open cotton, which is delivered to the receptacle absolutely free from dirt of every description. The capacity of the machine is measured by the number of acres it can be drawn over in a given time and the amount of open cotton it encounters. For instance, if there were half a bale to the acre, and it were drawn over eight acres a day, this would not be an excessive load for two horses. As the machine weighs about 800 pounds, it would pick out four bales per day, thus doing the work of sixty hands. At this rate this machine could gather cotton at a cost of less than one dollar per bale.

This machine, as will readily be perceived, is simple in construction, the parts are few and not liable to derangement, and it removes the cotton, whether from high or low plants, efficiently and rapidly, and leaves the plants in as uninjured a condition as possible.

Additional particulars regarding this cotton picker can be obtained by addressing the inventor, Mr. R. K. Charles, of Darlington, South Carolina.

The Temple of Baalbec.

Rev. Henry M. Field, D.D., after his return from an extended tour through Eastern countries, has published a book on India and the Holy Land which is both instructive and entertaining. Doctor Field, in a letter to the *Evangelist*, of which he is the editor, thus describes the ruins that mark the place where the grandest of ancient cities is believed to have existed:

The ruins of the ancient city of Baalbec, situated on the plain forty-three miles northwest of Damascus, are the wonder of modern architects.

Everything is colossal. The area is larger than that of the temple at Jerusalem. We may begin with the walls, which are half a mile around, and of such height and depth as are rarely attained in the most tremendous fortress. Where from within I climbed to the top, it made me giddy to look over the perilous edge to the depth below; and when from without the walls I looked up at them, they rose high in the air. Some of the stones seem as if they had been reared in place, not by Titans, but by the gods. There are nine stones 30 feet long and 10 feet thick, which is larger than the foundation stones of the temple at Jerusalem, dating from the time of Solomon, or any blocks in the great Pyramid.

But even these are pygmies compared with the three giants of the western wall, 62 feet, 63½ feet, 64 feet long. These are said to be the largest stones ever used in any construction. They weigh hundreds of tons, and instead of being merely hewn out of a quarry which might have been on the site, and left to lie where they were before, they have been lifted 19 feet from the ground, and there embedded in the wall. Never was there such cyclopean architecture. How such masses could have been moved is a problem with modern engineers.

Sir Charles Wilson, whom I met in Jerusalem, is at this moment in Baalbec. Standing in the grounds of the temple, he tells me that in the British Museum there is an ancient tablet which reveals the way such stones were moved. The mechanics were very simple; rollers were put under them, and they were drawn up inclined planes by sheer human muscle—the united strength of great numbers of men. In the rude design on the tablet the whole scene is pictured to the eye.

There are battalions of men, hundreds to a single roller, with the taskmasters standing over them, lash in hand, which was freely applied to make them pull together, and the king sitting on high to give the signal for this putting forth of human strength *en masse* as if an army were moving to battle. A battle it was in the waste of human life it caused. These temples of Baalbec must have been a whole generation in building, and have consumed the population of a province and the wealth of an empire.

How Disease is Spread.

Every one knows that scarlet fever is infectious, but it is not often one is able to trace the progress of the disease through simple carelessness so easily as in a case which has just come under the notice of the *Sanitary World*. The story is told as follows: A young Scottish lassie, in domestic service not far from the town of Elgin, died from scarlet fever in her "place." Her clothes were carefully packed up, and her "kist" containing them was conscientiously sent home to her native village. On its arrival at the station there was the usual difficulty of getting it conveyed over the hills to the place of its destination, so there it had to remain awaiting a friendly lift. Meanwhile the infected kist formed a happy hunting ground for the station master's children, who, in due time, all fell ill with scarlet fever. At last the friendly lift came, and the box (a large wooden one) was carried home, and the contents generously distributed among the neighbors. Needless to say that an outbreak of scarlet fever in the village was the result; and as to the station, where people do congregate and often have long to wait, it would simply be a center from which many a fever track would radiate, exciting the usual wonder whence and how the fever came.

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THE SCIENTIFIC AMERICAN SUPPLEMENT,

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SQUARE COTTER PINS.

Split pins, or "cotter pins," although not strictly and rigidly mechanical, are useful in many places. They are usually made of half round wire or rod, and doubled together, the flat faces meeting so as to form a cylindrical cross section; and while the two ends are left slightly apart "for spring," the doubled middle that forms the upper or handle end is made into a loop that gives a head and imparts a slight elasticity to the blades. For securing intermediate gears on stationary studs and for similar purposes, where the secured piece may be removed and replaced at pleasure, the cotter pin is very handy. Its philosophy is simply that the compressed halves will pass freely through the drilled hole, but that, when the compression of fingers, or tongs, or pliers is removed, the released halves will be forced against the sides of the hole, preventing removal or relaxation of tension by jarring.

Some machinists are like amateur gardeners, always trying some new plan. So, one has determined that a square cotter pin is better than a round one. He takes flat steel with a thickness as to diameter as one is to two, measures the desired length of shanks, and then forges the center of the piece to a thin blade like that of a pair of spring calipers, which he brings to a spring temper. When uncompressed, the blades or shanks stand wide apart; when compressed, they are passed through a round hole in the stud, and the force of the tempered spring end pushes them against the walls of the hole. The corners of the pin effectually prevent it from turning in the hole by the jar of the machinery in motion, and the elasticity of the spring head holds the jaws or blades out securely against the sides of the hole. The rigidity of the unforged steel makes its own seat by its corners, and the pin may be always put back into place. This prevention of turning in the hole appears to be an advantage.

SPRING GAUGES.

In these times of absolute measurements, exact estimates, and precision tools, it is time for spring gauges to give place to those of absolute movement. There is no spring calipers nor spring dividers that are absolute in both movements; one is a compression and the other a release, but only the compression is absolute, and that only to a limited degree. Our ordinary measurers of diameter should be governed by a screw or some other mechanical device that shall control the movement of the measuring points, whether they be "to or from." It is time that this old-fashioned, inaccurate system of measurement was given an indefinite recess. Exact mechanics and their productions have had enough of its "guess and try again" plan.

The spreading of the legs of a pair of spring dividers and the reach of the jaws of a pair of spring calipers depend wholly on the latent tension of the spring at the head of the instrument. This is a flat steel spring, between the legs or jaws, and is usually of a curvature representing nearly a circle. In not a single instance out of twenty-two tests has it been found that the almost circular curvature of the spring head has been of the slightest use. It appears that this form of end spring to caliper and divider is mainly a mechanical tradition, and that, in use, the curve was of no value; all the spring was close to the apex, just as in the main spring of a gunlock all the spring is in the U bend at the apex of the two arms of the spring. It follows, then, that the curve of the head of spring calipers and dividers might as well be made of the V form as of the circular form; it is certain that with this form they would be more active on demand.

But all this spring business should be taken out of our modern, exact, absolute mechanical work. If it is necessary to have temporarily adjustable gauges (which is doubtful), let them be made on the plan of the screw, which gives and takes exactly the same. Such adjustable measuring machines have been made, and readily usable hand appliances are not impossible.

CUT NAILS AND WIRE NAILS.

When a sliver is cut off the end of a section of thin iron plate, and is formed into a nail by upsetting the larger end for a head, no change in the quality of the iron takes place by the cutting and the upsetting; the fiber is the same, and the material remains of the same strength. If a piece of plate iron is cold short when in a flat plate of one or more inches area, it will not become strong, tough, and fibrous when divided into narrow widths. And yet this is the amount of the claim some cut nail makers make for their goods.

There can be—there is—no question about the economic value of cut nails; their introduction has been of the greatest service possible to all who use nails. But there is a point where their usefulness is superseded by better nails. Cut nails, like pegs, hold together superincumbent substances, but they do not, like rivets, resist transverse strains. If a nail holds the same amount of resistance to blows, the same quality of directing by blows, the same utility of double usage after being bent and crooked, as a rivet does, it is a good nail. Was there ever a cut nail that fulfilled these conditions? Never. But a wire nail does—all of them. On all its sides its fibers are compacted, and in one direc-

tion; its surface is smooth; it does not split; if it is drawn, it is again useful; if it is crooked, it may be straightened and used again. All the conditions and requirements of nails seem to be met by the wire nail; or if not met just now, there is room for improvement. There can be no improvement on the cut nail, except that of original excellence of material; all cut nails are simply cut slices from a presented sheet; on two sides at least there can be no compacting of the material, and they are left ragged. The wire nail, on the contrary, has a clean, longitudinally fibrous surface on all sides.

There may be cut nails—there are cut nails—that will stand a half twist about their own diameter; that will stand driving through hard seasoned wood; that will clinch on the other side, bending like lead. But these nails are made from Dannemora or other very tough, fibrous iron, and are costly as compared with the ordinary cut nails of the builder's use. These nails should no more be compared with the ordinary cut nails than should the boat builder's cast nails of Muntz metal; the materials are very different. It may be that some establishments, managed by practical mechanics and engineered by men with consciences, make reliable, tough, and really valuable cut nails. If there are any such, to them the article on the subject published in our issue of March 28 does not particularly apply; and possibly our readers, especially the wood workers, would be glad to hear from them in our advertising columns.

DIRT, DISEASE AND DISINFECTION.*

BY E. DWIGHT KENDALL.

"This water I purify; this earth I purify; how shall I purify the dwelling? . . . Combat uncleanness, the direct and the indirect."—*The Avesta* (*Vendidad*).

Long before that eventful dawn when Darius bestrode the historic steed and was uplifted to the throne of Persia, by *ascent* so extraordinary,† Zarathustra taught the Iranians to avoid bad smells: that those haters of mankind, "the Dævas, who slay a countless number, find joy in all to which stench clings, where are together dissolution, sickness, fever, uncleanness, cold fever, shivering." That antique medicine-man, high priest and prophet instituted laws that forbade accumulations of putrescible and noisome matters, allowed free operation of Nature's scavengers and protected wells and water courses from contamination. After all the centuries and the warning visitations of many filth-engendered epidemics, the people of every land, still heedless of the dangers that accompany impurity, need constant admonition and enforcement of sanitary laws. The ancients excelled in appreciation of the benefits of cleanliness and dislike to dirt: we may profit by their teachings; they recognized in filth the source of national plagues and opposed uncleanness in every form. "The pestilence walketh in darkness," said the psalmist, but the Jewish priests maintained a system of scavenage, themselves supervised the cleansing of cities and habitations, adopted methods of quarantining and, like other nations of the East, made personal ablution a part of religious duty.

During the centuries when ignorance prevailed and sanative regulations were unknown, successive waves of filth-disease swept over continents and unpeopled realms. Then epidemics were ascribed to sorcery, invisible fiends, the evil eye; to poisoned wells and food; to astral influence and telluric agencies, as when the earth emits, from cavern and volcano, poisonous fumes. Our good forefathers spoke of "visitations of Providence" (the sin of a people visited on other nations!) and depended more on prayer than purification. Not many years ago, the hypothesis of catalytic action was applied to explain the propagation of zymotic disease and other theories were favorably regarded by physicians. Now the morbific function of filth is shown to be a part of the natural economy and scientists say: "specific micro-organisms, septic and pathogenic bacteria: micrococci, bacilli, spirilla; behold them!" The mountain of Ages brings forth the microbes.

We are apt to adopt new conceits and often we are led astray by unfounded hypotheses, but even the luminary of the Middle Kingdom, the great opponent of innovation, who taught that truth lay in most ancient fountains of wisdom, could not have doubted the evidence that demonstrates the germ theory of disease. Science now shows that man is originated, developed and conserved by myriads of vitalized organisms, that work together in harmony and live in accord with cleanliness; that various forms of antagonistic organisms breed and dwell in filth, and when these invade the cleanly microcosm, they devastate and destroy. One foul procreant germ, conveyed into the human body by impure water, tainted food or polluted air, may generate a pestilent swarm. The disorders thus produced, mostly preventable, are classed as filth-diseases. The specific germs of many such diseases are identified: the bacilli of septicæmia, leprosy, enteric (typhoid) fever, dysentery and tuberculosis:‡ the micrococci of small pox, croupous pneumonia, scarlatina* and diphtheria, and many more.

Whether India's contribution to the plagues of mankind, the virulent septic cholera, is due to the presence of self-propagating organisms or to toxic chemical action, its source and sustenance is excrementitious filth. In the delta of the Ganges, a low and marshy tract, rendered pestiferous by continual heat and moisture, the cholera is endemic: there it has a permanent home; it is nourished by the unspeakable foulness that surrounds the huts of low caste Hindus, a despised and tabooed class, who unconsciously avenge their poverty and degradation, by sending forth this curse among the nations. It follows the paths of commerce, and where filth is, there it finds an abiding place; "in whatsoeuer contrie lyke cause and matter is, there commyng like aier and cause efficient wil make lyke effecte and disease . . . it cometh by infection and putrefaction . . . as nigh to dwelling places, merishe and muddy groundes, puddles or donghilles, sinkes or canales, easing places or carions, deadde ditches or rotten groundes, close aier in houses or uallies, with such lyke."

We must exterminate the enemy Filth, that invites the pestilence, after rendering the hydra-headed monster innocuous: we must improve the plan of Hercules and before decapitating, cauterize, attacking first with disinfectants, while we exclaim, with the Brahmins, in words from the oldest of books, "Whether thou, O greatest killer of Vritra, art in the light of heaven, or in the basin of the sea, or in the place of the earth, or in the sky . . . I turn the poison out from thee." In this work, as in therapeutics, chemistry is the ally of the noble profession—honored through all ages—which in every time of pestilence is prolific of heroes entitled to the civic crown. Hippocrates II., greatest of the Asclepiadæ, adopted means of disinfection devised by famed Empedocles, whom chemists claim, and fought a plague, successfully, with fire. Chemical science determines the nature and potency of disinfectants hitherto employed, and presents new agents with peculiar power to extirpate foul broods of parasitic microzymes. Many of the old preventives merely masked bad odor, leaving intact the contagium; others are really efficient, in themselves or by agents which they convey: thus when we wish to fumigate large spaces, we may imitate Odysseus, who purified his halls with burning sulphur and the smoke from wood. The sulphnrous acid operates in three ways to destroy organic life and the smudge from green and resinous wood contains acetic acid, certain hydrocarbons, phenols, cresols, xylenols, and acrolein, all having antiseptic qualities, with power to kill bacteria and cleanse all fomites.

No disinfectant, old or new, is adapted to all circumstances: in one place suitable solids, slowly dissolving, will suffice, as quicklime, alums, tannins, salts of lead, zinc, copper and iron; in another we must use a miscible liquid, like solutions of salts and alkalies, acids and phenols; elsewhere nothing will reach the evil but a searching gas or vapor, such as nitrogen oxides, chlorine, hot air, superheated steam. Dry earth, charcoal, peat and cinders will absorb and fix offensive matters, but have little power to disinfect.

Some disinfectants act by oxidizing, others by deoxidation: one will destroy anaërobic bacteria, the other kills the aërobic—the oxygen-consumers. Other agents, acting on feculent matter, form, by substitution, new and non-putrescible compounds; another class coagulate albumen and exert an undetermined destructive influence on all micro-organisms. Tannins and mineral astringents attack albuminoid and chitinous bodies. Certain solutions act as antiseptics and sterilize the mother of infection, while they do not harm the hardy species of the microzoa when matured, like certain vibrios that still live and thrive, and agitate their cilia rejoicingly. The skins of many forms of infusoria contain much cellulose, that resists weak acids, alkalies and feeble oxidizers, but all infusorial life succumbs to phenols and the halogen-elements. Wherever chlorine can be used it is effective; diffused through the air it decomposes and combines with the offensive sewage gases, hydrogen sulphide, methane and ammonia, which are not the causative principles of infection, while it also removes the peculiar and indescribable odors that usually accompany putrefactive emanations and seeks out and destroys non-odorous seeds of contagion.

It has been said that a quantity of chlorine sufficient to neutralize polluting germs, would prove injurious to man, but mere pure air is deadly to those germs, and one familiar with ozone, a natural disinfectant of the atmosphere, will hardly fear a little chlorine in the air. The use of larger proportions of chlorine, acting for a time within a confined space, is the most efficient of practicable methods of disinfection. Ten grains of chloride of lime, in solution, will disinfect a gallon of city sewage, but other chemicals are often preferable for this and similar purposes. Disinfecting agents should be used understandingly in every case, and one in doubt should consult his physician or a competent chemist. Only approved disinfectants should be employed and these in sufficient quantities. A few grains of thymol, a sprinkle of X's mysterious powder, or a spoonful of permanganate solution in a saucer—these are things too puerile for consideration. The refuse from certain manufactural operations may be utilized for the economical disinfection of large masses or areas, and the presence of such residuums in water reservoirs or running streams tends to prevent the development of zymotic germs.

Water may be freed from organic impurity by chemical means, but the best way to render it potable was pointed out by Hippocrates when he declared that suspected waters should be "boiled and strained." Mere filtration will not give immunity from infection, but advantage accrues from the use of freshly burned charcoal or spongy iron.

* Nec doctissimis.

† "Aer ex ferto *mare*."

‡ The infectious character of phthisis pulmonalis was recognized by Isocrates.

* The plague Thucydides describes resembled a malignant scarlatina.

HOW MUCH SHALL THE DOCTOR BE PAID?

What may the physician reasonably demand for his services? is a question that he and his patient are not always agreed on; and there being, unhappily, no fixed charge for medical attendance in this country, the physician, naturally enough, strives to obtain as much as he can.

Unless a contract is made before the services are rendered—rarely the case in the treatment of irregular patients—a physician can make any estimate he likes as to the value of his services, and the courts are continually being asked to examine into physicians' charges. The fact that juries rarely sanction these charges would indicate that they are apt to be extortionate.

In a recent paper in the *Medical Record* on "How Much Shall the Doctor be Paid?" a writer lays down some really excellent rules for deciding upon the value of medical services. He says:

"In considering the question of the amount of compensation due the physician or surgeon for his professional services, there are two or three preliminary points which require an answer favorable to the practitioner. There must be no doubt as to the fact of the services being faithfully and skillfully rendered, and the charge of malpractice must not be raised against him. If there is a question as to the skillfulness of the treatment, the compensation may be seriously cut down; or if an improper or harmful mode of treatment has been adopted, the right to any compensation at all may be denied, and the patient allowed to recover damages instead."

This is fair as far as it goes, and if the writer had laid down a rule for deciding what medical services are worth when successful, and just how much the doctor should hand over to his patient as compensation for rendering his case more desperate than it was when he began his ministrations, nothing would be wanting to make it as easy to deal with a physician or surgeon as it is with a mason or a brass finisher.

A physician, for instance, who poisoned his patients while experimenting with new qualities of vaccine virus, instead of charging them for the medical attendance necessary to insure their recovery, should pay to each a fair compensation for loss of health, etc.

As to what a physician should be paid when successful in his treatment could readily be determined, were it not for the fact that the unskillful are inclined to regard their services as of the highest market value.

The fact is that although in no profession there is to be found more ability and faithfulness to duty than in the medical, there is at the same time no profession in which quackery can ride rampant with such impunity. The physician who lives in a great house and rides about in state has no trouble in obtaining large fees for his services, even though these consist for the most part in feeding bread pills to old ladies and patent medicine to old gentlemen with the gout, whereas the obscure man, often of really commanding ability, often finds difficulty in obtaining small fees for really skillfully performed operations.

Dickens, a careful observer of character, understood this credulity of the public. His Mr. Bob Sawyer built up a flourishing apothecary business by sending his boy around to leave prescriptions at different houses, and then calling later to explain the mistakes. This gave the impression that he was doing a large business, and was therefore at least a fashionable, if not a skillful, compounder.

Patents in the Hawaiian Islands.

The authorities of the Hawaiian Islands have recently enacted a patent law, and the King has sanctioned the promulgation of its provisions. The term far which a patent may be taken is ten years. Applicants are allowed one year after the issue of the earliest patent in another country or the introduction of the article into the islands, to file their cases. The law governing the proceedings before the tribunal, and the final issuing of patents, is modeled after the United States patent laws, and the cost is about the same as an English patent.

Inventions may be secured for one year by caveat. Other particulars may be had on application to the office of this paper.