falls into a reject receptacle or chute 36 from which it may be discharged to a conveyor 37 and be carried away to any suitable place of deposit. The ore sample which has been segregated from the stream or mass of material discharged from the hopper 35 and dumped into the hopper 31 by the sampling buckets is conveyed by suitable means, as by a chute 38^a, to a crushing mill 38 which may be driven from a motor 39, and the product from said mill passes into a hopper 22^a beneath which the sampling buckets of a second set pass at intervals, cutting through the stream of material discharged from said hopper 22^a. The reject material not being taken by this second set of sampling buckets passes downward through a chute 40, while the sample material from this second set of sampling buckets is dumped into the hopper 31^a and passes thence through a chute 41 to a roller crushing mill 42 for further reduction, said crushing mill being driven from a motor 43.

The products from the crushing mill 42 pass into a hopper 44 beneath which sampling buckets of a third set pass at intervals, said sampling buckets dumping their contents into the hopper 31^b, while the material discharged from the said hopper 44, not taken by said sampling buckets, passes into a reject hopper 45 and thence through a chute 46 which discharges onto a conveyor 48 which carries the reject material to any suitable place of deposit.

The sample safe or hopper 31^b is provided at its bottom with a gate 49 which may be opened at intervals for permitting the contents of said hopper to be discharged into a dumping batch mixer 50 which will preferably be of the Jaeger type, such as shown in the Jaeger Patents Nos. 1,322,575 and 1,414,648, so that the sample material, now properly reduced, may be thoroughly mixed. The mixer is arranged to discharge into a trough or chute 51 which in turn discharges into a hopper 52 beneath which rotates a Vezin sampler hopper 53 of well known form, said sampler taking any desired proportion of the material discharged from the hopper 52 and discharging it into a sample bucket or receptacle 54. The material from the hopper 52, not taken by the rotating

sampling hopper 53, is discharged into a reject chute 55 whence it passes into a chute 56 discharging onto the reject conveyor.

From the foregoing it will be apparent that the improved sampling apparatus provides means, by releasing one or more of the horizontally rotated open-topped sample buckets or receptacles and displacing it or them from working position, as indicated in dotted lines in Fig. 3, or otherwise, by which the percentage of sample material taken from a stream of material being delivered may be varied, as desired; and this feature of the invention may of course be utilized in connection with a single set of horizontally rotating sampling buckets or receptacles, as will be understood.

The operation of turning the open-topped sampling buckets or receptacles upside down for dumping will be readily understood from the diagrammatic view Fig. 10, which shows, in dotted lines, a sampling bucket in different progressive positions as it is turned for dumping, and then restored to receiving position, by reason of the contact of the cam roll 29 with the horizontally curved cam ridge 30 as the bucket is carried around horizontally.

Also the feature of providing a dumping mixer for thoroughly mixing the sample material which has been properly reduced, and thereby rendering the same practically homogeneous, may be used in connection with a single sampler, or a single set of sampling buckets or receptacles, as will be understood.

In the operation of the sampling apparatus arranged, as shown in Figs. 1 and 2 in a sampling mill having several floors, and in which the vertical shaft 12, having a single drive, carries several sets of horizontal arms 18 at different levels, and which arms are each provided with an open-topped sampling bucket or receptacle 20, arranged to be turned relative to said arms, the upper set of sampling buckets, as they are rotated horizontally, cut through the stream of material delivered from the hopper 35 to which hopper such material is delivered by the conveyor 34, and the sample material passing into said buckets or receptacles is dumped into the upper hopper 31 by virtue of the engagement of the cam rolls 29 on the buckets 20 with a cam ridge 30 on the hopper 31. The material from the hopper 31 is next delivered to the crushing mill 38 through which it passes to a hopper 22^a, and the stream of material from the said hopper 22^a is cut through by the sampling buckets 30 of the second set and the sample thus taken is dumped into the hopper 31^a. From said last-named hopper the material is fed to the roller crushing mill 42 from which it passes to the hopper 44 beneath which the third set of sampling buckets pass at intervals, taking samples from the stream of material from said hopper 44, and dumping it into the hopper 31^b. The rejected material passing from the uppermost hopper 35 to the receptacle 36, as also the rejected material from the hoppers 22^a and 44, is carried away through the chutes hereinbefore described. It will thus be understood that while a certain quantity of sample material is taken from the stream of material delivered from the upper hopper 35, this sample material is reduced in quantity by the second set of horizontally rotating sampling buckets, and the sample material before it reaches the hopper 31^b is again still further reduced by the third or lowermost set of sampling buckets or receptacles. Thus the quantity of sample material finally delivered to the hopper 31^b is small in quantity relative to the amount of sample material taken by the uppermost set of sampling buckets.

As ore sampling operations are at present practiced, the sample material collected in a sample safe or hopper sometimes amounts to several thousand pounds, and the operation of reducing this large quantity of sample material down to a sample of say fifty pounds, by coning or quartering, involves a great deal of labor and there is often considerable inaccuracy in the samples. By using a mixer as described the sample material is rendered practically homogeneous, as above referred to, and by using a Vezin sampler, as hereinbefore described, and which divides the reduced and well-mixed sample material into any desired reduced quantity, much labor will be avoided and more accurate results obtained than heretofore.

The invention is not to be understood as being limited to the details herein shown and described, as such details may be varied widely, within the province of mechanical skill, without departing from the essence or scope of the invention as the same is defined by the claims hereunto appended.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a sampling apparatus, the combination with a horizontally rotating open-topped sample receptacle having a curved bottom, and a vertical rotating shaft by which said receptacle is carried, of means for turning said receptacle upside down for dumping, and a cutter or scraper mounted within said receptacle and stationary relative thereto, so as to assist in clearing said receptacle when the latter is turned for dumping.

2. In a sampling apparatus, the combination with a vertical rotary shaft having a plurality of horizontal arms, sample receptacles each having a pivoted connection with one of said arms, releasable means for holding said receptacles rigid with said arms, but permitting any desired number of said recep-

tacles to be displaced from their working positions to vary the percentage of sample taken from a supply of descending material, and means for turning said sample receptacles for dumping.

3. In a sampling apparatus, the combination with a vertical rotary shaft having a plurality of horizontal arms, sample-receiving receptacles each having a pivoted connection with one of said arms, releasable means for holding said receptacle rigid with said arms, but permitting any desired number of said receptacles to be displaced from their working position to vary the percentage of sample taken from a supply of descending material, a sample receiving hopper, and means for emptying said receptacles as they pass over said hopper.

4. In a sampling apparatus, the combination with sampling means, of a mixer into which the segregated sample material is discharged, so that said material will be thoroughly mixed and thus be rendered practically homogeneous.

5. In a sampling apparatus, the combination with sampling means, of a crushing mill through which the segregated sample is passed, and a mixer into which the crushed sample is discharged, so that said sample will be thoroughly mixed and thus be rendered practically homogeneous

6. In a sampling apparatus, the combination with sampling means, of a crushing mill and a grinding mill through which the segregated sample material is passed, and a mixer into which the crushed and ground sample material is discharged, so that said sample material will be thoroughly mixed and thus be rendered practically homogeneous:

7. In a sampling plant having successive mechanical samplers and crushing machines at different levels, a sample safe or hopper containing the segregated sample cut from the lowermost crushing machine, in combination with a mechanically operated batch mixer for receiving and mixing the accumulated contents from said sample safe or hopper.

8. In a sampling plant having successive mechanical samplers and crushing machines at different levels, a sample safe or hopper containing the sample cut from the lowermost crushing machine, in combination with a mechanically operated batch mixer for receiving and thoroughly mixing the accumulated contents from said sample safe or hopper, so that each small quantity of the mixed material selected at random will be practically a true sample of the mixture.

9. In a sampling apparatus, the combination with sampling means, of a crushing mill and a grinding mill through which the sample material is passed, a batch mixer into which the crushed and ground sample material is discharged, so that said material will be thoroughly mixed and thus be rendered practically homogeneous, and a dividing sampler for reducing the quantity of the mixed material.

10. In a sampling mill, the combination with a vertical shaft, extending through several floors of said mill, and means for rotating said shaft, of a plurality of sets of horizontal arms fixed to said shaft at different levels, sampling buckets or receptacles carried by said arms, means for emptying said sampling buckets or receptacles as they are rotated horizontally, a sample-receiving hopper beneath each set of sampling buckets or receptacles, a crushing mill through which the sample material from the upper sample-receiving hopper is passed, a grinding mill through which the crushed sampled material from the next lower sample-receiving hopper is passed, and a dumping batch mixer into which crushed and ground sample material from the lowermost sample-receiving hopper is discharged.

11. In a sampling mill, the combination with a vertical shaft, extending through several floors of said mill, and means for rotating said shaft, of a plurality of sets of horizontal arms fixed to said shaft at different levels, sampling buckets or receptacles carried by said arms, means for emptying said sampling buckets or receptacles as they are rotated horizontally, a sample-receiving hopper beneath each set of sampling buckets or receptacles, a crushing mill through which the sample material from the upper sample-receiving hopper is passed, a grinding mill through which the crushed sample material from the next lower sample-receiving hopper is passed, a dumping batch mixer into which crushed and ground sample material from the lowermost sample-receiving hopper is discharged, and means for carrying away the rejected material from the points at which the several sets of sampling buckets or receptacles cut through the streams of material passing downward through the sampling mill.

12. In a sampling mill, the combination with a vertical shaft, extending through several floors of said mill, and means for rotating said shaft, of a plurality of sets of horizontal arms fixed to said shaft at different levels, sampling buckets or receptacles carried by said arms, means for emptying said sampling buckets as they are rotated horizontally, a sample-receiving hopper beneath each set of sampling buckets or receptacles, a crushing mill through which the sample material from the upper sample-receiving hopper is passed, a grinding mill through which the crushed sample material from the second sample-receiving hopper is passed, a dumping mixer into which crushed and ground sample material from the lowermost

sample-receiving hopper is discharged, and a dividing sampler for finally reducing the sampled material to a desired and relatively small quantity.

13. In a sampling mill having several floors, the combination with a vertical shaft extending through several floors, a plurality of sets of horizontally rotating, open-topped dumping sampling buckets connected with said shaft at different levels, co-operating means for diverting the material downward through the mill and feeding it to the different sets of sampling buckets, and a single motor or driving device for said shaft.

In testimony whereof I affix my signature.

ALEXANDER GRANT McGREGOR.