THE HISTORY OF SALT

Dore's famous picture of Lot's wife being turned into salt *(see page 3)*

INTRODUCTION

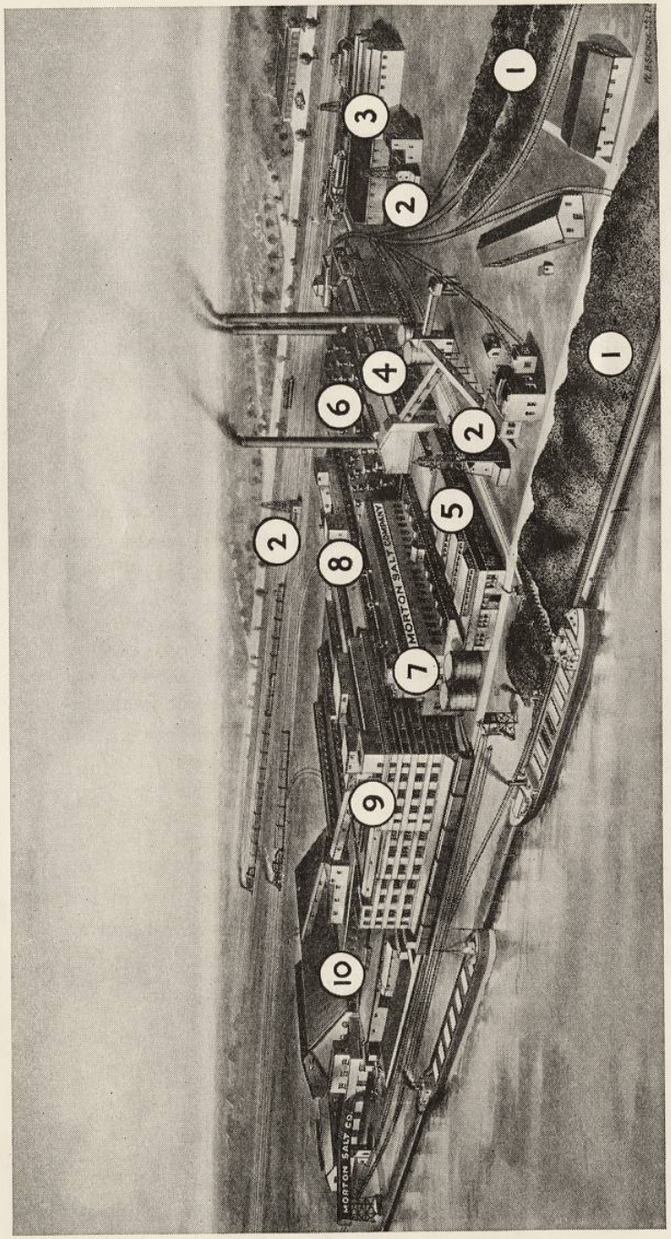
TO the vast majority of us salt is "just salt" . . . something to be used to season food, to preserve meat and fish, to cure hides, to melt ice, to give a tonic effect to the bath, to whiten teeth, or to make a gargle or mouth wash.

Yet the history of salt, with the story of its transformation from the impure, coarse, brown product of a few generations ago to the pure, tiny, dazzlingly-white crystals of today, is as fascinating as the most dramatic pages of a popular novel.

Ever since the beginning of time salt has played a picturesque part in man's life. It has influenced the location of nations and cities; it has been the cause of wars; it has given rise to any number of superstitions and religious beliefs, and, together with air and water, it has formed one of the three foremost needs of human life.

The salt of the past was not alone crude and impure . . . it was costly and hard to obtain. Today most salt is unfailingly pure, costs little to buy, and is seldom more than a short distance away. Here, again, science has scored a triumph fully as important as the radio, the electric light, the aeroplane and other spectacular discoveries.

Indeed, the development of salt is one of the great romances of human accomplishment . . . and it is offered you in this little book with the hope that it not only will afford you an entertaining hour of reading but will give you an insight into one of the most necessary industries known to mankind.



PORT HURON, MICHIGAN, PLANT OF MORTON SALT COMPANY. *(1) Coal supply. (2) Brine well houses and derricks. (3) Brine treating and settling tanks. (4) Boiler room. (5) Engine, pump and air compressor room. (6) Open evaporator room. (7) Vacuum evaporator room. (8) Drying department. (9) Screening and packaging department. (10) Storage warehouse, from which salt is shipped by boat or rail.*

OLDER THAN MAN

UNDOUBTEDLY every reader of this book knows what salt is; in fact, many of you may even be familiar with its chemical name . . . Sodium Chloride. But not all of you may know that salt is absolutely essential to normal health; that if all the salt in our systems were suddenly removed we could not live forty-eight hours!

We all are aware that salt is present in our bodies because both our perspiration and tears are salty. Yet few of us understand the function of that salt . . . that it is, so to speak, a policeman whose duty lies in patrolling our blood and keeping our chemical fluids in proper balance.

Fortunately the human body rarely suffers from a lack of salt, for Mother Nature wisely implanted in us a craving for it which must be satisfied. Unsalted food is flat and unappetizing, and the average person finds it a hardship indeed to go even one meal without this familiar seasoning. If one were to stop using salt completely he soon would experience extreme discomfort and in time would suffer greatly.

Thus it is certain that salt has been eaten by men and animals from the time they first appeared on the earth. We can, in imagination, picture our cave-dwelling ancestors forcing their way through dangerous mountain passes, swimming raging torrents and fighting off ferocious beasts in order to obtain that mineral so necessary to life . . . common salt.

In attempting to trace the history of salt we cannot hope to go beyond the time when man first learned to write or to record his manner of living by means of rude carvings on stone. Since that time ample evidence of the ancient use of salt has come down to us; before then we can only suppose that man's desire for it made its use a necessity.

Historians, for the most part, agree that never have there existed human beings who maintained themselves without partaking directly or indirectly of salt. They point out that the very few races known to have lived without salt ate liberally of animal foods containing that element in abundance.

REMEMBER LOT'S WIFE?

The first written reference to salt occurs in that greatest and most glorious of all books . . . the Holy Bible. In the Book of Job, which was written about 2,250 years before the birth of Christ, is found the line, "Can nothing which is unsavory be eaten without salt?"

The Bible also contains thirty-two other references to salt, perhaps the most familiar of which is the story of Lot's wife. Lot, you doubtless recall,

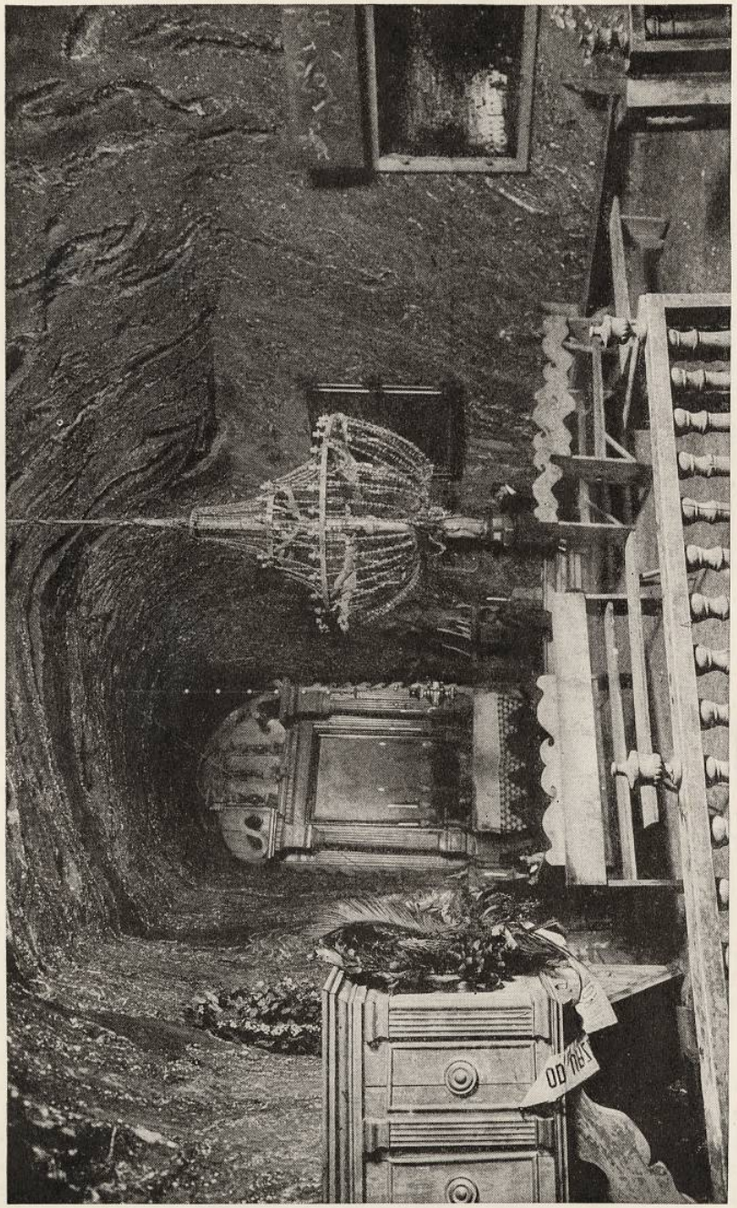


FIG. 1—*A chapel hewn out of solid salt 200 feet down in the Wieliczka salt mine, Galicia, Poland. Its once snowy-white walls have been blackened by the burning of thousands of candles. The prisms on the chandelier are crystals of pure salt.*

was a nephew of Abraham and lived with his wife and two daughters in Sodom. Shortly before that wicked city was to be destroyed for its sinfulness, two angels came to Lot and warned him to escape, cautioning him and his family not to look back once they had departed. Lot's wife, however, disregarded the command, and on turning to look at the burning city was changed into a pillar of salt (see picture on front cover).

Although the Bible traces the history of man back to four thousand years before Christ's birth, salt had been used for so many centuries before then that it is quite impossible to determine its origin as a seasoning for food. The Chinese, the Egyptians and the Hindoos all attempted to establish the time and place of salt's discovery, but because it had been in use long before man learned to record anything their efforts were unsuccessful.

We can, therefore, do no more than guess, and one man's guess is as good as another's. Some say salt was originally discovered on weeds cast up by the sea. Others believe it was first found in the form of exposed rock salt, such as the salt licks used by wild animals. Historians, though, are rather generally agreed that man's first salt was the crude deposits left by the evaporation of sea water.

While all we can do is speculate on the discovery of salt, we can very definitely determine how man first "made" or produced salt for his own use. It was by the solar process, which consisted of permitting the rays of the sun to evaporate or dry up imprisoned sea water, leaving rough salt. This primitive method was used for countless centuries and still persists in many parts of the world.

During ancient times hundreds of shallow salt basins or "evaporating flats" were operated along the shores of the historic Dead Sea in Palestine. In fact, most of the salt consumed in Biblical times was made there and carried into neighboring countries by caravans of camels or donkeys.

The next development in salt production came about the year 1000 A. D., when the mining of rock salt was begun. At that time the now world-famous Wieliczka salt mine in Galicia, Poland, was accidentally discovered.

Rock salt lies in vein-like deposits under the surface of the earth, very much like coal, and as in the case of coal occasionally crops out on the surface. Here is where we find the salt licks so necessary to wild animal life. Salt springs are, of course, the result of spring water flowing over underground salt deposits.

At the Wieliczka mine there are enormously large veins or deposits of salt, located at depths varying from 200 to 900 feet below the earth's surface. This mine has been yielding for almost a thousand years and salt from it has been shipped to all parts of the world, including at one time the United States.

The location of salt springs and deposits of rock salt have had much to do with the manner in which the earth has been peopled. Towns, cities and even nations have sprung up where salt is most easily obtainable. Were it not for salt it is likely that the map of the world as we know it today would be decidedly different.

SUPERSTITIONS ABOUT SALT

One of the most interesting things about the history of salt is that this "magic white sand," as the Indians called it, has always played an important part in the superstitions and religious beliefs of the world. From the dark ages of the past to the present day, salt has been valued by hundreds of creeds, tribes and races not only as a seasoning but as a source of protection against sickness and evil.

In the Bible are many references to the use of salt in establishing a covenant or agreement. It is thought that this was due to the widely-known preservative power of salt, and that those entering into an agreement believed it would prove more lasting if a certain amount of salt was exchanged by the contracting parties.

Even before the dawn of Christianity salt was considered sacred. The early Greeks worshiped it no less than the sun, and among the Hebrews it was a strict religious custom to rub all newly-born babies with salt to insure their well-being. This practice exists even to this day in parts of the Far East, as does also the custom of making children wear small bags of salt suspended from their necks to guard them from the "evil eye."

In certain districts of Russia no bride and groom will enter their new home without carrying a quantity of salt to be thrown to all corners of the house. Doing so is believed to protect them from evil and to encourage happiness and good health. A reflection of this belief is found in our own modern custom of throwing salt over the left shoulder to prevent a quarrel or other bad luck.

The Greeks had a saying that no one should trust a man without first eating a peck of salt with him. This, however, was based not so much on superstition as on the realization that by the time one had shared so large a quantity of salt with a man he would no longer be a stranger.

Another popular superstition about salt that is at once the delight and despair of every child is the belief that scattering a few grains on a bird's tail will make it easy to capture. Quite as amusing is the age-old superstition that if a man throws salt on a woman without her knowledge she will more readily respond to his love making.

SALT IDENTIFIED THE NOBILITY

In ancient England salt was considered so important that it determined the order of seating at meals. A large vessel filled with salt was placed in the middle of the table, and all those of noble birth were seated to one side of it. Thus one could easily tell a man's position in life by noting whether he sat "above" or "below" the salt, the nobility being seated above it. The English playwright, Shakespeare, 1564-1616, mentioned salt in his immortal works no less than thirty-seven times.

Our language abounds with sayings about salt, of which "He's the salt of the earth," "Take it with a grain of salt" and "Not worth his salt" are only a few examples. The latter, incidentally, dates back to the days when

carriers and other humble workers were paid partially in salt; hence to say that a man is "not worth his salt" literally means that he is unworthy of wages.

It will be seen, therefore, that since the very beginning of history salt has been a part of the religious and other beliefs of the world. Even today many of these beliefs still remain, and the previously-mentioned Wieliczka mine is one of Europe's most popular shrines for religious folk.

In this mine are numerous assembly halls, grottoes and chapels, one of which can be seen by referring to Fig. 1. In fact, there you will find an entire city of glittering salt, buried nine hundred feet below the surface of the earth. There are salt water lakes crossed by ferry boats and a railroad with stations has been constructed throughout the mine to carry the thousands of reverential pilgrims who visit it annually.

ONCE USED AS COIN

But even greater than the religious value of salt to the ancients was its material value. So definite was its worth that, at one time or another, it was used as a medium of exchange in almost every country on the face of the earth.

Up to a comparatively recent date salt was employed as coin of the realm in certain parts of Abyssinia. Small tablets of pure salt called "amoulies," each having a value equal to about one cent, were circulated as money and were accepted by the natives just as readily as we accept copper pennies.

In Roman times the legionaries or warriors received part of their pay in salt. That portion of their wages was known as their "salarium," and it is from this ancient Latin word that our own word "salary" is derived. So once again we see the influence of salt on our present-day words and sayings.

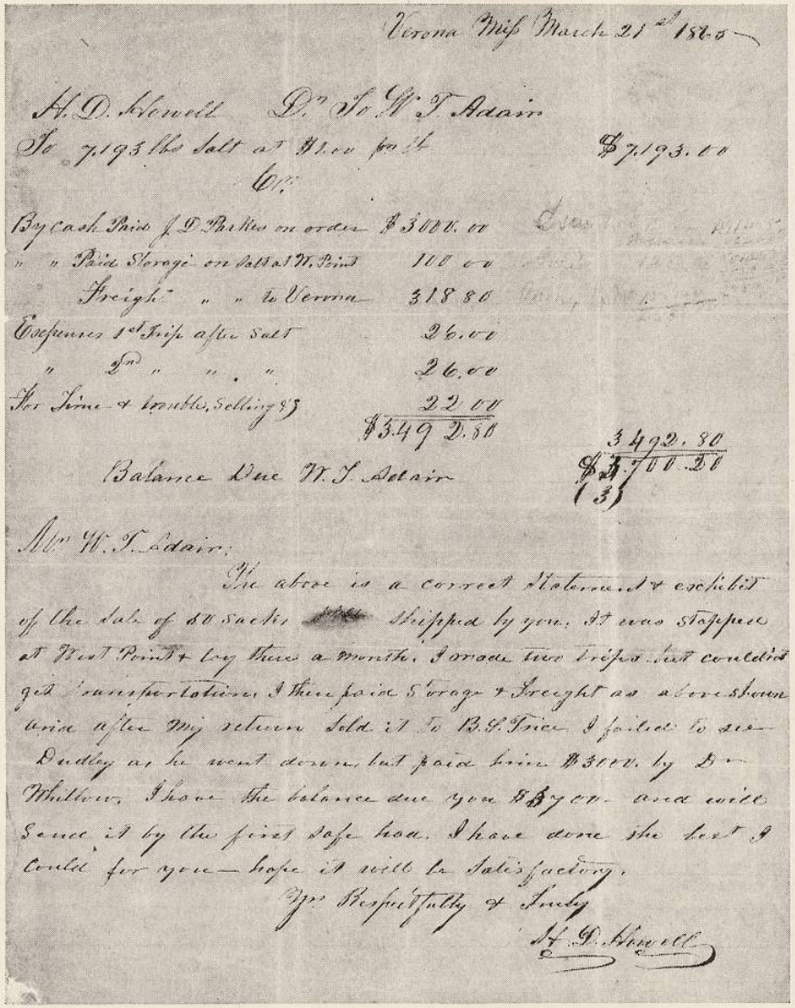
Even today salt remains the principal medium of exchange in the mountains of the South Sea Islands. These districts are far removed from the sea, consequently salt is difficult to obtain and the natives value it accordingly. Travelers report that a tablespoonful of salt for a peck of potatoes is the usual rate of exchange, and that half a sack of it will purchase two fine pigs.

Similar conditions exist in distant parts of Africa, where salt has long been used by explorers to trade with the natives and where slaves were at one time bought with it. Even in our own country the Indians were willing to accept the white man's salt in exchange for their land and other possessions.

Not only has salt been used the world over in place of money, but it has always been a favorite means of raising funds on the part of governments. Knowing that man's natural craving for salt cannot be denied, they have taken advantage of their opportunity to levy unusually high taxes on it. Today the manufacture of salt is under government control in many countries, and one of the recent grievances of the people of India against the British was the salt tax which was forced upon them.

A CAUSE OF BLOODSHED

With such world-wide acceptance of the material value of salt, it is not surprising that its sources of supply should have been the object of many a



Verona Miss March 21st 1865

H. D. Howell Dr to W. T. Adair

To 7,193 lbs Salt at $1.00 per lb $7,193.00

Cr.

By Cash Paid J. D. Phillips on order $3000.00
" " Paid Storage on Salt at W. Point 100.00
Freight " " to Verona 318.80
Expenses 1st Trip after Salt 26.00
" 2nd " " " " 26.00
For Time & trouble, Selling &c 22.00
$3492.80

Balance Due W. T. Adair $3700.20

Mr W. T. Adair:

The above is a correct Statement & exhibit of the Sale of 80 Sacks [illegible] Shipped by you. It was stopped at West Point by them a month. I made two trips but could get transportation & then paid Storage & Freight as above shown. Soon after My return Sold it to B. G. Price & failed to see Dudley as he went down, but paid him $3000. by Dr Whitlow. I have the balance due you $3700. and will Remit it by the first safe hand. I have done the best I could for you — hope it will be Satisfactory.

Yrs Respectfully & Truly

H. D. Howell

FIG. 2—*This interesting old document is a statement covering the sale of 7,193 pounds of salt at $1.00 a pound. It was drawn up at Verona, Mississippi, shortly before the close of the great Civil War, after the capture of the Confederacy's principal salt springs and deposits had made that mineral extremely scarce throughout the South. Today $1.00 will buy ten packages of the very finest table salt . . . enough to last the average family almost a year!*

raid and military invasion. The great Wieliczka mine, for example, has been fought over on several occasions, being seized from the Poles by the Austrians in 1772, but regained by Poland as a result of the Great War of 1914-18.

In really ancient days salt was likewise a cause of military operations. The salt caravans from the Dead Sea were repeatedly attacked, and in Roman times salt led to the building of one of the greatest military roads still in existence. Called the Via Salaria, it was constructed by Roman soldiers to bring salt to Rome from the salt works at Ostia near the Mediterranean. It goes without saying that this road was constantly guarded, for on it depended the salt supply of what was then the most important city in the world.

Here in our own country salt has led to much bloodshed, particularly during the Civil War. The Southern soldiers depended largely for their salt on springs and deposits not far distant from New Orleans, Louisiana. It was essential that the Northern troops should capture them, in order that the salt supply so necessary to the health of the men and animals in the Confederate army might be cut off.

This led to the long and bloody movement against New Orleans. It is certain that the capture of the nearby springs and deposits helped materially to shorten the war, for the Southerners were forced to depend on insufficient sources of supply and before long the shortage of salt became a serious danger to their forces. Toward the end of the war salt was selling in the South for as much as one dollar a pound (see Fig. 2).

During the many Indian wars which were fought later on, salt was often a cause of conflict. Any number of fierce battles were waged over the possession of salt springs and licks which the Indians had discovered by following the buffaloes and other wild animals. As these springs and licks were few and widely separated, it was to be expected that the savages should defend them even at the cost of their lives.

As civilization moved West the expense and danger of bringing salt from the East increased tremendously. So great were the hazards of transporting it that the responsibility was considered worthy of the bravest and hardiest plainsmen. At that time salt which was selling for $28.00 a barrel in Ohio fetched twice as much when it finally reached the frontier of Kansas and the Dakotas.

SALT NOW VASTLY IMPROVED

It is a far, far cry from the covered wagon period, with the Indians and pioneers fighting battles over the possession of salt springs, to the many refinements of today. The ox-drawn wagon has given way to the swift and luxurious motor car. Homespun clothing is a relic of history. The coal oil lamp has been replaced by the electric light. And the modern town crier is the radio.

The progress seen on every hand is no better shown than in the refinement of salt. When the Bible speaks of "salt that has lost its savor" it refers to salt so loaded with impurities that it had little or no flavor. Such salt was used right here in America less than a century ago!

FIG. 3—*Evaporating ponds at the Morton Salt Company's Burmester, Utah, plant, where Great Salt Lake water is converted into crude salt by the solar process and afterward refined.*

FIG. 4—*"Harvesting" solar salt with the aid of machinery at the Morton Salt Company's Burmester, Utah, plant. In the background a portable elevator is piling up a mountain of salt.*

Moreover, the salt used in those pioneer days was very coarse and almost always was dirty in appearance. So accustomed were the people of certain parts of the country to rough, brown salt that when manufacturers began making the fine, white salt we now know they had considerable difficulty in selling it.

Today most table salt is more than 99% pure, and is very fine, snowy-white, and of perfect flavor. This transformation is due to twentieth-century mechanical skill, aided by the microscope and test tube of the scientist. In the great laboratories and refineries of the Morton Salt Company, which we are about to visit in fancy, salt has been raised to its present high state of refinement in a little more than eighty years' time.

The following description of the methods employed in making Morton's Salt, whose famous slogan "When it rains, it pours" is familiar to every housewife, will prove very interesting reading indeed. You will be fascinated by the many steps through which this popular salt passes before coming to your table, and will marvel that a product made with such care and packaged so conveniently costs only 10c for a can large enough to last the average family an entire month!

SALT FROM THE SEA

There are three great sources of salt today . . . the sea, the mine and the well. And from each of these salt is gathered in an entirely different way.

The solar method, already mentioned, originally consisted of scooping shallow holes along the seashore into which the breaking waves would throw salt water. Then, with no chance to drain back, the salt water or *brine,* as it will hereafter be called, would be dried up by the sun, leaving deposits of crude salt on the sand.

The first actual refining of salt was done on the shores of the Dead Sea, where the coarse salt mixed with sand was placed in a stone vessel of water and dissolved into brine again. After the sand had sunk to the bottom the brine was run into shallow stone troughs and exposed to the sun's rays until the water had disappeared, leaving a rough but fairly pure salt.

In Europe great wooden troughs were erected near the ocean and sea water was pumped into them. Usually these troughs were built in series, so that the first would catch and hold the sand while the brine ran on to the next. After one or two such settlings, the sun was allowed to evaporate the water, leaving a coarse salt which was then "harvested" by men with rakes and shovels.

But American skill was not long content to be dependent on the sun for heat, especially in rainy districts, and a method of separating salt crystals by boiling sea water in large kettles was developed. Each held one hundred or more gallons of brine, and as salt crystals accumulated in the bottom of the kettle they were ladled out and more brine poured in. Later on this method was succeeded by what was known as the direct heat pan process, which employed enormous shallow pans of iron with extremely hot fires underneath.

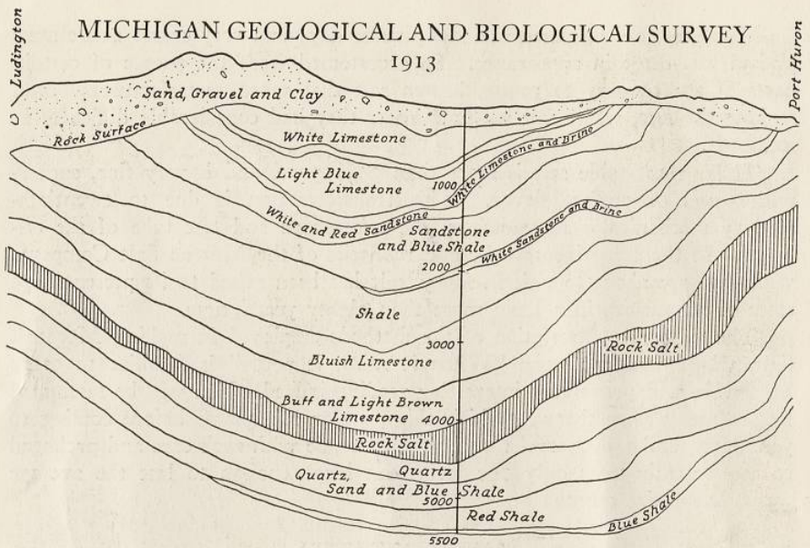


FIG. 5—*A geological cross-section of Michigan, showing the great salt deposit which extends from Lake Michigan to Lake Huron.*

However, salt is still made from sea or salt lake water in China, France, Portugal, Spain, Italy, Central and South America, the West Indies and, to some extent, in the United States. In fact, a very substantial tonnage of solar salt is produced annually in California and Utah, in both of which states the Morton Salt Company operates large, up-to-date plants for refining this salt.

The method employed is to pump tremendous quantities of sea or Great Salt Lake water into huge ponds (see Fig. 3), where it is allowed to evaporate until the water becomes thick with salt. From them it goes to other ponds, where all impurities are scientifically removed and the salt crystals are allowed to form.

Salt of this type is of high purity, and from it are made grades ranging from fine table salt to the coarser crystals intended for industrial purposes. Clean, modern machinery is used to gather the solar salt (see Fig. 4) and carry it to the refineries, where crushing, grading and separating take place.

SALT FROM THE MINE

Not even scientists have the slightest idea of the extent of the vast salt deposits or veins which underlie the earth. Salt is found in almost every part of the world and in almost unlimited quantities. Drillers of oil wells often bring in gushers that spout salt water instead of oil, and in Java there is even a salt geyser, or rather a salt mud volcano.

Occasionally these veins occur near the surface of the earth, and mines in such locations are merely shallow pits from which the salt is dug. In most cases, though, rock salt lies far beneath the surface (see Fig. 5), and

FIG. 6—*700 feet down! Drilling holes preparatory to blasting out solid salt with dynamite at the Morton Salt Company's Kleer mine near Grand Saline, Texas.*

FIG. 7—*Surface buildings of the Morton Salt Company's Kleer mine. That at the left is the "tipple," containing the crushers, screens, etc., while that at the right tops the elevator shaft of the mine.*

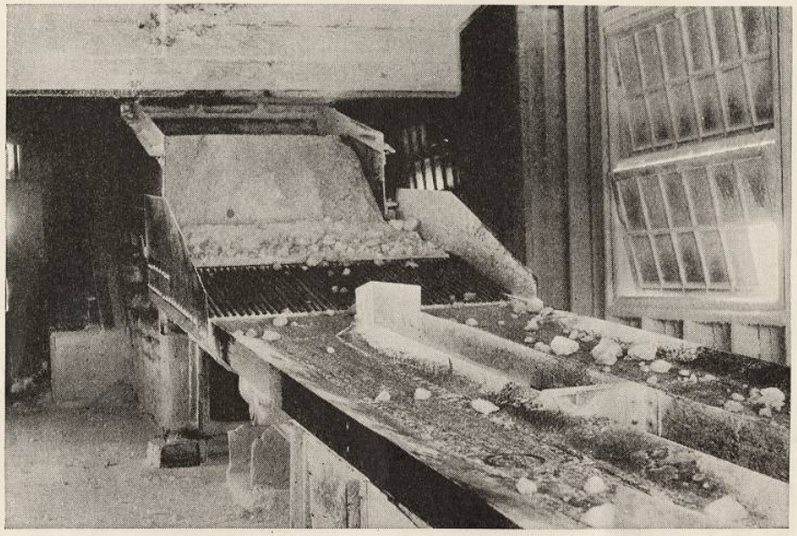


FIG. 8—*A crusher at the Morton Salt Company's Kleer mine. After crushing, the lumps pass along a "picking belt" from which discolored ones are removed by hand.*

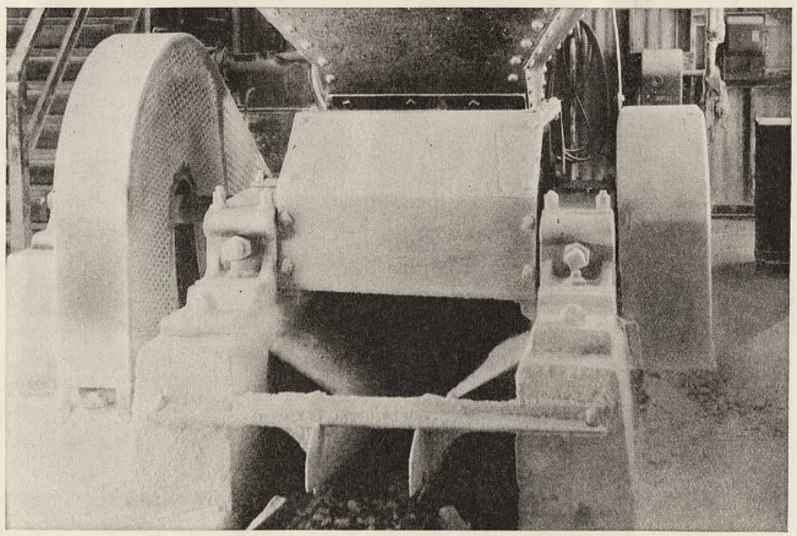


FIG. 9—*Another crusher at the Morton Salt Company's Kleer mine. This further reduces in size the lumps seen coming from the crusher in Fig. 8.*

is mined very much after the manner of coal. Shafts are sunk and working galleries are run off them just as in a coal mine.

Some of the salt mines, such as the Morton Salt Company's Kleer mine at Grand Saline, Texas, have a complete system of mine railroads, electric lights and elevators to bring loaded cars to the surface. Compressed air drills and electric crushing and shoveling machines are employed to break loose and load the lumps of rock salt (see Fig. 6).

When the salt reaches the surface it is elevated to the top of the eight-story mine building or "tipple" (see Fig. 7), where it goes through crushers (see Figs. 8 and 9) and then passes over automatic shaking screens which separate the various sizes of crystals. Finally it makes its way to the lower part of the tipple where it is sacked or barreled and trucked to waiting freight cars.

The larger lumps of rock salt are not crushed, but are taken by moving belts to the ground floor of the tipple where they are thoroughly examined for cracks and flaws. Then they are piled for seasoning and final shipment as lump rock salt. This salt must be carefully handled and stored until aged, as it is exceedingly brittle when taken from the mine and toughens only through exposure to the air.

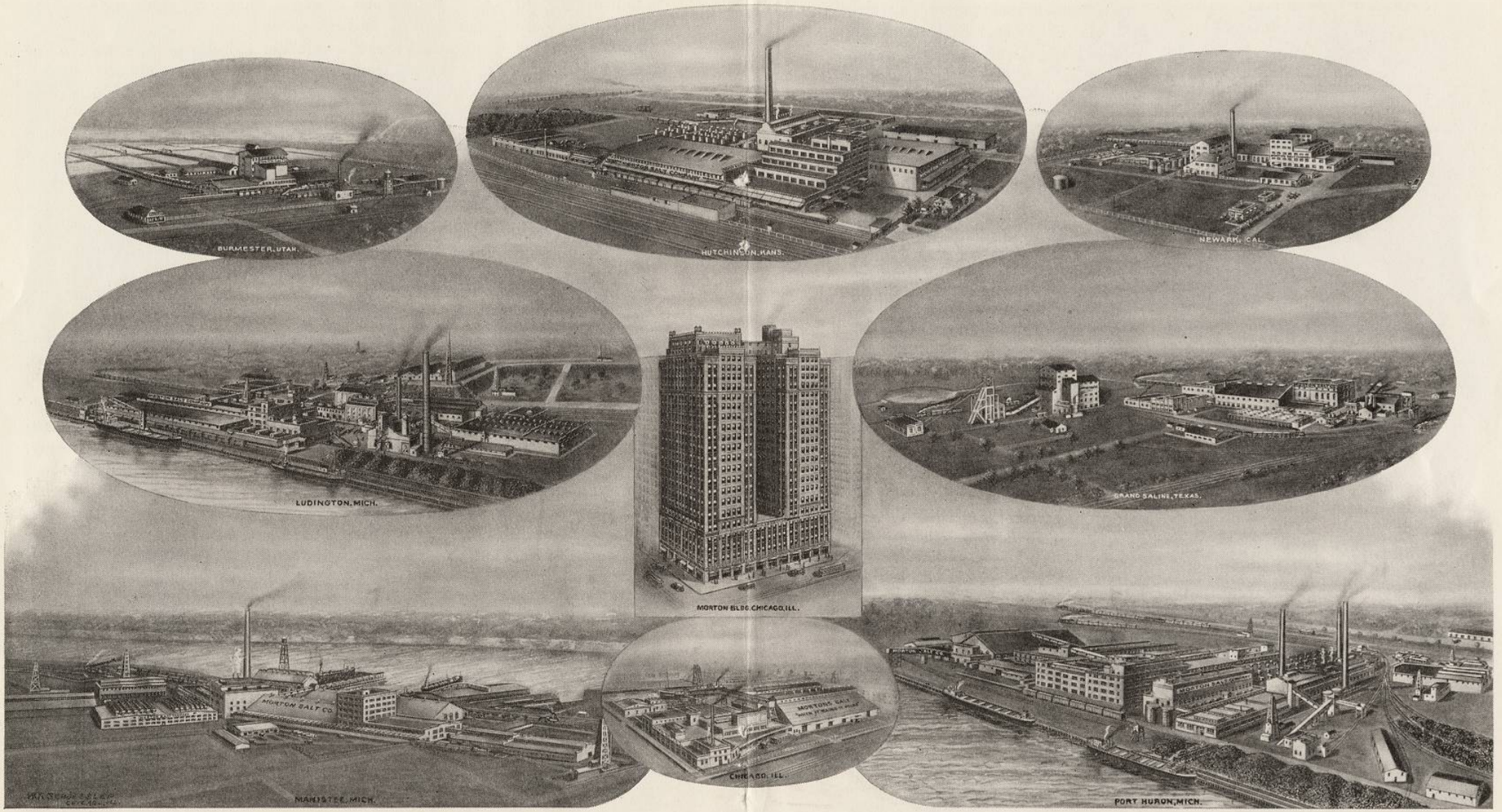
In the Kleer mine the Morton Salt Company has the newest and best-equipped salt mine in the United States. Located in Van Zandt County, Texas, about 60 miles east of Dallas, it taps an underground pillar of salt 30 miles around and of unknown depth. Salt wells have been sunk into it for many thousands of feet without reaching the bottom. This huge salt deposit is of much higher quality than those found in other states, averaging 99½% in purity.

Other deposits of "halite," as rock salt is known to scientists, are to be found in Europe, Asia and Palestine, as well as the United States. In this country salt mines are operated in Van Zandt County, Texas; Livingston County, New York; New Iberia Parish, Louisiana; Wayne County, Michigan, and Rice, Reno and Ellsworth Counties, Kansas. In portions of Utah and California there are thick deposits of rock salt on the surface which are worked by open-pit methods.

SALT FROM THE WELL

The salt well might easily be called a hydraulic or water mine, for it actually mines rock salt by means of water. It gets the salt out of the bowels of the earth without the use of drills, shoveling machines, trains, hoists, crushers and screens . . . and automatically throws out impurities while doing it.

A salt well is drilled down to the rock salt deposit in much the same way as a water, gas or oil well, except that it has a *double* casing or pipe . . . one inside the other (see Fig. 10). Pure, fresh water is pumped *down* the outer casing to the salt vein below and forms a brine or mixture of salt and water which, being heavier than water, sinks to the bottom of the cavity and is forced *up* the inner casing by the pressure of the fresh water coming down.



A COMPOSITE VIEW OF THE MORTON SALT COMPANY'S FAR-FLUNG PROPERTIES. THE EIGHT PLANTS ARE STRATEGICALLY LOCATED TO GIVE THE BEST POSSIBLE SERVICE TO SALT USERS THE COUNTRY OVER.

UPPER LEFT: *Burmester, Utah, plant. Converts Great Salt Lake water into crude salt by means of the solar process and afterward refines it.*

MIDDLE LEFT: *Ludington, Michigan, plant. Refines salt from brine obtained from salt wells.*

LOWER LEFT: *Manistee, Michigan, plant. Refines salt from brine obtained from salt wells.*

UPPER CENTER: *Hutchinson, Kansas, plant. Refines salt from brine obtained from salt wells.*

MIDDLE CENTER: *The 23-story Morton Building, located in Chicago's busy "Loop" district, which houses the general offices of the Morton Salt Company.*

LOWER CENTER: *Chicago, Illinois, plant. Sacks and barrels salt brought from Michigan plants by boat or rail.*

UPPER RIGHT: *Newark, California, plant. Converts Pacific Ocean water into crude salt by means of the solar process and afterward refines it.*

MIDDLE RIGHT: *Grand Saline, Texas, plant. Mines salt from a huge underground deposit; also refines it from brine obtained from salt wells.*

LOWER RIGHT: *Port Huron, Michigan, plant. Refines salt from brine obtained from salt wells.*

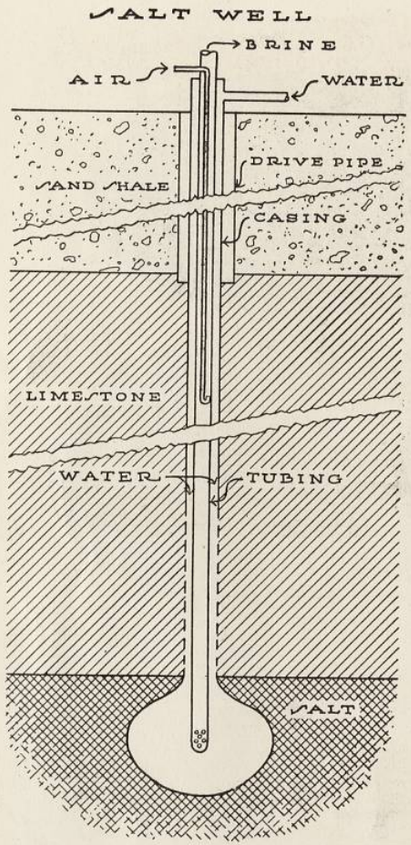


FIG. 10—*Cross-section of a salt well.*

In sections where the salt deposit is at a reasonably shallow depth, the pressure of the water pumped in is sufficient to force the brine to the surface. But where the rock salt is deep it becomes necessary to employ air under high pressure (commonly called "compressed" air) to elevate the brine.

In such wells a compressed air pipe with a "U" bend at the bottom (again see Fig. 10) is dropped down the inner casing to a point just below that to which the brine is raised by the pressure of the incoming water. Upon reaching that point the brine is carried the rest of the way to the surface by the upward force of the air.

From the foregoing description it is clear that water mines salt just as efficiently as can the most skilled miners. It digs great holes in the salt veins far under the earth's surface, often dissolving salt that is thousands of feet away from the well itself. The brine coming up brings only those impurities which are in solution, leaving practically all the solid foreign matter ordinarily found in rock salt at the bottom of the well.

The brine from a salt well contains (at 60 degrees Fahrenheit) 26½% salt or 2⅔ pounds to the gallon. Sea water contains about ¼ pound of salt to the gallon, while the water in the Great Salt Lake in Utah contains from 1⅓ to 2 pounds to the gallon. The water in the fabled Dead Sea contains from 2 to 2½ pounds per gallon.

WE VISIT A REFINERY

Now that we have seen how brine is produced, the next step is to see how it is made into salt. To do so we must go through one of the seven big refineries of the Morton Salt Company, representing an investment of many millions of dollars, and the one we have chosen for our visit is that at Port Huron, Michigan (see frontispiece).

Having just come from one of the fourteen wells which surround this plant, we very naturally will wish to inspect the big pumps and compressors

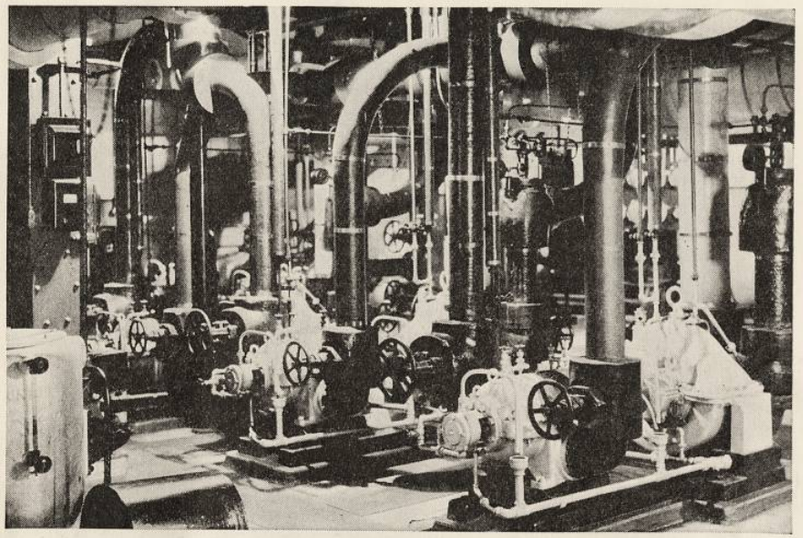


FIG. 11—*The pump room of a Morton refinery, which provides the vast quantities of water needed to operate the boilers and salt wells.*

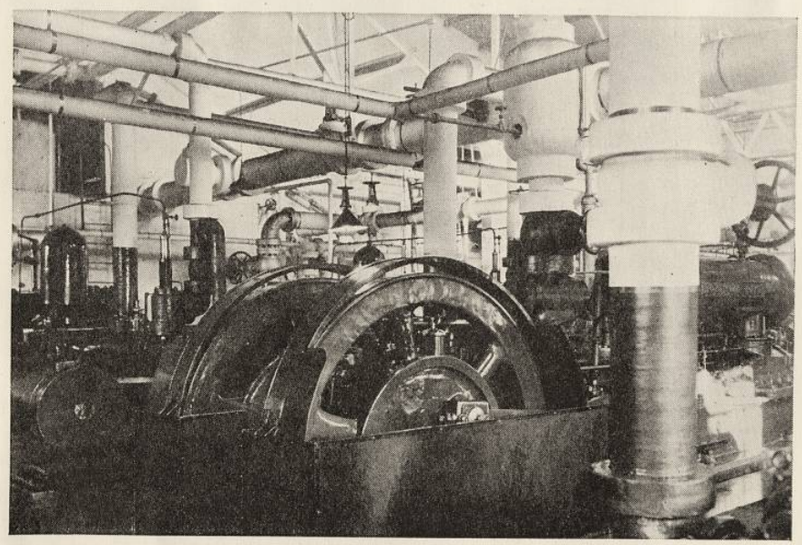


FIG. 12—*Air compressors in a Morton refinery. These produce the compressed air necessary to elevate brine from the salt wells to the surface of the earth.*

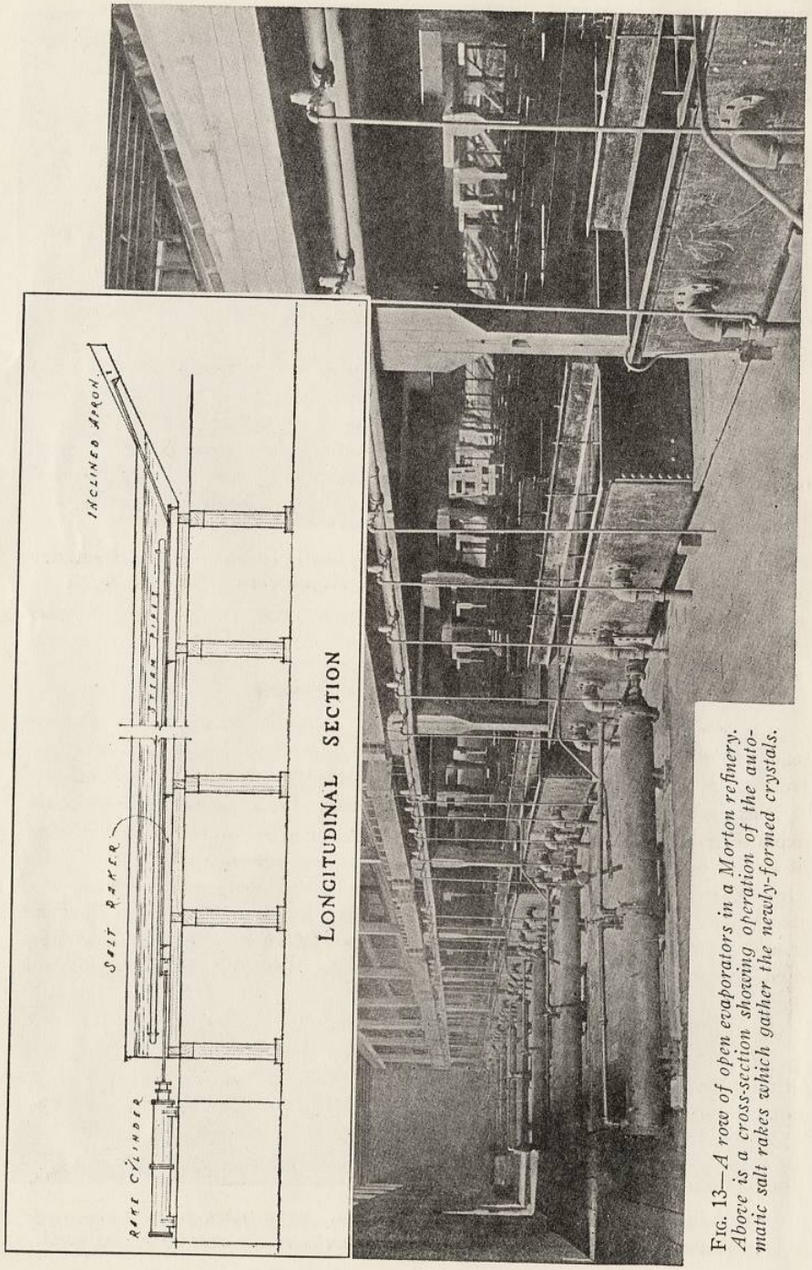


FIG. 13—*A row of open evaporators in a Morton refinery. Above is a cross-section showing operation of the automatic salt rakes which gather the newly-formed crystals.*

that provide the vast quantities of water and air so essential to salt well operation (see Figs. 11 and 12). It is estimated that the pumps of the various Morton refineries have a combined capacity sufficient to supply all the water needed by a city of 500,000 inhabitants.

As the brine comes into the refinery from the wells it goes first to great settling tanks, which are huge wooden vats or tubs holding about 125,000 gallons each. Here we see chemists drawing samples to determine the salt content of the brine and also what impurities are present.

The brine is required to stand in the first settling tanks until any non-dissolvable matter which has come up from the well has settled to the bottom. Then the clear brine goes into a second series of open tanks, heated with steam coils, where a special chemical treatment is given it to remove any impurities it may still contain.

Our position in the building which houses the settling tanks is on a narrow platform, elevated and extending over the tops of the vats. From this point we can see the brine in its various stages, noting that while it is cloudy in the first settling tanks, it becomes clear as crystal by the time it reaches the last. Our guide throws a coin into one of the latter and we are able to distinguish it easily even though the tank contains fifteen feet of brine.

The brine now is sparklingly clear and entirely free from impurities, consequently the next operation is to change it into salt. Two methods, the open evaporator process and the vacuum evaporator process, are the ones most commonly employed. We shall first watch the workings of the former.

THE OPEN EVAPORATOR PROCESS

On entering the open evaporator room we see a long row of shallow pans made of plate steel. They range in length from 90 to 120 feet, are from 12 to 15 feet in width, and are uniformly 2 feet deep (see Fig. 13).

Suspended in these pans is a series of 4-inch steam pipes, and our guide explains that steam continually flows through them to cause the evaporation or drying up of the brine with which the pans are automatically kept filled. He also explains that this brine must be kept at an even temperature . . . that should it vary more than two degrees an entirely different grain of salt would result. The size of the grain is determined by the degree of heat used, low temperatures producing coarse crystals and high temperatures fine ones.

As the brine becomes hot from the temperature of the steam pipes, the 73½% of water it contains turns into steam and passes out of the room through overhead hoods connected with ventilating stacks. Meanwhile the salt crystals form on the surface of the pan, float for a few minutes, and then sink gently to the bottom. It is this brief period of floating, our guide tells us, which gives the crystals the flat, flaky shape that is characteristic of open evaporator salt.

On looking toward the bottom of the open evaporator we see automatic rakes slowly pushing the salt crystals to the end of the pan and up an

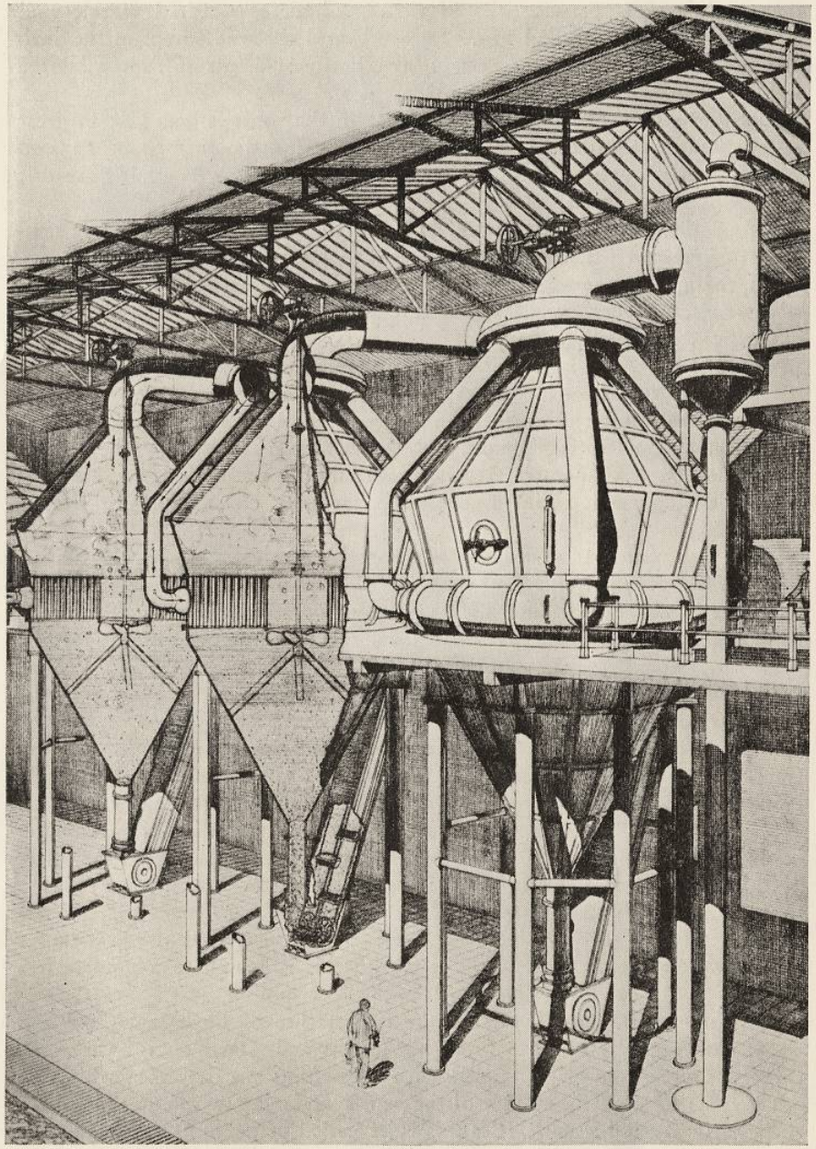


FIG. 14—*A battery of three vacuum evaporators in a Morton refinery. The gigantic size of these machines can be appreciated by comparing them with the attendants in the picture.*

inclined drain board (again see Fig. 13). There they pause for a moment, finally falling onto a moving belt which whisks them away to the drying department. This endless belt constantly passes through water to keep it free from impurities that might spoil the salt.

Open evaporator salt is used largely for making cheese and butter, as well as for dry salting meats. Great quantities are also used by bakers in producing our daily bread.

THE VACUUM EVAPORATOR PROCESS

And now our guide takes us to the other and considerably more complicated salt-making method . . . the vacuum evaporator process. This produces tiny crystals, each one a perfect cube, and it is from these minute cubes of salt that the famous Morton's Free Running Salt is made. As a matter of fact, the principal reason why it pours so freely on rainy days is that its cube-shaped crystals tumble off one another instead of sticking together as flake crystals do in damp weather.

The vacuum evaporator process is based on the well-known scientific fact that water boils at a much lower temperature in mountainous regions than it does at sea level. That is because the thinner air of the mountains exerts less pressure on the liquid, thereby reducing its boiling point.

By taking advantage of this law of physics it is possible, with the vacuum evaporator process, to produce salt more economically than with any other method. Less steam, and therefore less coal, is required, and by connecting a number of vacuum evaporators it is also possible to use the same heat again and again.

The vacuum evaporator is a large and costly piece of machinery whose appearance can better be appreciated by referring to Fig. 14. It will be seen that each evaporator consists of two gigantic cast iron cones, set base to base, and that between them is a thick doughnut-shaped section which is known to salt makers as a steam belt.

This steam belt extends far into the evaporator from all sides, leaving only a small hole or well in the center. However, between the well and its outer edge the steam belt is pierced by thousands of copper tubes, open at both top and bottom (again see Fig. 14). It is these heated tubes that boil the brine, which goes *up* through them and *down* through the well, its downward circulation being aided by a propeller like that of a ship.

To insure the utmost efficiency and economy, vacuum evaporators are usually operated in batteries or rows of three or four. You are asked, therefore, to pretend that you are watching the operation of the three shown in Fig. 14.

The evaporator to the left of the illustration is No. 1 and its steam belt is filled with live steam. This steam circulates around the copper tubes and causes the brine to boil violently, which it does at a much lower temperature than it would in the open because air has been pumped out to form what is

known as a vacuum . . . a complete or partial absence of air. As the brine boils, cube-shaped crystals of salt form and drop to the bottom of the evaporator, where they are removed by pumps.

Evaporator No. 2 does not require live steam, as its steam belt operates efficiently on the hot vapors cast off by the boiling brine in Evaporator No. 1. This evaporator, though, must have a higher vacuum than Evaporator No. 1, so that its brine will boil at a still lower temperature. Evaporator No. 3 is operated in the same way, the vapors from Evaporator No. 2 containing sufficient heat to boil its brine because its vacuum is even higher. Brine in Evaporator No. 3 boils at a temperature of only 140 degrees Fahrenheit, whereas it would require 226 degrees Fahrenheit to boil it in the open atmosphere.

By thus creating an atmosphere even thinner than that of the loftiest mountains, the vacuum evaporator process produces high-grade salt far more efficiently than any other method man has yet devised. Not only is the brine made to boil at much lower temperatures than had ever before been thought possible, but the heat is used several times over with a consequent reduction in fuel expense.

As is the case with open evaporator salt, the salt produced by the vacuum evaporator process is untouched by human hands from the time it is made until it reaches your table. It is, as already explained, drawn off by pumps and piped to the drying department, which will be the next stop on our trip through the Morton Salt Company's great Port Huron refinery.

DRYING AND SCREENING SALT

The newly-made salt comes from the evaporators in a very wet condition indeed. Small drops of brine still cling to the crystals, and the whole mass has a slushy appearance.

Therefore it goes first to a series of filters (see Fig. 15), which reduce the amount of moisture in the salt to about 2%. From there it proceeds to a rotary dryer, a revolving steel cylinder lined with rust-proof metal, which is heated to a very high temperature throughout its entire length of about 40 feet (see Fig. 16).

After the salt has passed from one end of the rotary dryer to the other we observe that it runs like hot sand. According to our guide it now contains less than 1/10 of 1% of moisture. Finally it is ready to be separated into crystals of various sizes, and this is accomplished by sifting it through no less than nine automatic shaking screens.

Following the screening process the salt wends its way to the storage bins, there to remain until the almost human machines which we are about to inspect weigh and pack it in bags or other containers.

PACKED BY AMAZING MACHINES

To the layman, perhaps the most entertaining sight in a salt refinery is the automatic packaging of the product. This is done by machines of such efficiency that they might actually be said to think.

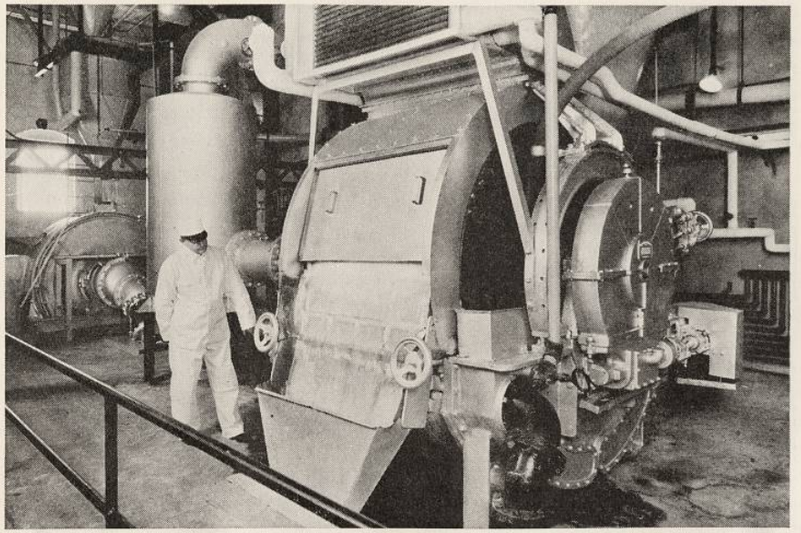


FIG. 15—*One of a series of salt filters in a Morton refinery. These remarkable machines quickly draw off all but a small part of the moisture that abounds in newly-made salt.*

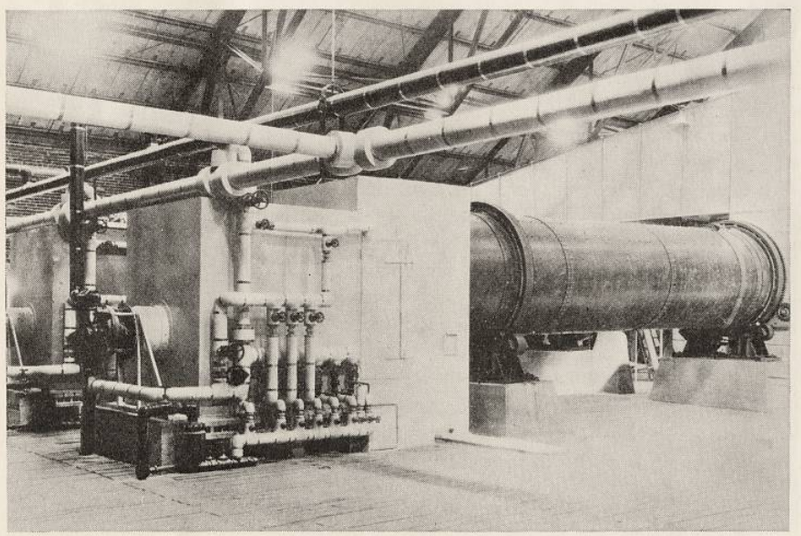


FIG. 16—*A rotary dryer in a Morton refinery. After passing through this super-heated cylinder, salt contains but 1/10 of 1% of moisture and is ready for screening.*

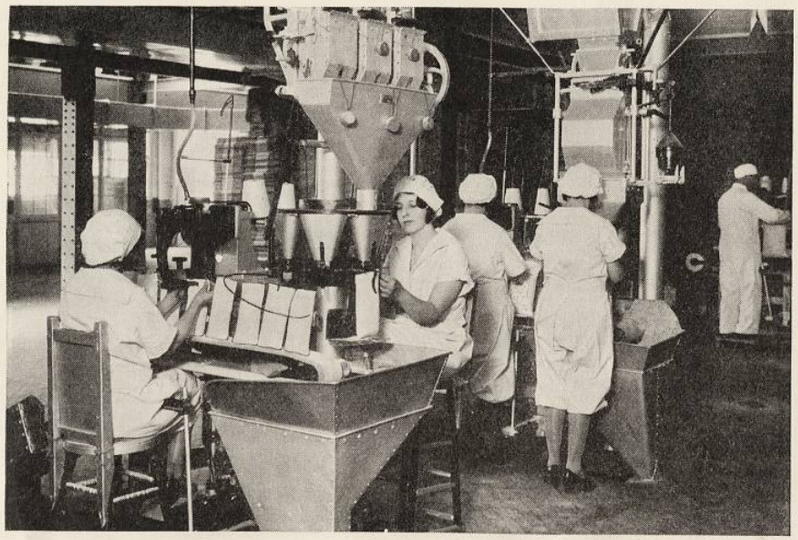


FIG. 17—*A combination sack filling and closing machine. After being filled by the girl on the opposite side of the machine, the sacks pass by belt to the girl in the foreground who securely sews them shut.*

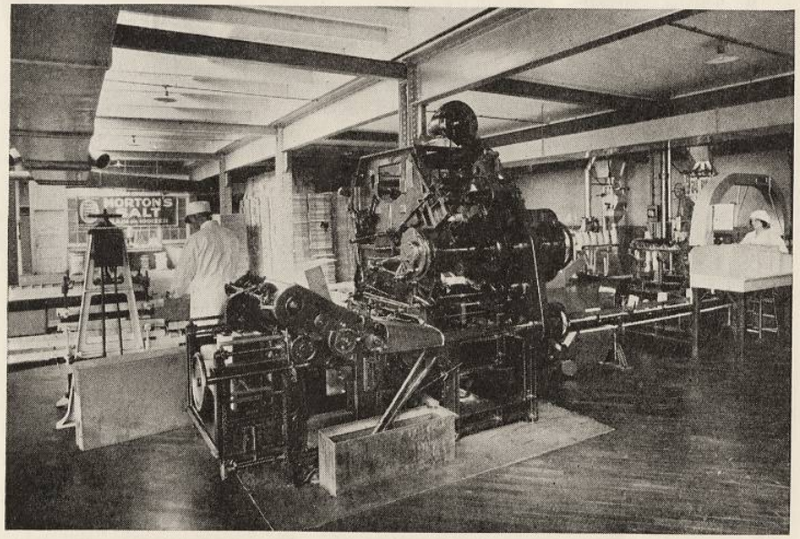


FIG. 18—*These almost human machines fill square cartons, glue shut their tops and bottoms, and then paste labels tightly about them. Thus they are doubly sealed against moisture.*

Because of the free running properties of Morton's Salt it readily drops by gravity from the storage bins to the machinery below. This machinery is equipped with self-acting scales so accurate that they do away completely with the possibility of short weight which might occur were the weighing done by hand.

Salt packaging is divided into three general classifications . . . sacks, square cartons and round cans. The smaller sacks, known to the trade as "pockets," range in size from 1 to 10 pounds, while the large sacks weigh from 25 to 200 pounds.

The salt for each sack is automatically weighed and dropped into it by a machine like that shown in Fig. 17. The sack is then moved by belt to a high-speed sewing machine (again see Fig. 17) which quickly and securely closes the top. Pockets, or small sacks, are packed in barrels or bales before shipping, but large sacks are loaded loose in the cars.

Machines that rival man in skill and surpass him in speed are used for packing square cartons. An endless stream of empty containers is fed to them, whereupon they weigh out the salt, deposit it in the cartons and neatly glue shut their tops and bottoms (see Fig. 18).

Other machines now take these filled cartons and tightly wrap and glue labels on them, carefully folding the labels over the ends. Thus the packages are doubly sealed, greatly increasing their resistance to moisture.

Morton's Salt, both plain and iodized, is packed only in round cans. Automatic machines apply the famous Morton blue label to these cans while still empty, following which they pass to a varnishing machine where a thin coat of moisture-proof lacquer is applied. More machinery removes the cans from the varnishing rolls and carries them away to be thoroughly dried before filling.

While the round cans are being prepared for filling a special treatment is given the salt to insure further its free running qualities. This consists of adding less than 1% of magnesium carbonate to prevent hardening in damp weather. By a secret process, which took years to develop, it is fastened to the grain of salt itself, thus doing away with the dust or powder so frequently found in imitations of Morton's Salt.

In the case of round cans the packages are filled through the spout (see Fig. 19). This spout is worthy of special comment, as it is made of rustless aluminum and is so securely hinged that it cannot possibly tear out. It might be added that the can itself consists of a layer of heavy fiberboard, a layer of asphaltum, or waterproof material, and another layer of fiberboard. Thus it is triple thick and is as moisture resisting as it is possible to make a cardboard container.

Another unusual salt "package" is the compressed or solid salt block used by farmers for stock feeding purposes. Years ago most farmers used lump rock salt or loose salt for their animals, but both were easily dissolved by rain and the latter was frequently trampled into the ground by the stock.

Consequently most farmers now find it more economical to use compressed salt blocks, which are made of pure, white, kiln-dried salt by hydraulic

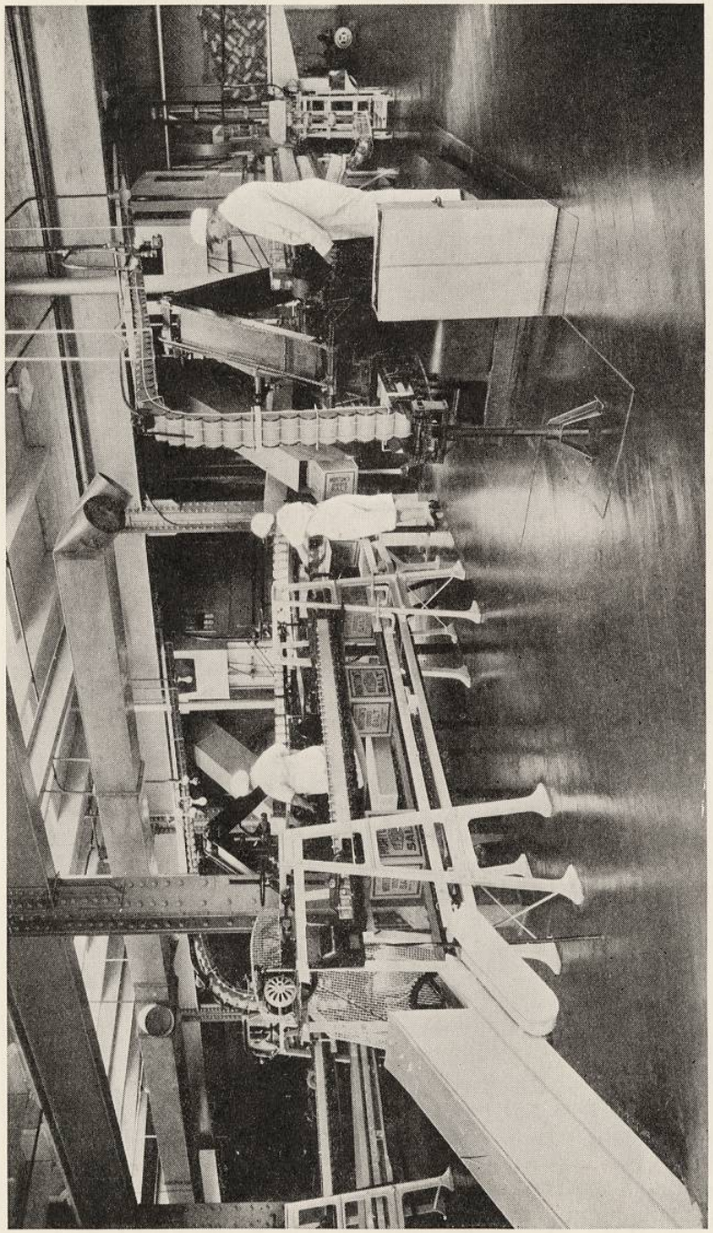


FIG. 19—*This series of amazing machines pastes labels on triple-thick round cans, varnishes and dries them, fills them with Morton's Free Running or Iodized Salt, and then packs them in sturdy fiber containers for shipping.*

or water-operated presses that exert a pressure of 700 to 1000 tons on each 50 pound block of salt (see Fig. 20). The result is a firm, smooth product which is proof against rain and which lasts an astonishingly long time.

A PRODUCT OF MANY USES

Having seen how salt is made and packaged, it might be interesting to devote a few minutes to a discussion of the many uses which this ancient product enjoys. It has, we are told, no less than 1,400 uses, ranging from melting ice on sidewalks to its place in every medicine cabinet.

The medicinal properties of salt have long been recognized, physicians agreeing that they have yet to find a better cleanser for open wounds than brine made from a good table salt. They also recommend a heaping teaspoonful of salt and as much ground mustard in a teacup of warm water as an emetic; one teaspoonful in a glass of warm water as a gargle for sore throats, and applications of damp salt for the relief of burns, insect stings, rash and hives.

Dyspepsia, heartburn and indigestion are often relieved, they say, by a cup of hot water in which a small spoonful of salt has been dissolved, while constipation can be banished by drinking upon rising each morning a quart of tepid water containing two level teaspoons of salt. Salt added to the bath gives the skin a delightful tingle and stimulates the entire body. Or, if preferred, it may be used as a rub.

For tired, aching feet, a salt water bath every night quickens the circulation and brings immediate comfort. Tender feet, apt to form callouses, can be hardened by bathing nightly in cold salt water.

Dentists recommend salt as a mouth wash (one-half teaspoonful to a glass of warm water) and also for daily use on the toothbrush. They assert that its use as a dentifrice will quickly whiten the dullest teeth and keep the gums firm, pink and free from pyorrhea.

Opticians advise the frequent use of a mild salt solution as an eye bath, pointing out that Nature's own eye wash, tears, is nothing more nor less than warm brine. And it is said that rubbing a salt solution into the hair once a week will keep it from falling out.

So much for the many and strongly endorsed medicinal uses for salt. There are numerous other tasks for this familiar product around the house, and a few of these will now be briefly described.

FURTHER USES FOR SALT

Are you aware that a little salt, sprinkled in the pan before putting in the fat, will prevent splashing when frying meat? That salt in the oven under baking tins will prevent their scorching on the bottom? Or that a pudding will cool more quickly if its container is placed in a dish of cold water to which a quantity of salt has been added?

Do you always think to sprinkle a little salt on parsley to make it chop easier and finer? Or, if a boiling egg is cracked, do you remember that a pinch of salt added quickly to the water may prevent the egg from boiling

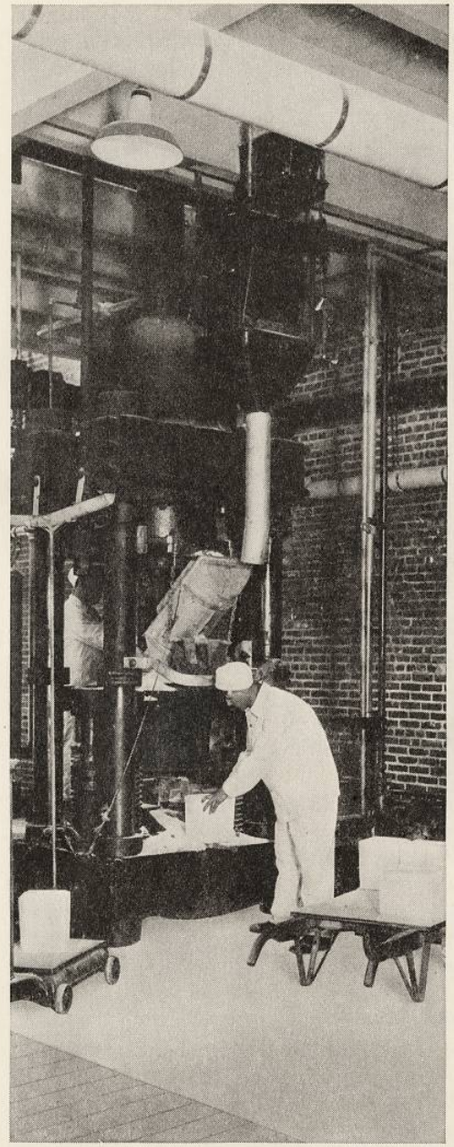


FIG. 20—*One of the powerful presses used for making compressed salt blocks for stock feeding. They exert as much as 1,000 tons pressure!*

out? And do you know that adding a tiny pinch of salt to fresh milk will make it keep much longer?

Butter may be kept hard without ice by setting the dish in which it is contained in cold salt water. To prevent a fish from slipping through the fingers while cleaning it, dip the fingers in salt. Meats will come out whole from nuts which have been soaked in salt water overnight before cracking. And eggs may be kept a long time by packing them in salt.

Sinks and drains can be kept clean from grease and disagreeable odors by pouring hot salt brine through them once a week. To restore to their original whiteness enameled bathtubs and washbowls which have become yellow, wash them with salt and turpentine.

Add a handful of salt to the last water on wash day and the clothes will not stick to the line in frosty weather. If clothespins are boiled in a salt brine before using, they will last longer and will not freeze to the clothes when it is cold. A handful of salt in the rinsing water will keep bluing from streaking clothes in winter. And a little salt in the water when washing colored fabrics will prevent the colors running.

AN ENEMY OF ANTS

An excellent dry cleaner is made by mixing equal parts of salt and cornmeal, moistened well with turpentine. For restoring freshness to a faded rug or carpet, wipe it vigorously with a wet cloth which has been wrung from strong salt water. Ants can be driven out of the house by sprinkling salt wherever they gather. And carpet moths can be eliminated by sifting dry salt over the carpet or rug before cleaning.

If you live in a district not yet reached by gas or electricity, putting a large pinch of salt in the tank of a kerosene lamp will produce a better light. Lamp chimneys should be polished with dry salt after washing to toughen them and prevent their cracking.

Goldfish thrive if a teaspoonful of salt is added to their water once a week. Deep glass vases which have become foul at the bottom can be cleaned by allowing a solution of salt and vinegar to stand in them for a time. Egg stains on silver can be removed by rubbing them with salt and then washing in warm water with a little soap. Matting should always be swept with a broom dipped in strong salt water to make it wear longer and keep it from turning yellow.

But salt does not confine its usefulness to our homes by any means. It is essential in the soap, paper, steel, oil, tanning, mining and textile industries; is used by farmers for feeding stock; is widely employed by packers and fishermen for preserving meat and fish; is consumed in vast quantities by the dairy industry in making butter and cheese, and is an ingredient without which the baker would be forced to shut up shop. Small wonder that more than *eight billion pounds* of this product, enough to fill 200,000 freight cars, are produced in the United States annually.

A MODERN MIRACLE

Yet the most amazing thing of all about salt remains to be told. We have already read how, in olden times, salt was thought to accomplish miracles in healing of the sick. But in this wise twentieth century we no longer believe in miracles, and are inclined to laugh pityingly at the faith which was placed in salt by those living centuries ago.

Nevertheless the medical world now is looking to salt to accomplish a greater miracle than any medicine man or witch doctor ever expected of it in the past. That task is to stamp out one of the most serious dangers which threatens the human race.

The danger referred to is simple goiter, a disorder considered by medical men to be one of the greatest sources, directly or indirectly, of human suffering. It is not the purpose of this little book to discuss simple goiter, except to state that it is among the commonest causes of ill health among children from six to eighteen. In some localities nine out of every ten school children have it, and, as it is not always accompanied by a noticeable enlargement of the neck, it is often very hard to know when it exists.

Knowing that simple goiter is caused by insufficient iodine in the system, it occurred to medical authorities that adding a tiny amount of it to table salt might in time do away with the disease. So they turned to the Morton Salt Company, as leaders in the field, and asked them to produce a table salt containing a trace of tasteless iodine.

This the Morton Salt Company did in 1924, and since that time iodized salt has proved its value beyond the wildest expectations. Said an article in a late issue of the Journal of the American Medical Association: "A recent examination of 50,134 school children who have been taking iodized salt for four years showed a decline in the average prevalence of simple goiter from 42% to 9% and further disclosed the highly significant fact that not one of the thousands of children taking the salt had been harmfully affected by it." And in Detroit, according to the same publication, a city-wide test of iodized salt reduced the prevalence of simple goiter from 36% to 2%.

Morton's Iodized Salt is treated with iodine by automatic machines which make it impossible for it ever to contain too much or too little iodine. These machines are operated under the constant supervision of certified chemists, who also make frequent examinations of the salt in the completely-equipped laboratory which is a part of every Morton plant.

SALT NO LONGER "JUST SALT"

So you see that salt is not "just salt" any more. It is a scientific product, produced by elaborate and costly machinery according to rules of the utmost exactness and having medicinal properties undreamed of in the past. Salt today is as different from the coarse, impure product made by the ancients along the Dead Sea as daylight is from dark. Railroad and street car companies now use far better salt for thawing ice from their tracks than a king's ransom could have secured five hundred years ago!

Never before in history has so much care, thought and money been devoted to the production of table salt as that which attends the making of Morton's Salt, both plain and iodized. However, the fact that it now is the country's largest selling salt proves beyond question that the public appreciates a product made and packaged with such devotion to quality standards.

We hope that you have enjoyed tracing the development of salt from prehistoric times up to the present day, and also that if ever you are in the vicinity of a Morton refinery you will visit it and see the making of salt for yourself.

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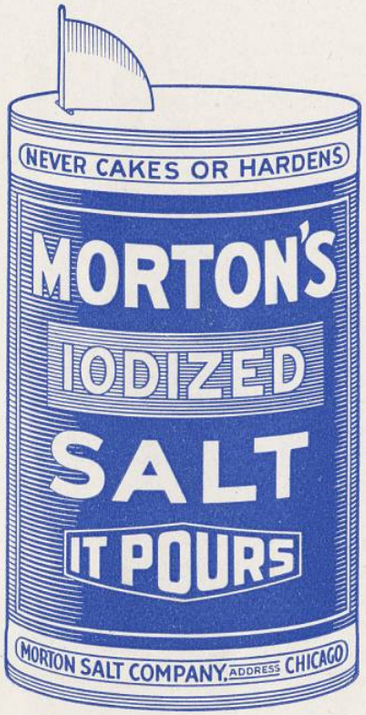

WHEN IT RAINS IT POURS

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