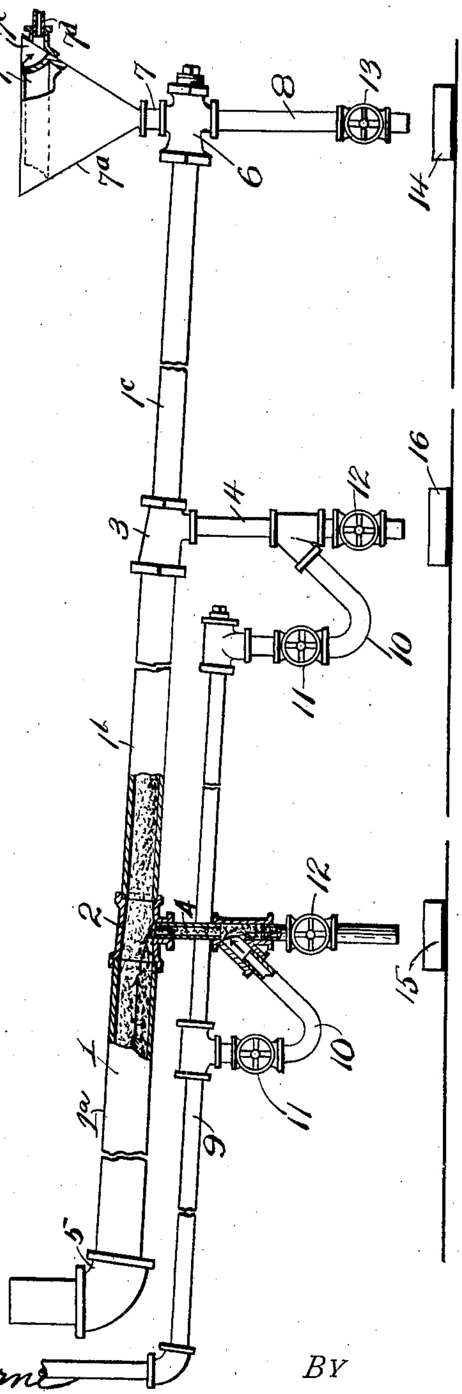
H. L. NEALL.
CLASSIFIER.
APPLICATION FILED MAY 25, 1910.

1,047,106.

Patented Dec. 10, 1912.



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HARRY L. NEALL, OF MEDFORD, OREGON.

CLASSIFIER.

1,047,106. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed May 25, 1910. Serial No. 563,415.

To all whom it may concern:

Be it known that I, HARRY L. NEALL, a citizen of the United States, residing at Medford, in the county of Jackson and State of Oregon, have invented certain new and useful Improvements in Classifiers, of which the following is a specification.

This invention relates to improvements in classifiers for crushed or otherwise comminuted materials, and more particularly for the classifying of ores and precious metal bearing slimes.

An object in view is the more efficient classification for increasing the facility and efficiency of subsequent concentration, a further object being the provision of an apparatus adapted for classification for any purpose, particularly the materials delivered from crushing machines, the apparatus selecting the oversize for returning same for recrushing or regrinding and passing the properly prepared materials on for further milling processes, thus saving the expense of screening.

With these and further detail objects in view, as will in part be hereinafter stated and in part become obvious, the invention comprises certain novel constructions, combinations and arrangements of parts as hereinafter specified and claimed.

In the accompanying drawing, the figure is a view in side elevation of the structure illustrating one embodiment of the present invention, parts being broken out for disclosing interior structure.

In the classification of materials it has been common to take advantage of the classifying power of water, particularly by the utilization of water currents of varying velocity. The present invention does not depend upon this principle, but instead comprehends the provision of means for allowing the materials to classify themselves while moving under pressure in a sufficiently liquid vehicle for allowing free distribution of the particles, the movement being in planes but slightly inclined from the horizontal. I find that in allowing such movement of the materials to be classified the classification occurs naturally and perfectly, and more or less clearly defined strata appear in the moving mass and the heaviest or bottom stratum may be removed and subsequently the remaining bottom stratum and so on until all of the several classifications have been separated and distributed to independent concentrating tables. I find also in carrying out this method of classification that with respect to the heavier materials it is advantageous to introduce an impinging agent which shall interrupt the movement of the lowest stratum and divert the same without appreciably affecting the movement of the upper stratum, and this may preferably be accomplished by the introduction of a current of water or other fluid having a velocity approximately the same as the velocity of the materials being classified, or sufficient greater to insure interruption of the travel of the lowermost stratum, but not sufficiently great to interrupt the process of natural classification going on above the lowermost stratum, the fluid of such impinging current being allowed to escape with the escaping materials. This impinging current in addition to facilitating the withdrawal of the heavier materials also serves as a washing or cleansing agent for removing from such heavier materials any of the finer particles of pulp adhering to such heavier materials, thus allowing such pulp to rise and classify itself in the proper strata above. Obviously, more than one impinging current may be utilized along the path of travel of the classifying materials according to the amount and varying gages of coarser material, but for the finer material I find the utilization of the impinging current unnecessary and at times possibly objectionable.

Referring to the drawing by numerals, 1 indicates an inclined pipe which is to serve as the confining agent for insuring the proper travel of the materials to be classified, the said pipe being inclined only slightly from the horizontal, the inclination being sufficient for causing a gentle travel of a liquid mass within the pipe, and the inclination from the horizontal being only sufficient for the purposes of such travel while leaving the pipe sufficiently near the horizontal to afford a substantial support for solids collecting on the lower portions of the pipe. Pipe 1 is divided up into classifying sections 1^a, 1^b, and 1^c, the section 1^a having the largest cross section and terminating in a reduced connection 2 tapering to and communicating with the section 1^b which is of smaller diameter than section 1^a, section 1^b in turn terminating in a tapering connection 3, which in turn communicates with the section 1^c which is of smaller diameter than section 1^b. Each of the connec-

tions 2 and 3 is provided with a depending discharge pipe 4 substantially equal or slightly greater in capacity than the difference in capacity between the preceding and succeeding sections of pipe 1. The upper end of section 1^a is formed with an upturned portion 5 which may extend to any height desired and in operation receives a supply of slimes or crushed ore and water to be classified, the materials supplied to the pipe being in a sufficiently liquid state to assure their moving by gravity along the pipe 1. The lower end of the section 1^c terminates in a connection 6 which is provided with an upstanding branch 7 and a depending branch 8. The upstanding pipe 7 preferably terminates in a flared or hopper-like portion 7^a, the upper edge of which is on the same elevation as the upper edge of the upturned portion 5, that is is equal in height to the height of the column representing the hydraulic head. Within the upper portion of the hopper-like element 7^a is arranged a contracted tubular section 7^b terminating short of the upper edge of the hopper and dividing the upper portion of the hopper for forming an annular space 7^c communicating with the discharge or overflow pipe 7^d. Pipe 7 with its hopper 7^a is designed essentially to prevent the head end of pipe 1 from shutting up and requiring constant cleaning out, and possesses the elevation stated to avoid discharge from the upper end of the hopper under normal conditions, but, when, from error of the operator, as by a miscalculation, an excess of slimes is delivered to pipe 1 above the quantity which valves 12, 12 and 13 are set to take care of, the excess will be discharged from the upper end of hopper 7^a and thus warn the operator of his error. Such overflow will however result in little if any damage and may readily be obviated by proper and proportionate regulation of valves 12, 12 and 13. During the time of such overflow, which may be allowed to continue if desired under some conditions, the liquid rising in the hopper-like portion 7^a passes upwardly through the section 7^b and over the edge thereof into the space 7^c and out through pipe 7^d. This decantation enables a certain amount of clarification to occur with the resulting depositing by gravity of solids down into pipe 8, most of the solids naturally falling into said pipe in the first instance.

A water or other cleansing fluid supply pipe 9 extends from a suitable source of supply either an elevated tank or a pump, not illustrated, along pipe 1 and is provided with a branch 10 for each branch 4 and communicates with the respective branch 4 in position for delivering an impinging current to the material moving along pipe 1 at the points of the respective connections 2 and 3. A valve or cock 11 is provided for each branch 10, and a similar valve or cock 12 is provided for each branch 4 below the point of communication therewith of the respective branch 10.

In operation, the materials to be classified are supplied to the upstanding portion 5 under approximately the same, or slightly less, pressure as the pressure of the current in pipe 9, and after the pipe 1 has been filled throughout its length the liquid begins to overflow and discharge through pipe 7 while the finest slimes are discharged through pipe 8, the discharge through pipe 8 being controlled by a valve or cock 13, and such discharge being delivered to an ordinary concentrating table 14. As the materials continue to move down the pipe 1 under the requisite pressure for producing the desired movement but which is not sufficient for interfering with the free natural classification of the particles, said particles assume various elevations according to their relative size and weight. Thus various strata are formed and more or less clearly define with the larger particles of each given material at the lower portion of the pipe and the particles constituting the successive strata decreasing upwardly to the finest in the uppermost stratum. That is to say, when like materials only are being classified, the large particles appear at the lower portions of the pipe and the particles constituting the successive strata decreasing upwardly to the finest in the uppermost strata, but, when the mass to be classified consists of dissimilar materials, the larger particles of each material will be found in the lower strata with reference to the distribution of that material. The strata in which the largest of any particular material will appear being regulated by the fact that unlike materials will associate themselves into the strata according to the law that, or nearly so as to bring the corresponding weight of dissimilar particles in the same strata, the particles of each material that may constitute the succeeding or upwardly successive strata relatively decreasing to the finest, lightest and most slime-like in the upper strata. Not always the intermingling of unlike material will be so, or nearly so, that the relative or like weight of dissimilar materials will be found in a given strata.

Valves 11 and 12 of branch 4 of connection 2 are, of course, regulated, the former to allow the admission of just the requisite impinging current for gently interrupting the longitudinal travel of the lowermost stratum and insuring the dropping of the solids constituting such stratum down through pipe 4, and the latter valve being regulated to accommodate the discharge of such solids with the fluid through branch 10, the valve 12 preventing any such excessive

drain as would allow any appreciable interference with the progress of the materials in pipe 1 additional to the action on the lowermost stratum, the materials passed through valve 13 being discharged onto any ordinary concentrating table 15 or otherwise disposed of according to the material being treated and the results desired. Valves 11 and 12 of branch 4 of connection 3 are similarly regulated relative, however, to the lowermost strata in the section 1^b of pipe 1, and the substance discharged through this valve 12 is delivered to concentrating table 16 of any ordinary type. It is to be observed that the reductions in diameter of pipe 1 at the several succeeding sections are proportioned relative to the number of sections constituting pipe 1, the full inlet capacity of pipe 1, the number of discharge openings leading from pipe 1, the size of such openings, and the size of the material to be delivered to the concentrator.

As it is not possible to accurately determine in advance the exact proportions of any grade or size of material that can be delivered to any of the classifiers, nor is it possible to get uniform ore from which to make pulp that is to be graded, or to exactly regulate the proportion of carrying water, it becomes absolutely necessary that there should be some means of regulating the device so as to enable exact and accurate work to be done at all times and under any conditions. Hence, I find that the best results may be obtained by decreasing the sections of pipe 1 each time a little less than would seem to be required, permitting this excess to be taken care of by the overflow from hopper 7^a, or by increasing the discharge openings, and thus not only would the slime be carried through without displacement, but the balance that is obtained by the proper manipulation of valves 11 and 12 will exactly and quickly enable the operator to determine the amount that is to be removed of each stratum, or where there is no valve 11, the result may be regulated by the opening or closing of valve 12. By this means perfect regulation is obtained, and the discharge being once adjusted, it needs practically no attention except at the opening and closing of each day's work or as the product may vary from time to time sufficiently that the operator may desire to change the load from one concentrator by making a division with another or all the others.

By reason of the simplicity and accuracy of the balancing between the lower stratum in pipe 1 and the amount and force of the water admitted through valve 11 and the opening made in valve 12, a perfectly even control can be obtained which enables the operator to determine quickly and accurately exactly what he desires shall be delivered at any given opening in the device, and, moreover, this harmony, once obtained, will be maintained until changed by the operator. I have seen, say on a table 15 a bed of metal being concentrated that covered thirty inches or more while on table 16 there was only a streamlet say two inches wide and on table 14 say twelve inches wide, the reason being that each concentrating table was simply getting the particles of metal and silica of a given weight as determined by the balance fixed by the operator in his regulation of valves 11 and 12, and so it would run all day, changing only as the weight of the particle in the pulp changed, when the tables would show the change at once without anything having been done to the classifier by the operator.

It will be obvious that as many sections and as many branch pipes may be utilized as preferred, and if desired more than one of the pipes 8 may be provided without the connected impinging current supply pipe, the natural classification being depended upon for separation of the finer slimes.

In the use of the impinging current, I always exercise care to only use sufficient current to interrupt the travel of the lowermost stratum, and the outlet is made sufficiently large to accommodate the discharge of such stratum together with all of the fluid of the impinging current, so that no dilution of the mass within the tubular container occurs, and displacement is carefully avoided. The word "displacement" in the present art has come to have a more or less clearly defined and accepted meaning, being employed to indicate the action occurring when one substance is substituted for another and the first substance is thus removed or displaced by the second, and it is quite common, in fact the general practice, to displace a part of a mass being classified by a cleansing current which enters the mass and takes up the space formerly occupied by the displaced ore, thus proportionately diluting the remaining mass. This displacement results in a constant increase in the bulk of the cyanide solution or other slimes vehicle, so that expensive dewatering apparatus must be provided and maintained. All this I obviate by preventing displacement and the resultant dilution of the mass.

I am herein claiming only the apparatus or mechanical structure, that branch of the invention represented by the steps of the process adapted to be carried out by such apparatus being made the subject matter of claim in my co-pending application filed May 25, 1910, and designated by Serial No. 563,416.

What I claim is:—

1. In a classifier, the combination of a tubular container inclined from the horizontal, the inclination being sufficient for causing travel of fluid material therein contain-

ing solids in suspension, and being sufficiently slight for leaving the material free for natural classification during travel, said container being formed of a plurality of sections each of a different cross sectional area from the other, the smaller being arranged after the larger in the direction of travel, each of said sections being of substantially uniform cross section throughout its length, the container being formed with a discharge outlet substantially at the juncture of two of the sections, means for supplying an impinging current in the outlet and for drawing off the impinging current, and means for controlling the impinging current and discharge for effecting a discharge of solids from the lower stratum free from slimes and preventing displacement within the container.

2. In a classifier, the combination of a tubular inclined container, comprising sections of successively decreasing transverse cross section and tapering connections connecting said sections, discharge pipes communicating with the container, each of said pipes being of a capacity substantially equal to the difference in cross sectional capacity between two adjacent sections of the container, an impinging current supply pipe having means of communication with the discharge pipes, valves controlling said impinging current, and valves in the discharge pipes controlling the discharge therefrom.

In testimony whereof I have affixed my signature in presence of two witnesses.

HARRY L. NEALL.

Witnesses:
W. P. RAYMOND,
MARTIN MARSHALL.