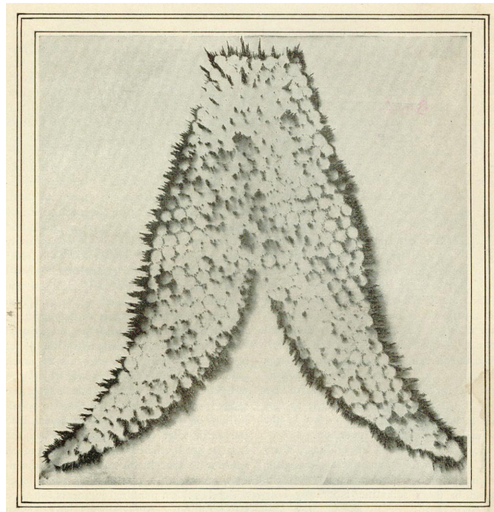
M'Govern, C. Montgomery. "Pure Gold and Iron from Sand." *Pearson's Magazine,* date unknown, pp. 181-185. (On the copy of this article in Gates's files, he made strikeouts and corrections. These appear here in smaller type within brackets.)

PURE GOLD AND IRON FROM SAND.
By C. Montgomery M'Govern.

By the courtesy of Prof. Elmer Gates, one of the foremost American investigators of today, we publish below the first account of his newly discovered method for the extraction of iron and gold from sand. This justly may be ranked as one of the most important inventions of this century. The facts presented *in this article were supplied by Professor Gates.*

A marvelous method has been perfected by which unlimited quantities of the purest iron and gold can be extracted from sand. This means that immense tracts of what has always been believed to be worthless territory—such as the arid, sandy plains of the West—are, on account of this wonderful discovery, turned into a treasure-ground whose value can hardly be estimated. All sand does not contain gold or iron, except in inappreciable traces. The ordinary sand of Maryland or Virginia or Indiana does not. But throughout this country sands are found containing iron in inexhaustible quantities. You may find such sand, in many localities, without going farther afield than your own yard. By the invention which Professor Gates has perfected the gold and iron is easily separated from the sand at the insignificant cost of from 3 cents to 5 cents per ton [Gates: for working raw sand].



This curious appearance is presented by the particles of iron [Gates: ~~and gold~~], extracted by magnetic power from the sand.

"The machines," says Professor Gates "will effect a revolution in the manufacture of iron for two reasons. First, they do away with the mining and crushing of rocky ores; and, second, they produce the finest ores in the world. I do not see how it will be expedient to continue to mine rocky iron ores at a cost of from 80 cents to over $1 a ton, when these sands can be mined for less than ~~5~~ [Gates: 25] cents per ton."

The simple apparatus which is to effect this revolution is no longer in the experimental stage. It has been fully perfected down to the last detail. Any one is privileged to see it in practical operation. Even before it reached its present state of perfection the inventor sold for a single mine a tenth interest for $75,000. Large as this sum may appear, it gives no idea of the commercial value of the invention.

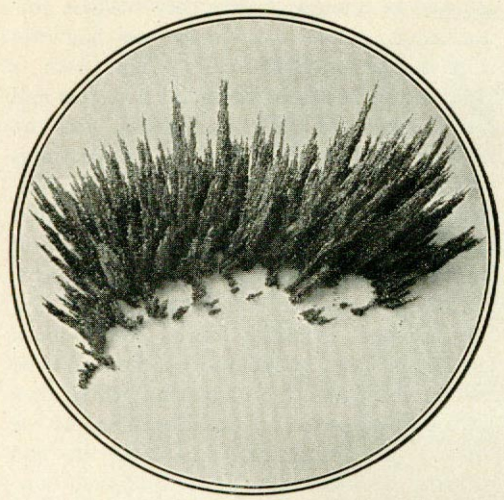
Prof. Elmer Gates, of Chevy Chase, Maryland, is a man of so many years' scientific standing that his name and past work are known in every scientific laboratory both here and abroad.

Contrary to the usual procedure in the matter of great inventions, not a word about this one has been communicated to the press. From the moment he discovered the theory of the process, up to the day he had the process entirely finished and in actual operation, Professor Gates has kept all knowledge of the matter to himself, his assistants, and a few intimate friends.

The process by which iron and gold are taken from sand by Professor Gates is an extremely simple one—a child could do the work. If the reader will go outside his house and get a handful of sand—not the white stuff that forms the Atlantic coast, but the sand so common along certain beaches and inland rivers, called "magnetic sand"—and look at the sand very closely in the direct sunlight, he will notice that it contains tiny black grains, and tinier yellow specks. It is no secret among people who know anything about minerals that the specks that shine so brightly are gold, and that the black specks are iron oxide. Ask any geologist, and he will tell you that ‘‘magnetic sand" is what today is left of what were once great mountains of stone that had an abundance of iron and gold strewn throughout them. The rains of a million or two centuries have washed the lofty mountains of rocks down to level plains of sand, but with the splitting of the mountains into fragments the particles of iron, gold, and rock of which the mountains were originally composed have continued to hold themselves together in the form of grains which we call sand. The mineralogist will also tell you that the iron in this sand is the best iron that can be found anywhere in the world.

As the reader is probably not acquainted with details of engineering, he will no doubt say here: ‘‘Well, since there is so much gold and iron in common sand, why do we not get all we use of these metals from the sands instead of being compelled to spend billions of dollars every year in boring into the earth after them, especially when the iron we get by the costly method is so much inferior to that in the sand?’’ That sentence embraces a problem the solution of which has been *puzzling* engineers for time out of mind. All engineers have known about this gold and iron in the sand; but although they have tried all sorts of schemes, they have never learned *how* to extract the two metals from the sand. Engineers have tried the plan of mixing the magnetic sand with resin, making little bricks of it, and then submitting it to the furnace, but none of these plans proved practical; for while in some cases they could indeed separate the iron from the sand proper, and the gold also, the treatment cost so much money as to make it much cheaper to get iron and gold in the usual way.

After all these elaborate plans had failed it is surprising that Professor Gates should have succeeded with a process that by the side of the former must seem ridiculously simple. But Professor Gates believes that nearly all inventors make their tasks too special—he believes that if they made less experiments and did more *thinking of how they make them* they would succeed twenty times sooner and twenty times better. In fact, it was to prove this to be a fact that Professor Gates went to work to solve this problem. And that he should have succeeded in doing in a few months what a host of others had failed to do in years is rather forcible evidence that there is something in his odd theory. Professor Gates, it should be explained here, is not an inventor in the popular sense of that word. He ranks not with those who, like Tripler, Maxim, and Edison, apply known laws to common usage; Gates's place is with those who, like Sir Isaac Newton and Dr. Harvey, make experiments to ascertain scientific laws of which man is at present entirely ignorant.*



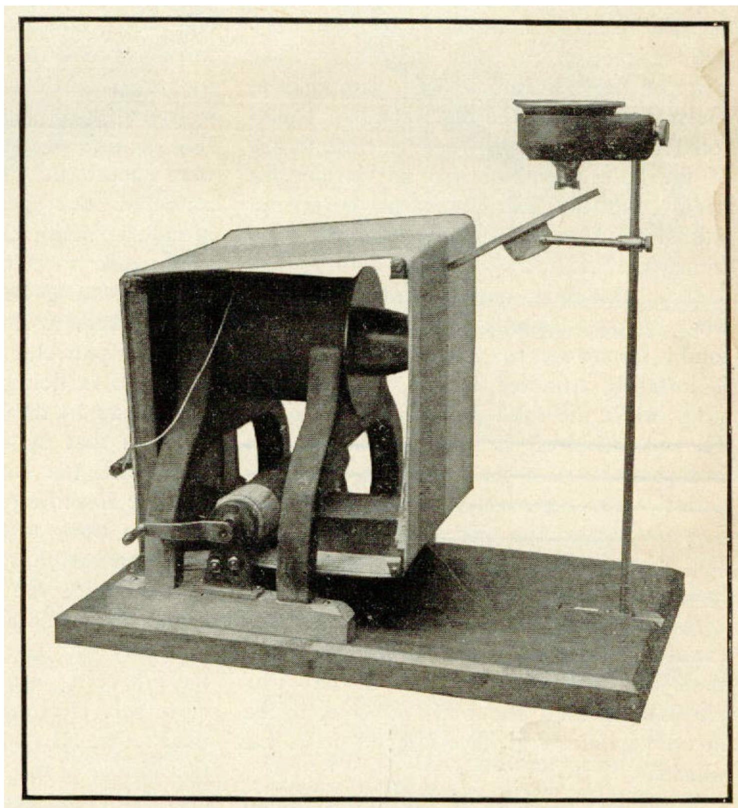
Particles of ~~gold and~~ iron clinging to the cloth.
(See illustration below.)

Particles of [Gates: ~~gold and~~] iron clinging to the cloth.
(See illustration below.)

Now to a simple description of this simple process by which Professor Gates separates iron and gold from the sand. As every schoolboy knows, if you take a toy magnet and hold it near a piece of iron and a piece of gold, the iron will jump at the magnet with the rapidity of lightning, but the gold is not at all affected. If you hold the magnet near a heap of common dust, the dust will remain absolutely still—the magnet will not affect it in the slightest degree.

Well, that law of nature applied to a bigger undertaking is the whole principle of the process by which magnetic sands can he made to yield out iron and gold. Professor Gates has erected a machine consisting of an electric magnet, to the end of which is fastened a piece of steel shaped like the whiskers of Trilby's friend "Taffy." Really there is nothing that this piece of steel resembles more strikingly; so that even among the humdrum engineers in

Professor Gates's workshop it is referred to as "Taffy 's whiskers." The face of these whiskers is not smooth; it is composed of a series of cells like a honeycomb. Over the face of these whiskers, under it, behind it, and above it, as will be seen in our illustration, runs a belt of rubber cloth on four rollers, so arranged that when a handle is turned the rubber belt moves and keeps moving continually down over the face of the whiskers.



The machine which will work a revolution in two great industries.
The sand falling onto the cloth, the [Gates: ~~gold and~~] iron particles adhere as shown above.

When a current of electricity is turned into the magnet, the attraction of "Taffy's whiskers'' is so strong that if you hold a penknife in front of it the whiskers will snatch it out of your hand in a wink. Hold a handful of gold ore dust in the same place, and they will not be at all affected. Now, it is according to a natural law that those parts of the whiskers which correspond to the walls of the honeycomb, the walls of the cells, have many thousand times more magnetic attraction in them than have those parts of the whiskers which correspond to the vacant cells in the honeycomb.

Therefore, if you hold a steel needle close to one of the holes, the hole will not attract the needle, but in a flash afterwards the nearest side of the hole will snatch the needle away from you.

It is, therefore, not difficult to imagine what happens when a handful of magnetic sand is thrown against the whiskers: the iron is instantly attracted by the honeycombed sides, while the sand proper will fall away. [Gates: ~~The attraction of the gold particles to the iron particles is so great that the gold goes with the iron particles although the magnet does not attract the gold of its own accord.~~] But the rush of the metal particles from the handful of sand to the embrace of the whiskers is so extremely rapid that, although you cannot see them, it is a fact nevertheless that there are countless thousands of very tiny particles of sand proper still adhering to the metal particles that have jumped up to the whiskers.

These tiny particles of sand proper would greatly depreciate the value of the metals if allowed to remain; hence they must be gotten rid of. Here is where the new magnetic form demonstrates its value. The cloth is always kept between the metal particles and the whiskers which attract them, and the moving of the cloth makes the particles move also in the same direction. Technically speaking, the movement of the cloth causes each of the metal particles to fall off from the magnet; but it is only for the millionth part of a second that they fall, for the magnet instantly draws them back again, only they strike the whiskers a trifle farther down than the place from which they have been removed by the movement of the cloth. This continual knocking off and drawing back has the desired object, however, for by the time the particles have reached the points of the whiskers each particle of metal has actually been *separately* shaken several thousand times, and with each shake some possibly adhering sand particles, not being attracted back again to the magnet, simply fall to the ground.

This is how the honeycombing of the whiskers does its work. Each particle of the metal as it courses down the face of the whiskers is kept continually jumping from side to side of the cells; if the whiskers were smooth, the particles of metal would be attracted back again, indeed, but the back attraction being even, they would haul the sand back with them. The cells in the whiskers, being neutral, cause the face of the whiskers to have an uneven attraction, and the particles of metal fly across the cells, and in doing so all the sand falls to the ground by the law of gravitation. The result is that by the time the particles of iron reach the last point of the whiskers they are absolutely free from sand, there not being as many as one sand particle among a million particles of the metals.

In practice the sand is placed in a box above the machine, and allowed to drop gradually on the whiskers. The crank at the side being turned constantly, the rubber cloth belt is always moving, and while the sand refuse falls away into a bin just below the middle of the whiskers, the metal particles fall into separate bins placed below the two extreme points.

In another machine, called a magnetic entangler, the iron and gold particles are mixed together when they leave the machine. They do not remain together very long, however. Professor Gates has only to pass them through [Gates: his magnetic separator,] a third sort of separator, which he calls a "diamagnetic separator'' (the first one is called simply ''magnetic separator"), [Gates: ~~and these gold and iron specks part company absolutely. Both metals are then ready for smelting~~ makes the gold and sand part company after the iron has been taken out].

It is an interesting fact not popularly known that almost all of the magnetic iron sand has a certain number of dollars' worth of gold in every ton. The richest mines in the world are of this kind. At present practically all of this gold goes to waste, for even with the best existing methods we are able to get only a few nuggets, all the fine or ''flour'' gold being lost. With Professor Gates's entangler and diamagnetic separator all this gold will in the future he saved.

It requires a much shorter time to do the separation than to read about it. A complete separator is provided with twenty-five of the magnets and whiskers I have described, and each machine extracts every particle of iron from 1,000 tons of sand in a single day of ten hours. Professor Gates has the control of some forty square miles of magnetic sand [Gates: ~~in one locality alone~~]. By running this sand through the separator he secures 350 tons of pure iron from every ~~1,000~~ [Gates: 4,000] tons of the sand handled. In addition, by his other machine he obtains ~~$800~~ [Gates: $8,000] worth of gold from each 350 tons of the iron-sand. Yet the machine that does this costs but ~~$75,000~~ [Gates: $95,000] to build, and is operated at the cost for fuel of only one dollar per day!

A plant of the usual type that could produce 350 tons of iron ore per day of ten hours would cost ~~$00000~~ [Gates: $1,000.000], an immense sum of money to operate, while the iron obtained would be of an inferior quality. It costs Professor Gates one-half cent per ton of iron for extracting, 5 cents per ton for handling, 75 cents per ton for freight, and $3; for smelting. This kind of ore is bought by the smelters at $15 per ton at times, while any quantity can be sold for $8 per ton. The enormous amount of money made in extracting iron from sand is therefore apparent. As to the gold Professor Gates separates from this sand, it is practically all clear profit.

"Not all magnetic sand is equally profitable to separate as that of the locality I have selected, although sand of that richness is very common,'' says Professor Gates. "In some localities, for example the sand is only 5 per cent. iron; but, on the other hand, I have found that these sands contain not less than $6 worth of gold of the best quality in every ton of the original sand—that is, $120 per ton of iron-sand—and at that rate Alaska will be a back number as soon as I get my separators to work in these localities." The separators for one mine are now nearing completion, and will soon be in actual operation.

No amount of money can buy one of the Gates separators, the tenth interest I have referred to having been sold merely to pay for the building of the first set of the machines; yet any responsible company can lease as many of them as they want, but upon a rather singular condition. The lifework of Professor Gates is to see established at Chevy Chase a unique scientific university for research, to become the property of the people he has trained as soon as it is completed. It will cost about $5.000,000 to finish the work of founding a single one of the science buildings—$300,000 of his own money and $130,000 of borrowed money have already been spent in the enterprise. The condition upon which he is willing to lease his wonderful separators is for a portion of the profits; the income he will use to complete the founding of this institution. Professor Gates has been allowed twenty patents for electrical methods of separating gold, iron, and copper, and he expects them to bring in enough money to fully endow and operate lines of original research in every science and art, with special reference always to the development of the science of the mind and the art of most efficiently using it.

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*An article on Professor Gates and his general work will appear in a later issue of *Pearson's Magazine*.