

AN AUTOMATIC VENDING MACHINE.

A slot machine designed to afford unusual facilities for vending a wide variety of articles, particularly such as are commonly supplied in elongated sized packages, is shown in the accompanying illustration, and has been patented by Charles W. Goldsmith, of New York. It is now being introduced in many places throughout the city. As shown in the illustration, the machine is arranged to deliver stamped envelopes and note paper of different kinds, various samples of which are shown in the vertical glass-covered case at the rear, the top of the machine casing being formed for use as a desk. The merchandise receptacle, as shown in the small view, is sustained centrally in the casing, and projections therefrom form bearings for rock shafts which operate frames to deliver the goods, a single package at a time, the mechanism being set in operation by a lever, an arm of which projects into an orifice of the coinway.

When the merchandise with which the machine is supplied has been exhausted, a stop lever comes automatically into operation to close the end of the coinway and prevent the insertion of additional coins. The machine, as manufactured, is easily operated, and does not seem liable to get out of order. The merchandise to be delivered, on the insertion of the proper coin, drops from the central receptacle through a guide, falling upon a chute, by means of which it is passed out through the delivery opening.

RECENT OBSERVATIONS OF MARS.

—An American astronomer wishes to speak to you, sir. There are two visitors, and here are their cards:

“Percival Lowell.”—“Alvan Clark.”

—Ask them to walk in.

—I am highly delighted to meet you, Mr. Lowell. We are familiar in France with your splendid work. Have you come to see a little of Europe?

—I arrived this morning at Saint Lazare station and shall be off again from Lyons station.

—What, so soon? The Americans are always meteors!

—I am going to the Sahara to find out whether there is a particle of atmosphere that is perfectly calm; but, in the first place, I am anxious to show you what we have already accomplished upon our Arizona Mountains. It was your work upon the planet Mars that gave us the impetus; but we no longer agree with you. You will utter a loud protest, perhaps?

—On the contrary, dear sir. You well know that I am looking for progress only, and no one was as happy as I to see you dedicate a special observatory to our friend the planet Mars. You know that independent science receives but little support in France. On the



GOLDSMITH'S COIN CONTROLLED VENDING APPARATUS.

contrary, you make quick progress in your country. Have you anything new? So much the better. Mr. Alvan Clark is the leading optician of the world, and he must have constructed a perfect instrument for you.

—Yes; as you remark, a perfect one.

—And of what dimensions?

—Of seventeen and a half inches diameter.

—At what altitude are you situated upon Flagstaff Mountain?

—At seven thousand, two hundred and fifteen feet. The atmosphere is excellent and the images are of perfect distinctness. We have been able to carry our magnifications up to 800 and 900 diameters.

—Mars transits at about thirty-eight million miles, but you have diminished its distance to forty-eight thousand miles, and even a little less. That is five times nearer than the moon seen by the naked eye. And you have seen . . . ? I believe you in advance.

—No; you are much too academical, and, I shall dare to say, timorous. You are afraid to cut loose from the leading strings of the school.

—Do you think so? Ask the astronomers of the Institute what they think of it.

—You are stopping by the way.

—That is in order to afford you the pleasure of going further.

—Well! the famous canals, you know. Of these you have but 79 upon your map, while we have 183, that is to say, 104 new ones. Several are as fine as hairs. And your lakes! We have 45 of these, almost all of which are exactly round. And as for the changes that you have described, they are not inundations.

—What then?

—All that is vegetation.

—And our seas?

—Prairies.

—And our lakes?

—O yes.

—“However,” added the able observer, “I also have written a book about Mars, and have brought you the proof sheets of it, along with an impression of the new map. You will conclude, as I do, that these are not seas here, since they are traversed by the so-called canals.”

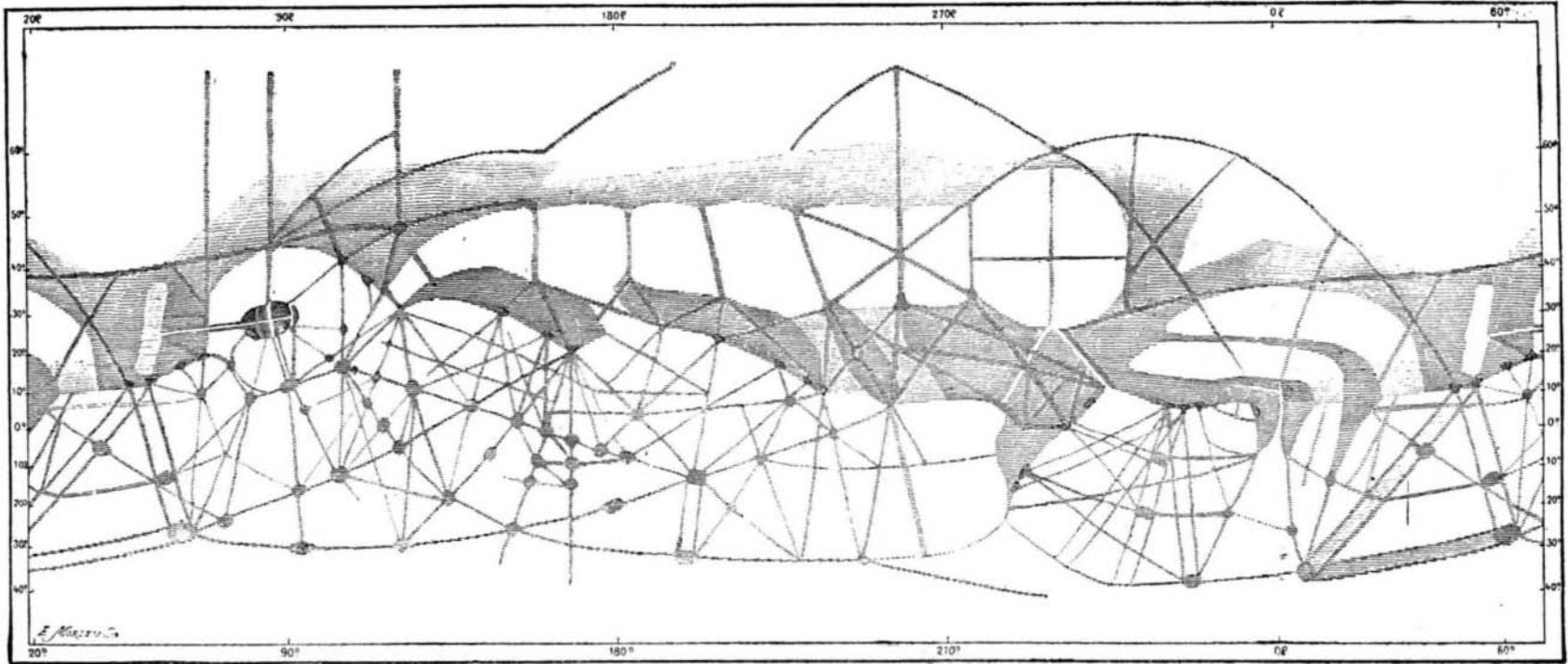
And Mr. Lowell unfolded before my eyes the map that is reproduced herewith.

—This is very remarkable. But are you sure of the accuracy of your observations? At the limit of visibility, one may be the victim of illusions, and even afterward see again what he thought he saw the first time.

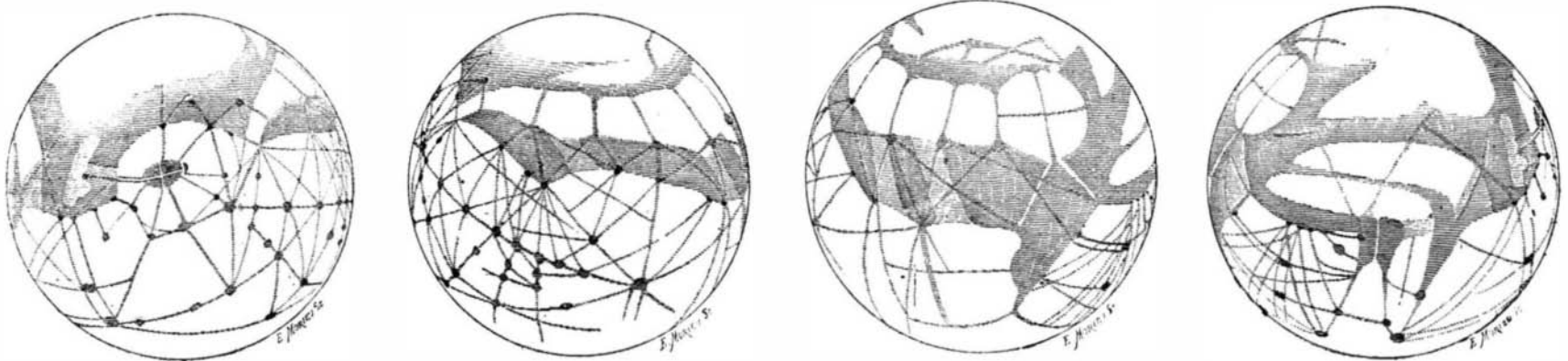
You know as well as I that the dumbbell figure, for example, drawn by Cassini two centuries ago does not exist, and yet every one thought he saw it.

—Mr. Pickering and Mr. Douglass, like myself, are perfectly sure. And now we confidently submit our observations to the criticism of astronomers. I call your attention especially to the geometrical pattern of the canals. See these meeting points. This arrangement is intentional and is for the express purpose of draining off the water.

The conversation between Mr. Lowell, Mr. Clark and myself upon this interesting subject expanded. I was not far from admitting (and I have already written) that we do not truly see the canals. All those who



NEW PLANISPHERE OF THE PLANET MARS.



FOUR TELESCOPIC ASPECTS OF THE PLANET MARS.

have had the unspeakable pleasure of traveling in a balloon and of hovering at a certain height over rivers have remarked that the latter are reduced to a mere thread, but that their course is admirably traced by the verdant valley that they water, the meadows outlining such course on both sides. One day, at six o'clock in the morning, while I was at an altitude of 8,000 feet above the Rhine at Cologne, I was much surprised at the tenuity of the river, which was scarcely visible as a green thread in the center of its meadow, which, likewise green, was elongated like a ribbon from south to north. I had the same impression one day in passing over Orleans at an altitude of 10,800 feet above the Loire, when the water was even invisible, and it was the bottom of yellow sand that was seen like a central thread of the strip of meadow land. In the canals of Mars, it is also the product of the water that we see; the vegetation and not the canals themselves.

As for the seas, we ask time to reflect until the month of December, when the planet will return to us, in obedience to the laws of attraction, and permit observers to confirm the lines of this new map. If these dark lines really traverse the seas as they do the continents, we shall be led to modify our interpretation and to no longer consider them as stretches of water.

Nevertheless, there is water upon this neighboring globe. The most evident proof of this is in the snow that extends all around the poles as far as to a latitude that corresponds to that of St. Petersburg, and sometimes even to that of Paris, and which, under the rays of the summer sun, melt almost completely. This melting of the circumpolar snow is much more complete upon Mars than upon the earth; doubtless because the seasons, which are analogous to ours, are twice as long. None of it remains except at one point—not at the geographical pole, but at the pole of cold, at 210 miles from the former. Whence is this water derived, and what becomes of it?

We know what becomes of it. It fills the canals and is distributed over the entire surface of the continents for the irrigation of the dry land. It never, or scarcely ever, rains upon Mars. Fine weather is perpetual there. There are no clouds, no rains, no springs, no brooks and no rivers. The circulation of the water takes place in an entirely different manner from that in which it does here.

According to these recent observations, the water derived from the melting of the snow in summer gives rise in the first place to the dark spots that we take for seas, in distributing streamlets of water thereupon that supply the fields and meadows, and perhaps the woods, the tone of which varies with the seasons. Then it is sent by the geometrical network of rectilinear canals to the most desert steppes.

The series of disks arranged in echelons at the intersections of the canals represent purposely created oases by these waters.

We know that upon this neighboring world a man weighing here 165 pounds would weigh but 52, that the density of substances is much less there than here, that the atmosphere is very light there, and that the conditions of life there all differ very sensibly from our own. It is probable that the human kind, whatever it may be as regards form, is more advanced than our own (Mars being much older than the earth) and much superior in intelligence. Such fraternal unity of organization would seem, moreover, conformable to our theoretical ideas as to our neighbors of the sky.

Optics is rapidly advancing and will continue to advance. Let us not draw conclusions yet; let us wait. But let us testify to the rapid progress of the finest and most attractive of all the sciences. We shall expatiate no further upon this subject. We shall merely add that Mr. Lowell was kind enough to postpone his departure in order to deliver a lecture before the Astronomical Society of France, and that it proved a great success. This session, which was presided over by Mr. Max Cornu, was particularly interesting. Do you ask me what the Astronomical Society of France is? It is an association of which all those who love astronomical science may form part, in consideration of ten francs a year, and which, through its monthly bulletin, keeps one posted upon all the progress made in astronomy.

We reproduce herewith four globes representing the planet Mars in its entirety, according to Mr. Lowell's observations. The American astronomer has laid out a planisphere which we likewise reproduce. This represents these same globes extended upon a plane according to the Mercator system of projection, used in geography for the construction of charts.—Camille Flammarion, in *L'Illustration*.

Opposition to Inventions.*

One of the most remarkable things in the history of mankind is the opposition to the introduction of inventions and improvements which has existed from the earliest times, and still exists to some extent.

From the time when the earth was believed to be flat, and Galileo was denounced and imprisoned for asserting, in accordance with the theory of Coperni-

cus, that the sun was the center of the planetary system, and that the earth had a diurnal motion of rotation, this opposition to new ideas has existed, and been manifested in the grossest outrages upon, and persecutions of, the originators and advocates of the new ideas. This has been true of inventions and improvements in the arts and sciences, as well as in governmental and religious improvements or reforms.

Much of this was due to the existence of the prevailing doctrine of the "divine right" of rulers and the arbitrary power exercised by them, and to the claim of superior wisdom and infallibility made by the then dominant church, supplemented and rendered possible by the ignorance and helplessness of the masses.

Besides, human nature seems to be subject to the same laws as moving bodies; it moves always in a direct line when once set in motion, unless interfered with by a power sufficient to deflect it from its course. In the arts and sciences, as in politics and religion, men prefer to remain undisturbed, and naturally resent any interference with their settled beliefs and habits. They look with suspicion on new suggestions or ideas, and especially such as, in their ignorance, they think will interfere in any manner with their present interests; and hence the tendency to continue in the old ruts, and violently oppose improvements or changes, and to denounce inventors as "cranks."

History shows that the great improvements in the arts and sciences have had their development only since free governments have been established, and general education introduced; and it is where these exist in the greatest perfection that the greatest advance has taken place.

In the United States, where there is the greatest freedom in governmental and religious matters, there has been the greatest advance in inventions. The growth and development of our manufacturing and agricultural interests, which is due to inventions fostered by our patent system more than to any other cause, have been marvelous, and excite the astonishment of the world. Under the benign influence of this system, in a single century, we have grown from a cluster of scattered settlements, mostly along the Atlantic seaboard, with a population of less than 4,000,000, to a powerful and compact nation of nearly 70,000,000; have increased our national territory from 830,000 to 3,314,220 square miles; have subdued the forests and built up the whole country from ocean to ocean; and have built more miles of railroad, and established more post offices, than all other nations combined. We have grown and prospered as no other nation has, until to-day we do one-third of the world's manufacturing, one-third of its mining, one-fifth of its farming, and possess one-fifth of its wealth.

With such an illustration of the benefits of our patent system, one would suppose that opposition to inventions would long since have ceased; but, unfortunately, while it has greatly diminished with the growth of intelligence and universal education, it still exists.

As illustrative of this spirit of opposition, it may be interesting to cite a few instances. When, in 1807, Papin, of France, the inventor of the digester in universal use for paper making and many other purposes, and also of the lever safety valve, made a small steam-boat and ran it down the river Fulda, the ignorant boatmen, who, like some of the laboring men of the present day, thought it would injure their business, seized and destroyed it.

So, too, when Jonathan Hulls patented his steam-boat in England, in 1736, he was laughed at and ridiculed in every conceivable way.

When Jacquard invented his loom, which was so wonderful that the great Arnout, French minister of war, caused him to be brought into his presence and said to him: "Are you the man who can do what the Almighty cannot—tie a knot in a stretched string?" there was the strongest opposition to its introduction, culminating in a mob of the silk weavers, who took it from his house into the streets, broke it up, and burned the fragments.

It was the same with Hargreaves in England, when he invented his spinning jenny in 1763. He was persecuted by his fellow workmen, who seized his machine, broke it in pieces, and drove him from his native town.

That invention, with the improvements of Arkwright and Crompton, and the invention of the cotton gin by Whitney, who was outrageously defrauded of his rights, have changed the entire art of producing woven fabrics. Indeed, so far as the cotton industry of the world is concerned, they may be said to have created the industry, which to-day gives employment to millions, and has so immensely cheapened the product that it is used the world over.

This opposition to and unbelief in the possibility of the success of inventions has not been confined to the ignorant alone, but has been shared by many educated and even great men. When it was proposed to build a railroad in the United States, Chancellor Livingston, one of the greatest men in the State of New York, published a letter in which, as he thought, he demonstrated the utter impossibility of the proposed undertaking. His reasons were, first, that it would require a massive substructure of masonry the

whole length of the road, and that would be so expensive that it would not pay; second, the momentum of such a moving body as a train of cars would be so great that the train could not be stopped until it got several miles past the place; and, third, no one would want to risk his life flying through the air at the rate of 12 or 15 miles an hour.

So, too, Daniel Webster expressed grave doubts as to the possibility of railroads, saying, among other things, the frost on the rails would prevent the train from moving, or from being stopped, if it did move.

When Murdoch invented or discovered a means for producing illuminating gas, no less a man than Sir Humphry Davy ridiculed the idea of using it for lighting purposes, and said if it was to be used for street lighting, they would have to use the dome of St. Paul's for a gasometer. Sir Walter Scott made clever jokes about "sending light through street pipes," and "lighting London by smoke," but subsequently had his house lighted by it. Wollaston, a scientific man, said "they might as well attempt to light London with a slice from the moon." It is but a few years since the scientists of Europe demonstrated mathematically that the electric current could not be divided for incandescent lighting, but to-day the contrary is demonstrated by millions of incandescent lights, illuminating every spot where civilized man resides.

But the strangest of all things in this connection is the fact that, even in this enlightened age, there are men who still insist that inventions are injurious. It is not many years since that, in a paper published at the national capital, there was the statement that the steam engine and the sewing machine were two of the greatest curses that ever befell mankind!

It is, moreover, a matter of history that in certain sections of this enlightened land prayers were fervently offered in churches beseeching that the wickedness of the newly invented sewing machine, which, it was supposed, would rob the sewing women of their means of obtaining a living, might become apparent, and its promoters be stricken by a conviction of their wrongdoing in making it, and thus be told by heaven to desist from its manufacture.

This spirit of opposition exists to-day to a greater or less extent among the labor unions, whose members, without investigating the subject, are made to believe that labor-saving machinery deprives them of employment, or at least will lessen their wages, just as the silk weavers of Lyons thought in regard to Jacquard's loom, and as the spinners of Lancashire thought in reference to Hargreaves' spinning jenny.

It is no doubt true that, when a new invention is introduced which revolutionizes some particular art or branch of business, it at first decreases the number of persons employed in that particular line; but that is only temporary, for in a short time the result is a cheapening of the product, a greatly increased demand for it, because of this cheapening, and then necessarily an increased demand for laborers in that line, and almost universally at increased wages.

The statistics of the country show this to be true beyond the possibility of question. The records of the Labor Bureau show that from 1860 to 1880, the most prolific period in this country of inventions, and the most intensified in all directions of their introduction, the population increased 59.51 per cent, while in the same period the number of persons employed in all occupations—manufacturing, agriculture, domestic service and everything—increased 109.87 per cent; and in the decade from 1870 to 1880 the population increased 30.08 per cent, while the number of persons employed increased 39 per cent.

As shown by the investigation of a committee of the Senate, wages have increased 61 per cent in the United States since 1860. And, as all know, during that same period the cost to the people of nearly all manufactured articles has been decreased in as great if not a greater ratio. As with manufacturers, so with farming. As a recent writer has well said, "The use of patented machinery has so changed agriculture that there is more propriety in saying that we manufacture crops than in saying that we grow them." And still another writer says: "We use implements that cheapen the cost of production, and make the labor of harvesting like the sport of the fairy books."

While most people have the idea that inventions have mainly benefited the manufacturing industries, it is susceptible of demonstration that they have benefited our agricultural industries nearly as much.

In speaking of the condition of the United States, a recent English observer says:

"America has for many years enjoyed an amazing degree of prosperity, so much so indeed, that, to use the eloquent words of Edmund Burke, 'generalities, which in all other cases are apt to heighten and raise the subject, have here a tendency to sink it. Fiction lags after truth, invention is unfruitful, and imagination cold and barren.' The United States has 65,000,000 people, who spend more on dress than any other people on the face of the earth," and who, he might have added, enjoy more of the comforts of life in all directions than any other people on earth.

*By Mr. William C. Dodge, in *Engineering Magazine*.