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Contents.

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TABLE OF CONTENTS OF
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A RAID ON INVENTORS' RIGHTS.

As the patent law now stands there are two ways for a patentee to recover for an infringement of his rights. He may proceed at law and recover damages, that is, what he has lost by means of the infringement: or he may proceed in equity to recover the infringer's profits, or the saving effected by the use of the pirated appliance or process.

These two courses are adapted to two entirely different classes of patents, though in many cases the patentee may elect which course he will pursue in case of infringement, both being open to him. Where the value of the patent consists wholly in the right to make and sell the thing patented, the rule of damages is applicable. Where the value of the patent consists wholly in the use of the patented appliance or process, cases of infringement go to courts of equity, and the amount of the patentee's money recovery is measured by the infringer's gains through the infringement. In an action at law the plaintiff recovers actual damages. If he has been in the habit of granting licenses to make and sell his invention, thus establishing a market value for the right, such license is made the primary (but not the absolute) basis for measuring damages. In case the evidence on this point is not sufficient to determine a just measure for damages, the court or jury determines the damages from all the evidence in the case. Where the profit of an invention accrues only to the user of it, the doctrine of equity is that a trust exists in behalf of the inventor or owner of the patent, for whose benefit the user of the patent is a trustee; and whatever money an infringer derives from the use of the invention he is bound to pay over to the owner of the patent. This even where the infringer fails to make a profit by the infringement, since his misuse of the patent may be more seriously injurious to the patentee than its proper and profitable employment could possibly be.

To obviate certain practical difficulties in the working of this last rule—obviously also to prevent the enactment of something worse—the Senate committee adopted Section 2 of the amended Senate bill No. 300. As analyzed by Judge Foote (it is too long to be quoted here), this section divides all cases of infringement into two classes. First, where no account of profits or savings shall be allowed; secondly, where it shall be allowed. In the first class there are two divisions—(*a*) where the patentee has elected to license other persons generally to use his invention, in which case the license fee is to govern the assessment of damages; (*b*) where it shall appear to the court and jury that it is for the interest of the patentee that other persons generally should use his invention and pay a license fee therefor; then the court and jury are to say what would be the proper license fee. In the second class of cases the bill provides that in taking an account of profits "the defendant shall not be charged with any saving he may have made, if he shall show that it has not enabled him to realize an actual profit in that part of the business connected with the use of the invention."

Strenuous objections were urged against this section. It was pronounced an unnecessary innovation in patent legislation, and unconstitutional, in that it turned the patentee's absolute and exclusive right, during the life of the patent, into a qualified and limited right. Mr. Walker claimed that its effect would be to abolish the recovery of profits altogether, and limit the recovery to the damages which the patentee has suffered, thus taking away the lion's share of the benefit derivable from a vast portion of the inventions made and conferring that share upon infringers. Among other objections, Mr. Hubbel urged that, in making the license fee the measure of the damage, the infringer would be placed on a better footing than the parties taking a license. "It would be simply a license to the defendant to go on and pirate a patent, and be subject to no greater license fee than was paid by the most favored parties of the patentee, who had risked their capital and everything they had, perhaps, to demonstrate whether or not it was a success. . . . What right has Congress, when a man has an exclusive right granted, to come in and say, 'If you demonstrate, through capital, through any of your friends, through any influences which will enable you to carry it into execution, that it is a successful business matter, therefore any pirate may come in and take away your profits or participate in them by setting up an infringement, and you shall only hold him to the same measure of license fee?'"

To leave it to judge or jury to decide whether or not it was to a man's interest to issue licenses, Judge Foote insisted, was not only a new feature in patent law, but new to the jurisprudence of any civilized country. Even worse in effect were the provisions forbidding the accounting of profits where the infringer did not make a profit on his entire business, and requiring the profit, where it was allowed, to be determined by an investigation into all the business connected with the use of the invention to determine its share of the gains. After going through the whole section to show that it had been draughted in the interest of infringers, Judge Foote said: "Suppose, Mr. Chairman, we had a band of robbers amongst us of great wealth and power; that they were accustomed to enter people's houses and drive them from their homes, that they took their cattle and their horses—that the wheat, the corn, the cotton, that others by their labor and expense had produced, they should appropriate, and to meet such an emergency you should pass an act like this second section, to wit, that there should be no recovery against these robbers beyond the price in the market of the articles taken, or what a court or jury should say ought to be a market price; that in case of an accounting nothing should be recovered unless the robbery had been profitable, and that the court should determine what proportion of profits was due to the robbery and what to other elements; and, finally, you should make all legal proceedings against them so onerous and expensive that none but very rich men could contend with them—would it not be justly said that you had promoted fraud and wrong, and discouraged industry, and injured all the best interests of society? I cannot view this section in any better light, in reference to the rights and interests of patented property."

In spite of such objections as these, the Senate committee saw fit to adopt the obnoxious section; most probably, as we have already intimated, as a compromise; for the enemies of the patent system were striving to introduce features even more vicious and disastrous in their tendency. Greater success has attended their efforts before the committee of the House. After a strangely brief consideration (less than five minutes, it is said) that committee adopted, April 26, a substitute for this second section (S. 300; H. R. 1,612), which seeks to reduce still more the limited right in his invention which the original allows the patentee. It provides that in all suits for infringement the measure of the plaintiff's recovery shall be the same both in law and in equity. That measure is the license fee, as established either by a reasonable number of transactions applicable to the case at bar or by a jury; and no evidence on account of the economy of the pirated invention is to be admitted to help the jury to determine its value. The only exception to the rule is "in cases where the defendant has made an actual profit from selling the thing patented or the product thereof; and in such cases the proportion of the actual profit of such sale due to such infringement shall be determined, and that proportion of such actual profit shall be the measure of the plaintiff's recovery."

It will be readily seen that this device puts all inventors practically under the thumb of infringers; and in the large number of cases in which the value of a patent consists in the use of the invention, as in railroading, and not in the sale of the thing patented or some product of it, the inventor's rights are laid open to the freest invasion. Whether or not the section was draughted by the attorney of the Western Railway Association, it certainly covers just what he has been laboring for before the committee.

Said a prominent railway superintendent and member of that association: "Whenever our attention is called to a patent of value, we use it, and in a few cases we are made to pay by plucky inventors; but in the aggregate we pay much less than if we took licenses at first." This provision, if made a law, will save them, and the like minded everywhere, no end of annoyance, and possibly a good part if not all of what they are now made to pay by "plucky inventors." But it seems impossible that Congress can adopt a measure so grossly unjust and mischievous. The would-be plunderers of our inventors are already too numerous and too willing to act upon "the good old plan, that they shall take who have the power, and they shall keep who can," to need any such legal authorization and encouragement. There never was a bolder raid upon the property rights of any class of the community; and it is to be hoped that the friends of justice will not suffer Congress to act on this matter unwittingly.

THE MECHANICS OF THE BICYCLE.

A correspondent wishes to know why it is that power is gained by the use of a velocipede in traveling long distances; or how it is that one can travel so much faster without getting fatigued by using a velocipede than when relying upon the ordinary means of locomotion; or where the extra force comes from that enables a velocipedist to accomplish high speeds, totally impossible to the pedestrian.

In answering our much esteemed correspondent's questions, we do not propose to open out the subject of the nomenclature of dynamics, and to pronounce upon the distinctions between force, power, energy, work, and all the rest. The questions, as asked in familiar terms, are susceptible of accurate and exhaustive replies in equally familiar language.

To condense the whole into a verbal nutshell, the walker or runner is wasting his strength in moving himself up and down, while the velocipedist has to contend solely against the friction of his machine.

The action of walking, as so happily described by Dr. Holmes in his article on "The Human Wheel; its Spokes and Fellies," is essentially a rolling one, the body rolling or rocking on the ball of one foot as a fulcrum, and rapidly moving the other foot ahead to prevent falling when the center of gravity of the whole overhangs the base. It is a forcible, perilous, and complex operation. That it is forcible is demonstrated whenever we "run against" a post at night. Its complexity is illustrated by the extreme difficulty in acquiring it; while the peril of the operation lies in the combination of its force and difficulty. Now that we are used to it, it seems a very easy and simple operation, of course—and the comparison with the rolling of a wheel with portions of the periphery removed is not a bad one—save in one thing, which is where the genial Autocrat of the Breakfast Table neglected dynamics to help along his simile. At each of those swinging motions which we call steps, the center of the wheel, and all the weight hung from that center, are lifted bodily as they swing over an upper arc of a circle.

That this is the case may be proved by attempting to walk along under a board placed at such a height as to exactly touch the top of the head. The rising of the whole body to

a height nearly equaling that to which the heel is raised in walking causes the board to hit the head, or the head to strike the board, whichever you may call it.

Now in walking a mile, or 5,280 feet, on level ground, in 20 minutes (ordinary gait), and taking military regulation steps of 28 inches each, one lifts the body 5,280 × 12 ÷ 28 = over 2,363 times in the 20 minutes. This means that the body is lifted 2,363 ÷ 20 = about 118 times per minute. If the rise of the center of gravity is but one inch, and the body weighs 160 lbs., there will be 118 × 160 ÷ 12 = 590 minute foot pounds, = nearly $\frac{1}{50}$ of a horse power, wasted just in lifting the body up and letting it come down again without any useful effect. In other words, the same amount of force expended in walking up 118 treadmill steps, each an inch high, in a minute, would develop $\frac{1}{50}$ of a horse power.

If, now, one were to walk so that the head and shoulders, as indicating the vertical position of the center of gravity, should not rise and fall with the steps, all this force would be saved; and if the muscles were of steel, and the motive power of the whole a spring, then walking on a level would resolve itself, very largely, into a question of overcoming the friction of the feet and joints, etc. But unfortunately (perhaps), the muscles are dependent, for their contraction and strength, upon the action of the motor nerves, and these last upon the mysterious chemistry, electricity, or whatever it be, of the brain and the nerves of volition. Thus, in holding the arm or the leg out steadily in any given position for even a short length of time, although there is no work being done, dynamically speaking, there is, to the muscular system, what amounts to the same thing, whether caused by action or by continued restraint—fatigue, followed by pain and by temporary paralysis if too prolonged—the limb dropping when the muscles refuse to perform their office.

There is thus much more physical fatigue caused by walking than corresponds to the 590 minute foot pounds, the foot pound account increasing arithmetically only, while the nerve tax mounts up in geometrical ratio. It is generally considered more "fatiguing" to come *down* a very long flight of steps, say those in Trinity Church spire, although lifting no weight, than to climb up, especially if one has taken no rest at the top.

We will now consider the work done by the velocipedist on a smooth and level mile course. Firmly seated, he causes the muscles of his leg to turn a wheel, and to do that only. His whole body is never lifted; and in one four-wheeled variety having treadle bars with reciprocating horizontal motion, even the weight of the legs is not raised, as in the common bicycle.

If an ordinary spring balance were fastened to the velocipede with rider in the seat, and the whole was hauled along, the spring would indicate in pounds the "draught," or the resistance due to the friction of the moving parts of the machine, and to that of the ground and the tires. A bicycle with driving wheel 3 feet in diameter would make 5,280 ÷ (3 × 3.14) = about 528 revolutions per mile; and if we suppose the mile to be made in 20 minutes, the wheel has made 528 ÷ 20 = about 26 turns per minute. If the crank is 4 inches long, the vertical stroke of the foot is 8 inches, but the center of gravity of the limb, which is located in the thigh, has been raised only about half that, or say 4 inches. Supposing the legs to weigh 55 lbs., the work in lifting the legs is 55 × 4 × 26 ÷ 12 = 476 foot lbs.

But every pound of this, less the ridiculously small amount lost in overcoming the friction of hip and knee joints, etc., has been utilized on the down strokes of the cranks as driving force; whereas, in walking, the fall of the whole body (which is utilized in treadmill work) is wasted.

We thus see that the velocipedist in traveling does less lifting than the pedestrian, and does not waste that force. He also strains the muscles less, and hence can keep it up longer and go further than if on foot; or he can "speed up" without getting fatigued by reaching the limit of endurance of the muscles and their motor nerves.

Furthermore, the velocipedist is apt to choose a better track than if walking.

A case in which the leg power is so employed that the velocipedist wastes the, say, 478 foot pounds used in lifting his legs, but expends none in lifting the body, is where he sits in a wheeled frame after the style of the baby go-cart, and propels himself and the vehicle by pushing with his feet against the ground. If he were to sit in such a frame and haul himself along by winding up, on a drum worked by foot cranks, a rope attached to a fixed point ahead, the power expended in lifting the legs could be utilized on the down stroke, as in the regular bicycle.

We think we have now answered our correspondent's questions, at least so far that he can readily "cipher out" for himself the entire interesting problem of locomotion.

CAPTAIN EADS' PROPOSED IMPROVEMENTS OF THE MISSISSIPPI AND ST. JOHN'S RIVERS.

Backed by the prestige of his magnificent success in opening the mouth of the Mississippi, Captain Eads has now no difficulty in securing the whole people as his audience when he comes forward with two more great projects for national improvements. One of these is no less important than the work already accomplished, for it aims directly at the saving of the enormous expense of constructing the new levees along the Mississippi by a means as simple, and without doubt as efficient, as the famous jetties themselves. This means is, briefly stated, to narrow the wide and shallow places of the river so as to confine its current to a uniform channel. The river naturally scours its bed out in the narrow parts and drops the sediment in the wider portions along its entire length, and wherever there is a widening there are the shoals, the islands, the snags, and the stumps which impede navigation.

To bring the wide parts to the uniform width Captain Eads proposes to cover the sand bars with brush and stone dams. These obstructions would cause a deposit of sand between them and force the waters to deepen the channel. The work should go on annually, the obstructions being gradually built higher, and finally, when the river had been brought to a uniformity of width, there would be a uniformity in depth, in current, and in transportation of sediment. This work could be much more easily accomplished than could the rip-rapping or mattressing of the banks, because it needs only to be done in shallow water. Levees are objectionable, it is argued, not because of the present amount needed for absolute protection from the near floods, for four or five millions would insure this, but it is because they must cave in at the wide places. Instead of diffusing the water by outlets and raising high levees at these points, as proposed by the United States Engineers, Captain Eads advocates its conservation—every drop of it—in one channel of uniform width, and the abolition of all the wide places, the closure of the outlets, and, if necessary, the closure of the island chutes. The United States Engineers propose to attack the bank of the river with shovels and wheelbarrow, to accommodate its anticipated elevation ten or a dozen feet higher than ever before. Captain Eads proposes to set the river to work in the bottom of its bed, as he did at the jetties, and, while deepening it for the benefit of commerce, to lower its haughty crest forever. They provide for a river carried threateningly above the land, a constant source of terror and anxiety, while he proposes that its vast volume, "in all the grandeur of its mightiest floods, shall be viewed with an admiration devoid of fear from happy homes safe above its surface."

Captain Eads' other project is the deepening of the channel through the bar at the mouth of the St. John's River, Florida. Here he suggests a system of jetties analogous to those used at the mouth of the Mississippi. He finds that there exists from Jacksonville to the sea a river basin 25 miles long and averaging one mile in width. At one end of this basin the average rise of the tide is nearly 1 foot, and at the other end 5½ feet. The average quantity of tidal water passing into and out of this basin twice a day is equal to nearly 2,000,000,000 cubic feet. This would produce an average rate of current equal to 2 miles per hour, through a channel having a cross section of 30,000 square feet, or a maximum current during average flood and ebb tides of about 4 miles an hour. With such a tidal basin, even without the additional advantage of the river current resulting from a large annual rainfall upon 7,500 square miles drained by the river, Captain Eads thinks that there would be no question of parallel jetties acting otherwise than as a certain means for deepening the channel through the bar. The inflowing waters, now nearly 3 miles wide, would be caused to traverse a channel only three or four tenths of a mile wide. The frictional resistance would thus be greatly decreased, and higher tidal oscillations would occur at Jacksonville. The river channel would, therefore, not only be deepened over the shoals in the river by a higher plane of water at high tide, but the increased flow of tidal waters through the river would deepen the bottom likewise and materially improve the navigation of the river.

THE CONFECTIONER REGARDED IN THE LIGHT OF A COLORMAN.

Should the dealer in paints for decorative purposes, tiring of his vocation, suddenly conceive the idea of exposing for sale bucketfuls of brilliantly colored, ready mixed paints as newly discovered but extremely toothsome and healthful substitutes for our present articles of dessert, as well as harmless and delicious offerings to the candy-loving maiden and child, it is quite probable that the public, with its own convictions as to "the eternal fitness of things," would promptly spurn the proffered products of this new-fledged industry, and look with extreme pity, if not contempt, on the chemist who should rashly lend his name to testimonials asserting their harmlessness. And yet, if we are to believe the testimony of "experts" recently given in the Supreme Court of Massachusetts, at Boston, the trade of the confectioner would seem, in some cases, to be separated by but few removes from that of the colorman; the paints of the latter being mixed with linseed oil, while those of the former—identical in composition—are prepared for "internal use" with the more palatable materials, sugar and starch. This, of course, is a distinction; but, as far as the health and safety of the public are concerned, with very little difference.

The trial referred to was that of a Boston firm of confectioners on the charge of manufacturing and selling candy adulterated with chrome yellow, or, more accurately speaking, chromate of lead. In view of the poisonous nature of this pigment, to which we shall presently refer, the evidence elicited from the witnesses was remarkable. A former member of the firm, who had been in the confectionery business for twenty-five years, stated that he had made a specialty of the lozenge department and had never known a case of injury to a person arising from chromate of lead, and had never heard of any complaint against it. He had always been in the habit of eating lozenges freely, and although he should probably not relish a grain and a half of chromate of lead, yet at the same time he should not consider it dangerous. One of the workmen testified that chrome yellow was used in nearly every large establishment in New York, and he, together with other workmen, had been in the habit of eating the raw article. He had no doubt that he had eaten between one and two grains at a time and never considered it dangerous to the extent it was used in making lozenges. One of the members of the firm testified that he was familiar with the confectionery business both in this country and in Europe; he had always taken the greatest precautions to have lozenges made pure (?), and, to the best of his knowledge, chrome yellow was very extensively used in this country; it was used to produce a harmony of color. By inquiry and observation he had taken pains to ascertain if chrome yellow was injurious, and among the chemists he had consulted was Dr. Liebig, in Europe.

The object of the defense in this trial seemed to be to prove that not only is chromate of lead (which includes "chrome yellow," "chrome green," "orange chrome," and the "American vermilion" of some manufacturers) not poisonous, but that, even if it were so, the small quantities in which it is used would render it harmless. In regard to the first proposition we may refer to a very recent case reported in the *Boston Medical and Surgical Journal* under the head of "Toxicology," where we find the following cases of poisoning by the inhalation of dust containing chrome yellow. The *Journal* says:

"Leopold reports five cases of this form of poisoning, one of which proved fatal. The patients were employed in weaving cloth, colored with chrome yellow (chromate of lead), which was quite loosely applied to the thread, so that a portion of the pigment was easily detached and became diffused throughout the air of the room. The patients were affected with a yellow-coated tongue, yellow sputa, loss of appetite, malaise, in some cases vomiting, pain in the region of the stomach and umbilicus, obstinate constipation, and debility. The fæces were yellow. These symptoms disappeared in a few weeks after the removal of the cause, except in the case of an infant nine weeks old, who died in six or eight days after the beginning of the symptoms, which, however, did not appear until three weeks after exposure to the infected atmosphere. The symptoms in this case were fever, restlessness, shrieking, several yellow fluid stools daily, redness of the skin over the chest and abdomen, parched lips, and, just before death, short respiration.

"After death there were found inflammation and perforation of the stomach, the same appearances which were seen in the two cases previously reported by Dr. Von Linstow, caused by ingesting the chrome yellow. None of the poison could be detected in any of the organs except the lungs, in which 3·6 milligrammes (0·055 grain) were found."

As to the second proposition, the small quantity used: there are but two to three salts of lead that as medicines are adapted for internal administration; and, when it becomes necessary for the physician to employ them in this manner, he uses them cautiously, and in what are called "medicinal doses," for it is well known that continued doses of exceedingly small quantities are the very ones that produce all the dangerous constitutional effects of the lead.

Familiarity with poisons, as with other things, is apt to breed carelessness in handling, if not contempt for their effects; and, because the worker among them testifies to their innocuousness to his own system when self-administered, it by no means follows that the practice is a safe one to recommend to the public. At all events, no such testimony as we have referred to above will serve to remove the prejudice that exists in the minds of parents against allowing their children to be fed on substances that are known to be injurious.

The vegetable kingdom yields such a large number and variety of harmless coloring matters, exactly suited to the requirements of the confectioner, that there is no necessity for resorting to the use of either colored earths or metallic salts, and their employment, therefore, being not only inexcusable, but criminal, should be promptly punished by the arm of the law.

CONGRESS TO BE MADE A PATENT MILL.

If that portion of the new patent bill is passed which provides for the lapsing of a patent in event of the non-payment of an auxiliary fee a few years after its issue, one result will be to convert Congress into more of a patent manufacturing concern than it already is. Every Congressman knows now that not a session passes but that legions of inventors, who have failed or who think they have failed to realize as much as they should during the lifetime of their patents, fill the records with applications for extensions. It was to relieve Congress from this increasing burden that the duration of the patent was lengthened from fourteen to seventeen years, the object being to afford the inventor more time to gather his profits. Under the provisions of the proposed new law, however, it must be obvious that Congress will be besieged by applications to revive patents which have lapsed because poor inventors may not have had the means to pay the additional fees required at the time fixed by law, and for a great variety of other reasons which will be urged. We have already pointed out other objections to this enactment, but the above in its results is by no means one of the least serious, as the consequence will be to engender an immense amount of special legislation, to take up the time and materially augment the work of Congress, and to hinder the progress of measures of public importance.