

ENGINEERING DEPARTMENT.

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In looking abroad upon the world and contemplating the various changes and improvements from the past in the physical conditions of life, we are naturally led to inquire about the forces and agencies that have been employed in effecting the present superior conditions of things, and also about the class of men who have proved themselves equal to the emergencies of distributing those forces and controlling their energies for ameliorating the lives of their fellow men.

Conspicuous among the contributors for these advanced and still advancing ideas are the engineers; let their work lie as it may in any one of the special departments of the chosen profession. It is well for us of to-day that brilliant minds have in the past devoted their life work to effect this mighty change. Are we to be heirs only of this heritage, or are we to use it as being the proper lever in our hands to effect still greater achievements? if so, then we must put ourselves in suitable condition with our surroundings, being equipped with all available knowledge; bringing to bear the experience of the past for the solution of the problems of the present, and bequeathing these as data for those of the future.

The engineer is in a position between the earth with its elements, its forces, and its people, to fill the barns of the farmer with plenty, to relieve in a measure the patient ox in his toil of the furrow, and the ever serviceable horse from over exertions on the road; to assist workman in all the avenues of life, by harnessing the elements for their relief; to give water to the thirsty land, and bid it depart from that which is submerged, to give light for darkness, heat for cold, to make the afar near, to bring that which is high, down and to elevate that which is low. The engineer's duties should not consist only of the performance according to the rule of certain pieces of work under pay, but his whole life should be one of continued careful observation, to be as sagacious in the various lines of his profession as the indian or the hunter, or trapper becomes in woods crafty; besides his skill and dexterity in the manipulation of his instruments of precision, and his ability for the correct solution of the problems in hand, he needs, as a further preparation for his work of usefulness, a thorough training of all his faculties and constant test of conclusions; let his senses by their training become so acute and under such subordination and control as apparently without effort to reveal to him the state and condition of nature in all her mutations as well as the state of things in general. But how shall the engineer go about to effect these things? Let us see. Are the roads bad, low, muddy, almost impassible for periods in the year? Investigate them

thoroughly, see what is required to make them good, what different modes of improvement may be adopted with feasibility, look up hills or beds containing gravel or quarries, in which to crush stone and are easily accessible with which to surface them after proper drainage and turnpiking. Are the well waters impure? Seek first the cause, then, if possible, the cure; or if a supply of better quality cannot be secured by some of the methods usually employed, construct waterworks. Does sickness prevail in a neighborhood and disease become epidemic? Be sure there is a cause, do not be content with ascribing it to the mysterious hand of Providence, but to a neglect of duty, a want of vigilance, a sleeping of the proper sentinels, be sure a foulness is lurking somewhere—construct sewers.

But as to the manner, and the means to effect these improvements, seek every favorably opportunity to post the people up as to the necessity for the needed measures, let no stone be unturned, no vigilance remitted, for having them thoroughly imbued with the necessity for the desired work and the advantages to accrue from the execution, and there will soon be found a leading spirit materializing who will rally the people and procure the necessary means to carry forward the undertaking. The people thoroughly aroused, the work is half accomplished, and little more effort is required for its successful completion. Our views are tied too much to the past, our movements too prone to the incumbency of yesterday, we hesitate to step into the fields where none have trod before, we are timid in venturing where the way has not been pointed out, and we would urge men to strive to rise sufficiently to seize the cord that may lift the curtain and lay hold of the string, to raise the latch, that may open the door for the mind to grasp, and the eye to gaze upon the things which lie upon the threshold of the, as yet, unknown.

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As long as the ashes and refuse from cities are taken out and dumped by the careless drivers on the nearest out-lying vacant spaces, these places will form very dangerous building lots, and when sanitary inspectors fail to notice unhealthful ground, private citizens should be on their guard. When such made land must be used, the cellars should be well cemented and the stone foundation run down deep enough to reach solid ground,

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Cities and towns with surface drainage may be more unsightly than those provided with underground drainage, but the former, in time of rains, are certainly made much cleaner and are swept of all filth, especially if the streets are hilly and uneven. Still it is very disagreeable, to say the least, to see house waste and wash water running from houses and buildings in gutters exposed to view.

There is, however, less danger to the

houses themselves, for when waste pipes connect with underground gutters, backward currents of air, especially when the house has been vacant or unused for a long time, are very liable to fill the house with sewer air.

As to the composition of sewer air, opinions differ, but it contains very few harmful bacteria. This is principally because the bacteria of decomposition act antagonistically to the disease-producing bacteria and the result is annihilation of the latter. Furthermore, the bacteria adhere to the moist surface of the underground sewer. This is why frequent examinations of the sewers of Berlin have shown almost complete absence of bacteria. Let the sewer, however, be unused for a long time and the bacteria attached to bits of dust may by backward currents of air be carried into the houses.

It is just as well to close all closets and sink outlets when the house is to be vacant for a long time and then the certainty of cutting off this mode of entrance for bacteria will be assured.

Roads.

The best road making in many populous and naturally thoroughly drained districts is complicated by the practice for many years of attempting betterment of clay, hard pan or gravel, containing much clay or loam, or other material which has destroyed the drainage of the road-bed, that formerly existed and increased its water holding capacity. In such cases it may be cheapest to select a new line for proposed rock road. Or, if sand is plenty and there is room enough in a rural street, let the artificial mud be scraped entirely away to grow grass upon, down to the original sand to which other sand may be added and on this well trampled by turning teams, may be built the best stone road. Many years of travel on simple sand will grind that to mud in wet weather.

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Wherever water with or without frost is liable to render the foundation of a road insecure, provision must be made against it. There are perennial springs that anyone can see, and basis of rock, hard pan or clay, which becomes springs in wet weather that few will see before hand. These are the cause of trouble where cuts have been made for roads—the chances are too numerous for specification. Simple land drainage of clay will improve lines of highway in frosty regions. Three inches of sand along the line of a wet meadow under drained, furnished a dry foot path. And when it is overgrown with grass, thatched roofed as it were with grass fibre, frost never softens that sand and we see illustrated the effect of solid stone floor roofing upon a ridge of drained clay.

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Drainage should be done separately from road work and months before it,