

"(3). That neither in steel nor in iron is the extensibility less in severe cold than at ordinary temperature, but that, from 266° to 320° Fah., it is generally diminished, not to any great extent in steel, but considerably in iron."

"(4). That the limit of elasticity, in both steel and iron, lies higher in severe cold; but that at about 284° Fah., it is lower, at least in iron, than at ordinary temperatures."

"(5). That the modulus of elasticity in both steel and iron is increased on reduction of temperature, and diminished on elevation of temperature; but that these variations never exceed 0.05 per cent for a change of temperature of 1.8° Fah. and, therefore, that such variations, at least for ordinary purposes, are of no special importance."

The experimenter gives it as his opinion that the cause of the frequent breakage of rails in cold weather, and of articles made of iron and steel, is unequal expansion and contraction and the rigidity of supports, where, as is the case with rails, frost may very greatly affect them.

Sandberg's conclusions, from 20 experiments, are thus given:

"(1). That, for such iron as is usually employed for rails in the three principal rail-making countries (Wales, France, and Belgium), the breaking strain, as tested by sudden blows or shocks, is considerably influenced by cold; such iron exhibiting, at 10° Fah., only from one third to one fourth of the strength which it possesses at 84° Fah."

"(2). That the ductility and flexibility of such iron is also much affected by cold: rails broken at 10° Fah., showing, on an average, a permanent deflection of less than one inch, while the other halves of the same rails, broken at 84° Fah., showed a set of more than four inches before fracture."

"(3). That, at summer heat, the strength of the Aberdare rails was 20 per cent greater than that of the Creusot rails; but that, in winter, the latter were 20 per cent stronger than the former."

Sandberg suggests that this considerable decrease of toughness at low temperatures may be due to the "cold-shortness" produced by the presence of phosphorus. Our knowledge on this point must remain imperfect until similar experiments have been made with iron free from phosphorus.

The practical result of the whole investigation is that iron and copper, and probably other metals, do not lose their power of sustaining "dead" loads at low temperatures, but that they do lose, to a very serious extent, their power of sustaining shocks or resisting sharp blows; and that the factor of safety in structures need not be increased in the former case, where exposure to severe cold is apprehended; but that machinery, rails, and other constructions which are to resist shocks, should have large factors of safety and should be most carefully protected, if possible, from extremes of temperature.

MEDICAL SCIENCE IN COURT.

Nearly two years ago James Fisk, a managing director of the Erie railway and a prominent man in various steamboat and other enterprises, well known, doubtless, by fame to many of our readers, was shot by the hand of an assassin. The scene of the tragedy was at the Grand Central Hotel, on Broadway, in this city. Fisk had just entered the premises, and was in the act of ascending the stairway of the ladies' entrance, when he was shot by a person standing on the landing above. The ball entered his abdomen just above the navel and passed obliquely downward through the intestines, lodging in the muscles of the thigh. Another ball made flesh wounds in the arm. The assassin was Edward S. Stokes, who was almost immediately arrested and lodged in jail, while the wounded man at once received medical attendance in the hotel, where, after lingering until the following day, he died.

Stokes has had three trials. On the first, the jury failed to agree. On the second, he was found guilty and sentenced to death. But the Court of Appeals, in consequence of certain informalities in the proceedings, ordered a new trial. This third trial has just been finished, resulting in the finding of the prisoner guilty of manslaughter in the third degree. The highest punishment of the law, four years in the State prison, was immediately pronounced, and thus has terminated one of the most remarkable cases in criminal jurisprudence.

To the superficial observer, the result of the trial seems strange enough. Here was a man ruthlessly shot down in broad daylight, and the shooting clearly brought home to the accused; yet he escapes with a comparatively slight punishment. It is even stated, on good authority, that nine of the jurors were in favor of an absolute acquittal, and consented, with great reluctance, to the verdict given. The questions naturally arise: What basis had these jurors for such a verdict, and why, if Stokes shot Fisk, was he not found guilty of murder?

The defences were: 1. That Fisk had threatened to shoot Stokes, that on this meeting he drew his pistol, when Stokes discharged his revolver in self defence. 2. That the previous threats of Fisk had affected the mind of Stokes, and that at the moment of the shooting he was insane. 3. That Stokes did not shoot with intent to kill. 4. That the death of Fisk did not result from the shooting, but from poisoning by malpractice of the doctors after the shooting. It is to the evidence pertaining to this last theory of the defence that we wish to direct attention, for it involves the testimony of some of our most distinguished physicians, acting in the capacity of scientific experts.

From this evidence, it appears that Fisk was attended by seven doctors and surgeons, all prominent men in this community, namely, Drs. Carnochan, Tripler, Steele, White, Sayre, Fisher and Wood. In the multitude of counsel, there is generally supposed to be wisdom; but it seems to have

proved otherwise in this case. Dr. Tripler began operations by deeply probing the distressing wound, an injudicious proceeding, according to some of the medical experts. Subsequently Dr. Fisher, Dr. Wood and Dr. White each used the probe. Several glasses of brandy and water were administered, also chloroform and morphine. The latter was administered by the mouth, and by subcutaneous injection, six times within four hours.

Dr. Wood testified that he told Drs. Fisher and Tripler, who were the choice of Mr. Fisk as attendants, that they had two lives on their hands, Fisk's and Stokes', and must administer the opium with their fingers on the pulse and watch carefully the condition of Fisk's pupil and of his intelligence. He ascribed Fisk's death to shock, but admitted that the latter symptoms, such as stertorous breathing, were symptoms of opium poisoning. He had heard of many cases of recovery from serious wounds in the intestines; he had seen, in cases of hernia, a portion of the intestines slough away and the patient recover; he did not, in the light of authenticated cases, consider Fisk's wound necessarily fatal.

Dr. John M. Carnochan, the distinguished surgeon, reached Fisk's bedside some seven or eight hours after the shooting. He did not think, when he saw Mr. Fisk, that he exhibited the symptoms of shock; he had reacted; he thought the giving of two and a half grains of morphia—thirty drops—hypodermically was a most dangerous way of using opium; it was, he believed, at least the cause of his premature death, that is, that it hastened his death. He thought Fisk could not intelligently have made his will, if he was laboring under shock. He related cases, that he had known, of penetration of the bowels which had not proved fatal. On cross examination, Dr. Carnochan said that he found Fisk, when he reached him, in an unnaturally somnolent condition; the wound did not kill him, the morphia did; there was a possibility that the wound had something to do with it, but he had none of the usual symptoms immediately following injury from a gunshot wound; there was nothing to indicate that he was suffering in any manner from the wound; it was a very dangerous wound, but not necessarily a fatal one. Q. You would expect him to get well? A. Of course I would.

Dr. Gurdon Buck testified that the wound was alone sufficient to account for death, and that the use of opium he regarded as a proper treatment; but some of the symptoms agreed with those of opium poisoning.

Dr. A. B. Crosby testified that he would consider such a wound fatal.

Dr. Thompson, professor at the university, explained that death from shock arose from enfeeblement of the heart, while death from narcotism arose from coma or from the head. Probing, in abdominal wounds, while the shock lasted, he thought should rarely be resorted to. Chloroform was contra-indicated by shock. It should not be used while shock lasted. He thought he had seen death result from the administering of twenty drops of chloroform. He described at length the symptoms of opium poisoning, which ends in coma, and declared that, in death by shock, though there might be insensibility, that was different from coma. Snoring was utterly inconsistent with shock. Deep breathing was the clear mark of recovery from shock. He declared that the symptoms described indicated that Mr. Fisk had recovered from shock. He thought the length of time excluded entirely the idea of death from peritonitis, and the only conclusion was that he died from an overdose of morphia.

Dr. Macready was examined as an expert on the effect of the wound, and the effect of the morphia administered. He was inclined to think, from their describing the doses by drops, that one half more had been given than was supposed, as ten drops would be fifteen minims. The administering of morphia hypodermically nearly doubled its power. He was strongly of opinion, from the description of the case, that Fisk did not die from shock or peritonitis. There was not enough peritonitis to produce death, and the development of the symptoms were not those of shock. The symptoms were those of inflammation of the brain or uræmic or narcotic poisoning. There being no disease of the brain or kidneys, he ascribed the death to an excess of narcotics.

Dr. Marsh, deputy coroner, testified that he made the *post mortem* examination. In his opinion the death of Fisk was due to shock and peritonitis. But the latter was not sufficient of itself to have caused death. As to narcotism, he did not make any examination. Subcutaneously administered, one twenty-third part of a grain of morphia had been fatal. Taken in the stomach, two grains had been fatal. As to wounds in the abdomen, in the Crimean war ten per cent of those wounded had recovered; in the recent rebellion war, twenty-five per cent had recovered.

Judge Davis, in submitting the case to the jury, made an elaborate and excellent charge. He solemnly warned them against allowing themselves to be influenced by any feelings of prejudice either for or against the prisoner. They must be wholly governed by the evidence before them. In reference to that branch of the defence here under consideration, the Judge was very clear and explicit. "If morphia, improperly administered, either as to the manner or as to the quantity, caused the death of James Fisk, Jr., on the 7th of January, 1872, not as an accelerating cause, but an independent cause, being in itself the sole agent producing death at that time, then the prisoner is not chargeable with the death, because another and an independent agent produced that result, in which his act—the wound he caused—did not occur."

* * I charge you, as the law on this subject, that if you come to the conclusion that the medicines administered were the sole cause of death, and at the same time that the prisoner intended to kill, that he fired the fatal shot with intent to kill, and inflicted a wound with that design, then it is your

duty to convict him of an attempt to commit murder in the first degree." In view of this charge, and the medical evidence, it would seem as if the jury had reason for giving the verdict they did, independent of the other points of the defence, which were well sustained.

THE GOVERNMENT BOILER TESTS.

We have already announced the appropriation by the Government of \$100,000 to be expended in an extensive and exhaustive series of boiler trials at Sandy Hook and at Pittsburgh. Although it was intended to conduct these tests during the past months of September and October, it has been found that the extent of the necessary preparation has caused an unavoidable delay, existing up to the present time. Now, however, it seems that the experiments will be begun at once, and some 20 workmen are engaged at Sandy Hook setting up the ten boilers to be employed. The latter are of the best material and construction, and will be placed in the position in which they are usually located upon steamers. The bomb proof shelter is to be built at a distance of 260 feet from the boilers. Suitable pyrometers, thermometers, and other necessary instruments will be supplied, and self-regulating gages are to be buried in the earth near the boilers.

The Government Commission consists of the following gentlemen: Supervising Inspector Addison Low and C. W. Copeland, of New York, J. H. Robinson, of Boston, Supervising Inspector John Menshaw, of Baltimore, J. V. Holmes, of Ohio, Benjamin Crawford and Supervising Inspector John S. Devinney, of Pittsburgh. The experiments will be mainly to determine the truth or fallacy of the various theories as to the causes and conditions of boiler explosions, which theories are briefly:

First: Explosions caused by the gradual increase of steam pressure.

Second: Those caused by low water and overheating of the plates of the boiler.

Third: Those caused by deposit of sediment, or incrustation on the inner surface exposed to the fire.

Fourth: Those caused by the generation of explosive gases within the boiler.

Fifth: Those caused by electrical action.

Sixth: Those caused by the percussive action of the water in case of rupture of boiler in the steam chamber—Clark & Colburn theory.

Seventh: Those caused by the water being deprived of its air.

Eighth: Those caused by the spheroidal condition of the water.

Ninth: Those caused by the repulsion of the water from the fire surface or plates.

The Sandy Hook trials will extend over several days, and the results will be duly noted on these columns. The Pittsburgh tests will begin on November 12; and on their completion the Commission will return to Sandy Hook, with a view of experimenting upon various safety valves.

SCIENTIFIC AND PRACTICAL INFORMATION.

SPIRITUALISM NOT PATENTABLE.

Spiritualism fails to meet with official recognition in the Patent Office of the United States. "Psychic stand" was the name of the device on which a Massachusetts inventor wanted a patent, because, as he stated, it would spell out words and sentences known as spiritual communications "through an alphabet not only invisible to the operator, but the very location of which he cannot know." "Moreover," he added, "the mode of its operation precludes all possibility of trick or imposture." The obturate examiner, however, not only refused to perceive the peculiar merits of this useful invention, but gave, as an opinion, that spiritual manifestations are "largely mixed with ignorance, deception, and fraud." The Office, it is stated, offered to issue letters patent on the contrivance as a game table, thereby adding insult to injury on the exasperated inventor, who, shaking the dust of the capital from his feet, departed in a state of indignation bordering on absolute ferocity. The alleged offer of the Patent Office to issue the patent for a game table seems to us quite improbable.

THAT EASTERLY CURRENT.

An attempt was recently made at San Francisco to find the easterly current, and by its aid to reach New York by balloon in a few hours' time. The machine took a fine start, having on board three passengers, who, instead of finding the breeze they wanted, struck a westerly current and came down in the Pacific ocean, happily near the shore. The balloonists were received by boats and had a narrow escape.

Donaldson made another ascension a few days ago from Newark, N. J. He found the easterly current, which took him over the cities of New York and Brooklyn, landing him near Roslyn, L. I. In attempting to reach the earth, the car was swept violently against a stone wall, and the aeronaut was considerably bruised.

PETROLEUM IN BURMAH.

According to the report of Captain Storer, agent for the British Government, there are at present about 150 wells worked at Yegnanyoung, which yield 62,500 barrels of oil a year. At Pagan there are about 50 wells. The oil from these wells is obtained in a more liquid state, and more resembles naphtha. It is of a brackish nature, and is better suited for lighting purposes than the Yegnanyoung oil.

THE back page of the special edition of this paper, to be published about November 15, has been all taken by advertisers; a few more advertisements will be received for the inside pages and Business and Personal column. For terms, see inside. Order immediately.