"This Machine May Largely Increase World's Gold Output." *New York Herald* (Sunday, December 9, 1900, Fifth Section) p. 6.

THIS MACHINE MAY LARGELY INCREASE WORLD'S GOLD OUTPUT

PROF. GATES HAS INVENTED A HYDROMAGNETIC SEPARATOR OF WONDROUS POSSIBILITIES.

A machine that bids fair to double the gold output of the world, revolutionizing methods of separating gold from crushed quartz, and particularly from river, beach and placer sands, has recently been constructed in Washington, D. C., and such confidence is entertained in its practical value that hundreds of thousands of dollars have already been invested in it. The right to use it in Colorado alone is expected to bring unusually large profits to the inventor and his financial backers.

For instance in one single mine, where the output has hitherto not quite paid expenses, the profits will be several million dollars annually. Mine owners out in that part of the country are wild about it, and a belief is entertained that it will convert at least five hundred non-paying Western properties of the kind into richly profitable deposits. Placer sands and beach sands by this apparatus will be made to yield from two to five times as much gold per ton as has been obtained from them hitherto.

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The Invention has been newly patented by Professor Elmer Gates, and its whole secret lies in removing from the gold bearing sand the magnetic iron (known as "magnetite") which such stuff always contains, as a preliminary to separating the gold. Under ordinary circumstances the sand, poured, with water, through a long trough called a "sluice box," is separated by gravity from the gold, the latter sinking to the bottom of the trough by reason of its greater weight, and then being caught in crosswise slots, from which it Is afterward removed. The chief difficulty in the process is due to the magnetite, which, being nearly as heavy as the gold, collects in the slots, or riffles, and chokes them up.

If the magnetite were absent a much larger percentage of the gold contained in the sand could be got out of it; hence for many years the problem of getting rid of this objectionable substance has

exercised the minds of inventors. Various machines have been devised for the purpose, but none of them has taken out all the magnetite, and not one of them has been able to handle wet sand. It costs too much money to dry sand, and this has been the financial difficulty. The obstacle is overcome, however, by the new machine, which not only removes every particle of the magnetite from the sand, but works wet sand under water. It handles moist or soaking wet sand as easily as dry.

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Perhaps the most striking points about the machine at first glance are its extreme simplicity and its small size relatively to the work it accomplishes. It may be stood conveniently on a small table and easily operated by hand with a crank. Ordinarily, however, an electric motor furnishes the trifling power required. The apparatus consists of a copper drum, about as big as a good sized toy drum, inside of which is a powerful electro-magnet. The core of the magnet consists of a bunch of iron plates with fluted edges on the pole race of one end, likewise within the drum, but which approach their fluted edges close to the inside of the copper periphery of the latter.

What is seen from the outside is simply the drum, which conceals the magnet and corrugated pole face plates, and a sort or hopper above, into which the sand is poured. Small as the machine is, it is capable of handling in this way 110 tons of sand in a day, sifting out every particle of magnetite from that quantity of the raw material.

As the sand is poured Into the hopper it falls through it and against the side of the revolving drum. The drum, thanks to the magnet inside of it, draws every particle of the magnetic iron out of the sand and holds it tightly against the outside or the revolving copper drum, while the sand—that is to say, the silicious particles and dirt—drops straight down into a receptacle beneath the table. The particles of iron while magnetically held against the drum are moved downward by it over the wavy lines of force of the fluted magnet face and vigorously shaken to and fro so as to detach all foreign matter.

It picks the attached sand into thousands of pieces and shakes out the non-magnetic sand. This is one of the prime features of the machine.

It will be understood that the silicious sand is not attracted by the magnet, and on that account falls vertically, whereas the particles of iron, which look like iron filings, stick fast to the drum in rapidly oscillating bunches until they drop off by their own weight into another receptacle. As a result, all the iron (magnetite) is in one box, and the sand and other non-magnetic stuff in another

box.

In practical mining work the gold (which is non-magnetic) would be left in with the silicious sand, which subsequently would be put through the ordinary washing or amalgamating processes for the purpose of separating out from it the yellow metal. The magnetite once removed, the separation of the gold from the sand from many mines becomes comparatively easy—so much so, indeed, that, as above stated, two to five times as much of the precious metal is derived from a given quantity of the raw material. To remove the magnetite by means of the apparatus described costs only three cents for each ton of sand treated.

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There are hundreds of mines in the West which have been worked hopefully for years because they have yielded nearly enough gold to pay. With the help of this machine it is confidently predicted, and, indeed, it has been demonstrated, they will become at once more profitable properties. Other mines, which yield a small profit already, will be rendered much more productive and proportionately more valuable. In the latter category might be mentioned one mine which has hitherto yielded only $1.16 a ton, and which recently, with the aid of the magnetic separator, has been shown to yield $3.10 a ton. Another mine yielded by ordinary washing processes fourteen cents per ton, and, after the magnetite has been removed, yields eighty-six cents per ton.

The iron removed from the sand in the manner described is an exceedingly valuable by product, being so pure that it may take the place of hematite iron ores, which, at present, we are obliged to import from Spain for making the best quality of steel. Our own iron ores make brittle pig iron, whereas magnetite affords a malleable iron.

At an expense of eighty-five cents a ton, by means of electricity, Professor Gates reduces it to lumps, in which form it maybe reduced to iron by any smelting furnace. Nevertheless, there are many furnaces that can work it unlumped. Companies in Colorado have already agreed to take several. thousand tons of magnetite as furnished by the separator, annually, and it is expected that Pittsburgh and Chicago will buy several millions of tons more, especially when lumped without cement.

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Professor Gates has just obtained a number of patents on still other processes for separating gold from placer or beach sand which do away with the washing, amalgamating and leaching processes, and save all the gold of any degree of fineness. The hydromagnetic separator heretofore described does not separate

gold, but by removing the magnetite enables ordinary washing and sluice box methods to save from two to five times more gold. Even then from twenty to thirty per cent of the gold is lost, because it floats away on the water. These new gold separating machines just patented, and which Professor Gates is now perfecting, save nearly all the gold, and they do this without sluice boxes, mercury or leaching.

One of these Inventions utilizes as its principle the fact that an electro-magnet repels gold slightly. If a stream of auriferous sand be permitted to fall in front of such a magmet there is a tendency for the gold particles to be pushed away and separated from the silicious particles. The tendency is so slight that the field of the magnet's attraction would have to be 100 feet long perhaps in order to accomplish a separation of one inch. This is out of the question, of course, and Professor Gates gets over the difficulty by causing the sand to fall very slowly through a brass tube, while an upward flowing current of water in the same tube retards the rate of feed. As a result every bit of gold contained in the sand is pushed out and made to fall into a separate receptacle. It is like sifting chaff out of wheat.

Another one of these gold separators causes a current to travel through a short section of a falling stream of gold bearing sand. By this method the gold particles in the stream become momentarily the path of the electric current, and while thus carrying the current a powerful electro-magnet repels the particles of gold, throwing them out as a fanning mill throws chaff out of wheat. He has five different methods, and he is engaged in determining which one is best and to what particular deposits each method is best adapted.

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While these gold separators promise to greatly extend the possibilities of gold separation, it does not seem necessary to wait for their commercial perfection before announcing a new era in gold mining, because the hydro-magnetic separator has already demonstrated practical results in that direction. Very likely it will make at least five hundred useless Western mines pay a big profit and will open hundreds of others. It has been conservatively estimated that this invention—or, rather, series of inventions, for there are thirty of them—will double the output of gold in Colorado, and what it can do for that State it will do for others.

Professor Gates intends to donate his part-of the profits to the endowment of scientific research at the institution which he has founded, which has already four laboratories at Chevy Chase, Md.

PARTICLES OF MAGNETIC IRON ADHERING TO THE OUTSIDE OF THE DRUM

THE HYDROMAGNETIC SEPARATOR

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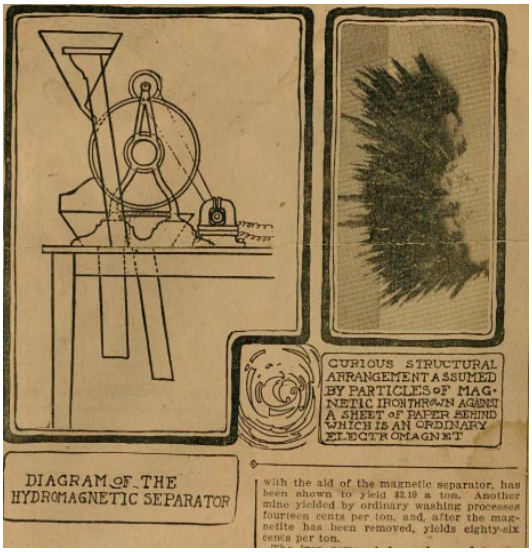

CURIOUS STRUCTURAL ARRANGEMENT ASSUMED BY PARTICLES OF MAGNETIC IRON THROWN AGAINST A SHEET OF PAPER BEHIND WHICH IS AN ORDINARY ELECTROMAGNET

DIAGRAM OF THE HYDROMAGNETIC SEPARATOR

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