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MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

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Dated 25.9.1875 196 .

Not to be folded or roughly handled

1414

Proceedings of the Madras Government, Revenue Department,
25th September 1875.

No. 228. Read the following Proceedings of the Board of Revenue, dated 30th June 1875, No. 1,804 :—

Read the following letter from Surgeon J. J. L. RATTON, M.D., Madras Army, to C. A. GALTON, Esq., Acting Sub-Secretary to the Board of Revenue, dated Madras, 4th March 1875.

I HAVE the honor to inform you that, pursuant to instructions contained in the Proceedings of the Madras Government, Revenue Department, dated 30th October 1874, received by me on the 28th December I went to the India Office on the 31st December to make inquiries, and applied also, by letter on the same date, to the Under-Secretary of State for India for the credentials to enable me to visit with facility the salt manufactories in the south of France.

2. I found on inquiry at the India Office that no previous intimation had been received there on the subject of my visit, and that it would take more than a week to obtain the necessary credentials from France. Under the circumstances, although my privilege leave would not expire until the 31st of January, and although in any case the time of my departure had not yet arrived, I determined to proceed at once to the south of France, and commence work either with or without the credentials as best I could. The brief interval at my disposal to visit the salt-pans and travel to India before the 28th February seemed to me to necessitate prompt action. I left London, therefore, on the morning of the 3rd January, and making inquiries by the way, reached Montpellier, the headquarters of the salt manufacturing industry on the Mediterranean Coast, on the 7th of January. Soon after my arrival, I applied personally to M. Mion, Representative of the *Compagnie des Salins du Midi Société Anonyme*, proprietors of the most extensive and best conducted of the salt concerns on the south coast of France, and from him learnt as follows :—

3. The French Government do not make their own or any salt. There are a large number of salt manufactories on the Mediterranean Coast, and yet a larger number of small ones on the Biscayen Coast, possessed by individuals or by companies as private property. These make as much salt as they can without restriction or interference on the part of Government, but, for every ton of salt they sell in France, they have to pay the Government a *droit* or tax of one hundred francs. To ensure the due collection of the tax, Government requires that the salt-pans be arranged and the salt stored in a manner to enable the Customs officers effectually to guard against smuggling and fraud. The Government itself maintains a guard of *Douaniers* at the pans, whose duty it is, as in India, to prevent contraband and to weigh or assist at the weighing of all salt delivered for home or inland consumption and observe the amount. The tax is collected accordingly. It is interesting to note that these Customs officials are chosen from the Army, that none but soldiers who have received a good conduct badge are eligible, and that the rate of pay in the Customs Department is higher than in the Army. No tax is levied on export salt.

4. Having ascertained that the French Government had nothing to do with the actual conduct of salt manufacture in France, I commenced my inquiries at once, without hesitation, without the credentials. I represented the matter to M. Mion, to whose great courtesy I here very thankfully testify my indebtedness, and was told by him, in reply, that he would do everything in his power to facilitate my work. In

fact, a day was appointed for visiting the salt-works of Le Perrier and Aigues Mortes, adjoining manufactories situated abou[illegible]wo hours' railway journey from Montpellier, and on the 11th of January, as agreed on, accompanied by M. Mion, junior, from the office, M. Alfred Gervais, Chief Inspecting Engineer, and M. Espinaski, Engineer in charge of the works, I went down to Aigues Mortes. I must here return my best thanks to these gentlemen for their undeviating kindness and solicitous attention to afford me every information during the two days, the greater part of which they were good enough to spend with me plodding through the salt-pans.

5. Before alluding further to Aigues Mortes, I will sketch the arrangement of this report. First, I may mention that I had no difficulty whatever in visiting the French salt-works, except the difficulty of finding them out and getting at them in out-of-the-way localities. M. Mion very kindly gave me letters of recommendation to the agents in charge of the other important stations belonging to his Company, and at those salt-works belonging to private individuals that I visited, I encountered always the most obliging civility. I will first name the salt-works that I visited with dates and a few brief remarks concerning their position and importance, without describing them in detail, as they are so much alike that their several descriptions would be neither useful nor interesting. Then I will describe the French system of salt manufacture as a whole. Afterwards, I will take up each part of the manufacturing arrangements and examine, in detail, into its uses, construction, &c. Finally, I will compare the French system with ours, and suggest such improvements in our method as the comparison may seem to indicate.

6. The adjoining salt-works of Le Perrier and Peccais, the latter commonly called Aigues Mortes, are situated close by the Mediterranean, at the southern edge of the Department Gard; they were visited by me on the 11th and 12th of January. Both of these works are situated on a sandy portion of the Mediterranean shore, which is lower than the sea-level on an average by eighteen inches. They are surrounded by embankments, about six feet in height, both to protect them from the not infrequent risings of the Rhone and from the sea; for although the sea is tideless, its water-level often mounts two feet or more on this coast during the prevalence of westerly and southerly gales. The extent of embank[illegible]ment may be inferred from the fact that Le Perrier occupies a surface of 293 acres, and that the Aigues Mortes salt-works extend uninterruptedly over a belt of ground ten miles long by four broad on the average. Sea-water, which here on the Mediterranean Coast has a density equal to 3·5° Beaumé, is brought to the pans in a large navigable canal nine feet in depth at the works, and usually about twelve feet deep on the bar. Its depth varies; but it is not liable to be blocked up with sand or flooded with fresh water. The same canal where it enters the works is furnished with a lock, the top of which is flush with the embankments partly to regulate the admission of water and partly to keep out floods. Subsoil brine marking 12° Beaumé is found abundantly at about three feet from the surface, but is not made use of in salt manufacture. Fresh water for the use of the work-people, &c., is obtained at a depth of 150 feet and brought to the surface by means of Artesian wells. It was ascertained, when sinking these wells, that the soil on which the pans rest is pure sand to a depth of forty [illegible] About fifty Customs officials at ten different points or stations patrol and [illegible] these works. They are the most important salt-works in the south of France.

7. On the 16th of January, I visited the salt-pans of Le Berre about fifty miles north-east of Marseilles in the Departme[illegible]t Bouches-du-Rhone. These works are situated on a sandy promontory on the north or mainland side of the Etang-du-Berre. The Etang-du-Berre is an enormous shallow estuary, occupying a surface of 143 square miles, formed by two mountain ranges which run out from the mainland about twenty miles, inclining towards each other in their course, so as to form a semi-circular sea-basin girt in by hills; the hills do not meet, however, but leave an opening or sea-gate between them, so small as to be invisible from the shore. Numerous streams and rivers, the mouths of the Rhone, discharge into this estuary; its outlet being small as described, it follows that the water must be weak; in fact, it never exceeds 2° Beaumé in strength. The works are at a lower level than the sea; they are surrounded by embankments to prevent inundation, and water flows into them naturally from the lake through canals provided with sluice-gates. There are a great number of salt manufactories round the lake, of which those called Le Berre are the most extensive. They are five miles long by about three miles broad, and are probably the most important works in Provence; the Manager who showed me round these pans obtained a Silver Medal for salt at the Paris Exhibition of 1856. He gave me some specimens of the identical salt which gained the prize, which I have much pleasure in forwarding to the Board. It is hard, firm, heavy, dry, translucent, and rings with a metallic sound.

8. On the 19th of January, I visited the salt-works known as Les Vieux Salins d'Hyères, belonging to the Compagnie du Midi in the Department Var. These works are seven or eight miles in circumference, and are about the largest in the department. As usual, they are on sandy soil below the sea-level, and surrounded by protecting embankments. The embankments are raised to keep out sea incursions, no fresh water inundations being to be feared here as in the neighbourhood of the Rhone. Sea-water, averaging 3·5° Beaumé in density, flows naturally to the pans through canals cut from the sea at different points. A navigable canal traverses the works; there is good anchorage for shipping in the near vicinity, and they enjoy perhaps the largest share of the salt export trade in the province.

9. On the 21st of January, I visited the Salins des Pecheurs or Salins Neuf; Compagnie de M. Girard, on the Toulon or west side of the last station and about seven miles from Toulon. This is also an extensive and important salt manufactory chiefly engaged in the export trade. I had cause to admire here the extent and completeness of the mechanical arrangements for facilitating salt transport and storage, the position of the crystallising beds with reference to the platforms, the construction of the latter, the use of tramways, piers, &c. When describing these parts of the French system, I will keep the Salins Neuf before me as a model. In other respects these pans do not differ in any way from those last mentioned.

10. On the 26th January, I visited the salt-pans of Martigues, Bouches-du-Rhone, about two hours' railway journey from Marseilles. There are numerous salt-works scattered round Martigues on the borders of creeks running towards the Etang-du-Berre. They are comparatively small and possess no features of special interest. That one which I examined most attentively belonged to M. Joseph Dol. It resembles in all respects those already noticed.

11. On the 27th of January, in consequence of information I received from a salt trader at Marseilles, I visited the salt-pans of Le Fos rather inaccessibly situated on the sea or outer edge of the eastern chain of hills enclosing the Etang-du-Berre. I was informed that the best salt obtainable in France was made there. When I arrived, I found workmen busily employed in removing a thick incrustation of Calcic Sulphate from the condenser's floors, preparatory to commencing manufacture. The Manager, who accompanied me, kindly presented me with a fragment of the crystalline Gypsum so removed. He also gave me a specimen of salt manufactured the previous year. These specimens are herewith forwarded to the Board. I could discover no reason why salt should be made better here than elsewhere, unless it be owing to the fact, which I noticed, that there is less sand and more clay in the soil here than at the other stations I visited. This is the last station that I had time to visit, as I left Marseilles for Madras on the 31st of January. At no station had I an opportunity of seeing manufacturing operations actually in progress.

12. A French Saline, such as I have seen it and heard it described, consists essentially of a large tract of waste shore-land, fifteen to twenty square miles in area, at a lower level than the neighbouring sea, protected from inundation and cultivated for salt. The salt-pans are divided into *Partie Exterieur, Partie Interieur, Avant Pieces, Tables Salant*, and Reservoirs, which I will call for the future in this report, outer condensers, inner condensers, finishing condensers, crystallising or salt-beds and reservoirs, respectively. There are also platforms, &c., which need not be noticed as yet. The condensers and reservoirs occupy 78 per cent. of the evaporating surface, the salt-bed, the remaining 22 per cent. A canal brings brine from the sea or estuary, as the case may be, to the works, and first to the outer condensers, into which it flows naturally as they are at a lower level than the sea. At the commencement of manufacture brine is retained, spread out in a thin sheet in the first system of condensers for seven or eight days, until it reaches 8° Beaumé in strength. It is then passed into the inner condensers, generally also by natural gravitation. Here the brine, still spread out shallowly, is allowed to evaporate until it reaches about 18° Beaumé. Then it is pumped up to the finishing condensers, and is passed slowly from one to another of these until it reaches the salt-beds, its passage being so regulated that it shall mark 25° Beaumé by that time. These preliminaries take about fifteen days. The brine from the finishing condensers is allowed to gravitate into the salt-beds, which are filled to a depth of about ten inches and replenished from time to time during salt formation with additional brine, so as to secure that its strength shall not at any time exceed 29° Beaumé. This continues until a bed of salt about two inches in thickness has formed, when the bitterns are drawn off for the supply of some less advanced bed and the salt is collected by means of wooden shovels in the dry state. The whole duration of manufacture from first to last is about five months, that is, from April to August or September. The time allowed for salt crystallisation on the beds is three months.

13. The condensers are not arranged in concentric circles surrounding the salt-beds, nor in regular progression towards them, as might perhaps be supposed from their names and the foregoing description. Such an arrangement is seldom or never practicable without going to great expense. Simply natural undulations of ground are made use of in salt manufacture in the best way that their circumstances will allow. A site possessing the requisite qualifications having been selected, a large portion of it and that at the highest level is apportioned off to the outer condensers. As all alluvial deposits or silted sands have a slope in one direction or another, and the outer condensers extend over two or three linear miles of ground, the whole of the tract that they comprise is never at the same level. They are divided, therefore, by cross bunds into communicating compartments, and sea-water is admitted first into that which is at the highest level, and from thence flows to the lowest. If the conformation or slope of the ground will allow of it, as it often does, the inner condensers, which also occupy a large tract of ground, begin where the outer end. They are also divided into compartments through which the brine flows from the highest to the lowest. Arrived at the lowest inner condenser after winding about from the sea, from one compartment to another, a long sinuous tract in which every variation in level has been taken advantage of, the brine has usually reached the lowest level in the whole Saline or salt-work. From here, then, it is pumped up to the first compartment of the smaller system of finishing condensers, probably at the same level or at a higher level than the first outer condenser, from whence it gravitates to the last compartment, and so on to the salt-beds which are on a slope, so that the brine can flow from one to another from first to last, or, by means of a channel, can pass by nearer beds and fill those further off. From this description it will be seen that I cannot furnish a diagram or drawing of the arrangement of parts at a French salt-work as they are not uniform. Sometimes the brine has to be pumped up from the last outer to the first inner condenser, and sometimes, though not so often, as these two parts together occupy a comparatively small space, from the last finishing condenser to the first salt-bed.

14. The floors of the condensers are not prepared in any way, and after manufacturing operations have been once fairly started the flow of brine through their compartments is not much looked after, as the sluices being left open just manage to supply daily the amount of brine removed by evaporation, so that uniformity is maintained without trouble. This can be arranged by a simple calculation. The brine that is left in the finishing condensers at the end of the season called *virgin* brine, and I suppose also the strong brine in the last few inner condenser compartments is pumped off to reservoirs at a high level, where it remains stored to a depth of three feet throughout the winter and until the commencement of the next manufacturing season, when it is, according to its strength, transferred to the inner condensers, finishing condensers, or salt-beds. At the salt stations I visited in January, this brine varied from 15° to 22° Beaumé in strength. At the end of the season, the mother-liquors are got rid of by being drained off or pumped out to sea according to the level of the salt-beds. There is not that amount of mother-liquor to get rid of that might be supposed from the fact that brine is not ordinarily evaporated beyond 29° Beaumé, as it is customary to make a certain amount of a comparatively inferior description of salt, in separate tables, from "used brine" at 29° Beaumé. This salt formed between 29° and 32° Beaumé is in great demand for fish-curing and for the manufacture of soda, and is sold exclusively for those purposes.

15. One square yard of crystallising surface at an average salt station yields 110 lbs. of salt in thirty days, but this must not be confounded with the mean produce of the salt-works per square yard. A cubic yard of the salt is said to weigh 168 lbs.

Proceedings of the Madras Government, Revenue Department,
25th September 1875.

1414
13

The salt when collected is stored on raised platforms as in India, and stacked in heaps of from 500 to 2,000 tons each, covered usually with tiles. The cost of manufacture is nearer five than six francs a-ton, and that includes everything to the completion of the heap, its covering, and maintenance of establishment. There is a permanent establishment of about 100 men and 60 mules at Aigues Mortes. The platforms are flanked by tramways or canals; when salt is sold a heap is broken up, and the salt, tied up in sacks, is put on board boats or removed in waggons. I will recur to the weighing process afterwards.

16. *Embankments.*—The embankments surrounding the works at Aigues Mortes, Bouches-du-Rhone, are about six feet high, twenty-five yards across the base, and have six feet of pathway on top. At other stations the embankments are of less dimensions according to their wants. All were, when I examined them, covered with vegetation, although originally formed with sand, and this because clay had been brought and placed upon them; brushwood, &c., planted and encouraged to grow, turf engrafted, and every care taken to put and preserve them in good order.

17. *Canals.*—There are commonly two or three supply-canals cut from the sea at different points to bring brine to the outer condensers, of which again there may be more than one set according to the local conformation of the ground. One canal, at all events larger and deeper than the others, is navigable, and is so arranged as to facilitate locomotion and the transport of salt. These canals have their opening sometimes blocked up with sand, sea-weed, &c., by the wind and waves as in India, but their maintenance is carefully attended to. They are provided with sluice-gates both to keep out the sea and floating debris, and are staked along their sides to keep the sand from falling in. Brushwood, reeds, &c., of a suitable kind are planted along their slopes to consolidate and preserve them. Boats are towed in the canals by mules, for whose use a tow-path is constructed at one side, and bridges are placed at different points of the canal to enable workmen, carts, mules, &c., to cross. These bridges are simply flat-bottomed boats, boarded over, and tied at each end with cords to a slightly projecting pier or staging, so that when one set of cords is let go the bridge swings to the opposite side, the side to which it is attached giving free passage to boats coming along the canal.

18. *Channels.*—From the main supplying canal, numerous channels branch off in every direction running along the sides of the different systems of condensers and of the salt-beds, crossing each other frequently, sometimes by means of wooden aqueducts of the ordinary kind, sometimes by means of what are locally termed syphons according as they may be at the same or at different levels. A syphon here means an underground wooden aqueduct, and is used when two channels at the same level meet at an angle, so that one may dip under the other and come to the surface again. These channels communicate with the condensers, &c., which at different points they can either supply or drain by means of wooden sluice-gates; they communicate with each other and with the main canal in the same way, and all have a *rendezvous* at the pumping station which is the centre of operations for the whole salt-work. By means of these channels and a pump hereafter to be described, the Manager can pump any one of the brine receptacles, by whatever name called dry, or pump it full again with sea-water or brine from any part of the works without touching or interfering with any other part, save the two for the time being placed in communication. This

Proceedings of the Madras Government, Revenue Department,
25th September 1875.

1414
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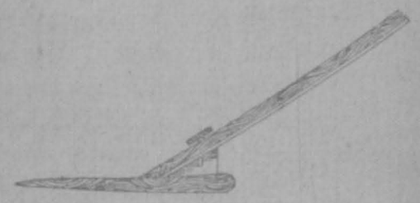
is not a theoretical advantage; it is one of great practical utility, and is constantly made use of. At important points,—wherever, in fact, it is necessary,—the sluice-gates are set in masonry frames. Sometimes also where two channels at the same level meet at a right angle, their point of intersection is made a waterway common to both by means of four sluice-gates,—a pair to each channel, one pair being closed, the other channel possesses the way and *vice versa;* but this arrangement is not practicable where both channels are important and in constant use.

19. *Condensers.*—The condensers,—outer, inner, and finishing,—have their sides staked and planted with brushwood to preserve them. They are but shallow sandy basins, and the brine stored in them seldom exceeds an average depth of three inches. The mean level of their floors is about eighteen inches below sea-level, but they seldom approach nearer to the sea than 100 yards, and extend away from it for miles. As before stated, their floors are not prepared in any way, and I think they must leak a good deal. The Engineers say there can be no great leakage, because brine 12° Beaumé in density is found below the surface. Now it is a fact that brines of different densities being of different weights will rest one upon another, and though transfusion or dialysis takes place, this is so slow a process as to be scarcely worth considering where the top layer of brine is constantly on the move. On the other hand, subsoil brine is not found immediately in contact with the condenser floors, but in the sand from one to three feet deeper, so that brine leaking into the stratum between the two must be removed, to a certain extent, by lateral drainage and ultimately lost, or effused into intersecting channels as may chance to be the case. And, again, the subsoil brine would, in any case, only protect the outer condensers from leakage. It would not protect those condensers containing brine at above 13° Beaumé, for, as the brine increases in density and in weight, it would penetrate more readily through the sand, and sink unimpeded through the subsoil brine.

20. *Salt-beds.*—The position of the salt-beds in the works and their precise arrangement is not, for obvious reasons, uniform throughout the different stations, but they are always either clustered together in parallel rows and surrounded by platforms and tramways or canals, or they run in a long line along the borders of the navigable canal, separated from it by a platform. Each salt-bed is usually about 80 yards long by 40 yards broad. In the first instance, the beds are levelled with great care. At some places, overlooking the sea, an ingenious method of levelling is practised, which might be of use in India. It is based on the assumption that a line drawn from the horizon at sea to the level of the eye of a man stooping is horizontal, and it is so practically for the purpose of levelling a large salt-bed. Two sticks are cut four feet in length, and their ends planed at right angles to their length. When these two sticks provided with plumb lines are held vertically, one by the observer, and the other by his assistant a few yards nearer the sea and in the line of sight looking towards the horizon, if the observer looks over the upper edge of his stick at the horizon, the upper edge of the other stick will be just tangent to his line of vision, if the two sticks are on level ground. If the assistant's stick obstruct the view, it is on higher ground, and the portion of stick between its upper edge and the point where the horizon cuts across it, is a measure of the difference of level. If the assistant's stick is not tangent to the line of vision but below it, the observer is on higher ground, and he can measure the difference of level on his own stick by lowering

his eye down along its side until the point is reached where his eye, the top of assistant's stick, and the horizon are in one line. The work-people fancy that this is as good a way of levelling the salt-beds as any, and it is admitted on all hands to be the quickest and simplest way of doing it. Besides being levelled, the floors of the salt-beds are well hardened by being trampled under foot by mules and are rolled with stone-rollers drawn by two men, at the beginning of each season. Strange to say they are not clayed, though brine at from 25° to 29° Beaumé must, I think, escape, to some extent, through a sand flooring, however well compressed. It is said that the larger and deeper these tables are, the better will be the salt. As a rule, they are from twelve to fifteen inches deep, and are boarded round the sides to keep the paths from falling in. Wooden sluice-gates at intervals give ingress and egress to the brine.

21. *Salt Collecting.*—When a cake of salt about two inches in thickness has formed, the mother liquors are drained off from that bed, and the salt is collected in the dry state. The hardness of the floor allows of this being done without soiling the salt. A wooden shovel sometimes tipped with tin is used for this purpose. (See diagram). It is pushed under the salt, which is lifted up and heaped on one side in small mounds as clay might be, and left there to drain for eight or ten days. This is done by skilled laborers on the permanent establishment of the works. Afterwards, the salt is carried to the platforms and heaped by contract, as this part of the work being almost purely mechanical, there is no fear of injury being done through inferior or scamped work. Salt is removed from the pans to the heaps in wheel-barrows. Formerly, it was taken away in baskets as in India, but from experiments that have been lately made, it is found that barrows remove it quicker and more cheaply. Boards are laid down from the salt-mounds to the platforms to enable the barrows to travel with greater facility.



22. *Platforms.*—The platforms are long narrow raised causeways from five to six feet high, and about ten yards broad on top, flanking the salt-beds on one side and flanked by a navigable canal on the other. Some of them have a tiled flooring at the places marked out for salt-heaps, others are boarded, and others again are merely gravelled and rolled hard. On some the position of the salt-heap is indicated by a low stone-wall forming a three-sided enclosure, on others the same thing is indicated by a similar arrangement of boards. Finally, many of them are traversed by a tramway.

23. *Salt Storage.*—The great bulk of the salt made at the pans is stored in the masonry or wooden frames open at one end, mentioned in last paragraph, within which the salt is heaped up so as to exactly resemble, when covered, a long low-tiled cottage with gable ends. Formerly, reeds, rushes, and straw were used for covering the salt, but now they are discarded everywhere in favor of tiles, and the wastage which was formerly about 10 per cent. has been reduced almost to nothing, besides the tiles keep the salt much cleaner. So cleanly is the salt removed from the pans and preserved on the platforms that it is taken at once from the heaps and ground

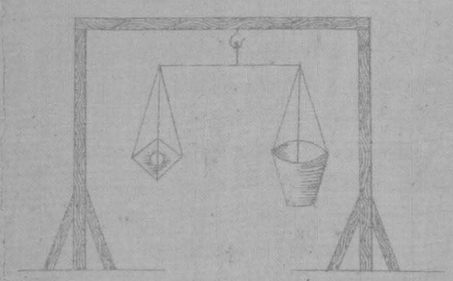
Proceedings of the Madras Government, Revenue Department,
25th September 1875.

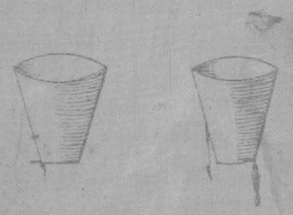
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down in mills, of which there are always one or two at each station, for table use, without further preparation. The tiles are two feet long by one foot broad, and are bent or curved at right angles to their length. They weigh 7 kilogrammes or 15·4 lbs. English, and cost 90 francs a thousand or less than a penny, and not much more than half an Anna a piece. The number of tiles required is easily ascertained by calculation when the superficies to be covered is known. Table salt ready ground for use is stored in godowns adjoining the mills. Salt for fish-curing and for the manufacture of soda is heaped coverless on the platforms.

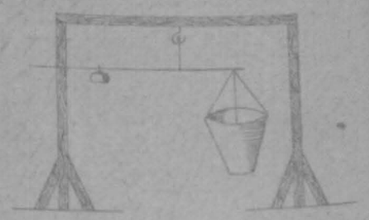
24. *Salt.*—The salt-heaps that I examined were composed of salt very similar in appearance to that of Merkanum. A large number of firm lumps of salt made up of intercalated crystals scattered through the smaller debris of salt-cakes, but, on the other hand, the crystals were in every instance larger, firmer, cleaner, more translucent and dryer than those made in India. This salt is said to bear carriage with very little alteration or wastage. The table salt stored in the godown was perfectly white, dry, and finely ground, such salt, in fact, as one is accustomed to see on an English table.

25. *Weighment.*—When salt is going to be sold, a heap or as much of one as is wanted is untiled and attacked with picks and shovels at the open face of the enclosure and broken upright through, or as far as may be required. The weighing machine is as shown in the annexed diagram. Two uprights support a beam, from which depends a pair of scales; in one scale is placed a weight of 100 kilogrammes or 220 lbs. English; the other, funnel-shaped, holds the salt, and is of a size to hold 220 lbs. and not much more. Salt is poured from baskets into the funnel, when the scales balance, a sack is held under the funnel, which again has a movable bottom, the bottom is let fall and the salt tumbles into the sack. A blow on the catch causes the bottom to fall, and it is replaced with equal facility. The diagram shows the arrangement of the catch with the bottom closed and open. Ordinarily speaking, when a whole heap is being broken up, about twenty men are employed. Some with picks destroy the heap; others with shovels fill baskets; others carry the baskets to the weighing machine and weigh it; others fill the sacks and tie them up; and others carry the sacks on trucks either to the waggon or boat and arrange them on board. Not less than five men can do the work, and it has been ascertained that five men working in this way for six hours put twenty tons of salt away, or one man stows away on board a boat or tram-waggon four tons of salt in a day





of six hours. It should be added that it is calculated that more would be done, only that the Customs officer who stands by keeping tally for Government has the power, and frequently exercises it, of reweighing the salt. Another form of weighing machine with a lever arm, as shown in the diagram, is used at some places, and I am informed that six men working with this machine will put away in sacks 13,200 lbs. or nearly six tons an hour, which seems a good deal. As no tax is levied on export salt, salt for exportation is not weighed, but sold by measure to save time; for, as it is always made in precisely the same way, there is a constant relation between weight and measure, which being once ascertained the salt may be economically sold by measure. For this purpose, salt is shovelled into a great wooden box like an inverted pyramid with a wide base having a sliding bottom like the door of a sluice-gate; measures holding 220 lbs. each are passed under the box and filled by withdrawing the slide a little; they are then struck clean to the edge and emptied into sacks.

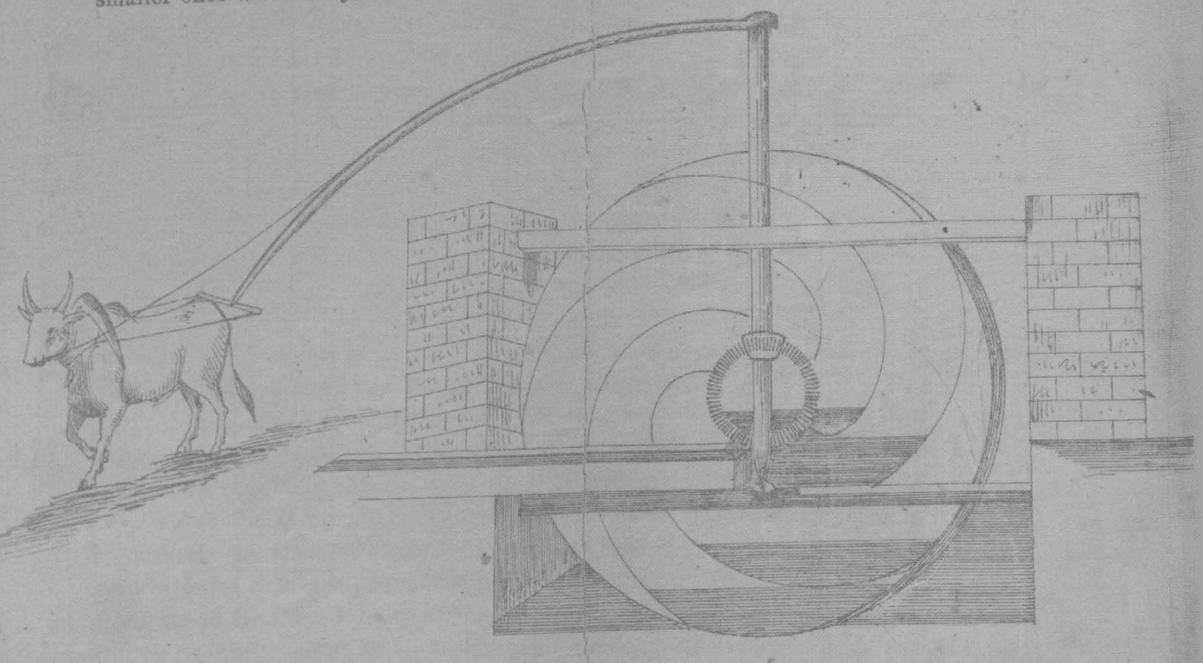


26. *Waste Products.*—A large quantity of Calcic Sulphate or Gypsum is deposited year by year in the inner and finishing condensers, where it forms in time a mass of impacted lenticular crystals similar to, but smaller than those found under the salt-pans at Chunampet near Merkanum. About every twenty years or so, this deposit has to be removed, as by its thickness and its liability to blister up off the soil, it diminishes the capacity of the condensers, and sometimes also their evaporating surface. Its removal is attended with some expense, which, as far as the Gypsum is concerned, is a loss, as it is utterly useless being mixed up with mud, debris, &c., and has to be thrown away. Sodic Sulphate or Glauber's salt is occasionally formed in the reservoirs. Whenever there is sharp frost on the Mediterranean Coast, as happened this year, a double decomposition takes place in the *virgin* brine: Magnesic Sulphate, and Sodic Chloride reform themselves into Sodic Sulphate and Magnesic Chloride, and the Sodic Sulphate being in excess at low temperatures falls to the bottom, generally at the lee side of the reservoir towards which its crystals are driven by the wind. It cost about three francs a-ton to gather it, and is used chiefly with common salt for forming refrigerating mixtures. Formerly, it was intentionally produced, but now-a-days, since the discovery of large mines of it in Prussia, its manufacture has been given up in France, and its formation simply injures the *virgin* brine, by breaking up the common salt in it, and adding to its quantity of Magnesic Chloride. Magnesic Sulphate and Chloride are got rid of with great care at the French works, especially the latter which is recognised as the most fertile source of wastage. They are pumped out to sea before they reach their point of saturation in bitterns of a comparatively low density from 29° to 32° Beaumé, and thus their deposition is entirely avoided.

27. *Pumping Machine.*—The machinery for raising water seems to me one of the most important and interesting studies at the French works, looking to the wants of Indian salt manufacture; and I quite think that the machine in use in the south of France is one which can be applied at our salt-pans without any great difficulty and with every prospect of success. It is called a tampon. At most stations there

1454
6

is one large tampon worked by ten to twenty horse-power engines, and one or two smaller ones worked by mules. The subjoined diagram represents a vertical section



of a mule tampon showing its chambers, the application of the motive power, and the flow of water. It is not, however, a correct drawing from nature, as it is intended to show a good deal more than can be seen of a real tampon from any one point of view.

Similar tampons to this are described in books, but this one is special to the Compagnie du Midi, and is said to throw least labor on the mules, as from the uniform development of the curve, the centre of gravity of the mass or particles of water is displaced downwards rapidly and uniformly with consequent diminution of weight and friction. The curve is made by winding a piece of string round the edge of the inner circle or tube orifice of the tampon and unwinding it again, making a pencil score the extremity of the curve it describes. As the string unwinds, the radius of the circle described becomes longer and longer and the dimensions of the tube increases in the same ratio. By lengthening the pole or belts to which the mule or bullock is harnessed the labor may be greatly diminished, but the circle to be traversed is increased to the same extent, and ground wasted as well as time lost. An ordinary mule tampon has a diameter of about 12 feet, costs about francs 3,000 or £120, raises water 3 feet 3 inches, and discharges it at the rate of 263 cubic yards an hour. The circumstance of the machine dips into the water which the chambers take up and discharge at the centre, out of which it flows into the channel at the higher level. By increasing the diameter of the machine it may be made to lift water as much as 5 feet, but this would not be necessary in India. The tampon is made of wood strengthened with iron, and there is a good deal of iron-work about it, but it is not injured to any great extent by the salt-water, as after the first coating of

oxide has formed it protects the iron underneath from further rust. By means of the large double steam tampon at the centre of the works, at which part all the channels, &c., communicate with each other through sluice-gates, the Manager has perfect control over the flow of water throughout the works, and can empty or fill any part with brine or sea-water at pleasure.

28. It is not easy to institute a close comparison between two methods of salt manufacture, differing so much in detail as do the French and Indian systems. It will be sufficient for my purpose, however, to compare their results, and endeavour to attribute them to their right causes. Salt of an excellent description, hard, heavy, well-crystallised, clean, and almost chemically pure is produced for about five francs a-ton in the south of France by the wholesale method. Salt comparatively of an inferior description, light, friable, flaky, somewhat dirty and impure, is produced in India for a trifle more than that sum; that is, the contractors are paid on an average Rupees 10 a-garce, or at the rate of 5·6 francs a-ton. Now to give this comparison its true value, it must be stated that the conditions under which salt is made are not the same in both places. On the contrary, there is every reason why salt should be made better and cheaper in India than in France. Comparing notes with M. Gervais, I found that the rate of evaporation of sea-water, or, in other words, the rapidity of production was nearly three times greater on the Madras than on the Mediterranean Coast, and that the price of labor was about one-fourth; besides the presence of a stiff clay soil at most of our salt-pans renders it morally certain that they leak less than those in France. M. Gervais believes that the Compagnie du Midi with their system would turn out salt equal to their own in India at the rate of two francs a-ton.

29. It thus appears that salt is made in India for 5·6 francs a-ton of a decidedly inferior description to that made in France for five francs a-ton. This, again, concerns the merits of the two systems in the abstract only, as the latter price includes the cost of establishment of works of construction, maintenance, repair, &c., and the coverings of the heaps, &c., and the former price includes none of these things, the Madras Government supplying them as separate from the cost of manufacture. To form a correct estimate of the real merits of the comparison, I must here, therefore, perforce compare the position of the Madras Government as proprietors of salt manufactories partly worked by contract, with that of the Compagnie du Midi making its own salt. I think that it costs the Madras Government about twenty francs a-ton to make salt certainly inferior to that made in France under less advantageous meteorological conditions for five francs a-ton. The cost of manufacture is made up approximately as follows: Cost of establishment reckoning it at the recognised rate of 3 Annas a-maund 12·7 francs a-ton, departmental works including salt coverings, &c., a little less than 6 Pies a-maund or 1·7 francs a-ton, payment to contractors 5·6 francs a-ton, total 20 francs a-ton. So that, as compared with the Compagnie du Midi, it costs in Madras four times as much to make a salt which is neither so clean nor so pure, nor so wholesome, which will not bear carriage as well, and which is subject to a heavier loss from wastage. The reverse of all this should be the case.

30. I will now endeavour to ascertain the cause first of the absolute cheapness of the French salt. I attribute it to the economy of a wholesale method of manufacture. At Aigues Mortes, for instance, which is as large as all the salt stations on the Ennore canal put together, there is a permanent establishment of only 100 men, and

Proceedings of the Madras Government, Revenue Department,
25th September 1875.

one or two Superintendents. At the Ennore salt-stations there are hardly less than a thousand contractors, four or five thousand coolies, five Superintendents, ten assistants, five clerks, and about fifty peons who all after a fashion live upon salt. Suppose all the outlying stations on the Ennore canal turned into condensers. The salt-beds and platforms collected at Ennore under the eyes of a single Superintendent, his Assistant, and a staff proportionate to the diminished area to be looked after, and the rest of the people diverted to other industries, and we get an idea of the economies effected by the French system. Conversely, the relative dearness of the Madras salt is due to the fact that Government gives out its manufacture on contract to petty contractors, supplies all the requisite large works, such as canals, embankments, platforms, &c., and maintains an establishment to look after the contractors and salt sufficiently strong to make the salt in a well-arranged manufactory. The low level of the French salt-pans has not much to do with the cheapness of the salt, for after all the brine is pumped up to the finishing condensers and sometimes to the inner condensers, and when the pumps are not in action the mules still go on eating in the mangers. Steam-pumps are, of course, relatively economic, but their use in this connection only serves to show that the French works are not much benefited by their low level.

31. The crystalline superiority of the French salt is no doubt due to the length of time it is allowed to form, the depth of brine under which it forms which protects it from the disturbing influence of the wind, and, in a great measure, also to the custom, strictly enforced, of keeping the brine in the salt-beds always at or below 29° Beaumé, so that salt formation is never hurried or pressed upon by the approaching saturation of the Magnesic salts. To these reasons should be added two others, the rate of evaporation is less rapid in France than in India, and the winds, as a rule, are lighter there.

32. The superior clearness of the French salt is due to the gravelly hardness of the salt-beds, careful handling and tile coverings, and its chemical purity to the careful exclusion from the works of brine capable of parting with its Magnesic salts. In these respects, Indian salt is evidently capable of being improved up to the French standard without much trouble or expense, granted only a sympathetic state of feeling and hearty co-operation on the part of the native manufacturers.

33. Finally, there remains the question—what proposals calculated to benefit Indian salt culture are suggested by this report? In the first place, there are certain mechanical arrangements which may perhaps be advantageously introduced into this country, which I will here merely enumerate and draw attention to, as before any of them could be adopted on a large scale, the question of advantage would have to be settled by limited experiments. I allude here to the pumping machine, the weighing machine, the platform arrangements for preserving the salt-heaps, the tile coverings for the salt, the stone-rollers for hardening the beds, the wheel-barrows for removing the salt, the stick apparatus for levelling the beds, &c. Many of these might, I believe, be introduced with advantage, but I have returned so lately from France that I cannot as yet speak positively about them. I have already by recommending in former reports a larger and shallower condensing area, a smaller number of salt-beds collected at the end of the works next to the platform, deeper and stronger brine in the crystallising beds, larger crystallising beds well sanded, more time for

crystallisation and the removal of mother liquors, &c., anticipated most of the proposals relative to improvements in the details of manufacture suggested by the French works.

34. But besides these questions of detail, there are other and more important proposals which flow naturally from an attentive consideration of the foregoing facts. One which I put forward as a logical deduction from that consideration rather than as a serious proposal is, that Government make its own salt. As at present managed, Government pays for the construction, up-keep, and establishment, of the manufacturing stations, and yet pays ignorant contractors 5·6 francs a-ton for manufacturing an inferior description of salt. Its total outlay is twenty francs a-ton, whereas the French believe, and I also think, that they could make better salt here, everything included, for two or three francs a-ton. By making the salt itself, Government could introduce those working economies and scientific improvements in the details of manufacture noticed in France. It is difficult to understand in what other way they can be introduced. The native contractors are in an independent position, and they know it. Happily ignorant, confident of their power, invincibly prejudiced and conservative, they go on making salt of the old kind in the old way, and, for anything that I can see to the contrary, they will continue to do so for an indefinite number of years. At the end of 1873, I had begun to foresee this, and drew attention to it at the end of my report for that year. I can now only repeat that in so far as my efforts are directed towards improving the present method of salt manufacture, subject to existing surrounding conditions, they are not, I fear, likely to be productive of any great benefit.

35. Nothing would be better calculated to improve the salt culture of India than the excise system applied to salt, if only salt was sold by weight instead of by measure. But as the reverse is the case, as there is a premium placed on light salt by merchants at present buying by weight and selling by measure any withdrawal of Government supervision from salt manufacture would be at once followed by a decided deterioration in the quality of the salt in so far as there is room for it. On the other hand, if salt was sold by weight as well as bought by it, the excise system would, I believe, result in causing an immense improvement in the present state of salt manufacture. On the whole, I believe that the excise system, combined with an enactment compelling the sale of salt by weight, is the best proposal that can be made by one employed, as I am, in endeavouring to improve the manufacture of salt in this Presidency.

36. As long as the present state of things continues, intermediate between direct Government manufacture and excise, the best thing to do is to give or sell all new salt stations that are opened to intelligent capitalists, whether Native or European, on the understanding or agreement that they will manufacture salt in an enlightened way and of a superior quality, and I know of no better test of quality apart from the cleanliness of the salt than a comparison of its weight with swamp salt. A manufactured salt, which, bulk for bulk, weighs as much as Vedarniem swamp-salt for instance, is pretty sure to be well crystallised and free from Magnesium, &c. By an enlightened way of making salt, I understand its wholesale or economic method of manufacture as adopted by the French, with one restriction. In a tropical climate salt should not be left in the crystallising beds longer than one month at most.

1414
8

Tropical showers come without much warning, and are more copious and destructive than days of rain in France. There may be difficulty in getting men to buy or at least agree to work a whole salt-station on the terms mentioned for the existing Kudivaram. I have professed to be able to make salt at a very low figure. This report contains strong evidence to show that it can be made at any rate for very much less than it costs at present and better made; but how much better and for how much less are questions that nothing but a sufficiently extensive experiment can settle practically. If Government desire it, I am ready to undertake the conduct of an experiment, only, to be of use, it should be on a sufficiently large scale; time enough should be allowed for its completion and adequate funds provided for its conduct. The area at my disposal at Ennore last year was far too limited to have enabled me to do more than show how salt may be best and most economically made in an ordinary cramped native ullum.

37. I regret to state that, though I made diligent inquiries at different towns in the south of France, and from men long connected with salt manufacture, I could discover no plans, models, or books, likely to be of use to the Salt Department here. In fact, it is believed that nothing has been written on the subject further than such passing notices as appear in works on Chemistry under the head of Sodic Chloride. Under the circumstances, and considering also that the French gentlemen who courteously assisted me in my work are anxious to see my observations on their method of salt manufacture, I would ask the Board to send some copies of this report to M. Mion, Representative of the *Compagnie des Salines du Midi*, Montpellier.

In this interesting report Dr. Ratton gives an account of his visit last January to the French salines or salt-manufactories on the Mediterranean Coast.

2. It appears that the French Government make no salt. The manufactories are worked by private individuals or companies who pay an excise of 100* francs per ton of salt sold at the pans for home-consumption. No tax is levied on salt for export.

	Rs.	A.	P.
* Equivalent to—			
Per Garce	176	0	0
Per Indian Maund	1	7	6

3. The works are situated on sandy littoral wastes generally below sea-level, and are surrounded by heavy embankments to protect the pans from floodings. The areas enclosed seem to vary from several hundred acres to some fifteen to twenty square miles. Sea-water is supplied by canals with locks or sluices where they enter the embanked spaces. The salt-water flows naturally into several series of shallow tanks or condensers arranged, not in artificial order, but suitably to the natural undulations of the sites which are utilised to the utmost, and is gradually passed on by gravitation or pumping to the finishing condensers and crystallising beds. The manufacture is carried on generally from April to September.

4. The salt is stored in masonry or wooden frames, the floors being tiled or boarded, or sometimes merely gravelled and rolled hard. Tiles are now used to cover the salt instead of thatch, by which a considerable saving in wastage and greater cleanliness is said to be secured. The salt produced is described as decidedly superior to that ordinarily manufactured in the Madras Presidency.

5. Comparing the results of the French and Indian systems, Dr. Ratton says: "Salt of an excellent description, hard, heavy, well-crystallised, clear, and almost chemically pure is produced for about five francs a-ton in the south of France by the wholesale method. Salt comparatively of an inferior description, light, friable, flaky, somewhat dirty, and impure is produced in India for a trifle more than that sum, *i.e.*, the contractors are paid on an average Rs. 10 a-garce, or at the rate of 5·6 francs a-ton." In the next paragraph, however, Dr. Ratton proceeds to say that the 5 francs in France covers the cost of establishments and of works of all sorts from first to last; whilst, if these are taken into account for Madras, the Indian price is raised from 5·6 to 20 francs a-ton, or the Indian cost for an inferior is four times the French cost for a decidedly superior description of salt. And the opinion is further expressed that, with certain advantages considered to attach to the circumstances of Indian manufacture, the relative cost should be less; in fact, that salt equal to the French might be produced at two francs per ton.

6. The Board have no means of knowing how Dr. Ratton's comparative calculations of the prices of French and Indian salt have been arrived at in detail. He does not appear to have included the cost of the excise establishment in the French price, whilst the cost of managing the Government monopoly is evidently debited in the Indian price. In fixing the cost of establishment at the rate of three annas a-maund, however, he is obviously in error, for this sum is not the "recognised rate for the cost of establishment," but rather for all charges incidental to manufacture on the East Coast as shown by the figures submitted to Government with reference to the Bill for the amendment of the Salt Law (now Act XI. of 1875) in Board's Proceedings, dated 12th July 1873, No. 1,275. The average cost of manufacture based on calculations for a period of six years is there shown to have been three Annas and one Pie per maund, inclusive of all charges except wastage, the addition of which raises the cost to three Annas and three Pies. This estimate may not be absolutely correct, as it is difficult to estimate the sum to be allowed for construction, maintenance, and repair of salt-works, but it is approximately correct. The Board have recently called for information which will enable them to frame a more trustworthy estimate as directed in G. O., dated 3rd February 1875, No. 179. Three Annas and three Pies per maund is equivalent to 13·3 francs a-ton, and this much more nearly represents the cost to the Madras Government than 20 francs a-ton. The average quantity manufactured from 1867-68 to 1872-73 appears, from the Board's Proceedings already quoted, to have amounted to 5,826,655 maunds, the cost of which, at three Annas and three Pies per maund, would amount to Rupees 11,83,540. At 5 francs a-ton it would amount to Rupees 4,45,092 and at 2 francs a-ton to Rupees 1,78,037, resulting in a saving of Rupees 7,38,395 in the former and Rupees 10,05,450 in the latter case. Could salt be produced, therefore, in this Presidency at the rate at which it is described as being produced in France, the saving to Government would be very considerable; and, though there may be room for a difference of opinion as to the actual difference in cost, there can be no doubt that there is immense economy in the French system, and that probably from its study much practical improvement and a very considerable saving of expense may be effected in our own salt-manufacture.

7. Dr. Ratton appears to attribute the positive cheapness of French salt to the wholesale method of manufacture conducted on intelligent principles, and its comparative cheapness in reference to Indian salt to the facts that private manufacturers generally work more economically than a Government department and that Government, besides entertaining expensive establishments and executing salt-works, pay a large number of petty contractors wedded to a slovenly and comparatively expensive system.

8. As to steps calculated to benefit Indian salt-culture, he indicates certain arrangements of detail which may be tested by experiments. He puts forward rather as "a logical deduction" from a consideration of the facts he has adduced than has "a serious proposal" that Government should make its own salt, and considers that nothing would be better calculated to improve the salt-culture of India (if salt were sold by weight instead of by measure) than the introduction of the excise system. It is sufficient to observe that, apart from the fact that the retail sale of salt by measure is the rooted habit of the country, which it would be very difficult to interfere with even if such a step were considered desirable, the objections to the substitution of the excise system for that at present prevailing in this Presidency have been clearly and conclusively shown in the Revenue Secretary's letter to the Government of India, dated 17th February 1875, No. 256. This part of the general question, therefore, need not be further considered at present.

9. The main subject for immediate consideration is the financial aspect of the question. Although it is, of course, desirable to improve the quality of our salt, the salt now produced is, the Board believe, perfectly wholesome, and is well adapted to the tastes of the people. The mass of the consumers would probably purchase the salt now supplied at present rates rather than pay even a slightly enhanced price for what Europeans would consider a very superior quality of salt. The object should therefore be, whilst seeing that a sound wholesome standard of quality is maintained and improvement effected as far as may be, to reduce the cost to Government to the utmost both as regards production and departmental management from beginning to end. It seems to the Board that all that can practically be done with advantage now is—

1*st.*—To see that every attention is paid to the introduction of approved mechanical arrangements and the improvement of the system of operations at the salt-works, so that the expense of production and management may be reduced to the utmost under the present system.

2*ndly.*—To undertake experiments at some convenient place on a sufficiently extensive scale to determine practically whether salt can be produced in a very much more economical manner than at present or not.

3*rdly.*—When any new ground is taken up for salt-manufacture to deal, if possible, with a capitalist instead of with a number of petty contractors as has been the practice hitherto, so as to reduce to a minimum the cost of manufacture and of the Government establishment required to be maintained.

10. With these remarks, the Board resolve to submit Dr. Ratton's report to Government with a request that, if the Government approve of experiments on a considerable scale being made (as advocated above), the Board may be authorised to communicate with Dr. Ratton, and prepare a scheme in detail. The opening of new pans at Harigoshti in the South Arcot District affords a favorable opportunity for

Proceedings of the Madras Government, Revenue Department,
25th September 1875.

1424
9

conducting the experiment on a sufficiently extensive site which the Board believe to be available for the purpose.

11. In accordance with the request at paragraph 37, Dr. Ratton will be furnished with ten copies of his report for distribution.

(A true Copy and Extract.)

(Signed) C. A. GALTON,
Acting Sub-Secretary.

No. 229. MINUTE BY HIS EXCELLENCY THE GOVERNOR.

DR. RATTON'S report is very valuable, and establishes a serious contrast as regards price, quality, industry and manufacturing intelligence between the large, free and scientific capitalist-factory system (subject to excise duty) of France and the small, slovenly, costly, *peasant* manufacture for the State monopolist of South India. The contrast is doubtless true, and is what the two systems respectively produce however appalling.

2. A finer salt is made on the shores of the Mediterranean, under comparatively adverse conditions, at a somewhat less prime cost than that prepared on our tropical shores; while experts tell us that salt such as is produced in France, at 5 francs per ton, should be manufactured in South India for 2 francs per ton. The cost of fiscal management apparently runs up the value of our salt to upwards of 13 francs a-ton before it is ready for sale, while I gather that salt is sold for export at 5 francs a-ton,—the prime cost,— at the factories in the south of France.

3. There is clearly something here that will force early and somewhat revolutionary attention to our system, and the difficulty, as it seems to me, is "what to do with" the important report at present.

4. Clearly, we ought to do what we can in the direction which [illegible] research and fact indicate. These are concentrations and use of capital under the stimulus of free manufacture (subject to excise). We might try gradually to pass the manufacture of salt into the hands of large capitalists, we are doing as in the matter of distilling.

5. The *Mirassi* system may make concentration difficult in some parts, but this should be looked to at once everywhere. It is clear that capital and plant are applied in France to an extent which our system entirely ignores, and Government will never attempt. Nothing but science and capital can arrest the waste and shortcomings of our system, and these we may find private Companies will not hesitate to apply if we encourage them. They are taking up at cotton mills, distilling, &c.:—why not salt? I would certainly endeavour to start some private salt works on the French system, and allow Dr. Ratton to be their adviser in starting.

6. I would ask the Board to consider this matter at once with Dr. Ratton, and invite proposals for selected works.

7. I do not think much of a large experiment at State cost as suggested by the Board. If new pans are to be opened, why not invite proposals for manufacturers on the excise system, and try the effect of capital and excise together. I think, we might here do what we are doing in Abkari,—keep up the existing system of monopoly purchase where the small native system of producing salt continues,—and at the same time endeavour to have capitalist manufacturers alongside of them manufacturing on a large scale under excise, until we are ripe for entire transition.

9*th August* 1875.

(Signed) W. ROBINSON.

No. 230. ORDER THEREON, 25th September 1875, No. 1,414.

Separate Revenue, No. 15.
Stamps.

THE thanks of the Government are due to Dr. Ratton for his interesting report on the method of salt culture in France, which will be communicated to the Chamber

Proceedings of the Madras Government, Revenue Department,
25th September 1875.

1414
10

of Commerce. The Government will be prepared to entertain proposals from capitalists to undertake salt manufacture on their own account on such a scale as to admit of the Excise Act being extended to their works.

(Signed) A. MACGREGOR,
Acting Secretary to Government.

Exd. F. R. Bantleman.

Govt. of Madras

REVENUE.

To

THE CHAIRMAN OF THE
CHAMBER OF COMMERCE,
&c., &c., &c.

Dated September 25th.

Rec'd.

Encl.

G. O. 24th September 1875, No. 1,804.

SEPTEMBER.
Nos. 228—230.

Salt Culture in the South of France.—Tendering thanks to Dr. Ratton for his interesting report on the method of —, and communicating it to the Chamber of Commerce. Expressing willingness to entertain proposals from capitalists to undertake salt manufacture on their own account on such a scale as to admit of the Excise Act being extended to their works.

No. 1,804.

PROCEEDINGS OF THE BOARD OF REVENUE, dated 30th June 1875.

Read Dr. Ratton's report on the system of salt-culture pursued in the South of France, dated 4th March 1875.

IN this interesting report Dr. Ratton gives an account of his visit last January to the French Salines or salt-manufactories on the Mediterranean Coast.

2. It appears that the French Government make no salt. The manufactories are worked by private individuals or companies who pay an excise of 100* francs per ton of salt sold at the pans for home-consumption. No tax is levied on salt for export.

	Rs.	A.	P.
* Equivalent to—			
Per Garce	176	0	0
Per Indian Maund	1	7	6

3. The works are situated on sandy littoral wastes generally below sea-level, and are surrounded by heavy embankments to protect the pans from floodings. The areas enclosed seem to vary from several hundred acres to some fifteen to twenty square miles. Sea-water is supplied by canals with locks or sluices where they enter the embanked spaces. The salt-water flows naturally into several series of shallow tanks or condensers arranged, not in artificial order, but suitably to the natural undulations of the sites which are utilized to the utmost, and is gradually passed on by gravitation or pumping to the finishing condensers and crystallizing beds. The manufacture is carried on generally from April to September.

4. The salt is stored in masonry or wooden frames, the floors being tiled or boarded, or sometimes merely gravelled and rolled hard. Tiles are now used to cover the salt instead of thatch, by which a considerable saving in wastage and greater cleanliness is said to be secured. The salt produced is described as decidedly superior to that ordinarily manufactured in the Madras Presidency.

5. Comparing the results of the French and Indian systems, Dr. Ratton says: "Salt of an excellent description, hard, heavy, well-crystallized, clear, and almost chemically pure is produced for about five francs a-ton in the south of France by the wholesale method. Salt comparatively of an inferior description, light, friable, flaky, somewhat dirty, and impure is produced in India for a trifle more than that sum, *i.e.*, the contractors are paid on an average Rupees 10 a-garce, or at the rate of 5·6 francs a-ton." In the next paragraph, however, Dr. Ratton proceeds to say that the five francs in France covers the cost of establishments and of works of all sorts from first to last; whilst, if these are taken into account for Madras, the Indian price is raised from 5·6 to 20 francs a-ton, or the Indian cost for an inferior is four times the French cost for a decidedly superior description of salt. And the opinion is further expressed that, with certain advantages considered to attach to the circumstances of Indian manufacture, the relative cost should be less; in fact, that salt equal to the French might be produced at two francs per ton.

6. The Board have no means of knowing how Dr. Ratton's comparative calculations of the prices of French and Indian salt have been arrived at in detail. He does not appear to have included the cost of the excise establishment in the French price, whilst the cost of managing the Government monopoly is evidently

debited in the Indian price. In fixi[illegible] the cost of establishment at the rate of three annas a-maund, however, he is obviously in error, for this sum is not the "recognized rate for the cost of establishment," but rather for all charges incidental to manufacture on the East Coast as shown by the figures submitted to Government with reference to the Bill for the amendm[illegible]t of the Salt Law (now Act XI. of 1875) in Board's Proceedings, dated 12th J[illegible]y 1873, No. 1,275. The average cost of manufacture based on calculations for a period of six years is there shown to have been three annas and one pie per maund inclusive of all charges except wastage, the addition of which raises the cost to three annas and three pies. This estimate may not be absolutely correct, as it is difficult to estimate the sum to be allowed for construction, maintenance, and repair of salt-works, but it is approximately correct. The Board have recently called for information which will enable them to frame a more trustworthy estimate as directed in G.O., dated 3rd February 1875, No. 179. Three annas and three pies per maund is equivalent to 13·3 francs a ton, and this much more nearly represents the cost to the Madras Government than 20 francs a-ton. The average quantity manufactured from 1867-68 to 1872-73 appears, from the Board's Proceedings already quoted, to have amounted to 5,826,655 maunds, the cost of which, at three annas and three pies per maund, would amount to Rupees 11,83,540. At five francs a-ton it would amount to Rupees 4,45,092 and at two francs a-ton to Rupees 1,78,037, resulting in a saving of Rupees 7,38,395 in the former and Rupees 10,05,450 in the latter case. Could salt be produced, therefore, in this Presidency at the rate at which it is described as being produced in France, the saving to Government would be very considerable; and, though there may be room for a difference of opinion as to the actual difference in cost, there can be no doubt that there [illegible]s immense economy in the French system, and that probably from its study much pra[illegible]cal improvement and a very considerable saving of expense may be effected in o[illegible] own salt-manufacture.

7. Dr. Ratton appears to attribute the positive cheapness of French salt to the wholesale method of manufacture conducted on intelligent principles, and its comparative cheapness in reference to Indian salt to the facts that private manufacturers generally work more economically than a Government department and that Government, besides entertaining expensive establishments and executing salt-works, pay a large number of petty contractors wedded to a slovenly and comparatively expensive system.

8. As to steps calculated to benefit Indian salt-culture, he indicates certain arrangements of detail which may be tested by experiments. He puts forward rather as "a logical deduction" from a consideration of the facts he has adduced than as "a serious proposal" that Government should make its own salt, and considers that nothing would be better calculated to improve the salt-culture of India (if salt were sold by weight instead of by measure) than the introduction of the excise system. It is sufficient to observe that, apart from the fact that the retail sale of salt by measure is the rooted habit of the country, which it would be very difficult to interfere with even if such a step were considered desirable, the objections to the substitution of the excise system for [illegible]at at present prevailing in this Presidency have been clearly and conclusively shown in the Revenue Secretary's letter to the Government of India, dated 17th February 1875, No. 256. This part of the general question, therefore, need not be further considered at present.

9. The main subject for immediate consideration is the financial aspect o[illegible]he question. Although it is, of course, desirable to improve the quality of our salt, the salt now produced is, the Board believe, perfectly wholesome, and is well adapted to the tastes of the people. The mass of the consumers would probably purchase the salt now supplied at present rates rather than pay even a slightly enhanced price for what Europeans would consider a very superior quality of salt. The object should therefore be, whilst seeing that a sound wholesome standard of quality is maintained and improvement effected as far as may be, to reduce the cost to Government to the utmost both as regards production and departmental management from beginning to end. It seems to the Board that all that can practically be done with advantage now is—

1*st*.—To see that every attention is paid to the introduction of approved mechanical arrangements and the improvement of the system of operations at the salt-works, so that the expense of production and management may be reduced to the utmost under the present system.

2*ndly*.—To undertake experiments at some convenient place on a sufficiently extensive scale to determine practically whether salt can be produced in a very much more economical manner than at present or not.

3*rdly*.—When any new ground is taken up for salt-manufacture to deal, if possible, with a capitalist instead of with a number of petty contractors as has been the practice hitherto, so as to reduce to a minimum the cost of manufacture and of the Government establishment required to be maintained.

10. With these remarks the Board resolve to submit Dr. Ratton's report to Government with a request that, if the Government approve of experiments on a considerable scale being made (as advocated above), the Board may be authorized to communicate with Dr. Ratton and prepare a scheme in detail. The opening of new pans at Harigoshti in the South Arcot District affords a favorable opportunity for conducting the experiment on a sufficiently extensive site which the Board believe to be available for the purpose.

11. In accordance with the request at paragraph 37, Dr. Ratton will be furnished with ten copies of his report for distribution.

(A true Extract.)

Acting Sub-Secretary.

To the Acting Secretary to Government, Revenue Department,
with printed copy of Dr. Ratton's report.

Copy to all Collectors of Salt Districts, with do.
,, to Dr. Ratton, with ten copies of do.
,, to Surgeon-General, I. M. D.
,, to Inspector-General of Police.

Exd. J. W. Fischer.

Rec. 1875. July
No. 1414 of 1875. 326
3 Aug. 75 - 45 - 369 - 210.

Board of Revenue,

MADRAS.

PROCEEDINGS, 30TH JUNE 1875, No. 1,804.

Despatch Enclosure

Received 21 Aug 75.

JUNE.

No. 1,804.

Salt culture.—Report of Dr. Ratton on the system of — pursued in the south of France, submitted to Government with remarks and with request that, if they approve of experiments on considerable scale being made, Board may be authorized to communicate with that officer and prepare a scheme in detail.

9625 Sept 1414/75

Dr. Croft

1414/13

MINUTE BY HIS EXCELLENCY THE GOVERNOR.

DR. RATTON's report is very valuable, and establishes a serious contrast as regards price, quality, industry and manufacturing intelligence, between the large, free and scientific capitalist-factory system (subject to excise duty) of France and the small, slovenly, costly, *peasant* manufacture for the State monopolist of South India. The contrast is doubtless true, and is what the two systems respectively produce however applied.

2. A finer salt is made on the shores of the Mediterranean, under comparatively adverse conditions, at a somewhat less prime cost than that prepared on our tropical shores; while experts tell us that salt such as is produced in France, at 5 francs per ton, should be manufactured in South India for 2 francs per ton. The cost of fiscal management apparently runs up the value of our salt to upwards of 13 francs a-ton before it is ready for sale, while I gather that salt is sold for export at 5 francs a-ton,—the prime cost,— at the factories in the south of France.

3. There is clearly something here that will force early and somewhat revolutionary attention to our system, and the difficulty, as it seems to me, is "what to do with" the important report at present.

4. Clearly, we ought to do what we can in the direction which research and fact indicate. These are concentrations and use of capital under the stimulus of free manufacture (subject to excise). We might try gradually to pass the manufacture of salt into the hands of large capitalists, we are doing as in the matter of distilling.

5. The *Mirassi* system may make concentration difficult in some parts, but this should be looked to at once everywhere. It is clear that capital and plant are applied in France to an extent which our system entirely ignores, and Government will never attempt. Nothing but science and capital can arrest the waste and shortcomings of our system, and these we may find private Companies will not hesitate to apply if we encourage them. They are taking up at cotton mills, distilling, &c. :—why not [illegible] salt? I would certainly endeavour to start some private salt works on the French system, and allow Dr. Ratton to be their adviser in starting.

6. I would ask the Board to consider this matter at once with Dr. Ratton, and invite proposals for selected works.

7. I do not think much of a large experiment at State cost as suggested by the Board. If new pans are to be opened, why not invite proposals for manufacturers on the excise system, and try the effect of capital and excise together. I think, we might here do what we are doing in Abkari,—keep up the existing system of monopoly purchase where the small native system of producing salt continues,—and at the same time endeavour to have capitalist manufacturers alongside of them manufacturing on a large scale under excise, until we are ripe for entire transition.

9th August 1875. (Signed) W. ROBINSON.

From Surgeon J. J. L. RATTON, M.D., Madras Army,

To C. A. GALTON, Esq., Acting Sub-Secretary to the Board of Revenue.

SIR,

I have the honor to inform you, that pursuant to instructions contained in the Proceedings of the Madras Government, Revenue Department, dated 30th October 1874, received by me on the 28th December, I went to the India Office on the 31st December to make inquiries, and applied also by letter on the same date to the Under Secretary of State for India for the credentials to enable me to visit with facility the salt manufactories in the south of France.

2. I found on inquiry at the India Office, that no previous intimation had been received there on the subject of my visit, and that it would take more than a week to obtain the necessary credentials from France. Under the circumstances, although my privilege leave would not expire until the 31st of January, and although in any case the time of my departure had not yet arrived, I determined to proceed at once to the south of France, and commence work either with or without to India before the 28th February seemed to me to necessitate prompt action. I left London, therefore, on the morning of the 3rd January, and making inquiries by the way, reached Montpelier, the head-quarters of the salt manufacturing industry on the Mediterranean Coast, on the 7th of January. Soon after my arrival, I applied personally to M. Mion, Representative of the *Compagnie Des Salins du Midi, Société Anonyme*, proprietors of the most extensive and best conducted of the salt concerns on the south coast of France, and from him learnt as follows:—

3. The French Government do not make their own or any salt. There are a large number of salt manufactories on the Mediterranean Coast, and yet a larger number of small ones on the Biscayen Coast, possessed by individuals or by Companies as private property. These make as much salt as they can without restriction or interference on the part of Government, but for every ton of salt they sell in France, they have to pay the Government a *droit* or tax of one hundred francs. To insure the due collection of the tax, Government requires that the salt-pans be arranged and the salt stored in a manner to enable the Customs officers effectually to guard against smuggling and fraud. The Government itself maintains a guard of *Douaniers* at the pans, whose duty it is, as in India, to prevent contraband and to weigh or assist at the weighing of all salt delivered for home or inland consumption and observe the amount. The tax is collected accordingly. It is interesting to note that these Customs officials are chosen from the Army, that none but soldiers who have received a good conduct badge are eligible, and that the rate of pay in the Customs Department is higher than in the Army. No tax is levied on export salt.

4. Having ascertained that the French Government had nothing to do with the actual conduct of salt manufacture in France, I commenced my inquiries at once, without hesitation, without the credentials. I represented the matter to M. Mion, to whose great courtesy I here very

crystallizing or salt beds and reservoirs, respectively. There are also platforms, &c., which need not be noticed as yet. The condensers and reservoirs occupy 78 per cent. of the evaporating surface, the salt bed, the remaining 22 per cent. A canal brings brine from the sea or estuary, as the case may be, to the works, and first to the outer condensers, into which it flows naturally as they are at a lower level than the sea. At the commencement of manufacture, brine is retained, spread out in a thin sheet in the first system of condensers for seven or eight days until it reaches 8° Beaumé in strength. It is then passed into the inner condensers, generally also by natural gravitation. Here the brine, still spread out shallowly, is allowed to evaporate until it reaches about 18° Beaumé. Then it is pumped up to the finishing condensers and is passed slowly from one to another of these until it reaches the salt beds, its passage being so regulated that it shall mark 25° Beaumé by that time. These preliminaries take about fifteen days. The brine from the finishing condensers is allowed to gravitate into the salt beds, which are filled to a depth of about ten inches and replenished from time to time during salt formation with additional brine, so as to secure that its strength shall not at any time exceed 29° Beaumé. This continues until a bed of salt about two inches in thickness has formed, when the bitterns are drawn off for the supply of some less advanced bed and the salt is collected by means of wooden shovels in the dry state. The whole duration of manufacture from first to last is about five months, that is, from April to August or September. The time allowed for salt crystallization on the beds is three months.

13. The condensers are not arranged in concentric circles surrounding the salt beds nor in regular progression towards them, as might perhaps be supposed from their names and the foregoing description. Such an arrangement is seldom or ever practicable without going to great expense. Simply natural undulations of ground are made use of in salt manufacture in the best way that their circumstances will allow. A site possessing the requisite qualifications having been selected, a large portion of it, and that at the highest level, is apportioned off to the outer condensers. As all alluvial deposits or silted sands have a slope in one direction or another, and the outer condensers extend over two or three linear miles of ground, the whole of the tract that they comprise is never at the same level. They are divided, therefore, by cross bunds into communicating compartments, and sea-water is admitted first into that which is at the highest level, and from thence flows to the lowest. If the conformation or slope of the ground will allow of it, as it often does, the inner condensers, which also occupy a large tract of ground, begin where the outer end. They are also divided into compartments through which the brine flows from the highest to the lowest. Arrived at the lowest inner condenser after winding about from the sea, from one compartment to another, a long sinuous tract, in which every variation in level has been taken advantage of, the brine has usually reached the lowest level in the whole Salin or salt work. From here then it is pumped up to the first compartment of the smaller system of finishing condensers, probably at the same level or at a higher level than the first outer condenser, from whence it gravitates to the last compartment and so on to the salt beds, which are on a slope so that the brine can flow from one to another from first to last, or by means of a channel can pass by nearer beds and fill those further off. From this description it will be seen that I cannot furnish a diagram or drawing of the arrangement of parts at a French salt-work as they are not uniform. Sometimes the brine has to be pumped up from the last outer to the first inner condenser, and sometimes, though not so often, as these two parts together occupy a comparatively small space, from the last finishing condenser to the first salt bed.

14. The floors of the condensers are not prepared in any way, and after manufacturing operations have been once fairly started the flow of brine through their compartments is not much looked after, as the sluices being left open just manage to supply daily the amount of brine removed by evaporation so that uniformity is maintained without trouble. This can be arranged by a simple calculation. The brine that is left in the finishing condensers at the end of the season, called *virgin* brine, and I suppose also the strong brine in the last few inner condenser compartments is pumped off to reservoirs at a high level, where it remains stored to a depth of three feet throughout the winter and until the commencement of the next manufacturing season, when it is, according to its strength, transferred to the inner condensers, finishing condensers or salt beds. At the salt stations I visited in January, this brine varied from 15° to 22° Beaumé in strength. At the end of the season, the Mother liquors are got rid of by being drained off or pumped out to sea according to the level of the salt beds. There is not that amount of Mother liquor to get rid of that might be supposed from the fact that brine is not ordinarily evaporated beyond 28° Beaumé, as it is customary to make a certain amount of a comparatively inferior description of salt, in separate tables, from used brine at 29° Beaumé This salt formed between 29° and 32° Beaumé is in great demand for fish-curing and for the manufacture of soda, and is sold exclusively for those purposes.

15. One square yard of crystallizing surface at an average salt station yields 110 lbs. of salt in thirty days, but this must not be confounded with the mean produce of the salt works per square yard. A cubic yard of the salt is said to weigh 168 lbs. The salt when collected is stored on raised platforms as in India, and stacked in heaps of from 500 to 2,000 tons each, covered usually with tiles. The cost of manufacture is nearer five than six francs a ton, and that includes everything to the completion of the heap, its covering and maintenance of establishment. There is a permanent establishment of about 100 men and 60 mules at Aigues Mortes. The platforms are flanked by tramways or canals; when salt is sold a heap is broken up, and the salt, tied up in sacks, is put on board boats or removed in wagons. I will recur to the weighing process afterwards.

16. *Embankments.*—The embankments surrounding the works at Aigues Mortes, Bouches du Rhone, are about six feet high, twenty-five yards across the base, and have six feet of pathway on top. At other stations the embankments are of less dimensions according to their wants. All were, when I examined them, covered with vegetation, although originally formed with sand, and this because clay had been brought and placed upon them; brushwood, &c., planted and encouraged to grow, turf engrafted, and every care taken to put and preserve them in good order.

17. *Canals.*—There are commonly two or three supply canals cut from the sea at different points to bring brine to the outer condensers, of which again, there may be more than one set according to the local conformation of the ground. One canal at all events larger and deeper than the others is navigable and is so arranged as to facilitate locomotion and the transport of salt. These canals have their opening sometimes blocked up with sand, sea-weed, &c., by the wind and waves as in India, but their maintenance is carefully attended to. They are provided with sluice-gates both to keep out the sea and floating debris, and are staked along their sides to keep the sand from falling in. Brush-wood, reeds, &c., of a suitable kind are planted along their slopes to consolidate and preserve them. Boats are towed in the canals by mules, for whose use a low path is constructed at one side, and bridges are placed at different points of the canal to enable workmen, carts, mules, &c., to cross. These bridges are simply flat-bottomed boats, boarded over and tied at each end with cords to a slightly projecting pier or staging, so that when one set of cords is let go, the bridge swings to the opposite side, the side to which it is attached, giving free passage to boats coming along the canal.

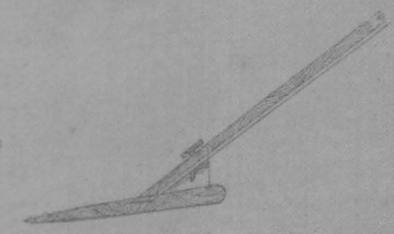
18. *Channels.*—From the main supplying canal, numerous channels branch off in every direction running along the sides of the different systems of condensers and of the salt beds, crossing each other frequently, sometimes by means of wooden aqueducts of the ordinary kind, sometimes by means of what are locally termed syphons according as they may be at the same or at different levels. A syphon here means an underground wooden aqueduct and is used when two channels at the same level meet at an angle, so that one may dip under the other and come to the surface again. These channels communicate with the condensers, &c., which at different points they can either supply or drain by means of wooden sluice-gates; they communicate with

each other and with the main canal in the same way and all have a *rendezvous* at the pumping station which is the centre of operations for the whole salt work. By means of these channels and a pump hereafter to be described, the Manager can pump any one of the brine receptacles, by whatever name called dry, or pump it full again with sea-water or brine from any part of the works without touching or interfering with any other part, save the two for the time being placed in communication. This is not a theoretical advantage, it is one of great practical utility and is constantly made use of. At important points, wherever in fact it is necessary, the sluice-gates are set in masonry frames. Sometimes also where two channels at the same level meet at a right angle, their point of intersection is made a waterway common to both by means of four sluice-gates, a pair to each channel, one pair being closed, the other channel possesses the way and *vice versa*; but this arrangement is not practicable where both channels are important and in constant use.

19. *Condensers.*—The condensers, outer, inner and finishing, have their sides staked and planted with brushwood to preserve them. They are but shallow sandy basins, and the brine stored in them seldom exceeds an average depth of three inches. The mean level of their floors is about eighteen inches below sea level, but they seldom approach nearer to the sea than 100 yards, and extend away from it for miles. As before stated, their floors are not prepared in any way, and I think they must leak a good deal. The Engineers say there can be no great leakage, because brine 12° Beaumé in density is found below the surface. Now it is a fact that brines of different densities being of different weights will rest one upon another, and though transfusion or dialysis takes place, this is so slow a process as to be scarcely worth considering where the top layer of brine is constantly on the move. On the other hand, subsoil brine is not found immediately in contact with the condenser floors, but in the sand from one to three feet deeper, so that brine leaking into the stratum between the two, must be removed to a certain extent by lateral drainage and ultimately lost, or effused into intersecting channels as may chance to be the case. And, again, the subsoil brine would in any case only protect the outer condensers from leakage. It would not protect those condensers containing brine at above 13° Beaumé, for as the brine increases in density and in weight, it would penetrate more readily through the sand and sink unimpeded through the subsoil brine.

20. *Salt Beds.*—The position of the salt beds in the works and their precise arrangement is not, for obvious reasons, uniform throughout the different stations, but they are always either clustered together in parallel rows and surrounded by platforms and tramways or canals, or they run in a long line along the borders of the navigable canal, separated from it by a platform. Each salt bed is usually about 80 yards long by 40 yards broad. In the first instance, the beds are levelled with great care. At some places, overlooking the sea, an ingenious method of levelling is practised which might be of use in India. It is based on the assumption that a line drawn from the horizon at sea to the level of the eye of a man stooping is horizontal, and it is so practically for the purpose of levelling a large salt bed. Two sticks are cut four feet in length, and their ends planed at right angles to their length. When these two sticks provided with plumb lines are held vertically, one by the observer and the other by his assistant a few yards nearer the sea and in the line of sight looking towards the horizon, if the observer looks over the upper edge of his stick at the horizon, the upper edge of the other stick will be just tangent to his line of vision, if the two sticks are on level ground. If the assistant's stick obstruct the view, it is on higher ground, and the portion of stick between its upper edge and the point where the horizon cuts across it, is a measure of the difference of level. If the assistant's stick is not tangent to the line of vision but below it, the observer is on higher ground, and he can measure the difference of level on his own stick by lowering his eye down along its side until the point is reached where his eye, the top of assistant's stick and the horizon are in one line. The work people fancy that this is as good a way of levelling the salt beds as any, and it is admitted on all hands to be the quickest and simplest way of doing it. Besides being levelled, the floors of the salt beds are well hardened by being trampled under foot by mules and are rolled with stone-rollers drawn by two men, at the beginning of each season. Strange to say they are not clayed, though brine at from 25° to 29° Beaumé must, I think, escape to some extent through a sand flooring, however well compressed. It is said that the larger and deeper these tables are, the better will be the salt. As a rule, they are from twelve to fifteen inches deep, and are boarded round the sides to keep the paths from falling in. Wooden sluice-gates at intervals give ingress and egress to the brine.

21. *Salt Collecting.*—When a cake of salt about two inches in thickness has formed, the Mother liquors are drained off from that bed and the salt is collected in the dry state. The hardness of the floor allows of this being done without soiling the salt. A wooden shovel sometimes tipped with tin is used for this purpose. (See diagram). It is pushed under the salt, which is lifted up and heaped on one side in small mounds as clay might be, and left there to drain for eight or ten days. This is done by skilled laborers on the permanent establishment of the works. Afterwards, the salt is carried to the platforms and heaped by contract, as this part of the work being almost purely mechanical, there is no fear of injury being done through inferior or scamped work. Salt is removed from the pans to the heaps in wheel-barrows. Formerly, it was taken away in baskets as in India, but from experiments that have been lately made, it is found that barrows remove it quicker and more cheaply. Boards are laid down from the salt mounds to the platforms to enable the barrows to travel with greater facility.



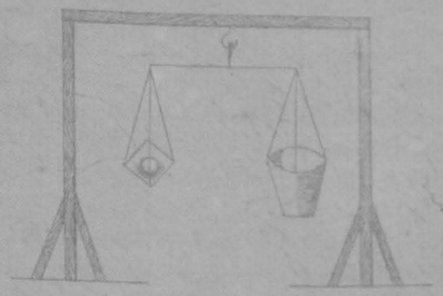
22. *Platforms.*—The platforms are long narrow raised causeways from five to six feet high, and about ten yards broad on top, flanking the salt beds on one side and bounded by a navigable canal on the other. Some of them have a tiled flooring at the places marked out for salt heaps, others are boarded, and others again are merely gravelled and rolled hard. On some the position of the salt-heap is indicated by a low stone-wall forming a three-sided enclosure, on others the same thing is indicated by a similar arrangement of boards. Finally, many of them are traversed by a tramway.

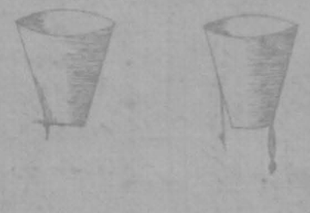
23. *Salt Storage.*—The great bulk of the salt made at the pans is stored in the masonry or wooden frames open at one end, mentioned in last paragraph, within which the salt is heaped up so as to exactly resemble, when covered, a long low-tiled cottage with gable ends. Formerly, reeds, rushes and straw were used for covering the salt, but now they are discarded every where in favor of tiles, and the wastage which was formerly about 10 per cent. has been reduced almost to nothing, besides the tiles keep the salt much cleaner. So cleanly is the salt removed from the pans and preserved on the platforms, that it is taken at once from the heaps and ground down in mills, of which there are always one or two at each station, for table use, without further preparation. The tiles are two feet long by one foot broad, and are bent or curved at right angles to their length. They weigh, 7 kilogrammes or 15·4 lbs. English and cost 90 francs a thousand or less than a penny, and not much more than half an Anna a piece. The number of tiles required is easily ascertained by calculation when the superficies to be covered is known. Table salt ready ground for use is stored in godowns adjoining the mills. Salt for fish-curing and for the manufacture of soda is heaped coverless on the platforms.

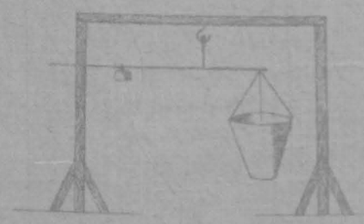
24. *Salt.*—The salt heaps that I examined were composed of salt very similar in appearance to that of Merkanum. A large number of firm lumps of salt made up of intercalated crystals scattered through the smaller debris of salt cakes, but, on the other hand, the crystals were in every instance larger, firmer, cleaner, more translucent and dryer than those made

in India. This salt is said to bear carriage with very little alteration or wastage. The table salt stored in the godown was perfectly white, dry, and finely ground, such salt in fact as one is accustomed to see on an English table.

25. *Weighment.*—When salt is going to be sold, a heap or as much of one as is wanted is untiled and attacked with picks and shovels at the open face of the enclosure and broken upright through, or as far as may be required. The weighing machine is as shown in the annexed diagram. Two uprights support a beam, from which depends a pair of scales; in one scale is placed a weight of 100 kilogrammes or 220 lbs. English; the other, funnel-shaped, holds the salt and is of a size to hold 220 lbs. and not much more. Salt is poured from baskets into the funnel, when the scales balance, a sack is held under the funnel, which again has a moveable bottom, the bottom is let fall and the salt tumbles into the sack. A blow on the catch causes the bottom to fall and it is replaced with equal facility. The diagram shows the arrangement of the catch with the bottom closed and open. Ordinarily speaking, when a whole heap is being broken up, about twenty men are employed. Some with picks destroy the heap, others with shovels fill baskets, others carry the baskets to the weighing machine and weigh it, others fill the sacks and tie them up, and others carry the sacks on trucks either to the wagon or boat and arrange them on board. Not less than five men can do the work, and it has been ascertained that five men working in this way for six hours put twenty tons of salt away, or one man stows away on board a boat or tram-wagon four tons of salt in a day of six hours. It should be added, that it is calculated that more would be done, only that the Customs Officer who stands by keeping tally for Government has the power, and frequently exercises it, of reweighing the salt. Another form of weighing machine with a lever arm, as shown in the diagram, is used at some places, and I am informed that six men working with this machine will put away in sacks 13,200 lbs. or nearly six tons an hour, which seems a good deal. As no tax is levied on export salt, salt for exportation is not weighed, but sold by measure to save time; for, as it is always made in precisely the same way, there is a constant relation between weight and measure, which being once ascertained, the salt may be economically sold by measure. For this purpose, salt is shovelled into a great wooden box like an inverted pyramid with a wide base having a sliding bottom like the door of a sluice gate; measures holding 220 lbs. each are passed under the box and filled by withdrawing the slide a little; they are then struck clean to the edge and emptied into sacks.

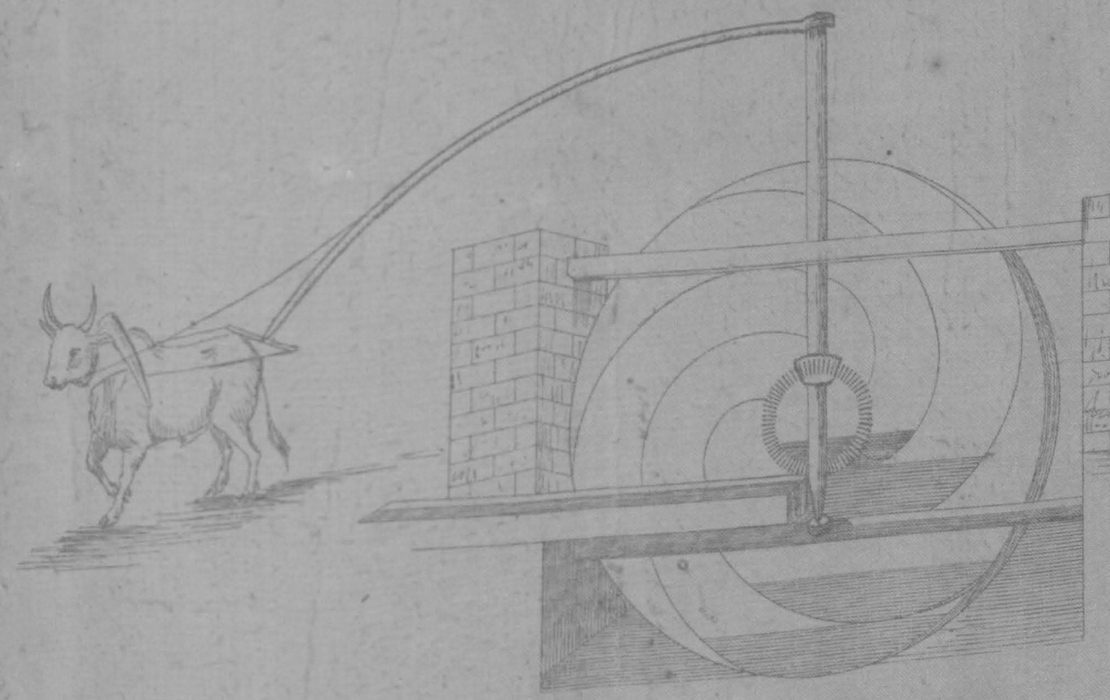






26. *Waste Products.*—A large quantity of Calcic Sulphate or Gypsum is deposited year by year in the inner and finishing condensers, where it forms in time a mass of impacted lenticular crystals similar to, but smaller than those found under the salt-pans at Chunampet near Merkanum. About every twenty years or so, this deposit has to be removed, as by its thickness and its liability to blister up off the soil it diminishes the capacity of the condensers, and sometimes also their evaporating surface. Its removal is attended with some expense, which, as far as the Gypsum is concerned, is a loss, as it is utterly useless being mixed up with mud, debris, &c., and has to be thrown away. Sodic Sulphate or Glauber's salt is occasionally formed in the reservoirs. Whenever there is a sharp frost on the Mediterranean Coast, as happened this year, a double decomposition takes place in the *virgin* brine: Magnesic Sulphate, and Sodic Chloride reform themselves into Sodic Sulphate and Magnesic Chloride, and the Sodic Sulphate being in excess at low temperatures falls to the bottom, generally at the lee side of the reservoir towards which its crystals are driven by the wind. It cost about three francs a ton to gather it, and is used chiefly with common salt for forming refrigerating mixtures. Formerly it was intentionally produced, but now-a-days, since the discovery of large mines of it in Prussia, its manufacture has been given up in France, and its formation simply injures the *virgin* brine, by breaking up the common salt in it, and adding to its quantity of Magnesic Chloride. Magnesic Sulphate and Chloride are got rid of with great care at the French works, especially the latter which is recognised as the most fertile source of wastage. They are pumped out to sea before they reach their point of saturation in bitterns of a comparatively low density from 28° to 32° Beaumé, and thus their deposition is entirely avoided.

27. *Pumping Machine.*—The machinery for raising water seems to me one of the most important and interesting studies at the French works, looking to the wants of Indian salt manufacture; and I quite think that the machine in use in the south of France is one which can be applied at our salt-pans without any great difficulty and with every prospect of success. It is called a tampon. At most stations there is one large tampon worked by ten to twenty horse-power engines, and one or two smaller ones worked by mules. The subjoined diagram represents a vertical section of a mule tampon showing its chambers, the application of the motive power and the flow



of water. It is not, however, a correct drawing from nature, as it is intended to show a good deal more than can be seen of a real tampon from any one point of view.

Similar tampons to this are described in books, but this one is special to the Compagnie de Midi, and is said to throw least labor on the mules, as from the uniform development of the

forward as a logical deduction from that consideration rather than as a serious proposal is—That Government make its own salt. As at present managed, Government pays for the construction, up-keep and establishment of the manufacturing stations, and yet pays ignorant contractors 5·6 francs a ton for manufacturing an inferior description of salt. Its total outlay is twenty francs a ton, whereas the French believe, and I also think, that they could make better salt here, everything included, for two or three francs a ton. By making the salt itself, Government could introduce those working economies and scientific improvements in the details of manufacture noticed in France. It is difficult to understand in what other way they can be introduced. The native contractors are in an independent position, and they know it. Happily ignorant, confident of their power, invincibly prejudiced and conservative, they go on making salt of the old kind in the old way, and for anything that I can see to the contrary, they will continue to do so for an idefinite number of years. At the end of 1873, I had begun to foresee this, and drew attention to it at the end of my report for that year. I can now only repeat that in so far as my efforts are directed towards improving the present method of salt manufacture, subject to existing surrounding conditions, they are not, I fear, likely to be productive of any great benefit.

35. Nothing would be better calculated to improve the salt culture of India than the excise system applied to salt, if only salt was sold by weight instead of by measure. But as the reverse is the case, as there is a premium placed on light salt by merchants at present buying by weight and selling by measure any withdrawal of Government supervision from salt manufacture would be at once followed by a decided deterioration in the quality of the salt in so far as there is room for it. On the other hand, if salt was sold by weight as well as bought by it, the excise system would, I believe, result in causing an immense improvement in the present state of salt manufacture. On the whole, I believe that the excise system, combined with an enactment compelling the sale of salt by weight, is the best proposal that can be made by one employed, as I am, in endeavouring to improve the manufacture of salt in this Presidency.

36. As long as the present state of things continues, intermediate between direct Government manufacture and excise, the best thing to do is to give or sell all new salt stations that are opened to intelligent capitalists whether Native or European, on the understanding or agreement that they will manufacture salt in an enlightened way and of a superior quality, and I know of no better test of quality apart from the cleanliness of the salt than a comparison of its weight with swamp salt. A manufactured salt, which bulk for bulk weighs as much as Vedarniem Swamp-salt for instance, is pretty sure to be well crystallized and free from Magnesium, &c. By an enlightened way of making salt, I understand its wholesale or economic method of manufacture as adopted by the French, with one restriction. In a tropical climate salt should not be left in the crystallizing beds longer than one month at most. Tropical showers come without much warning and are more copious and destructive than days of rain in France. There may be difficulty in getting men to buy or atleast agree to work a whole salt station on the terms mentioned for the existing Kudivaram. I have professed to be able to make salt at a very low figure. This report contains strong evidence to show that it can be made at any rate for very much less than it costs at present and better made; but how much better and for how much less, are questions that nothing but a sufficiently extensive experiment can settle practically. If Government desire it, I am ready to undertake the conduct of an experiment, only, to be of use, it should be on a sufficiently large scale ; time enough should be allowed for its completion and adequate funds provided for its conduct. The area at my disposal at Ennore last year was far too limited to have enabled me to do more than show how salt may be best and most economically made in an ordinary cramped native ullum.

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French gentleman who courteously assisted me in my work are anxious to see my observations on their method of salt manufacture, I would ask the Board to send some copies of this report to M. Miou, Representative of the *Compagnie Des Salines du Midi*, Montpelier.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) J. J. L. RATTON, M.D.,

Surgeon, Madras Army.

MADRAS,
4th March 1875.

curve, the centre of gravity of the mass or particles of water is displaced downwards rapidly and uniformly with consequent diminution of weight and friction. The curve is made by winding a piece of string round the edge of the inner circle or tube orifice of the tampon and unwinding it again, making a pencil score the extremity of the curve it describes. As the string unwinds, the radius of the circle described becomes longer and longer and the dimensions of the tube increases in the same ratio. By lengthening the pole or belts to which the mule or bullock is harnessed the labor may be greatly diminished, but the circle to be traversed is increased to the same extent, and ground wasted as well as time lost. An ordinary mule tampon has a diameter of about 12 feet, costs about francs 3,000 or £120, raises water 3 feet 3 inches, and discharges it at the rate of 263 cubic yards an hour. The circumference of the machine dips into the water which the chambers take up and discharge at the centre, out of which it flows into the channel at the higher level. By increasing the diameter of the machine it may be made to lift water as much as 5 feet, but this would not be necessary in India. The tampon is made of wood strengthened with iron, and there is a good deal of iron work about it, but it is not injured to any great extent by the salt water, as after the first coating of oxide has formed it protects the iron underneath from further rust. By means of the large double steam tampon at the centre of the works, at which part all the channels, &c., communicate with each other through sluice-gates, the Manager has perfect control over the flow of water throughout the works, and can empty or fill any part with brine or sea-water, at pleasure.

28. It is not easy to institute a close comparison between two methods of salt manufacture, differing so much in detail as do the French and Indian systems. It will be sufficient for my purpose, however, to compare their results, and endeavour to attribute them to their right causes. Salt of an excellent description, hard, heavy, well crystallized, clean, and almost chemically pure is produced for about five francs a ton in the south of France by the wholesale method. Salt comparatively of an inferior description, light, friable, flaky, somewhat dirty and impure, is produced in India for a trifle more than that sum, that is, the contractors are paid on an average Rupees 10 a garce, or at the rate of 5·6 francs a ton. Now to give this comparison its true value, it must be stated that the conditions under which salt is made are not the same in both places. On the contrary, there is every reason why salt should be made better and cheaper in India than in France. Comparing notes with M. Gervais, I found that the rate of evaporation of sea-water, or in other words the rapidity of production was nearly three times greater on the Madras than on the Mediterranean Coast, and that the price of labor was about one-fourth ; besides the presence of a stiff clay soil at most of our salt-pans renders it morally certain that they leak less than those in France. M. Gervais believes that the Compagnie de Midi with their system would turn out salt equal to their own in India at the rate of two francs a ton.

29. It thus appears that salt is made in India for 5·6 francs a ton of a decidedly inferior description to that made in France for five francs a ton. This again concerns the merits of the two systems in the abstract only, as the latter price includes the cost of establishment of works of construction, maintenance, repair, &c., and the coverings of the heaps, &c., and the former price includes none of these things, the Madras Government supplying them as separate from the cost of manufacture. To form a correct estimateof the real merits of the comparison, I must here, therefore, perforce compare the position of the Madras Government as proprietors of salt manufactories partly worked by contract, with that of the Compagnie de Midi making its own salt. I think that it costs the Madras Government about twenty francs a ton to make salt certainly inferior to that made in France under less advantageous meteorological conditions for five francs a ton. The cost of manufacture is made up approximately as follows : Cost of establishment reckoning it at the recognized rate of 3 Annas a maund 12·7 francs a ton, departmental works including salt coverings, &c., a little less than 6 Pies a maund or 1·7 francs a ton, payment to contractors 5·6 francs a ton, total 20 francs a ton. So that, as compared with the Compagnie du Midi, it costs in Madras four times as much to make a salt which is neither so clean, nor so pure, nor so wholesome, which will not bear carriage as well, and which is subject to a heavier loss from wastage. The reverse of all this should be the case.

39. I will now endeavour to ascertain the cause first of the absolute cheapness of the French salt. I attribute it to the economy of a wholesale method of manufacture. At Aigues Mortes for instance, which is as large as all the salt stations on the Ennore Canal put together, there is a permanent establishment of only 100 men, and one or two Superintendents. At the Ennore Salt-stations there are hardly less than a thousand contractors, four or five thousand coolies, five Superintendents, ten assistants, five clerks, and about fifty peons who all after a fashion live upon salt. Suppose all the outlying stations on the Ennore Canal turned into condensers. The salt beds and platforms collected at Ennore under the eyes of a single Superintendent, his Assistant, and a staff proportionate to the diminished area to be looked after, and the rest of the people diverted to other industries, and we get an idea of the economies effected by the French system. Conversely, the relative dearness of the Madras salt is due to the fact that Government gives out its manufacture on contract to petty contractors, supplies all the requisite large works, such as canals, embankments, platforms, &c., and maintains an establishment to look after the contractors and salt sufficiently strong to make the salt in a well arranged manufactory. The low level of the French salt-pans has not much to do with the cheapness of the salt, for after all the brine is pumped up to the finishing condensers and sometimes to the inner condensers, and when the pumps are not in action the mules still go on eating in the mangers. Steam pumps are of course relatively economic, but their use in this connection only serves to show that the French works are not much benefited by their low level.

31. The crystalline superiority of the French salt is no doubt due to the length of time it is allowed to form, the depth of brine under which it forms which protects it from the disturbing influence of the wind, and in a great measure also to the custom, strictly enforced, of keeping the brine in the salt beds always at or below 29° Beaumé, so that salt formation is never hurried or pressed upon by the approaching saturation of the Magnesic salts. To these reasons should be added two others, the rate of evaporation is less rapid in France than in India, and the winds as a rule are lighter there.

32. The superior clearness of the French salt is due to the gravelly hardness of the salt beds, careful handling and tile coverings, and its chemical purity to the careful exclusion from the works of brine capable of parting with its Magnesic salts. In these respects Indian salt is evidently capable of being improved up to the French standard without much trouble or expense, granted only a sympathetic state of feeling and hearty co-operation on the part of the native manufacturers.

33. Finally, there remains the question—what proposals calculated to benefit Indian salt culture are suggested by this report? In the first place, there are certain mechanical arrangements which may perhaps be advantageously introduced into this country which I will here merely enumerate and draw attention to, as before any of them could be adopted on a large scale, the question of advantage would have to be settled by limited experiments. I allude here to the pumping machine, the weighing machine, the platform arrangements for preserving the salt heaps, the tile coverings for the salt, the stone-rollers for hardening the beds, the wheel-barrows for removing the salt, the stick apparatus for levelling the beds, &c. Many of these might, I believe, be introduced with advantage, but I have returned so lately from France, that I cannot as yet speak positively about them. I have already by recommending in former reports a larger and shallower condensing area, a smaller number of salt beds collected at the end of the works nearest to the platform, deeper and stronger brine in the crystallizing beds, larger crystallizing beds well sanded, more time for crystallization and the removal of Mother liquors &c., anticipated most of the proposals relative to improvements in the details of manufacture suggested by the French works.

34. But besides these questions of detail, there are other and more important proposals which flow naturally from an attentive consideration of the foregoing facts. One which I put

forward as a logical deduction from that consideration rather than as a serious proposal is—That Government make its own salt. As at present managed, Government pays for the construction, up-keep and establishment of the manufacturing stations, and yet pays ignorant contractors 5·6 francs a ton for manufacturing an inferior description of salt. Its total outlay is twenty francs a ton, whereas the French believe, and I also think, that they could make better salt here, everything included, for two or three francs a ton. By making the salt itself, Government could introduce those working economies and scientific improvements in the details of manufacture noticed in France. It is difficult to understand in what other way they can be introduced. The native contractors are in an independent position, and they know it. Happily ignorant, confident of their power, invincibly prejudiced and conservative, they go on making salt of the old kind in the old way, and for anything that I can see to the contrary, they will continue to do so for an idefinite number of years. At the end of 1873, I had begun to foresee this, and drew attention to it at the end of my report for that year. I can now only repeat that in so far as my efforts are directed towards improving the present method of salt manufacture, subject to existing surrounding conditions, they are not, I fear, likely to be productive of any great benefit.

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36. As long as the present state of things continues, intermediate between direct Government manufacture and excise, the best thing to do is to give or sell all new salt stations that are opened to intelligent capitalists whether Native or European, on the understanding or agreement that they will manufacture salt in an enlightened way and of a superior quality, and I know of no better test of quality apart from the cleanliness of the salt than a comparison of its weight with swamp salt. A manufactured salt, which bulk for bulk weighs as much as Vedarniem Swamp-salt for instance, is pretty sure to be well crystallized and free from Magnesium, &c. By an enlightened way of making salt, I understand its wholesale or economic method of manufacture as adopted by the French, with one restriction. In a tropical climate salt should not be left in the crystallizing beds longer than one month at most. Tropical showers come without much warning and are more copious and destructive than days of rain in France. There may be difficulty in getting men to buy or at least agree to work a whole salt station on the terms mentioned for the existing Kudivaram. I have professed to be able to make salt at a very low figure. This report contains strong evidence to show that it can be made at any rate for very much less than it costs at present and better made; but how much better and for how much less, are questions that nothing but a sufficiently extensive experiment can settle practically. If Government desire it, I am ready to undertake the conduct of an experiment, only, to be of use, it should be on a sufficiently large scale ; time enough should be allowed for its completion and adequate funds provided for its conduct. The area at my disposal at Ennore last year was far too limited to have enabled me to do more than show how salt may be best and most economically made in an ordinary cramped native ullum.

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French gentleman who courteously assisted me in my work are anxious to see my observations on their method of salt manufacture, I would ask the Board to send some copies of this report to M. Mion, Representative of the *Compagnie Des Salines du Midi*, Montpelier.

I have the honor to be,
Sir,
Your most obedient servant,

(Signed) J. J. L. RATTON, M.D.,
Surgeon, Madras Army.

MADRAS,
4th March 1875.

Rlg 25 September/75
N 1414 -

Rev 12
3986/3

Proceedings of the above

Forwarded
Under date the 25 Sept 1875
Read the following Min: of the Board of
Revenue
3 M. E. 30 June 75 N 1804

1414
26

Revenue Department.

No. 3265

1414
27

From Bd of Rev.

Dated 30 June 1875.

FOR ORDERS.

Dr Rattons report is very interesting & may prove very valuable in improving the quality & reducing the cost of Salt Manufacture We must wait before taking action for the advice of the Govt of India

The Board is very interesting Letter of Dr Ratton & the Remarks of Govt - but it is unnecessary to write more in addition to what we have already said in our Report. We shall be glad to receive the Govt of India's decision & to be informed whether any steps are to be taken in the way of improvements

Dr Ratton
Superintendent &c

If the Essex system is
to be introduced on the East
Coast. Dr. advocates an
Estuative experiment
under Dr. Ratton's
superintendence. To establish
a definite standard of
coarse quality. as to
the time that might
greatly reduce the former
duration of the latter.
The composition is exact
is not accurate. but
I have no doubt that
a considerable margin
exist for improvement.
I observe that in the Bds
calculs. I accept Dr Ross
& thy quote from him Dr

relative to the
Essex system -
but if the system
is not introduced
on the East coast
I agree with Mr.
Hudleston that
Dr. Ratton should
make the experiment
on a sufficiently large
scale.

RK

I believe that
in Italy there is
a simple but excellent
system of salt
manufacture - Dr
Ratton might be asked

Proceedings of the ab

Instructg. copies of Dr Ratton's mg
with the date of Treaty &c

Foreign Office
Under date the 25 Sept 1795
Read the following Proc: of the Board of
Revenue
3. M. 2. 30: June 95 &c

1414 / 20
1414
Assumed by
1804

of 12 July 73 (Ref to No.
17 Oct. 74. No. 338/. they
have included Guernsey
&c. - in the W. Line - should
the wrong - The guards
are maintained in the
interests of Revenue - &
all persons to be detained
after telling pria in order
to arrive at the so called
Duty - Item 8d. Smuggling
Guards to in the case of
Sea Customs -
Abstract of that Act.
of. on 31. Oct. Ld Not
Rec. the Ex. of 30 Oct.
Ld Rat Dr. Letter 2nd
Encloses statistical
the Dispatch is in the
hands. She did it
Ed. Litre Lowe

letter

such a scale as
result of the Essex
being extended
ten cases -

Alle

Members of Commerce
Dr
Dr L Ratton
Commissr Customs &c

Jan 25/10

Salt Culture in South of France

for copy of D. R. report.

Minute

Dr Rattos report is very valuable & Establishes a Contract - as regards price quality, industry, manufacturing intelligence &c &c - between the large, free & Scientific Capitalist-factory System (Subject to Excise duty) of France and the Small slovenly cash peasant manufacture for the State Monopolist of South India. The Contract is true and is precisely what the 2 Systems respectively produce however applied

A far finer salt is made on the shores of the Mediterranean

C-2d Sept/75 under

FOR ORDERS.

under Comparatively adverse Conditions at a somewhat less prime Cost than that prepared on our tropical shores, while Experts tell us that Salt such as is produced in France at 5 francs per ton should be manufactured in South India for 2 francs per ton The Cost of fiscal management apparently runs up the value of our Salt to upwards of 13 francs a ton before it is ready for sale, while I gather that Salt is sold for Export at 5 francs a ton - the prime Cost - at the factories in the South of France.

There is clearly something here that will force early and Immediate revolutionary attention to our System; and the difficulty as to

Proceedings of the Ch

Remarks, report of Dr Rattray on the Salts of France &c

Government
Under Date the 25 Sept 1875
Read the following Proc: of the Board of Revenue
No. 1414 dated 20 Sept 1875
3. N.E. 30: Lines 95 to 1804

as it seems to me, is "What to do with" the important report at present.

Clearly we ought to do what we can in the direction which research & fact indicate. These are Concentration & use of Capital under the Stimulus of free manufacture (subject to Excise). We should try gradually to pass the manufacture of salt into the hands of large Capitalists - as in the matter of distilling and I cannot but think we might do so extensively

The Mirasee System may make Concentration difficult in some parts but

such a scale as

spirit of the Excise

being extended

ters under

All

Member of Council
Dr Rattray
Commander Martin R.N.

25/10

but this should be looked
to at once everywhere
It is clear that Capital
and plant are applied
in France to an extent
which our System entirely
ignores and Govt. will
never attempt. Nothing
Else but Service & Capital
can arrest the ~~to the~~
waste ~~& indictable~~
barbarism of our system
and these we may
feist private Companies
will not hesitate to
apply, if we encourage
them. They are flying at
Cotton, distilling &c. Why
not at Salt? I would
certainly endeavour to start
some

Proceedings of the Board

Statements, report of Dr Ratton on the
Salt works of France, &c

Government
Minute of the 25th Septr 1805
Read the following Mins of the Board of
Revenue
3. 10. 2. 30. June 25 1804

Some private Salt works
on the French System, and
ask Dr Ratton to form
if if possible a Company
And allow him to be
their Official adviser -
Ratton become of
Mr Minchins (Alaska)
proposals?

I would ask the
Board to consider
this matter at once
with Dr Ratton and
invite tenders for
selected works.

I do not think much
of a large experiment at
Stoke cost as suggested
by the Board. If new pans
are to be opened, why not
invite tenders for
manufacturers on the
Excise System and
buy

Member of Council
Dr L Ratton
Commissr Martin & Co

June 25/05

buy the effect of Capital and Excise together - I think we might here do what we are doing in Abkari - keep up the existing system of monopoly purchase when the small native system of producing Salt continues - and at the same time endeavour to have Capital manufacturers along side of them manufacturing on a large scale under Excise until ripe for the entire transition.

I would call on the Board to arrange, if possible for some Capitalist factories in several Districts

9/8

h: 229

Salt Officers in Salt of France

Frontiers

G. 6 25 September 1875
No 1414.

G/A 25 September/75 No 1414

Proceedings of the ab

Letter from Treasury, reports of Dr Rattray on the Salt Duties in the Salt of France, &c

1414 Revenue

Government
Under date the 25th Sept 1875
Read the following Res: of the Board of
Revenue
1414/20
3 M. E. 30: June/75 No 1804

The thanks of the Govt are due to Dr Rattray for his interesting reports on the method of Salt ture in France - ich will be communi the Chamber of Com. Ger will be prepar entertain proposals fro pitalists to embarke manufacture on ir own account on ale as to the Excis t of the Excise being extended to ir works -

Alle

23/9

1 To The Chamber of Commerce
14 " Bombay
1 " Dr J. L. Rattray
1 " Messrs Commander Northcott & Co

G/A 25/10

Sent to Hon. Wm. Ellis Wash. 20 Sept/75 Rec'd 26 Sept/75

C 16 Sept/75 Rec'd 20 Sept/75