## EFFECT OF ANIMAL EXCRETA IN WATER.

BY PROFESSOR CHARLES F. CHANDLER.

The products of the decomposition of animal matter in water, are the most objectionable impurity. Organic matters, produced by the decomposition of vegetable substances, are not especially dangerous, but the products of decomposing animal substances are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character are often caused by an irruption of sewage into wells, either from a break in the sewer or cesspool, or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease. At a convent in Munich, 31 out of 121 of the inmates were affected with typhoid fever. It was found, upon investigation, that the well was polluted by sewage, and the disease disappeared as soon as the proper repairs were made.

At Pittsfield, Mass., the typhoid fever suddenly broke out in a large boarding school for young ladies. The water was found to be contaminated with sewage owing to a leak in the cesspool.

At Edgewater, on Staten Island, in 1866, the inmates of a small block of houses were afflicted with typhoid fever, several deaths occurring. On making investigation, the health officers found that a neighbor, through whose land the underground drain passed, had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the well, and actually murdering the unfortunate victims with sewer poison.

Dr. Stephen Smith, one of the health commissioners of this city, describes an interesting case that came to his knowledge. He visited an old schoolmate, a clergyman, in the country, and in the course of conversation his friend told him of a family in which typhoid fever had made its appearance, five members having already died, while another was then fatally sick. The physician called the attention of his friend to the fact that typhoid fever is now attributed to the poisoning of the water by animal refuse. This was new to his friend, the clergyman, who had not thought of attributing it to anything else than to the visitation of Providence. They went together to visit the locality, and found the house situated on an elevation, with all its surroundings admirably arranged for health. One readily believed the statement that there had not been a case of sickness in the house for twelve years. A few weeks before the fever appeared, when the laborers on the farm were busy taking in the crops, one of the valves of the pump got out of order. Being unable to get their usual supply of water, and being too busy to send for the pump maker, they sent a man down to a neighboring spring to draw water, who, finding that it was not easy to dip the water from the spring, owing to the shallowness of the pool, drew his supply from a brook near by. From this source the family was supplied for two or three weeks. This stream, higher up, ran through several farm yards and received the surface drainage. The first symptoms of poison by this water were a slight nausea and mild diarrhœa; after several days, typhoid fever in its worst form was ushered in. Of the entire family, but two escaped an attack, and they did not use the water.

This city, during the last century, and before the introduction of sewers or the Croton water, was ravaged every few years by deadly epidemics, which are now believed to have been favored and invited by the defilement of the wells then in use, by sewage and fæcal soakage. No such visitation has occurred since the introduction of the Croton water, and the completion of the very perfect system of sewers.

Cholera, though it does not originate from polluted water, is disseminated chiefly by the aid of wells and other impure water supplies.

At Exeter, England, in 1832, 1,000 deaths occurred from cholera. A purer supply of water was then introduced from a locality two miles higher up the river, above the point at which it received the sewage of the town. When the cholera again invaded the city in 1849, only forty-four cases occurred, and in the cholera season of 1854, there was hardly a case.

In London, in 1854, the water supplied by the Southwark Company contained much sewage, while that supplied by the Lambeth Company was very pure. Both companies had pipes in the same streets, supplying water indiscriminately on both sides. Among those who used the Southwark water, the deaths amounted to 130 in 10,000, while among those who drank the Lambeth water, they amounted to only thirty-seven in 10,000; 2,500 persons were destroyed by the Southwark water in one season. On the previous visitation of 1848–9, the case was the reverse. The deaths from the Lambeth amounted to 125, while those from the Southwark amounted to 118 in 10,000. At that time, the Lambeth company took their water from a point lower down the river.

Another very striking instance occurred in London. The famous Broad street pump supplied water in one of the most fashionable localities of the West end. During the visitation of 1848-9, this pump killed 500 persons in a single week, by disseminating cholera. The wealthy people of the west end went to Brompton, a fashionable summer resort, about five miles up the Thames, and soon the cholera broke out among them there. The health officers soon discovered, on investigation, that these people had been in the habit of sending to the Broad street pump for tea water, and had brought the cholera with it. A curious case was that of an old spinster who had moved to Hampstead, three miles from the pump, but who sent her maid daily, for a kettle of the highly prized tea water. She and her maid were the only persons who suffered from cholera at Hampstead.

A similar story might be told of an outbreak of cholera in a shanty village, west of Central Park, and another in a shanty village on the hights across the river. In both cases, it was clearly shown that the cholera germs were distributed among the unfortunate squatters by the waters of the single well in each village. There is a famous pump in the twelfth ward of Brooklyn, at the corner of Van Brunt street, from which over fifty families obtained their water supply. In 1866, cholera broke out in five or six of these families, but the spread of the disease was prevented by the prompt action of the health officer, who removed the pump handle.

From these facts, it is seen that water aids in disseminating two of the most fatal diseases which affect the human race, the typhoid fever and the deadly cholera. During the ten years from 1856 to 1866, there were 21,000 deaths from cholera in England and Wales, and 150,000 deaths from typhoid fever. There is every reason to believe that at least three fourths of these deaths might have been prevented had proper attention been paid to the purity of the water supply. This poisoning by bad water is now fully established, and must awaken communities to the vital importance of securing a pure and unfailing supply of this indispensable beverage.

In Iceland, it is stated that one sixth of the deaths are caused by hydatids in the liver. These are the larval forms of the tænia or tapeworm of the dog. Young leeches, contained in drinking water, sometimes fix themselves on the pharynx. In a march of the French in Algiers, 400 men were in the hospital at one time from this cause.—*American Chemist.*

## ASBESTOS PISTON ROD PACKING.

[From the Engineer.]

Few engineers who have to do with the steam engine are ignorant of the trouble which is met with in obtaining a really good piston rod packing. Sound hemp, properly "laid up" and copiously lubricated, makes a tight joint enough for a time, especially if the rod is in first rate condition; but the period of tightness is usually short, and the gland requires constant screwing up, and much friction results, which is very prejudicial in small engines. If hemp is bad in the case of low pressure engines, it is infinitely worse when we have to do with high steam, especially if the steam is slightly superheated. A process of slow carbonisation appears to go on, the hemp packing loses its elasticity, and becomes nearly useless for its intended purpose. All manner of schemes have been tried to get over the difficulty; combinations of cotton, india rubber, and wire gauze, such, for example, as Crickmer's patent packing, have hitherto given on the whole the best results. One inventor, indeed, dispenses altogether with cotton and rubber, and uses copper wire gauze alone. In this case, the tightness of the joint is no doubt secured by the presence of water and oil lodged in the meshes of the gauze; and we have received very favorable reports from those who have tried this packing. It is still certain that something, better than anything hitherto in use, is required, and we have a strong belief that this something is supplied by asbestos.

Asbestos is a mineral fiber consisting of silicate of magnesia, silicate of lime, and protoxide of iron and manganese. In mineralogical parlance, it is a fibrous variety of actinolite or tremolite. It exists in vast quantities in the United States, also in the Tyrol, Hungary, Corsica, Greenland, Wales, Cornwall, Banffshire, and in the north and east of Ireland. It is found under various forms, from that of soft silky fibres to that of a hard block capable of taking a polish. As a rule, the lumps or blocks taken from the vein are easily broken up and separated into fibers extremely flexible, elastic in the sense that each fiber admits of great extension in the direction of its length without contracting again, greasy to the touch, and very strong. The fibers vary in length from a couple of inches to about two feet. They can easily be spun or woven if proper precautions are used. Furthermore, asbestos is an admirable non-conductor of caloric, and is practically indestructible by heat. All these conditions are just those which are required in a material for piston rod packing; and it is therefore somewhat strange that, until a very recent period, no one thought of utilising asbestos for this purpose. The credit of suggesting it as a piston rod packing is due, we believe, to Mr. St. John Vincent Day, C.E., who on the 5th inst. read a very interesting paper, on "Asbestos, with special reference to its use as steam engine packing," before the Institution of Engineers and Shipbuilders in Scotland. The new packing, we learn from this paper, was first used in America with much success, and it has since been tested in this country with results of which we shall speak in a moment. In referring to the value of the new packing, Mr. Day said: "The packing used for piston and valve rods or spindles has, as we all know, three prime elements of destruction to contend with, namely, an elevated temperature, friction, and moisture; and one of them only, namely, friction, has any appreciable effect on asbestos packing when the mineral is pure and properly prepared. No matter how high the temperature of the steam, how rapid the stroke of the piston, or how great the pressure of the steam, the packing seems to be unaffected by those conditions. In America, where the new packing was first used, some of it was taken from the piston rod stuffing box of a locomotive engine, after having been in, and the engines at constant work, for three months, with steam at 130 lb. pressure per square inch, and making an average daily run of 100 miles, including Sundays; and, as you can see by the sample shown, the fiber, with the exception of being discolored by oil and iron, is just as flexible and tenacious as originally. After having been once disintegrated, it appears impossible to so pack or mat the fibers together that they are not easily separable by the fingers."

Asbestos packing was first used in Great Britain by Mr. Benjamin Conner, locomotive superintendent of the Caledonian Railway, and Mr. Day exhibited to the members of the Institution the packing of a locomotive stuffing box which had been used on that line from the 27th of July to the 18th of November, 1871. The engine in which it was used has outside cylinders, and single drivers 8 feet in diameter. The piston stroke is 2 feet. The engine was employed in working the fastest train on the Caledonian line: to wit, the 10 A. M. express from Glasgow, reaching Carlisle at 1 P. M., with three stops on the journey. The best ordinary packing lasts, under these conditions, two months at most, rarely so long, and the gland requires constant screwing up. The asbestos packing was apparently as good as when it was put in, and the engine had run a distance of 2,000 miles in three weeks, during which the gland screws had never been touched. The following letter from Mr. Conner to Mr. Day contains valuable testimony to the excellence of the packing:—

"The box herewith contains the asbestos packing put into a piston rod stuffing box of one of our main line service passenger engines on 27th July, and taken out on 18th November; in that time the engine had run 14,070 miles.

As the packing was put in coiled instead of being cut into rings, the gland was nearly home on 12th September, and an additional ring was put in at that date."

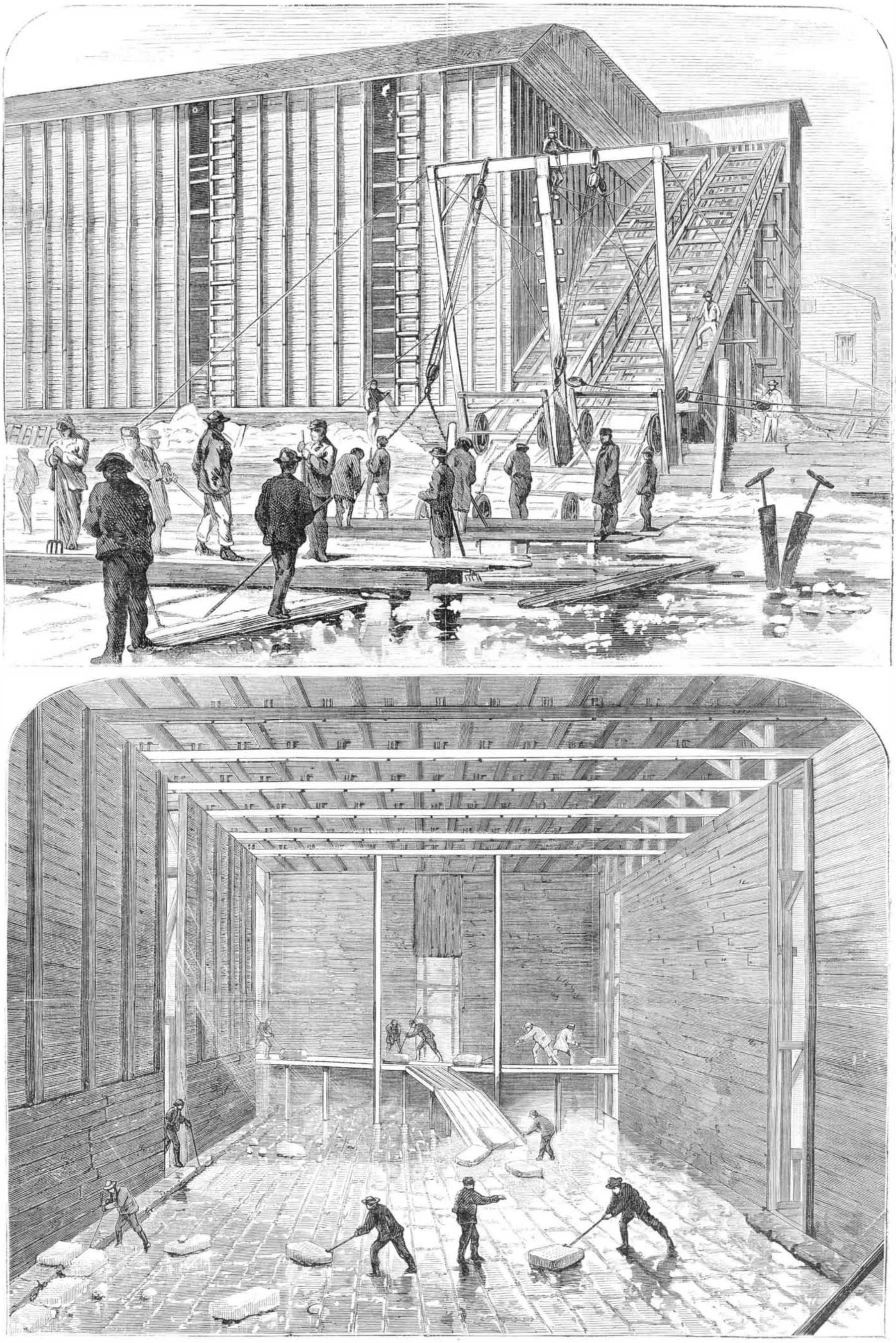
In the course of the discussion Mr. Conner stated that: "The advantage of the asbestos packing over the soapstone packing was that, with the latter, at the high temperatures of steam from 125 lbs. to 130 lbs., the lower portion of the packing got thoroughly charred, and another ring had to be put in after the first week; so that in course of a month the packing had almost entirely changed. The asbestos packing, being practically incombustible, did not waste; and I suggest that the covering of the packing should be made of incombustible material also. At first I had applied it coiled round the piston rod continuously; but I think it should be applied in rings. The inside of the packing seemed to me as fresh as when first put in. I believe it takes less oil to lubricate the piston rod, for the oil remained on the rod, not being absorbed by the packing. It kept the rod beautifully polished, more so than any other packing."

We think that with such testimony as this before us, supported further by that of Mr. David Rowan, who spoke to the value of asbestos packing for marine engines, we are fully justified in holding the belief that this mineral will supply a way out of one of the most troublesome obstacles to the use of very high pressure steam. There is, furthermore, not the slightest chance of the supply being exhausted; on the contrary, it is likely to last as long as our coal fields. We are unable to say at present what the price of the asbestos packing is, or where it can be obtained. It is probable, however, that when once the value of the material as a packing is recognised, its regular manufacture in this country will follow.

### Action of Heat on Germ Life.

Dr. Crace Calvert, in a paper "on the action of heat on protoplasmic life dried on in cotton fabrics," published in the London *Chemical News*, relates a series of experiments which have a direct bearing on the question of the disinfection of fabrics and wearing apparel by exposure in heated stoves with the object of destroying contagion or animalcule life. To carry out these views, a piece of ordinary gray calico was treated chemically, and washed until free from any sizing material, and dried; this prepared cloth was then steeped in a solution of putrid albumen, containing abundance of animalcule life, wrung out, and dried at the natural temperature; it was then cut into small pieces five centimeters square. Each of the pieces was rolled up and introduced into a strong glass tube which was hermetically sealed. Some of these were exposed to temperatures raised successively to 100°, 200°, 300°, 400°, 500°, and 600°F. Other pieces were placed in pure distilled water, and another series of pieces were placed in tubes containing an albumen solution, each being successively subjected to temperatures varying from 100° to 600° F. In all cases it was found that, at 300° F. vibrios were present in small numbers, while in the water series bacteria were also detected. At 400° F., no evidence of life was found. In order to ascertain what changes the calico had undergone, one of each of the small tubes which had been heated to the different temperatures was broken, and its contents carefully examined. The pieces heated to 200° were quite sound; that heated to 300° was of a slightly brown color, much injured, and for practical purposes completely spoiled. At 400°, the cloth was very much charred. These results show that the temperature which will not destroy germ life is quite sufficient to materially injure cotton fabric; hence, it is concluded that no beneficial results can be obtained by the employment of public stoves as a means of destroying germ life and contagion.

THE total annual circulation of newspapers printed in the State of New York is 492,770,868 copies, being more than twice the number issued in any other state. The next greatest number of issues is in Pennsylvania, where 233,380,532 copies are annually printed. Massachusetts prints 107,691,952 copies, Illinois, 102,686,204, Ohio, 93,592,448. Next comes California with 45,869,408 newspaper sheets per annum.



ICE HARVESTING ON THE HUDSON