United States Centennial Commission.

INTERNATIONAL EXHIBITION,

1876.

REPORTS AND AWARDS

GROUP XXIV.

EDITED BY

FRANCIS A. WALKER,

CHIEF OF THE BUREAU OF AWARDS.

PHILADELPHIA:

J. B. LIPPINCOTT & CO.

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SYSTEM OF AWARDS

[*Extract from Circular of April* 8, 1876.]

Awards shall be based upon written reports attested by the signatures of their authors.

The Judges will be selected for their known qualifications and character, and will be experts in departments to which they will be respectively assigned. The foreign members of this body will be appointed by the Commission of each country and in conformity with the distribution and allotment to each, which will be hereafter announced. The Judges from the United States will be appointed by the Centennial Commission.

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Reports and awards shall be based upon inherent and comparative merit. The elements of merit shall be held to include considerations relating to originality, invention, discovery, utility, quality, skill, workmanship, fitness for the purposes intended, adaptation to public wants, economy and cost.

Each report will be delivered to the Centennial Commission as soon as completed, for final award and publication.

Awards will be finally decreed by the United States Centennial Commission, in compliance with the Act of Congress, and will consist of a diploma with a uniform Bronze Medal, and a special report of the Judges on the subject of the Award.

Each exhibitor will have the right to produce and publish the report awarded to him, but the United States Centennial Commission reserves the right to publish and dispose of all reports in the manner it thinks best for public information, and also to embody and distribute the reports as records of the Exhibition.

ORGANIZATION AND DUTIES OF THE JUDGES.

[*Extract from Circular of May* 1, 1876.]

Two hundred and fifty Judges have been appointed to make such reports, one-half of whom are foreigners and one-half citizens of the United States. They have been selected for their known qualifications and character, and are presumed to be experts in the Groups to which they have been respectively assigned. The foreign members of this body have been appointed

by the Commission of each country, in conformity with the distribution and allotment to each, adopted by the United States Centennial Commission. The Judges from the United States have been appointed by the Centennial Commission.

To facilitate the examination by the Judges of the articles exhibited, they have been classified in Groups. To each of these Groups a competent number of Judges (Foreign and American) has been assigned by the United States Centennial Commission. Besides these, certain objects in the Departments of Agriculture and Horticulture, which will form temporary exhibitions, have been arranged in special Groups, and Judges will be assigned to them hereafter.

The Judges will meet for organization on May 24, at 12 M., at the Judges' Pavilion. They will enter upon the work of examination with as little delay as practicable, and will recommend awards without regard to the nationality of the exhibitor.

The Judges assigned to each Group will choose from among themselves a Chairman and a Secretary. They must keep regular minutes of their proceedings. Reports recommending awards shall be made and signed by a Judge in each Group, stating the grounds of the proposed award, and such reports shall be accepted, and the acceptance signed, by a majority of the Judges in such Group.

The reports of the Judges recommending awards based on the standards of merit referred to in the foregoing System of Awards, must be returned to the Chief of the Bureau of Awards not later than July 31, to be transmitted by him to the Centennial Commission.

Awards will be finally decreed by the United States Centennial Commission, in compliance with the Act of Congress of June 1, 1872, and will consist of a special report of the Judges on the subject of the Award, together with a Diploma and a uniform Bronze Medal.

Upon matters not submitted for competitive trial, and upon such others as may be named by the Commission, the Judges will prepare reports showing the progress made during the past hundred years.

Vacancies in the corps of Judges will be filled by the authority which made the original appointment.

No exhibitor can be a Judge in the Group in which he exhibits.

An exhibitor, who is not the manufacturer or producer of the article exhibited, shall not be entitled to an award.

The Chief of the Bureau of Awards will be the representative of the United States Centennial Commission in its relations to the Judges. Upon request, he will decide all questions which may arise during their proceedings in regard to the interpretation and application of the rules adopted by the Commission relating to awards, subject to an appeal to the Commission.

A. T. GOSHORN,
Director-General.

[*Extract from Director-General's Address to Judges, May* 24, 1876.]

"The method of initiating awards which we have adopted differs in some respects from that pursued in previous exhibitions. In place of the anonymous verdict of a jury, we have substituted the written opinion of a Judge. On this basis awards will carry the weight and guarantees due to individual personal character, ability, and attainments, and to this extent their reliability and value will be increased. It is not expected that you will shower awards indiscriminately upon the products in this vast collection. You may possibly find a large proportion in no way raised above the dead level, nor deserving of particular notice. The standard above which particular merit worthy of distinction begins is for you to determine. In this regard I have only to express the desire of the Centennial Commission, that you should do this with absolute freedom, and when you meet with a product which you consider worthy of an award, we desire you to say, in as few words as you may deem suitable, why you think so.

"This, gentlemen, is all we ask of you in the Departments of Awards. Opinions thus expressed will indicate the inherent and comparative merits, qualities, and adaptations of the products,—information which the public most desires.

"Elaborate general reports and voluminous essays, though of great value as sources of general information, give little aid in determining the reliable or intrinsic merits of particular, individual products.

"The regulations which have been published divide the work of awards into three parts:

"1st. The individual work of the Judges.

"2d. The collective work of the groups of Judges.

"3d. The final decisions of the United States Centennial Commission in conformity with the acts of Congress.

"Each award will thus pass three ordeals, which, doubtless, will be ample and satisfactory."

GROUP XXIV.

JUDGES.

AMERICAN.

C. B. WHITE, M.D., New Orleans, La.

J. H. THOMPSON, A.M., M.D., Washington, D. C.

FOREIGN.

W. A. ROTH, M.D., Surgeon-General German Army.

Dr. ERNST FLEISCHL, Austria.

GROUP XXIV.

INSTRUMENTS AND APPARATUS OF HYGIENE, MEDICINE, SURGERY, PROSTHESIS, ETC.

CLASS 272.—Medicines; officinal (in any authoritative pharmacopœia); articles of the materia medica; preparations, unofficinal.

CLASS 273.—Dietetic preparations, as beef extract and other articles intended especially for the sick.

CLASS 275.—Instruments for physical diagnosis, clinical thermometers, stethoscopes, ophthalmoscopes, etc. (except clinical microscopes, etc., for which see Class 324).

CLASS 276.—Surgical instruments and appliances, with dressings, apparatus for deformities, prosthesis, obstetrical instruments.

CLASS 277.—Dental instruments, appliances and materials.

CLASS 278.—Vehicles and appliances for the transportation and relief of the sick and wounded, during peace and war, on shore or at sea.

Mineral waters.

GENERAL REPORT

OF THE

JUDGES OF GROUP XXIV.

INTERNATIONAL EXHIBITION,
Philadelphia, 1876.

PROF. FRANCIS A. WALKER, *Chief of Bureau of Awards:*

SIR,—I have the honor herewith to transmit the report of the Judges of Group XXIV., on Medicine, Surgery, and Prothesis.

Respectfully yours,

J. H. THOMPSON,
Secretary Group XXIV.

GROUP XXIV.

MEDICINE, SURGERY, PROTHESIS.

Much complaint was made by exhibitors in this group of the arrangements at the International Exhibition held at Vienna, in 1873. Medicine, with its allied industries, was there almost ignored; not one of the twenty-six groups into which the entire Exhibition was divided being exclusively reserved to that science. Most of the objects pertaining to the various branches of medical science were exhibited under Groups III., IV., XII., XIV., XVI., XVIII., and XXVI. Thus divided into different classes, it was difficult to trace and impossible to compare them.

The International Exhibition of 1876 gave no cause for complaint on this ground, for not only was abundant space afforded for the full display of every article worthy of exhibition, but the grouping and classification were so admirably arranged as to afford every facility for general examination and comparison.

The system of awards adopted by the Commission was new, but worked satisfactorily. The responsibility for the recommendation for an award rested where it properly belongs,—with the Judge who made it; as, over his own signature, he has to state the reasons for the judgment given, thereby rendering the award of more value to the exhibitor, and ultimately of benefit to the public.

The awards recommended in this group have been comparatively few, for it was considered by the Judges that if the awards were to be of any value to the public, in assisting them to discriminate, and to the manufacturer, as an indorsement of proficiency in his art, they should be based on real as well as comparative merit. For example, three or more exhibitors might display products of their own manufacture, none of which possessed real merit, but of which one was comparatively better than the other. In such instances neither exhibitor was entitled to an award, and none received a recommendation for one; but, where the same number of exhibitors competed, and the exhibit of each possessed real merit, differing in character and degree,

each received a recommendation for an award, the grounds for such award being distinctly stated.

The Judges of this group are indebted to Drs. Hills, of Washington, and Keyser, of Philadelphia, who were appointed by the Commission at the unanimous request of the Judges of this group to assist them in the examination of the exhibits belonging to their respective specialties.

The exhibits under Group XXIV. were many and diversified, and, with very few exceptions, comprised contributions from every nation represented at the Exhibition. America was largely in the ascendant, particularly in surgical instruments, prothesis, and pharmaceutical compounds. This may be readily accounted for. Exhibitors send their products for competition as a matter of commercial speculation as well as pride, and can scarcely be expected to prepare a large exhibit and send it at great expense thousands of miles unless they expect to realize profit by the outlay. The duties upon foreign goods, particularly those coming under this group, are necessarily large, and in some instances nearly equal to the cost of production; and unless they possess some peculiar merit, or cannot be manufactured here, but little advantage would be gained by competition in this market. The almost entire absence of exhibits from the French, English, and German manufacturers of surgical instruments was particularly noticeable, and may in a measure be accounted for by the reasons just given, and by the further fact that simultaneously with this Exhibition was an Exposition at Berlin of the principal manufacturers of surgical instruments and appliances. They naturally sought their own market, as affording more decided prospects of success.

England was represented by one manufacturer of surgical instruments only, and that one a German firm. In the French department we missed the familiar names of Laer Charrière (now Robert & Collin), M. Marthieu, and M. Galante. There was not one exhibitor of surgical instruments proper. Germany sent nothing of importance. We looked in vain for Leiter, Reiner, Thurrigel, Windler, Blumberg, and Weber. America demonstrated, by the magnificent displays of Tiemann & Co., J. A. Gemrig, Codman & Schurtleff, Teufel, Kolbe, and others, that in this line of industry she is able to compete successfully with the most celebrated manufacturers of the Old World.

Before entering into a description of individual exhibits, as marking the special progress made in the arts within the last century, it may be appropriate to refer to the general exhibits under this group by the different nations represented.

ARGENTINE REPUBLIC.

In pharmacy there was nothing of interest, the display consisting of a large collection, so far as variety was concerned, of medicinal roots, barks, and leaves indigenous to that country. The exhibit was without scientific interest, the common name of articles exhibited being used only, and no attempt having been made at classification. One was recommended to be used externally as a remedy for phthisis pulmonalis; another was supposed to be valuable, the decoction being used to strengthen the eyesight; others as purges, tonics, etc.; but the larger part had no therapeutic properties associated with them. One exhibit of an artificial leg and arm was all that came under prothesis. These were very well made, showing considerable ingenuity and excellent workmanship.

CHILI.

A few pharmaceutical preparations came from Valparaiso, and some dried leaves and herbs, for part of which special medicinal virtues were claimed.

PERU.

The visitor would naturally expect to find among the exhibits in this department a fine collection of cinchona bark, but diligent search was only rewarded by disappointment; not one grain of the bark was to be found. Mummies, in a dilapidated condition, were in painful abundance. One small jar claimed special attention; it contained some dried leaves of the world-renowned "coca." For this plant the natives claim most wonderful power; it is said and believed by them that those who partake of it fear neither heat nor cold, hunger nor thirst; poverty has no horrors; in the deep sleep which follows the soul revels in Elysian fields, and enjoys to the fullest extent the extreme of pleasure which the most fertile imagination of an epicure can depict. It is said to be scarce and costly.

NORWAY.

This country sent a large exhibit of cod-liver oil from different manufacturers, no less than eight firms being represented. The world-wide reputation of Peter Moller has undoubtedly induced many others to enter into this branch of industry. All the specimens were exceedingly fine; from the color, taste, and odor, it was evident that none but fresh livers were used in their manufacture. Unfortunately, chemistry has furnished as yet no absolute test for the purity of cod-liver oil. In the examination made of all the samples of oil coming

from this country, not one specimen was found to which a suspicion of impurity or adulteration could be attached. In the entire Exhibition there was but one manufacturer whose oil would bear the test of comparison with the Norway oils, and that was Marvin Brothers, of Portsmouth, New Hampshire. A very compact little medicine-case was exhibited by H. S. Dilton, of Christiania; it could be carried in the pocket, and contained everything necessary for an emergency, and may be said to be valuable to tourists.

CHINA.

China had but one entry under the head of medicines, but it embraced 750 different articles, officinal and unofficinal, and in the Chinese sectional catalogue occupied 35 pages of description. The exhibit was from the Imperial Maritime Customs. This exhibit was not examined by the Judges officially, as it was not unpacked until after their work was completed. For want of room in the Main Building it was placed in the Annex.

Passing over a few of the standard medicines of the world, such as opium, rhubarb, aloes, etc., the specimens of which were poor and possessed no special interest, we found a long array of articles more calculated to surprise and to amuse than to instruct.

JAPAN.

A microscope and some slides, and a few surgical instruments of inferior workmanship, were shown. There were also about twenty diagrams representing skin diseases; and a few chemicals completed the list. Within the last few years a Medical College has been established at Tokio; the lectures are delivered in German; a preparatory school is connected with it; and the class numbers between five and six hundred. From the natural aptitude of this remarkable people we may expect, in the course of a few years, a wonderful advance in the arts of medicine and surgery.

PORTUGAL.

The principal exhibits under this group from that country were mineral waters, of which there were several. For all of these extraordinary virtues were claimed: such as "incontestable for disease of the organs of digestion, and indubitable in curing every variety of skin disease," etc. A display of pills and other nostrums completed the list.

TURKEY.

The samples of gum tragacanth cannot be surpassed, if equaled, the finer specimens being large white flakes, free from any impurity.

The collection of scammony was of an equally high grade. The large, beautiful, and costly exhibit of gum opium was of so high a standard that successful competition from any other source was out of the question. These three articles only were exhibited from this country in the line of pharmacy.

SPAIN.

A small display of artificial teeth came from three mechanical dentists; an apparatus for finishing pills; a blepharatome and a uteroscope. There was also a large collection of nostrums and mineral waters, with a few standard pharmaceutical preparations.

RUSSIA.

The Crown Surgical Instrument Manufactory exhibited a complete army outfit of surgical instruments of excellent workmanship. Doctor Wywodzef, of St. Petersburg, submitted for examination a most complete apparatus for embalming, with the preparation used; as also a specimen of a child's arm which had been embalmed for several months; the flesh and skin were natural in color, plump, and looked as if the limb might have been recently removed from the living body. It was entirely free from odor. There were three separate exhibits of artificial dentures, and appliances for the correction of deformities of jaws and palates.

GREAT BRITAIN.

Here were seventeen exhibitors under the head of Medicine, Surgery, and Prothesis. One very creditable exhibit of surgical instruments was sent by Mayo & Meltzer. Lynch & Co. sent a good assortment of druggists' sundries, and the remainder was divided between diet for invalids, surgical bandages and dressings, and a few unimportant pharmaceutical preparations. Dental art was not represented. Artificial mineral and aerated waters were in abundance, and, although not strictly under Group XXIV., were referred to us for examination.

New Zealand, New South Wales, Victoria, South Australia, and the Cape of Good Hope were not represented in this group.

JAMAICA.

One Government exhibit from the Botanical Gardens, Kingston, of cinchona barks, jalap, senna, aloes, etc.

BERMUDA.

One exhibit of indigenous medicinal roots, herbs, etc.

BRITISH GUIANA.

One exhibit of drugs and medicines, the product of the colony.

INDIA.

Dr. J. Forbes Wilson, the Director of the India Museum, exhibited a very choice collection of barks, opium, aloes, and a large number of other medicinal products from Madras, Bombay, Calcutta, and other parts of India.

CANADA.

Three pharmaceutical exhibits, one display of trusses, and an artificial limb comprised the extent of representation from this country.

FRANCE.

The *pharmacopæa elegans* of Parisian pharmaceutists was well represented. Among the twenty exhibitors under this class were the well-known firms of Vie, Garnier, & Co., Limousin, Rigollet, & Co., and Torchon & Co. The display of rubber surgical instruments was remarkably fine. The three manufacturers in competition have reason to congratulate themselves on their beautiful exhibits. Of surgical instruments proper there was no exhibit.

AUSTRIA.

Three dental exhibits and one of leather trusses. Politzer, of Vienna, exhibited some remarkably fine anatomical and pathologico-anatomical preparations.

SWITZERLAND.

Nothing but goat's-milk, condensed or mixed with some farinaceous preparations.

NETHERLANDS.

At the Vienna Exhibition the Committee of the Red Cross made a valuable exhibit of hospital cars, and all the most approved modes of conveyance for the sick and wounded during war; they, however, contented themselves with sending here a very able report of what they exhibited then, and contributed nothing in addition but plaster and bandages.

NETHERLANDS EAST INDIA COLONIES.

These colonies sent alkaloids of cinchona bark, quinium, quinine, quininodine, cinchonine, cinchonidine, cinchona powder, catechu, and some other native gums.

SWEDEN.

A large exhibit of mechanical gymnastics, illustrating what is known as the Swedish movement cure; also, an excellent collection of surgical instruments for military use, from the Sanitary Department at Stockholm.

ITALY.

Here was nothing of pharmaceutical interest, the contributions in this department being mostly nostrums. Ample amends were made by the beautiful dental exhibit from Noel Wenderling Bros., of which a full account is given under the head of *Dentistry*. There were also a few surgical instruments.

Tunis, Egypt, and the Grand Duchy of Luxemburg were searched in vain for a single object of medical interest.

BRAZIL.

This was the first time this interesting country had entered into competition with the great nations of the world at any International Exhibition, and it was a matter of surprise as well as satisfaction to find how successful her maiden effort was.

Her pharmaceutical display, although not large, was varied, and every article exhibited intrinsically good. One feature in particular attracted the attention of the Judges, viz., the absence of any nostrums or secret remedies; each preparation was made in accordance with some recognized standard established by the regular profession. The whole exhibit was highly creditable, and indicative of an advance in this department far ahead of many countries much more pretentious in their general exhibits. The standard of medical education in Brazil is unsurpassed; the profession is surrounded by safeguards which effectually shut the door against the admission of charlatans or uneducated men.

There are two faculties of medicine in the capital of the Empire, and another in the province of Bahia; both pursue the same course of studies, comprising the following subjects: physics in general, but particularly in its application to medicine; chemistry, organic and inorganic; descriptive and comparative anatomy, general pathology, surgical anatomy, therapeutics, materia medica, hygiene, medical jurisprudence, midwifery, mineralogy, botany, and zoology. The studies are extended over a period of six years, and the subjects divided among twenty-one cathedrated professors and fifteen assistants, appointed by the Government after a competitive examination. Each faculty has a chemical laboratory, cabinet of physics, of natural

history, of anatomy, of materia medica, and a pharmaceutical laboratory. The faculties have a three years' special course of studies in pharmacy for the education of druggists, which comprises physics, chemistry, mineralogy, botany, organic chemistry, materia medica, and general pharmacy. To matriculate in the medical course, the student must have passed a satisfactory examination in Latin, French, English, history, geography, rational and moral philosophy, arithmetic, algebra as far as equations of the first degree, and geometry. For the pharmaceutical course, the student must pass an examination in arithmetic, Latin, geometry, and French. A special course of two years is given for licentiate of midwifery at the Hospital Santa Casa da Misericordia; and before admission the student must pass an examination in arithmetic, reading, writing, and French. When such requirements are demanded before matriculation, and a punctual attendance upon the full course of lectures for a period of six years is required, and then, when the course is completed, a public examination of the strictest character, before graduation, is held, it may be reasonably supposed that among men who successfully pass this ordeal there will be jealous guard kept over the ethics of a profession they have labored so hard to master, and which it will be their ambition to adorn. With the physician thus educated, the druggist a competent and scientific man, and the midwife intelligent and possessed of knowledge adequate to the duties she has to perform, a profound respect from the masses necessarily follows, while quackery and secret nostrums find no support.

The Rio de Janeiro Hospital and Lunatic Asylum are not surpassed by any in the world. In the year 1875 there were 14,512 persons treated in this institution, of whom 9617 were foreigners of all nations and religions. The mortality was 14 per cent., but the larger number of those who died were patients suffering from yellow fever, who died within twenty-four hours after admission; if these were deducted, the mortality would be below 4 per cent.

The Lunatic Asylum—the Hospital Dom Pedro II.—had 390 patients during the same year. They are both under charge of the Sisters of Charity of St. Vincent de Paula.

The Santa Casa da Misericordia, besides the establishments mentioned, the separate infirmaries which it maintains and those which it immediately creates when any epidemic assumes large proportions, has established four consulting-rooms or dispensaries in different parts of the city and suburbs, where medical aid and medicines are furnished to the suffering poor free of charge; to these are attached a staff of medical officers, who visit such of the sick as are unable to come

to the dispensary. The out-door visitations last year numbered 10,354.

Asylums, foundling institutes, reformatories, and indeed all charitable institutions, receive the fostering care of the Government.

UNITED STATES.

In the exhibits included in Classes 272 to 278, the United States more than made up the deficiencies of other countries. The first impression experienced by the uninitiated in passing through that portion of the Main Building occupied by the United States must have been that we were a nation of cripples and hypochondriacs; wherever you went, whichever way you turned, the eye rested upon some mechanical contrivance in the shape of trusses to support ruptures, splints, simple and complicated, to retain adjusted fractures, orthopedic instruments to strengthen crooked legs, deformed feet, and curvatures of the spine, wooden legs for the maimed, artificial arms, hands and fingers, to substitute natural deficiencies or parts lost by accident, crutches for cripples, chairs for the paralyzed, beds for invalids, health-lifts for the weak and sickly, artificial eyes, electric apparatus for the paralytic, and teeth for the toothless. In pharmacy the display was large and beautiful. The exhibits of pharmaceutical chemicals by Powers & Weightman and Rosengarten & Son were exhaustive, and gave more satisfactory evidence of the vast progress made in this branch of industry during the last half-century than the most elaborately written treatise could accomplish. Pharmaceutical compounds exceeded in numbers and value the display of all other nations combined. Vast arsenals of pills, compressed, sugar-coated, and covered with gelatine; tempting elixirs in which the nauseous drugs were so well masked that the compounds were preferable in taste to the seductive absinthe or the aristocratic curaçoa; simple and compound fluid and solid extracts of every drug that would yield its virtues to the universal solvent-water; plasters, powder, suppositories, and an almost endless list embracing every officinal compound. With the single exception of Brazil, this country stood alone in the absence of nostrums or patent medicines, but one manufacturer offering his goods for competition.

The exhibit of surgical instruments embraced all the newest inventions, were perfect in construction and finish, and demonstrated beyond question that the products of the manufacturers in this country were fully equal, if not superior, to those of any other nation.

DENTISTRY.

Egypt, the "mother of the arts and sciences," was the first nation of the world to adopt dentistry as a specialty of medicine. How far the specialists of that remote period had advanced in the art is not known, but Herodotus (500 B.C.) notices the division of medicine into equal branches, among which was dentistry, and to only one of which was the physician allowed to devote himself. Abundant evidences, however, are to be found that the ancients understood the art of filling teeth with gold, and of the manufacture and insertion of artificial teeth.

The museums contain mummies from Thebes with gold-filled teeth, and artificial teeth of sycamore-wood set in gold; but the most perfect specimens demonstrate that the art was in its infancy. Coeval with medicine, but little apparent progress was made until within the last century, during which period dentistry has outstripped every other branch of medicine, and now stands before the world as a specialty equal in importance to any branch of surgery; indeed, it may claim what medicine cannot,—to have risen from an art to the dignity of a science.

Prior to 1776 there was no dentist, so called or practicing as such, to be found in this country. All operations for extraction were performed by the general practitioner or surgeon; and the principal, indeed, almost the only instrument used was that instrument of torture, the "key," with its adjuncts, the "punch" and "elevator." Prior to the time of Dr. Randall, who died in 1843, forceps were not known as an article of commerce, although he used them. Pain was the indication for extraction, and ruthlessly was it enforced; fracture of the alveolus or jaw was more the rule than the exception.

In 1776, Mr. Wooffendale, a pupil of Thomas Berdmore, of London, arrived in New York, but, although he was the only man in the country who devoted himself exclusively to this branch of surgery, so little did the public appreciate his services that in 1778 he returned to England, being unable to secure sufficient business here to support him. We next hear of Joseph Le Maire, of whom Dr. James Gardette speaks as an eminent dentist in Philadelphia in 1784. Isaac Greenwood was the first dentist in Boston; he practiced before 1784, at which date his son, the celebrated John Greenwood, commenced practice; he was dentist to George Washington, and constructed artificial dentures for him.

Next in order comes Josiah Flagg, an itinerant dentist, in 1785

The following is an extract from his circular: "Dr. Flagg transplants teeth; cures ulcers; and eases them from pain without drawing; fastens those that are loose; mends teeth with foil or gold to be as lasting and useful as sound teeth; and *without pain in operation;* makes artificial teeth and secures them in an independent, lasting, and serviceable manner. . . . Sews up harelips and fixes gold roofs and palates, greatly assisting the pronunciation and swallow. . . . Cuts the defects from teeth, and restores them to whiteness and soundness, without saws, files, or acids, and such abusives as have crept into the profession and which have destroyed the confidence of the public. Sells by wholesale and retail dentifrices, tinctures, chewsticks, masticks, teeth- and gum-brushes suitable for every age, complaint, and climate, with instructions for their use."

In 1783, James Gardette, who was a surgeon in the French navy, came to this country and settled in New York, but removed to Philadelphia in 1784, and continued there in successful practice for forty-five years. He was the first to substitute flat clasps for ligatures or wires; he introduced the "mortise plate," to which the teeth are secured by pins. The first application of the principle of suction or atmospheric pressure has been attributed to him.

Dr. Horace Heyden commenced the practice of dentistry in Baltimore in 1804. He was a man of great energy, and made up for the deficiencies of his early education by hard and successful study. Appreciating the importance of the profession he had adopted, and realizing the necessity for a higher standard of scientific attainment by its members, he joined a number of gentlemen in petitioning the Legislature of Maryland in 1839 to establish a Dental College, "the faculty to consist partly of medical practitioners and partly of dentists." The institution was established, and, at the age of seventy, he assumed the duties of the chair of Dental Physiology and Pathology. Dr. Heyden was also one of the founders of the American Society of Dental Surgeons; was elected its first president in 1840, which office he continued to hold until his death, in 1844.

From this time dentistry has made rapid strides, until it now numbers among its practitioners some of the most scientific and enlightened men in the country. From a mere itinerant pursuit it has arisen to a position equal to any branch of the medical profession, and is decidedly the most lucrative of all.

The system of instruction in the various colleges is comprehensive, and the requirements necessary to be complied with before one can enter upon the regular practice of dentistry are such as to insure intelligence and more than average ability.

ARTIFICIAL TEETH.

When dentistry was in its infancy, artificial teeth were made of bone, teeth of cattle and sheep, hippopotamus tusks and teeth, elephant and other ivories. Human teeth were also used for transplanting, and for pivot-teeth. The use of human teeth for transplanting was confined to the incisors and molar teeth. When one of these was lost, it was replaced by a similar one, taken from the mouth of a healthy person who was willing, for a consideration, to part with it.

In an advertisement inserted in a Philadelphia newspaper in 1784 M. Le Mayer, a dentist, offers *two* guineas for sound teeth, to be obtained from "persons disposed to sell their front teeth, or any of them."* This practice is occasionally pursued to the present date. In a paper recently published in Washington, D. C., was an advertisement, inserted by a prominent dentist of that city, for a sound front tooth for transplanting. When not used for transplanting, the portion used by dentists was the part of the tooth covered by enamel, and called the crown; the operation was known as "pivoting." I cannot describe the process better than by using the language of Robert Wooffendale, to whom reference has previously been made. He says in regard to this operation, "Another method of supplying the loss of teeth by art is by fixing the crown or enameled part of a sound human tooth to the root of a tooth of which the enameled part is wholly, or in part, decayed or broken. This is done by filing each properly, and uniting them by the assistance of a screw of gold or silver, which may be done so completely that it is sometimes not without difficulty they can be separated, in some instances rendering good service for several years; provided the orifice in the root of the tooth, through which the nerve passes, is not much decayed. This operation can only be performed when the teeth have but one root; neither can it be practiced when the root of a tooth is out."†

Benjamin James, in 1814, says, "Dentists pursue very different methods of fastening the new crown upon the roots; some drive the wire, which is attached to the crown, into the canal of the root, with cotton wrapped around it to make it tight; while others previously place a piece of wood in the root, and attach a crown to this substance. As the cotton of the former method absorbs and retains the saliva, which, from stagnation, becomes offensive, and as teeth set in

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* Watson's *Annals of Philadelphia*, vol. i. page 179.

† *Practical Observations on the Human Teeth*, by R. Wooffendale. London, 1782.

this way are sooner loosened, we are induced to prefer the latter manner of setting them."*

Human teeth were also fastened in the mouth by tying them by ligatures of gold or silver wire, silk, unbleached thread, sea-grass, etc. All these methods fell into comparative disuse on the introduction of gold and silver plates fitted with clasps. Strong prejudice existed against the use of human teeth, from a belief that they might be vehicles for introducing disease, and the profession were compelled to seek less expensive and objectionable substitutes, such as hippopotamus and elephant ivory, bone, etc. To all of these there were valid objections, owing to their decomposition when brought in contact with secretions of the mouth.

Porcelain Teeth.—Prior to the advent of Dr. A. A. Planton, who arrived in Philadelphia in 1817, porcelain teeth were unknown in this country. They were used in France as early as 1774, and a stock of these teeth was brought to America by Dr. Planton. While in many points they were an improvement, they were still, in their then crude state, very objectionable. They were bad in color and shape, made coarsely and of poor material, white, opaque, and brittle. They were made without gums, being designed for adaptation to ivory or bone bases. In speaking of them, Dr. Flagg says, "The mineral or china teeth are very imperfect; they have an opaque, earthy appearance; are brittle, and the sensation they produce when brought in contact with the natural teeth in mastication is very disagreeable."†

There is much confusion as to the priority of claim for their manufacture in this country, but it is generally conceded that the credit belongs to Dr. Planton. He commenced manufacturing about 1819, and, in 1822, exhibited his work before the Medical Society of Philadelphia, and received from it a certificate of approbation.

Next following was Mr. Charles W. Peale, a man of extraordinary mechanical ability; first a saddler, then silversmith, watch-maker, dentist, and lastly portrait-painter, in which latter vocation he acquired his most enduring reputation. He was public-spirited and given to scientific research. His first teeth (1822) were made with holes through them for riveting to the plates, as he had been accustomed to do with teeth made of animal substance. These, however, proving inefficient, he placed platinum wire in the composition before firing it.

Samuel Stockton commenced his experiments in 1825. He was the first in this country whose manufacture of porcelain teeth attained

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* *Treatise on the Management of the Human Teeth*, by Benjamin James, M.M.S.S. Boston, 1814.

† *The Family Dentist*, by Josiah Flagg. Boston, 1822.

to any commercial importance. Most of those who manufactured previously did so to supply their own wants. His manufacture was the most extensive in this country up to 1845, his production reaching as high as five hundred thousand per annum. His bodies were opaque and uniform in color throughout their whole extent; the gum enamel was a smooth paint, applied on the surface before final vitrification of the teeth; the grinding surfaces of the bicuspids and molars were formed by a three-sided file, in single or crossed grooves; each tooth was of uniform thickness from side to side, no attempt being made to preserve an unbroken lingual surface, in entire dentures, by shading the thin incisors into the broad molars, through a gradual thickening of the intermediate teeth. He gained several premiums in competition with his contemporaries.

James Alcock and D. C. Ambler both gained considerable notoriety and established large manufactories.

To Elias Wildman, of Philadelphia, must be accorded the honor of first reducing the manufacture of artificial teeth to a scientific basis. His labors resulted in the production of a tooth more life-like in appearance than any previously made; he far outstripped his rivals.

Mr. S. S. White, now the largest manufacturer of artificial teeth in the world, commenced the production of his teeth, in a very small way, in the garret of a dwelling-house at the corner of Seventh and Race Streets, Philadelphia. The improvements with which he stands credited are numerous and valuable. He claims to make over four million of teeth annually.

Mr. H. D. Justi, of Philadelphia, in 1852, first had his attention called to artificial teeth, having at that time obtained a thorough knowledge of the manipulation of metals, and especially of steel, for the manufacture of surgical and dental instruments, in which he had served his time in Germany with one of the best experts. After his arrival in this country he entered into an engagement with a house of great reputation for the manufacture of surgical and dental instruments. This establishment was the rendezvous of dentists and manufacturers of artificial teeth, for it was here they could obtain everything needed in their line: instruments for dentists, machines for making platina-pins, and tooth-moulds for their manufacture; here they were furnished with teeth as patterns for moulds, and in reality they had a collection of artificial teeth of all the known makers of the world, and here it was that his study commenced,—carving teeth in metal. Having been successful in this branch of the business, he felt a desire to advance in the art of artificial dentures, and therefore engaged himself with one of the leading dentists of Philadelphia, who

was then manufacturing for himself all the teeth required in his practice; they were made in moulds and also in carved blocks, in which branch he took a special interest. His preceptor was expert in taking the articulation, and here it was left for him to do justice to the case,—to carve and to mount the proper type of teeth. He therefore asserts that in this establishment were manufactured the first sectional teeth ever made in moulds, and that these moulds were made by his hands. Having thus obtained the practical knowledge and experience which he thought a manufacturer of artificial teeth ought to have, he pursued his investigations still further in that direction.

Up to about the year 1855, only one kind of teeth had been manufactured,—teeth for gold and silver plate,—and but very little attention had been paid to their construction of form to approach nature. Then a rubber base was introduced, and from that time the entire dental business has been revolutionized. He made a specialty at that time of supplying manufacturers with moulds of sectional teeth. There were then two different modes of manufacturing these teeth, but neither worked to good advantage, one mode being that in which all the colors were put into the mould, and this resulted in bad colors of the gums, owing to the construction of the mould. By the other mode the blue and yellow colors were put into the mould first; then the material was taken out of the mould and carefully put into the first fire to undergo a slight degree of heat, called a "biscuiting," and the gum was next applied with a brush and then fused or burned ready for use. Seeing that in this latter mode there was room for improvement, he commenced to make experiments, and succeeded in constructing moulds suitable to the various formations of the jaws, adopting curved lines in which he could sink any depth around the neck of the teeth to receive the gum color, and temporizing the materials so that in one very easy operation he had the tooth ready to finish. The results created general admiration, the teeth being light in bulk, and remarkably life-like in their appearance, the gums especially so. In order to distinguish this make of teeth from others, he adopted a trade-mark accompanied with his name. This mode of manufacturing artificial teeth has since been copied by all other manufacturers.

Since the manufacturing of artificial teeth, especially of sectional teeth, has been brought to such perfection, dentists no longer make the teeth they require. They can nowbe supplied by the manufacturer, at less cost to themselves, with a more suitable article better adapted to the case, whatever it may be. To carve an upper and lower set of teeth in a dentist's laboratory would consume the best

part of one day, besides the great inconvenience of getting the furnace ready to burn this single set. Now, one man, in a factory, can produce fifteen full sets in a day, and in one furnace can be burned at one firing two hundred and fifty full sets, or about seven thousand teeth.

Tooth-moulds are made by first taking an impression of natural teeth, the shape and size desired, and then comes the task for the carver, to be able to extend each tooth in size and yet retain the same style and character, when finished, as the natural tooth, as the materials shrink or diminish nearly one-third in size while in the fire. Teeth are modeled in plaster of Paris, in two sections, the outer side and the inner side; from these, castings are taken in hard brass metal, then filed and carved again after the original impression, and are then ready for use. The large number of moulds thus required can hardly be imagined by those not familiar with this business, until they consider the great multitude of people, no two of whom have faces alike.

After having taken good care in imitating nature in her great variety of forms by reproducing these in moulds, the manufacturer has to commence the study of compound materials which he finds in the combinations of feldspar, silex, or silica, kaolin or alumina, from which minerals he receives clearness and strength according to the proper proportions. From the above-named minerals the clearest crystals are selected, finely pulverized, and colored. Colors are received from the oxides of gold, platina, cobalt, manganese, uranium, and titanium; from each single color and its combinations is obtained an endless variety of shades and tones; each manufacturer having his own mode of compounding.

BASE-PLATES.

Previous to 1784 ivory and bone were the materials used for the base-plates of artificial teeth; but both were subject to many objections. Only the greatest care, skill, patience, and experience could, with these materials, produce results having much accuracy of adaptation, or securing ease and comfort to the wearer; and when we add to these the objections applying to the same materials when used as teeth, we can understand with what delight the profession and the public hailed the advent of metallic bases.

Dr. Gardette has the credit of being the first to introduce gold as a base in this country. Gold, being costly, was within the reach of the rich only, and silver was the common and cheaper substitute. Platinum alloyed with silver and iridium has been commonly used, and for a time aluminium was a favorite base. It was first used and pat-

ented by Dr. Bean, and met with much favor, as it withstands the ac tion of acids; but, unfortunately, alkalies destroy it, and it has fallen into disuse. Gutta-percha comes next in order, introduced in England by Edward Freeman about 1851. This, although designed for permanent sets, was found by experience to be available only for temporary dentures, and even for that purpose has long been abandoned. Vulcanite followed. In 1851 the publication of Nelson Goodyear's process for making hard-rubber compounds, afterwards called "vulcanite," turned the attention of many manufacturers to the adaptation of this material, which was announced as a substitute for horn, bone, and ivory, and as susceptible of being colored; but it was several years before the dental profession adopted it.

In 1855, Charles Goodyear, Jr., obtained in England a patent for making a dental plate of hard rubber, in which the teeth were secured before the compound was vulcanized. This was the first recorded or published suggestion of this use of the new material, which contains not only the adaptation of vulcanite, but also the use of the mould as now applied.

The adaptation of the vulcanite had, I believe, been previously made by Cummings, but in his *caveat* of 1852 no mention was made of the mould, and it was not until 1865 that he secured a patent embracing both points. Long and vexatious litigation followed; suits were carried from court to court; and they were finally appealed to the Supreme Court of the United States, where they now await action.

CELLULOID.—In 1870 the Hyatts obtained a patent for converting collodion into a homogeneous and durable compound in masses. This is essentially a mixture of camphor-gum finely comminuted with cellulose fibre. Being naturally colorless, it can be readily colored of any desired tint. It is strong, light, plastic under heat, and elastic when cold. It can be remoulded frequently without injury, and can be repaired easily and promptly, through its perfect welding properties. It is now in extensive use as a substitute for rubber. The principal objection made by its opponents is on account of its highly inflammable nature. Gold, vulcanite, celluloid, and platinum are to-day, as they have been for some years, the principal materials upon which mechanical dentistry depends. The great advance made in instruments and appliances will be referred to in noticing the exhibit of Mr. S. S. White.*

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* In the preparation of this report I am indebted for much of my information on dental progress to the researches of Mr. James E. Dexter, of New York, and have made liberal extracts from the *History of Dental and Oral Surgery in America*, published by S. S. White.

Mr. H. D. Justi exhibited nothing but teeth, but his display was beautiful in the extreme. He claims that all were made by his own hand. In color, translucency, and texture they were all that could be desired; they were a faithful reproduction of the physiological characteristics of the natural organs, both to the individual teeth and relatively to the entire set. Their conformation with reference to close and easy adaptation to the maxillary arch showed careful study of the needs of both patient and operator. Their various and numerous deviations from uniformity of arch and outline, simulating the irregularities of nature, was so perfect that when in the mouth no suspicion of their artificial nature would be entertained. The disposition of tooth-material was so skillfully managed as to secure the greatest amount of strength with the least bulk; and the insertion of platinum pins was so arranged as to render their displacement an almost impossible accident.

The display of artificial teeth made by S. S. White was immense, their variety being only equaled by their beauty. All that has been said concerning the artificial teeth manufactured by H. D. Justi can with strict justice be applied to those exhibited by S. S. White. It does not appear possible that any further improvement can be made; they are as perfect as can be desired. In addition to teeth, this exhibitor displayed a vast museum of every article required by the dentist; an entire day could have been profitably spent in the examination of this costly and beautiful collection. It would be impossible to enumerate all the articles exhibited; I shall, therefore, select a few of the most important, as marking the progress made in the last few years in this important branch of industry. "The S. S. White Dental Chair" is especially deserving of notice, and may be regarded as nearly perfect in all its details. The various positions desired for the patient are obtained with the greatest ease and rapidity. The arm- and body-rest is a valuable addition to the operator, enabling him to prolong his efforts with great comfort and avoidance of fatigue. The head-rest is all that can be desired in variety of motion, firmness of position, and comfort to the patient. A valuable feature of the chair is its adjustable back, which may be easily raised or lowered, or varied in its angle to give support to the body of the patient where most needed, these movements not interfering in any way with the adjustment of the head-rest or seat. The padded seat is exchanged for one of cane in warm weather. The foot-board is self-sustaining at any point in its range, and can be adjusted by the patient. The great improvements effected in the construction of this chair are the remarkably easy and quick adjustment of all or any of its special

parts, and their perfect adaptability, when adjusted as a whole, to meet any requirement of patient or operator. The form, frame, and character of the finish and upholstering leave nothing to be desired.

DENTAL ENGINES.—The dental engine originally introduced by Dr. Morrison, of St. Louis, Missouri, with the improvements since added by this manufacturer, may be considered one of the greatest in importance that has ever been presented to the dental profession. The ease and safety with which operations upon the most delicate teeth are performed completely overthrow the objections offered by those who are prejudiced against the "innovation," as they term it, without being particularly acquainted with its merits. It is absolutely certain that with the aid of this engine operations for excavation can be made almost painless,—a great consideration to the patient.

The almost endless variety of points embrace burs of every shape and size for removing decay preparatory to filling, viz., round, wheel, cone, inverted cone, bud, fissure, square end, fissure-pointed, and oval. In drills there are flat spear point, square, flat-square point, round, twist drills, trephines, five-sided flexible burs, and drills for opening and preparing nerve-canals. Plug-finishing burs are in every variety of shape adapted to every want of the dentist,—Arkansas, Hindostan, and Scotch polishing-stones mounted on mandrels in great variety; boxwood disks, wood-polishing points, corundum points, corrugated and smooth-polishing burnishers, etc., all of which can be adapted.

The right- and acute-angle attachment are valuable additions to the engine, enabling the operator to prepare cavities in the posterior portion of the teeth with great facility. When we view its various uses and manifold appliances, and the vast amount of labor it overcomes, the question naturally arises, How did the dentist ever do without so valuable an instrument?

Before closing this paper, a simple act of justice demands the most favorable notice for the "rubber dam" introduced and presented to the profession by Dr. S. C. Barnum. As an auxiliary to dentistry its value cannot be computed. Operations that were once considered impossible are by its aid made comparatively easy to patient and operator. The absolute dryness which should be secured for all teeth to be filled is by its use attained without trouble, and the complete success of the operation insured. The method of applying the dam is simple. With a plain, suitably-sized punch a hole is made in the rubber, which is then passed over the teeth to be filled, and fastened by a silk ligature, which prevents moisture encroaching upon the

cavity. To Dr. Barnum belongs the honor not only of its introduction but the gratuitous presentation of his simple and valuable invention to the dental profession.

DENTAL MUSEUM—ITALIAN DEPARTMENT.

One of the most instructive exhibitions in the Main Building was the dental museum in the Italian department. It occupied little more space than a medium-sized parlor book-case, but it was complete, containing more practical information for the student of dental art than a whole library. Such a collection must have required years of patient and intelligent labor by masters of their profession, who have spared no pains in accumulating a series of anatomical preparations of the teeth and jaws illustrating most comprehensively their physiology and pathology. The selection of anomalous and pathological cases was of peculiar interest.

The student could find in this museum, either in natural preparations or in wax reproductions, all that a practicing dentist need know, and, by a careful study of the exhibit, complete the knowledge he has acquired theoretically.

The museum was divided into two parts:

1. Descriptive anatomy and physiology.
2. Pathological anatomy, surgery, prothesis, and orthopedy.

The first specimen in the anatomical division showed the almost spherical protuberances which contain the dental gums, or the outer face of the jawbone in a fœtus six months of age.

No. 2 was injected with red wax, showing the same, but more perfectly, from a fœtus of the same age.

In specimens 3 and 4, the external lamella of the right side was removed, showing the somewhat thickened bags, some of which were opened to demonstrate the first period of solidification of the teeth.

The next series explained the progressive development of the temporary and permanent teeth.

a. The degree of development of the temporary teeth three months after birth.

b. The development of the same about the age of two years.

c. Development of the same at four years of age, showing the complete formation of the temporary teeth.

d. The first permanent tooth, age corresponding to *b.*

e. Permanent teeth, age corresponding to *c.*

f. Permanent teeth, replacing the twenty temporary, and complete formation of first molars; age nine years.

g. Age fifteen years, twenty-eight permanent teeth, the last four molars still in a state of formation.

h. Age from sixteen to twenty-five years; the thirty-two permanent teeth complete.

Next in order were exhibits of the left side of the jawbone, exposing the connection between the temporary and permanent teeth, and the disposition of the roots in the alveoli.

Following these were specimens of the jawbones at the age of first teething, after the end of the second teething, and after the loss of the thirty-two teeth; also, the development and disposition of the alveoli in the first and second periods of teething.

Next followed longitudinal and horizontal sections of the twenty temporary teeth, showing:

a. The position and volume of the dental pulp;

b. Longitudinal sections of the thirty-two permanent teeth;

c. Two sections from the teeth of an aged person, in which the pulp is reduced to the minimum of its volume;

d. Horizontal sections of the thirty-two permanent teeth.

The next division was devoted to the microscopical study of the hard substance of the teeth:

e. Enamel (horizontal section of a crown);

e'. Enamel (longitudinal section of a crown);

f. Dentine (section perpendicular to the pulp);

f'. Dentine (section parallel to the pulp);

g. Cementum;

h. Longitudinal section of an entire tooth;

i. Section showing various fissures of the enamel and solution of continuity;

k. Piece of bone for comparative study.

Then followed illustrations of the mouth at different stages of development and at old age, embracing the following instructive divisions:

a. Mouth of child when the first teething is complete, with the twenty temporary teeth;

b. Mouth at five years, showing the first permanent molars;

c. Mouth at fourteen years of age, with total absence of temporary teeth, and presence of twenty-eight permanent ones;

d. Mouth at twenty-five, second teething complete;

e. Mouth of an old subject, with the thirty-two teeth, but worn and shortened by use;

f. Mouth of an old subject after the loss of some teeth, demonstrating the deviations undergone by those left without support, and the modification produced in the articulation of the jaws;

g. Mouth of an old subject entirely deprived of teeth, showing the absorption of the alveolar process.

This completed the anatomical and physiological divisions of the cabinet, each preparation being an almost perfect work of art, and reflecting the highest credit upon the skill and patience of the exhibitors. The pathological department embraced almost every deviation, irregularity, or anomaly of the teeth and gums. Forty specimens were devoted to the demonstration of the various irregularities in the size, shape, length of root, and position of the teeth, depending upon constitutional depravity, arrest of development, and want of proper care at the period of second dentition. Four of these specimens were worthy of special notice; they were marked in the cabinet 69 to 72; Nos. 69 and 70 showed the mouth at the period of second teething; irregular process on account of the position taken in the alveoli by the germs of the permanent teeth. In the upper jaw the central incisors were in their normal place, the right lateral one appeared internally behind the temporary one, without having worn away the root; the first left bicuspid grew quite obliquely, with its crown turned towards the palate, wearing out only partly the roots of the first temporary molar; a protuberance produced by the cuspid, that will appear outwardly without touching with its crown the root of the temporary one, was seen on the gum in the region of the left canine fossa. The lower jaws presented about the same anomalies; 71 and 72 demonstrated irregularity in the curve of the parabola of the jaws and in the number of the teeth. Both in the upper and lower jaw the dental arch was narrow at the sides and much widened at the extremities. There were three upper supernumerary teeth; two, without characteristic form, on the roof of the mouth, one on the gum, between the left central incisor and the lateral one. The left lateral incisor had a double crown, as if another tooth was fixed on its posterior face.

The next series showed the different phases of dental caries, with sections of the cariated teeth of the first, second, and third period showing the cones of resistance, formed by the pulp, towards the caries, and its retraction, so as to detach itself from the invasion of the disease.

Following this were twenty-seven specimens devoted to demonstrations of diseases of the intra-alveolar periosteum, gums, and alveoli, with illustrations of the effect upon the teeth and gums of a departure from the normal alkalinity of the saliva.

Specimen 109 showed the copious deposit of tartar on the outward face of the upper front teeth. The particular color of this tartar and

the partial alteration of the underlying enamel indicated that the saliva in this case is not continually alkaline, but becomes momentarily acid at intervals more or less long, then dissolves the tartar in part and produces with it a chemical combination, which develops carbonic acid and decomposes the enamel. This accidental acidity of the saliva ceases, and the alkali prevailing again, another quantity of tartar is produced, and so forth. The inflammation of the gum caused by the presence of the tartar is well marked.

No. 116 exhibited the effect of tobacco-smoking on the teeth and on mucosa. The teeth are covered by a hard, bright crust of smoke, together with tartar, which clings strongly to the enamel; they are also bared, especially the last molars, the internal roots of which are half bared. The mucosa around the neck is white, spongy, and soft, alteration caused by the continual artificial heat of the smoke, and by the acid and caustic elements found in the tobacco.

Then followed twenty-two specimens of prothesis and orthopedy, embracing pivot-teeth, dentures, complete and incomplete, with and without spiral springs, the various methods of retention by atmospheric pressure and by clasps, and a series of orthopedic apparatus for the correction of congenital malformations of the palate and loss by scrofulous and syphilitic necrosis.

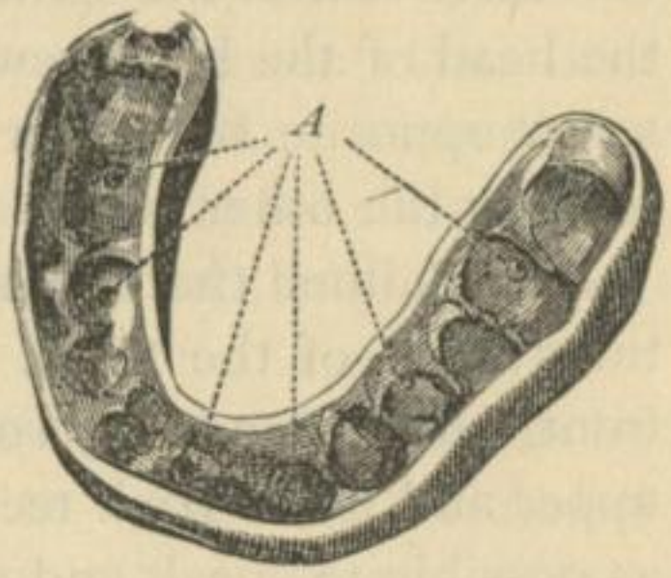
HARD-RUBBER APPLIANCES FOR FRACTURED JAWS AND CLEFT PALATE.

Mr. Thomas B. Gumming, of New York, exhibited a series of splints and appliances for the treatment of simple and compound fractures of the jaw. Prior to 1840, fractures of the jaw were treated principally by bandages and external supplementary contrivances, many of which were more than objectionable. Teeth loosened by the injury were left unsupported, and the motions of the jaw, cheeks, and lips painfully restricted. It is claimed by the inventor that when a well-adapted splint is on the teeth and gums, the other parts around the bone are to a great extent a counter-support to the splint. Thus, the broken jaw, together with any teeth loosened by the injury, is held securely in place until the fractured bone is reunited and the teeth become firm. Meanwhile the motions of the jaw are in most cases unrestricted and the cheeks and lips always left free.

In the use of these splints, fractures of the lower jaw are divided into two distinct classes: 1, those in which the teeth and gum of the fractured jaw are alone used to control the fractured bone; 2, those in which the splint is fitted to both the upper and lower teeth.

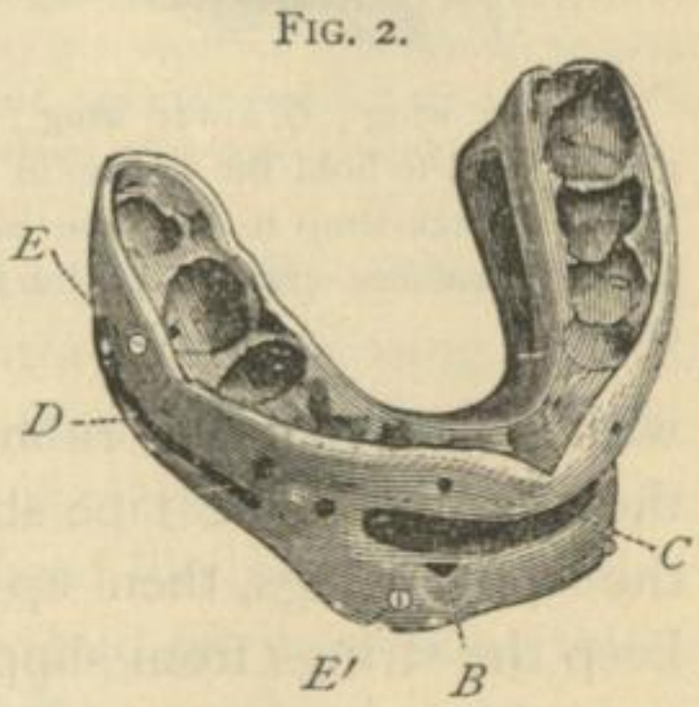
Fig. 1 represents a hard-rubber splint which has been moulded for the treatment of a case in the first, or that in which the jaw is left free; it is turned up to show its inner surface, which incloses all the teeth and part of the gum of the lower jaw, and when adjusted in position rests against the upper teeth when the jaws are closed. It is used without any bandages around the head, the jaw being allowed its natural movement during treatment. The holes marked *A* go through the top of the splint, for the purpose of syringing the parts within with warm water during treatment. The dark, round spots in all the cuts represent holes for similar purposes. The cut is taken from a photograph of a splint exhibited by the inventor, who applied it to a fractured jaw in 1862. He claims, and I believe justly, that it was the first splint ever used without an appliance outside the mouth. This splint will control all single fractures which have teeth on both sides; also double, or even comminuted fractures, forward of the bicuspid teeth, when molar teeth are present to hold the back ends of the splint down, and thus keep the front fragments up. This splint is generally used without any fastening, but, with children, and in some cases with adults, it is sometimes secured by screws pressing into the teeth, or by the wings and bands shown in Fig. 4. When screws are used, they pass through metal nuts, sunk in the splint, and the ends of the screw are made smooth where they enter holes drilled into the teeth. In the explanation given by the inventor, he claims that the drilling of the holes does not injure the teeth; they must be filled, however, after the jaw is united.

Fig. 1.



When the jaw is broken so that it is found impracticable to hold the parts until reunited, except by keeping the fractured bone still, the splint, in addition to fitting the teeth and gum of the lower jaw, is made to inclose the upper teeth also, as shown in Fig. 2, where screws may be seen opposite both lower and upper teeth. By this arrangement the fragments of the lower jaw are secured, not only relatively to each other, but also to the upper jaw. *B* is a triangular opening, of which one side corresponds to the cutting edge of the lateral incisor, which tooth stood

Fig. 2.



in the end of the fragment most displaced before the splint was applied; *C* is an opening for food, speech, etc.; *D* is a channel for the saliva from parotid gland to enter the mouth, its fellow being seen on the other side of the splint; *E'* is a screw to enter lower canine tooth, the head of the left screw being just discernible; and *E* the head of screw opposite the upper first molar tooth, the end of its fellow being seen on the other side.

It is claimed that this splint is adapted to the treatment of all fractures back of the teeth. In these cases the splint is cut away in front, and extended across the roof of the mouth, when there are upper and lower back teeth to fasten to, and thus give as much room as possible to speak and eat through. Opening the teeth a quarter or three-eighths of an inch would not have any bad effect on the position of the fragments, even if the jaw were broken through the necks of both condyles, as the parts near the fractures would move but little, and the back of the jaw could be raised high enough to keep the broken surfaces in contact.

FIG. 3.

F, upper wing; *G*, lower wing; *H*, mental band to hold the jaw up in the splint; *I*, neck-strap to keep the band back; *K*, balance-strap to hold the cap in place.

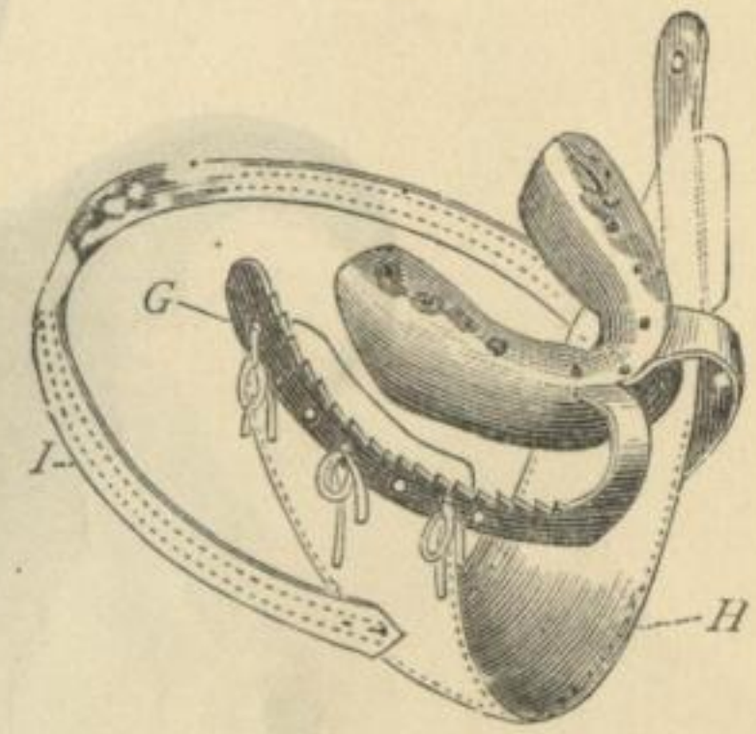
Fig. 3 shows wings and caps to which fastenings are adjusted for cases having no teeth in either jaw,—the ends of the wings within the mouth are imbedded in a vulcanite splint similar in principle to that of Fig. 2. The wings are made of steel, and quite light. They have fine teeth along the edges, where the bands and tapes bear, to prevent slipping, and small holes every half-inch to hold the strings, lacing, etc. The arch of the wings is high enough to give the lower lip room for upward movement. The wings for each side of the jaw are in one piece, and the parts within the mouth pass back in the line of the upper gum. They are thinned down and pierced with holes, that the rubber in which they are imbedded may hold them firmly. The tape strings pass from the cap inside and under the upper wings, then up between them and the tape lacings, which keep the strings from slipping to the cap whence they started. The mental band passes up between the sides of the lower jaw and the wings, where it is tied by the strings which pass through the holes. The band is cut off to show this; but when worn it should be turned

down on the outside and pinned just below the wings. The neck-straps should be sewed to the mental band on one side and pinned on the other, and worn tight enough to keep the band from slipping forward over the chin. The jaw and splint are supported by the cap forward of its centre. This is counterbalanced by the elastic strap which passes from the back of the cap down around an unelastic and much heavier strap, extending across and fastened to the shoulders by elastic ends. The balance-strap returns to the cap, and is buckled tight enough to hold the jaw up.

By this arrangement the splint is a resting-place for the broken jaw, while the wings give firm attachment to appliances which hold the jaw up with the least possible pressure upon the external parts, as the wings need not press either against the jaw or the zygoma.

The same exhibitor presented also an ingenious metal splint adapted for the same purpose as the hard rubber. It is made of cast-tin, and is intended to be used with a lining of gutta-percha. It is cast in seven different sizes, from which the desired size can be selected. Fig. 4 represents the splint, which has a handle in front, that it may be used as a cap to take the impression of the jaw; the holes are for the purpose of allowing a small probe to be pressed through the wax down to the teeth, thus allowing air to enter to facilitate the removal of the impression, and, when in use as a splint, to give entrance to warm water, thrown from a syringe, to keep the parts clean. This splint has the advantage of being easier of application than a rubber splint, especially if the fractured bone can be set and held by ligatures firm enough to bear the pressure of the warm gutta-percha; for the splint can then be applied to the teeth, without being first moulded to a plaster cast, and the gutta-percha closing around them keeps the bones in place without further fastening. If the fracture cannot be set firm enough without, a plaster cast must be made. This splint can be arranged to be used like any of the rubber splints, and the wings, if needed, can be soldered on, care being taken that their edges are clear of the corners of the mouth when open.

FIG. 4.



G, wing of malleable iron, projecting with its fellow from the splint to which they are soldered; *H*, mental or splint band, with the end left up to show the manner of tying; *I*, neck-strap.

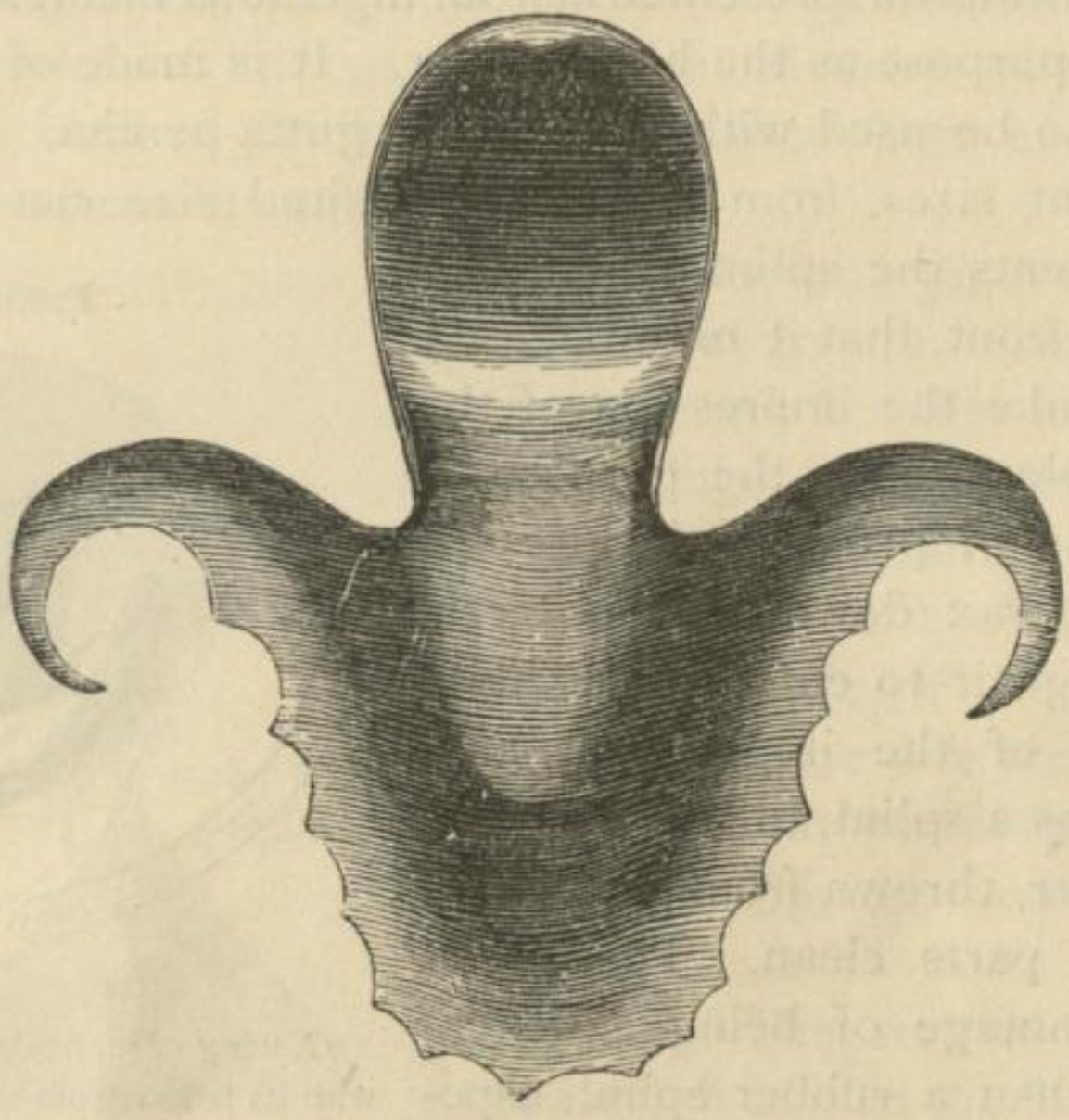
In connection with the splints shown, was a series of casts illustrating the double-compound fracture of the jaw of the late Hon.

William H. Seward, showing the jaw broken on both sides between the bicuspid teeth. Also, a double cast of the upper and lower jaw as held by the splints for sixty-eight days. As no teeth were left in the upper jaw, the wings and cap were used as shown in Fig. 3. The result was thoroughly satisfactory.

HARD-RUBBER APPLIANCE FOR CONGENITAL CLEFT PALATE.

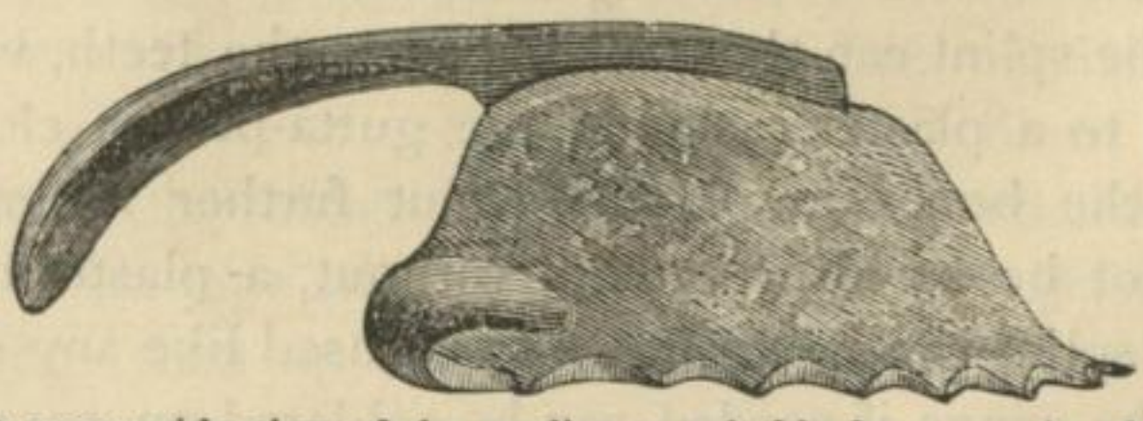
This contrivance is a very marked improvement over all previous appliances for rectification of this distressing malformation. It was first applied by Dr. Gumming in 1864. These plates, illustrations of which are seen in Figs. 5 and 6, avoid the objectionable features of

FIG. 5.



Cleft-palate plate, lower view. When worn, the back part is covered for the space of a quarter of an inch on either side by the cleft soft palate.

FIG. 6.



Cleft-palate plate, upper side-view of the appliance, suitable for a case in which the cleft does not reach the front teeth.

earlier appliances, and to some extent enable the wearer to utilize the action of the muscles of the cleft velum. The palate is easily made,

and does not deteriorate in the mouth. It is not supported by any part of the cleft, and may therefore be worn from early childhood. The plate which is held up by the teeth against the hard roof of the mouth extends up into the cleft and thence to the back of the pharynx near the tubercle of the atlas, the end being rounded to allow the sides of the pharynx to close during the act of swallowing. This extension into the cleft being spread out over the soft parts on each side, the ununited muscles can draw up against it and close off the nasal cavity. The vowel sounds are therefore preserved from the resonance of the nose by the natural action of the muscles, while the nasal sounds are used when necessary, and the tongue is able to form all the lingual consonants, the stiffness of the hard rubber affording the best possible substitute for the muscular firmness of the natural soft palate. There being no forward action whatever of the superior constrictor muscles, a rigid plate can be worn without intermission, not only in comfort, but with improved condition of the mucous membrane, which is covered in, and of the general health, the nose being as free for breathing as in a normal condition of the parts.

FIG. 7.

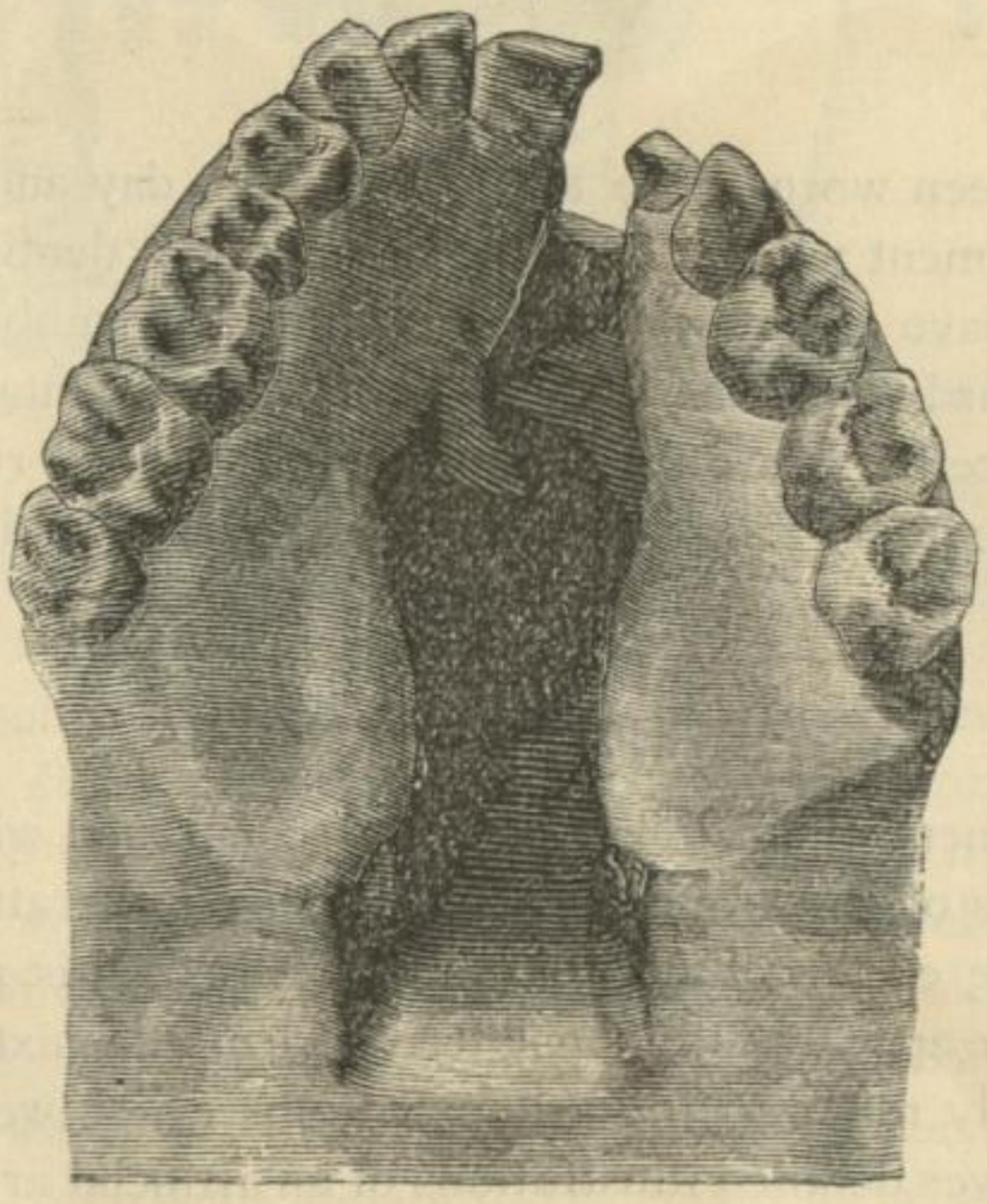
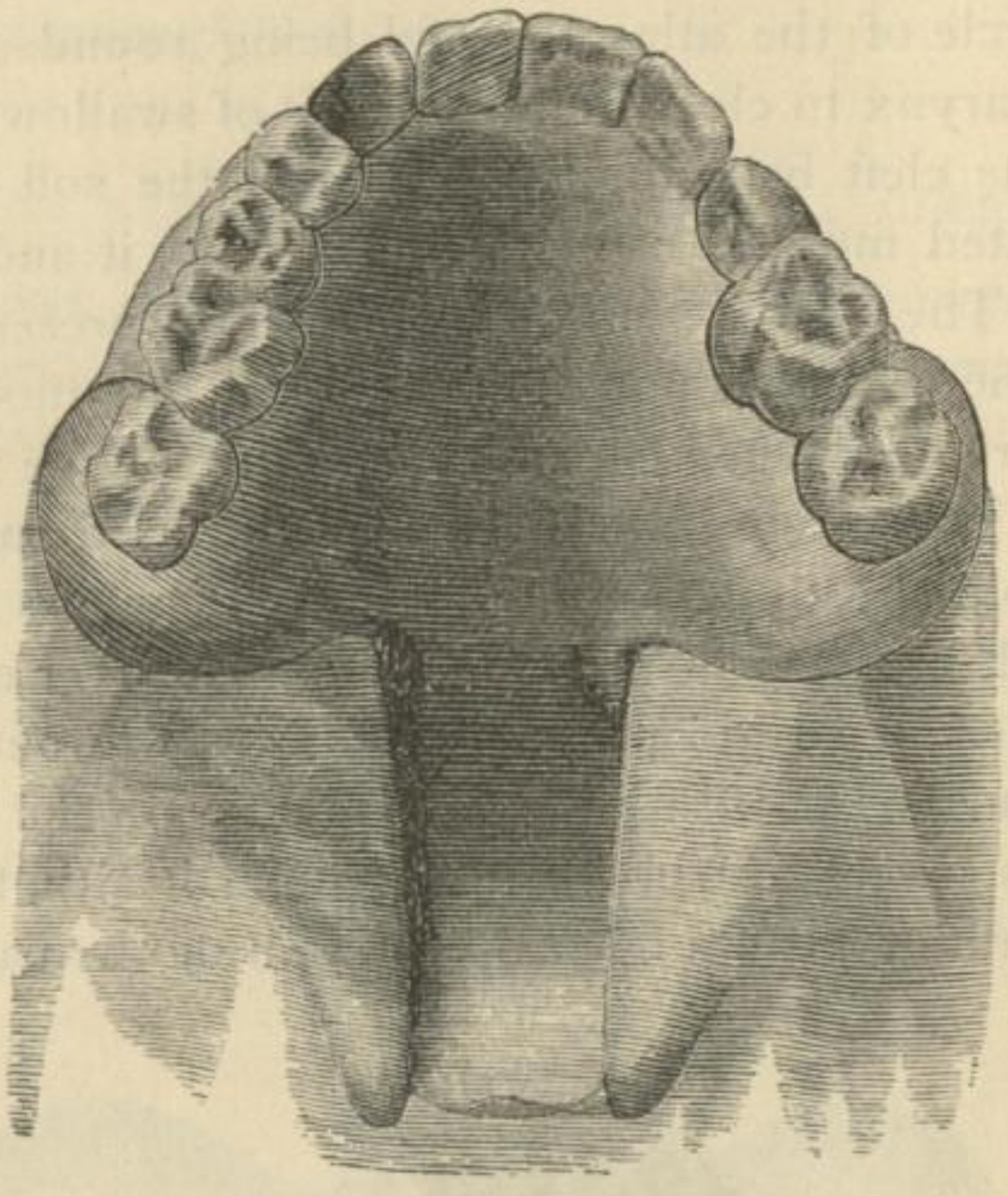


Fig. 7 is taken from a photograph of a cast exhibited. The case was one of a large cleft through hard and soft palate in a patient twenty years of age. The cleft in the lip had been closed in infancy. Several unsuccessful attempts had been made to close the soft palate.

Fig. 8 shows the plate as adjusted to remedy the deformity exhibited in Fig. 7. The cut was made from the cast of the plate *in situ*

FIG. 8.



after it had been worn more than four years, day and night. The whole arrangement will be familiar to scientific dentists, as similar contrivances have commonly been made in soft rubber. Over this material the hard rubber has many and marked advantages. I should imagine that celluloid would be preferable to hard rubber, as it is without odor, equally durable, and as plastic for moulding.

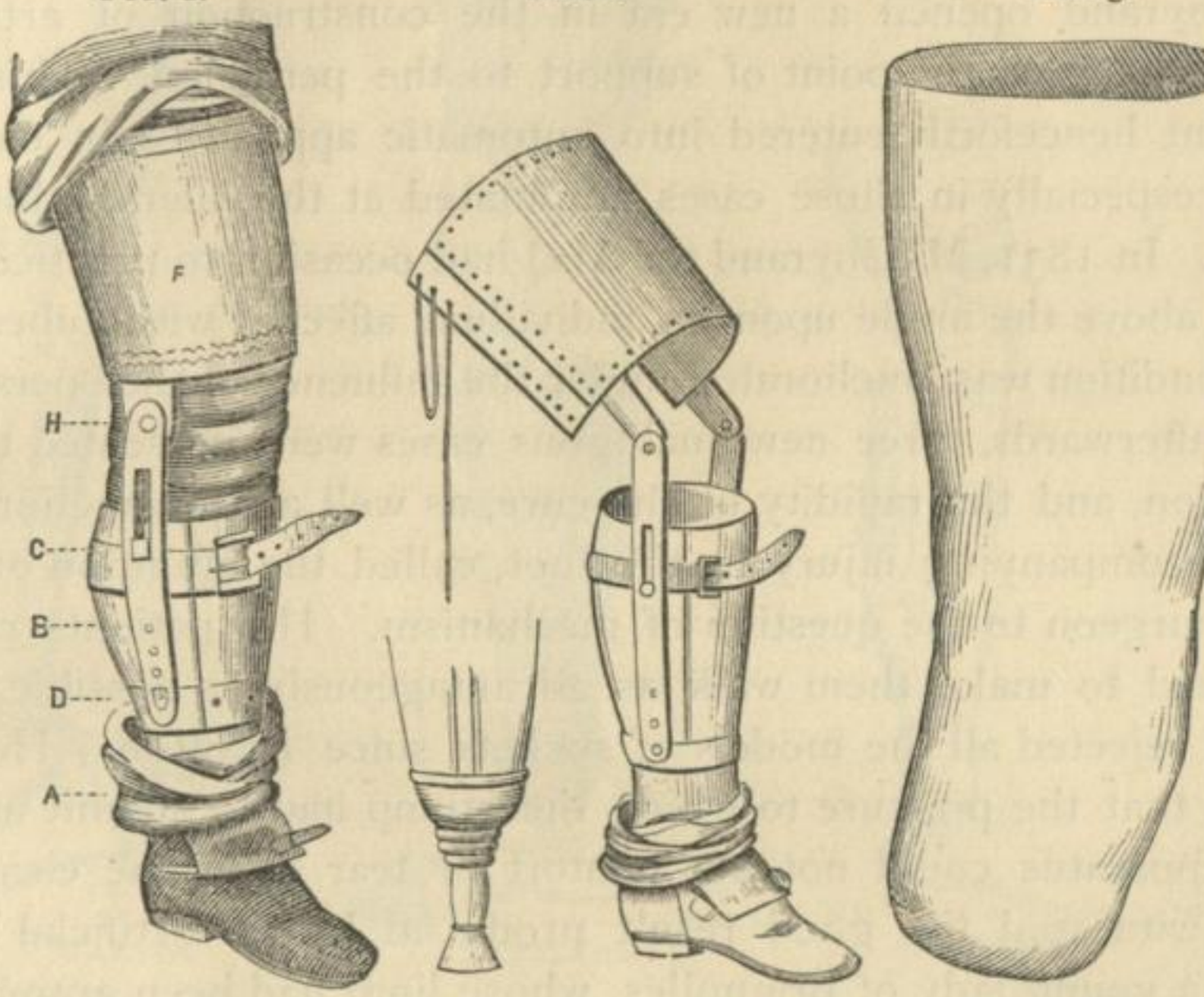
ARTIFICIAL LIMBS.

The department of prothesis, which is concerned with the reparation of the loss of the arm or leg, has received the attention of surgeons from the earliest time. Ambrose Paré, in his great work on surgery, which appeared in the latter part of the sixteenth century (1579), not only refers to the artificial limbs which were supplied in his day, but gives detailed illustrations of an artificial arm and leg, and explains fully their construction. The devices were of a very rude character, but they show the early attempt to conceal the mutilation by means of a mechanical substitute made to resemble as nearly as possible the form and motions of the natural member. Paré seems to have recognized it as an important part of the duty of a surgeon

to provide for the comfortable locomotion of the patient after the removal of the limb,—a consideration which, since his day, has been too often overlooked by the operator, who has allowed himself to be guided by surgical considerations alone.

In an article of May 30, 1860, in *Le Bulletin Général de Thérapeutique*, Paris (to which journal we are much indebted), is found the following account of an artificial limb invented by Verduin, a learned Dutch surgeon, in 1696. Verduin gave to the art the model of an

FIG. 1. FIG. 2. FIG. 3.



artificial limb. This limb (Figs. 1 and 2) was composed of a wooden foot, *A*, on which were fastened two pieces of steel, going up to a level with the articulation of the knee.

A copper boot, *B*, incased the stump, and was fastened by rivets to the side-pieces *D*. A thigh-socket, *F*, the anterior part of which incased the small of the thigh, was articulated, by a hinge-joint, with the side-pieces *H*. A chamois stocking (Fig. 3), which enveloped the stump, and went up as far as the superior part of the thigh, was held by the thigh socket, and kept the stump suspended. Finally, to better protect the cicatrice, a soft cushion was placed at the bottom of the metallic boot. Verduin's apparatus depended, as is easily seen, upon the principle that we must seek a point of support upon the segment of the member superior to that which has undergone amputation, instead of taking it at the condyles of the tibia and about the knee, as his fellow-countryman Von Sollingen had done. Unfortunately, Louis did not approve of the principle advocated by Verduin, and so great

was the influence of his authority that all the surgeons of the eighteenth century, those of Italy and England, as well as France, with the exception of Ravaton, endeavored to make their patients walk with appliances taking their point of support around the knee. None of these, despite their varied forms, were found to answer, and more than a century was passed in fruitless attempts.

In 1826, Professor Serre, of Montpellier, returning to Verduin's principle, proposed a new artificial limb, taking its point of support at the small of the thigh.

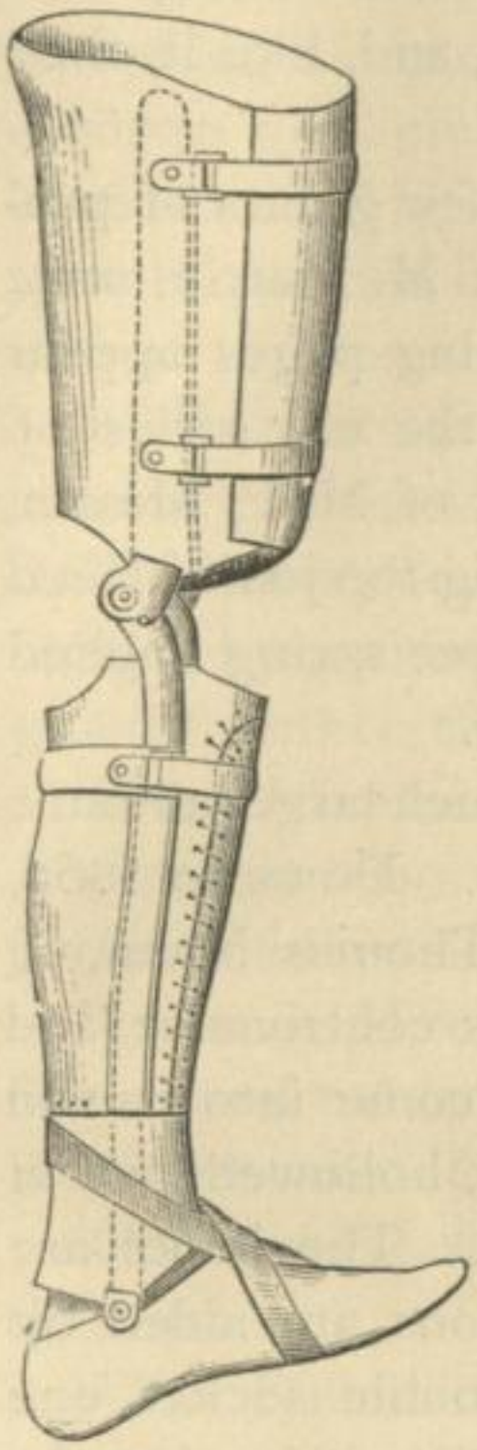
M. Goyrand opened a new era in the construction of artificial limbs, in changing the point of support to the perineum. This improvement henceforth entered into automatic appliances in current practice, especially in those cases amputated at the inferior third of the limb. In 1831, M. Goyrand (of Aix) had occasion to practice amputation above the ankle upon an individual affected with tubercles, whose condition was ameliorated under the influence of the operation. Shortly afterwards, three new analogous cases were presented to his observation, and the rapidity of the cure, as well as the amelioration of the accompanying injury to the foot, called the attention of that learned surgeon to the question of mechanism. His patients cured, it remained to make them walk as advantageously as possible. M. Goyrand rejected all the models of sockets since Ravaton. He understood that the pressure to which the stump had to submit in this sort of apparatus could not but contort or tear open the cicatrice. Having witnessed the good result produced by an artificial limb worn by a young lady of Brignolles, whose limb had been amputated at the place of election, and whose apparatus had its principal point of support at the tuberosity of the ischium, M. Goyrand resolved to apply a similar one to his patients. The ingenious orthopedist, Mille, inventor of that artificial limb, had it quickly modified to serve for amputation above the ankle. In fact, he merely had to dispose the side-joint in such a way as to incase and hold the long stump of those so amputated.

The apparatus of Mille, in the opinion of the French surgeons, marked an important advance in the art, and led to still further improvements by other makers. His modification for amputations above the ankle rendered that operation popular among the French surgeons, whose favorable attention had been attracted to it by its demonstrated safety.

The annexed figure represents the artificial leg invented by M. Ferd. Martin. Desirous of preventing injury to the extremity of the foot, in walking, M. Martin had the extremity of his new apparatus

raised; he did not perceive that by this modification he had transformed his artificial leg into a peg, and changed the statical condition of the body. His patients could not then walk with a flexible knee,

FIG. 4.

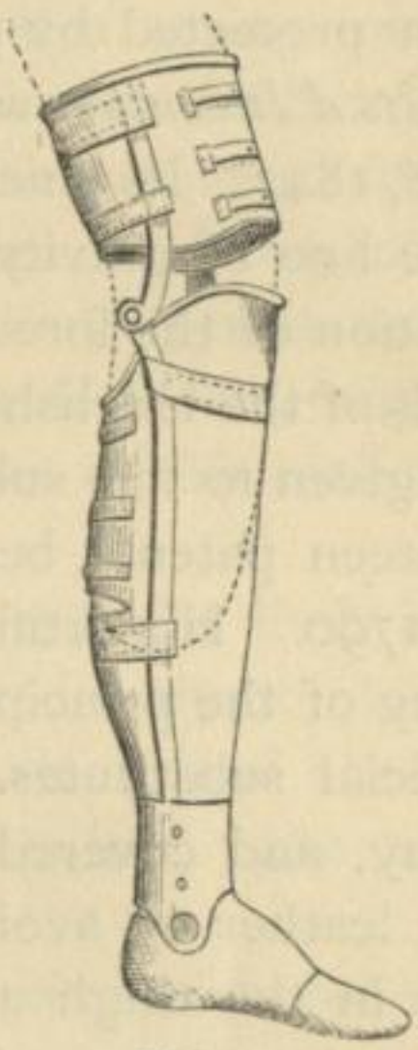


MARTIN.

FIG. 5.

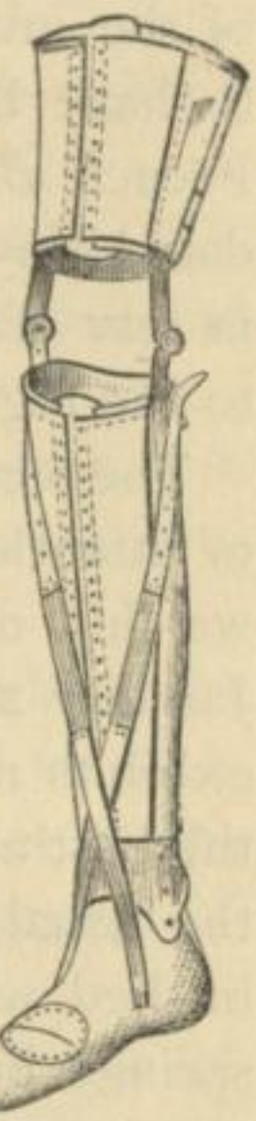
CHARRIÈRE.

FIG. 6.



BÉCHARD.

FIG. 7.



MATHIEU.

and the limb had to be kept stiff by the aid of a stop-joint. The modification necessary to give flexibility to the knee was so simple that I am astonished that so expert a mechanician as M. Martin remained so long without finding it out. It was merely needful to carry behind the axis the articulation of the shin- and thigh-pieces. The principle stated, the means are found. Do not the springs which hold open the "capote" of our cabs present eccentric articulations enough to offer the greatest resistance? Fig. 4 (see cut) represents the model of M. Martin's; it is his first attempt, that is to say, the extremity of the foot raised, and the eccentric articulation of the shin- and thigh-pieces.

In the artificial leg of M. Charrière (5), as in that of Mille, the foot is preserved, and the movements of flexion and extension of the extremity of the member produced by elastic springs. In the model presented in 1856 to the Société de Chirurgie the extension of the foot is maintained by the action of an artificial muscle, *C*, which from

the heel, *A*, is inserted in the posterior and inferior part of the thigh-socket *D*.

To complete the account of the French limbs, we introduce the annexed cuts of those of MM. Mathieu and Béchard. They have as a base two pieces of steel incased in leather, the foot being held raised by springs as in the apparatus of F. Martin, and, like it, they operate on the principle of the peg.

The official records of French patents show very few grants of protection for artificial limbs. With the exception of M. Martin, none of the inventors whose names occur in the foregoing pages appear to have been protected by patent. In vol. liv. of the old series of French *Brevets d'Invention* will be found the patent of M. F. Martin, dated May 28, 1842. Its chief peculiarities are the gig-top joint placed in rear of the line of gravity of the body, and a fusee spring applied to the regulation of the force of flexion of the limb.

The records of the English Patent Office show a much larger amount of attention given to the subject of artificial limbs. Down to 1865, we find nineteen patents, beginning with that of Thomas Mann, of January 20, 1790. His artificial leg is an ingenious contrivance, and exhibits many of the principles which have since come into use in the best artificial substitutes. It is made of wood, hollowed out in the usual way, and covered with chamois leather. The joints are bushed with leather to avoid noise, and the motions are aided by springs both in the thigh and foot. There is a double socket, one playing within the other, and operating as a device for preventing the flexure of the leg when the weight of the wearer is supported upon it. The leg is superior in simplicity and design to those of Verduin, Mille, and Martin, heretofore referred to, and foreshadows the course of improvement in which perfection in the manufacture was to be sought and realized.

The leg of James Potts, patented in England, November 15, 1800, is that which has since become celebrated as the Anglesea leg, because it was so long worn by the illustrious Marquis of Anglesea. The socket is made of leather. The knee-joint is a hinge provided with a lock to prevent flexion when the weight of the wearer is supported on the artificial limb. The foot is united to the leg by a ball-and-socket joint allowing of lateral motion, and the suggestion of lateral motion, since claimed as a novelty, is distinctly made in the specification. The whole leg is covered and stuffed to give it a natural form and softness to the touch, and the joints are padded to prevent noise. The toe-piece is hinged to the foot in the manner now usual. This invention had much merit, and we believe the limb is still a favorite

in England. An improvement on the Anglesea leg was patented and long manufactured by the late William Selpho, of New York. Before the invention of Palmer, the Anglesea leg of Selpho was the best artificial limb to be obtained in this country.

Thomas Mann, October 31, 1810, patented an improvement on his patent leg of 1790. It consists in the addition of certain springs and cords to give greater naturalness to the movements of the limb at knee and ankle, and to assist the wearer in recovering readily the upright position of the leg after flexure, while allowing the easy retention of the flexed position while in a sitting posture.

William Strand, June 1, 1816, patented a spring joint for giving elasticity to the foot and greater naturalness to the tread.

H. Wilms, May 8, 1817, introduced a new material into the manufacture by making limbs of cartouch-paper and linen interleaved and glued together, the object being to combine lightness and strength.

The celebrated artificial leg of B. Frank Palmer was patented in England in 1849, but we reserve our notice of this maker for another portion of this sketch.

Benjamin Mitchell, April 5, 1853, describes a limb in which the flexion and extension of the leg are effected without internal mechanism, by means of straps attached to a belt around the waist of the wearer, and the action of the limb is controlled by the movements of the hip.

W. C. Fuller, in 1855, describes in a patent for various forms of rubber springs their adaptation to artificial limbs.

J. Ashman, in 1856, suggests the use of hide, papier-maché, and vulcanite in the construction of limbs, and introduces a spiral spring in the heel.

In 1857, W. E. Newton patented, as a communication, an artificial leg in which elastic cords were employed to connect the thigh with the foot, to imitate the action of natural muscles. It also shows an application to the thigh-socket, in cases of amputation above the knee, of a leather sack, made of a form to fit the stump of the natural limb, and suspended at its mouth from the edge of the socket of the artificial one, for the purpose of assisting to support the patient and relieving the stump from the unpleasant and often painful and injurious pressure produced upon it by the ordinary method of supporting it by forcing it into a tapered socket. This seems to be the earliest embodiment in a patented invention of a device for supporting the patient wholly or partially on the end of the stump; but the suggestion had been made years before by Palmer, some of whose patients walked in that way. (See Palmer's *Bane and Antidote*, 1852.)

It was not a mode of support which, when it was first suggested, commended itself to the favor either of the surgeon or the manufacturer of limbs, and it was not until the more perfect devices embodied in Palmer's United States patent of 1873 that this method of supporting the patient received a development which makes it, at the present time, the most remarkable advance in this department of prothesis.

The last English patent we shall notice is that of M. Henry, No. 675, of 1860, which is for a leg made in open-work of light wood, strengthened by stays and metal plates. The joints of the foot are made of leather.

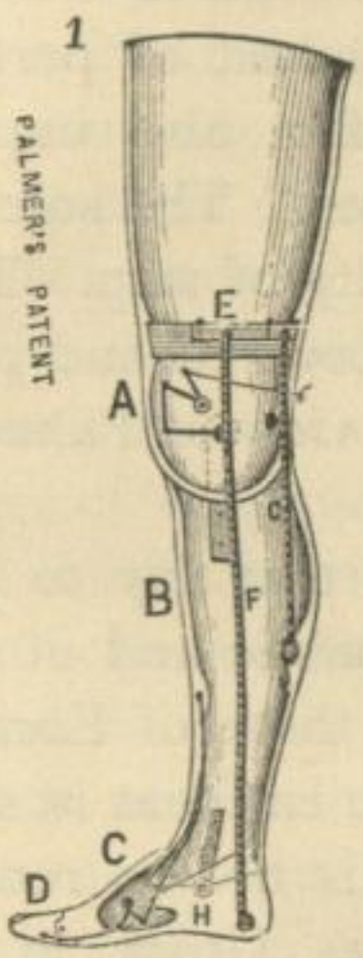
The American Patent Office shows a record of nearly 150 patents for artificial limbs. The Civil War, which caused the mutilation of multitudes of soldiers, and the noble liberality of the Government in making provision for supplying the mutilated with artificial limbs, naturally acted as powerful stimulants to the efforts of inventors to produce substitutes which should command the patronage of the Government. The mass of these patents are either for crude and ill-considered devices, entirely unfitted to supply properly the want they were intended to meet, or for mere details of improvement on recognized inventions.

First, both in time and importance, is the artificial limb of B. Frank Palmer, which was patented November 4, 1846, and improved by further patents in 1849 and 1852. This leg is more widely known, and has met with more general approval by the profession and the public, than any invention of its class, and for that reason we give the detailed notice and description of it from the great work of Velpeau on operative surgery:

"ARTIFICIAL LEGS.—After a patient has submitted to an amputation of his limb, he very naturally inquires of the surgeon what is the best substitute he can suggest to him, and we know that this question has often given rise to much perplexity. As to the lower extremity, we now have it in our power to furnish every desirable information upon this point, and for this we are indebted to Mr. B. Frank Palmer, the inventor of the artificial leg which has won the admiration of the most prominent surgeons in Great Britain, France, and America. During the Great Exhibition in London, 1851, we had an opportunity of inspecting the large number of artificial limbs there presented, and we know that there was but one opinion as to the vast superiority of Mr. Palmer's invention to any hitherto offered. In a word, Mr. Palmer bore away the palm, the adjudicators being, among the rest, no less than the distinguished surgeon of St. Bartholomew's Hospital, Mr. William Lawrence, and the renowned veteran of the Hôtel Dieu,

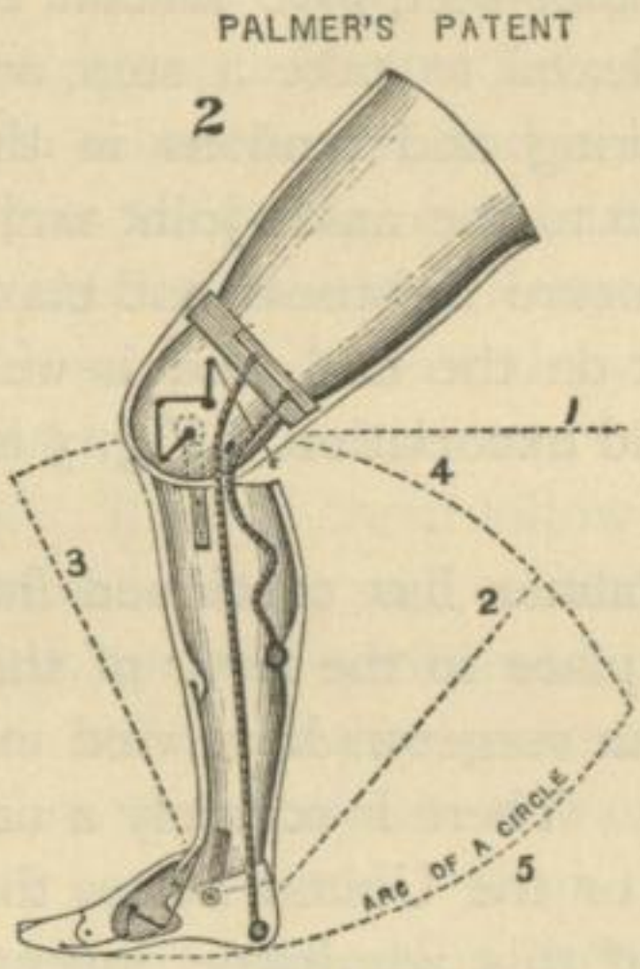
Roux, recently deceased. We confess that after walking some distance with Mr. Palmer, we did not in the least suspect that he had himself been provided with one of his own artificial limbs, yet such is the fact. This certainly is one of the greatest triumphs of American ingenuity. We copy from a pamphlet issued by Mr. Palmer the description of its peculiarities, remarking, at the same time, that through his politeness and liberality we are enabled to present to the reader an internal view of this beautiful piece of mechanism. We also insert the views of Mr. Palmer, which have special reference to the comfort and usefulness of the mutilated who may desire to avail themselves of his substitute. The articulations of knee, ankle, and toes consist

FIG. 1.



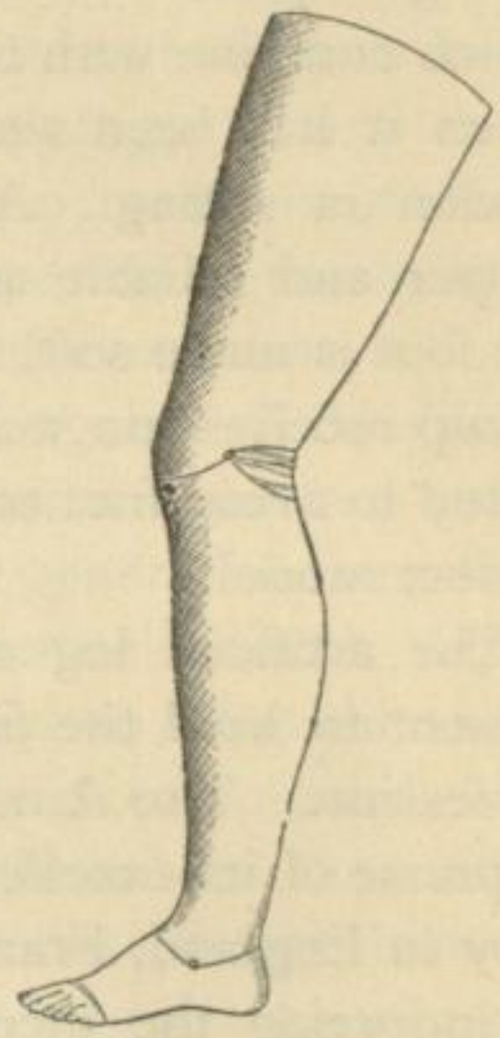
Internal view.

FIG. 2.



Internal view, semi-flexed.

FIG. 3.



External view.

of detached ball-and-socket joints, *A*, *B*, *C*. The knee and ankle are articulated by means of the steel bolts *H*, *H*, combining with plates of steel firmly riveted to the sides of the leg, *B*, *B*. To these side-plates are immovably fastened the steel bolts *H*, *H*. The bolts take bearings in solid wood (properly bushed) across the entire diameter of the knee and ankle, being stronger, more reliable, and durable than those of the usual construction. All the joints are so constructed that no two pieces of metal move against each other in the entire limb. The contact of all broad surfaces is avoided where motion is required, and thus friction is reduced to the lowest degree possible. These joints often act for many months without need of oil or any attention,—a desideratum fully appreciated by the wearer. The tendo-Achillis, or heel tendon, *F*, perfectly imitates the natural one. It is attached to the bridge, *E*, in the thigh, and passing down on the back

side of the knee-bolt, *E*, is firmly fastened to the heel. It acts through the knee-bolt, on a centre, when the weight is on the leg, imparting security and firmness to the knee- and ankle-joints, thus obviating all necessity for knee-catches. When the knee bends in taking a step, this tendon vibrates from the knee-bolt to the back side of the thigh, Fig. 2. It descends through the leg, so as to allow the foot to rise above all obstructions in flexion, and carries the foot down again, in extension of the leg for the next step, so as to take a firm support on the ball of the foot. Nature-like elasticity is thus attained, and all thumping sounds are avoided. Another tendon, *G*, of great strength and slight elasticity, arrests the motions of the knee, gently, in walking, thus preventing all disagreeable sound and jarring sensation, and giving requisite elasticity to the knee. A spring, lever, and tendon, which combine with the knee-bolt, give instant extension to the leg when it has been semi-flexed to take a step, and admit of perfect flexion in sitting. A spring and tendons in the foot also impart proper and reliable action to the ankle-joint and toes. The sole of the foot is made soft, to insure lightness and elasticity of step. The stump receives no weight on the end, and is well covered and protected to avoid friction and excoriation. Fig. 3 is a view of Palmer's perfect model."

The artificial leg of Palmer has continued from that day to the present to hold the first place in the favor of the public and of the profession. The American surgeons have vied with those of Europe in praise of its excellence. There is scarcely a name eminent in surgery in England, France, or the United States that is not on record as indorsing the merit of this admirable invention. Gross, in his great work on surgery, says, "It would be difficult to conceive of any apparatus more beautiful in its construction, or more admirably adapted to the end proposed, than the artificial substitutes of Mr. Palmer, who obtained the prize-medal at the Great Exhibition in London in 1851. Combining lightness with strength, and neatness with symmetry, they are worn with great comfort and satisfaction, and are apparently as perfect as any piece of human mechanism can be made, the whole arrangement being a close imitation of the natural muscles and tendons, if not in shape at least in position and function. The socket is made with special care, neatly fitting the stump in every portion of its extent, and is well padded to prevent friction and excoriation, the pressure being diffused over the whole circumference of the stump, while the extremity of the latter is perfectly free in the interior of the former."

But admirable as was the Palmer leg of 1846–1852, it remained

for the same inventor and manufacturer to surpass even his original triumph by the still more perfect limb which he has now exhibited, and which has secured the unanimous award of this Committee. The attainment of this superiority has doubtless arisen from the fact that Mr. Palmer had the misfortune to lose a leg in his early boyhood, and has given the best energies of his life and his utmost skill as a mechanician to the invention of a substitute that should, as nearly as possible, replace, in form and movement, the lost member. To secure all the required conditions is no easy problem, and has been well described as a work of combined surgical, mechanical, and artistic skill. The artificial limb must be in size, shape, and action a close counterfeit of the one whose place it supplies. It must fit the stump with accuracy and ease, and to be comfortable must be light and yet strong, flexible yet firm, and must act with certainty, promptitude, and force, yet without noise. Nothing but constant and intelligent attention to every minute detail of construction, and a long personal experience of the effect of every modification, could be expected to result in an appliance adapted to meet all the requirements of every case.

The patents of Palmer were followed by a long list of American inventions, which present little in the way of new or important principles of construction. Most of them follow the general construction and finish of the Palmer limbs, and content themselves with slight modifications in joints, springs, cords, and pulleys to effect the same purposes which had been already successfully accomplished. A glance at the limbs in the Exhibition was sufficient to show after what model they have been formed. Even the extraordinary demand created by the war did not succeed in bringing into actual use any large number of these inventions. About a dozen makers, and much less than that number of patents, seem to have divided the Government patronage, guided by the choice of the mutilated soldiers. About half the limbs furnished by the Government were of Palmer's make, and the testimony shows that they gave general satisfaction. Of the other half, many were mere colorable alterations of Palmer's model, made by persons who had been connected with or employed in his establishment.

A noticeable construction claimed as a novelty was the introduction, by Dr. Bly, into the ankle-joint of a peculiar device for allowing lateral motion at that joint, in supposed imitation of nature, and for the alleged purpose of giving increased security to the tread. This arrangement seemed to meet with some approval even in the profession, and a large number of limbs provided with it was furnished to our maimed soldiers. It was not, in our judgment, sufficiently con-

sidered by those who approved this device that, in the absence of the control of the will, guided by sensation and exercise by living muscles and tendons, the introduction of a laterally flexible joint at the ankle could only prove a source of increased insecurity. This would not for a moment be disputed if it were proposed to place such joints near the ends of crutches or canes. All the required adaptation to uneven surfaces can be safely left to elastic cushions placed under the foot of the artificial limb. These yield sufficiently to maintain a sure foothold, while they do not introduce an element of instability in the continuity of the leg itself. In most if not all of the numerous patents of Bly, the provision for lateral motion is introduced and insisted upon.

We have examined carefully all the patents for artificial limbs, granted by the United States Government. Of this large number the following are the only ones represented in the Exhibition:

Wickett & Bradley (Selpho).		Marks	2
Clement	1	Palmer	4
Condell	2	Pingree	1
Foster	2	Trees	1

It would be unprofitable to enter into any further description of the majority of the American patents, since the alleged inventions consist, for the most part, as before intimated, of mere mechanical modifications in the details of construction and arrangement of parts, and present no new and important features marking a true advance in the art.

We except from this remark the last patent of B. Frank Palmer, dated April 8, 1873. The following description of this invention is taken from the specification of the American patent, No. 137,711, dated April 8, 1873:

"Figure 1 is a side elevation of an artificial leg having my improvements. Fig. 2 is a bottom view of the foot. Fig. 3 is a longitudinal vertical central section of the foot. Fig. 4 is a transverse vertical section of the foot through the ankle-joint. Fig. 5 is a longitudinal central vertical section of the leg. Fig. 6 is a similar section of the stump-socket. Fig. 7 is a view, partly in section, of my improved heel-cord or tendon. The same part is marked by the same letters of reference in all the figures. This invention consists in various details of improvement in the construction of the artificial leg heretofore invented and patented by me, and generally known to the public as the Palmer leg. The object of these improvements is to render the leg lighter, stronger, more elastic, and lifelike in its

motions; to adapt it to support the weight of the wearer in certain cases upon the end of the stump by the introduction of a properly-constructed socket; to give a double support to the foot in certain positions, one of which takes effect before the other, by the introduc-

FIG. 3.

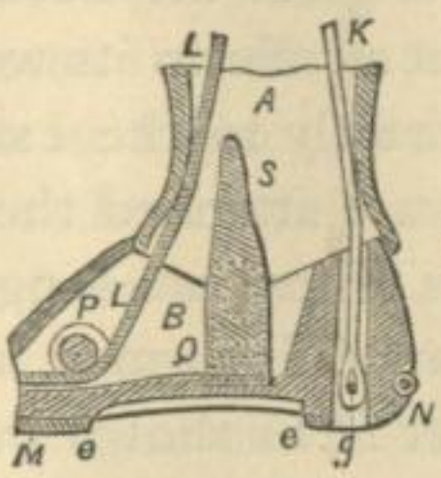


FIG. 2.

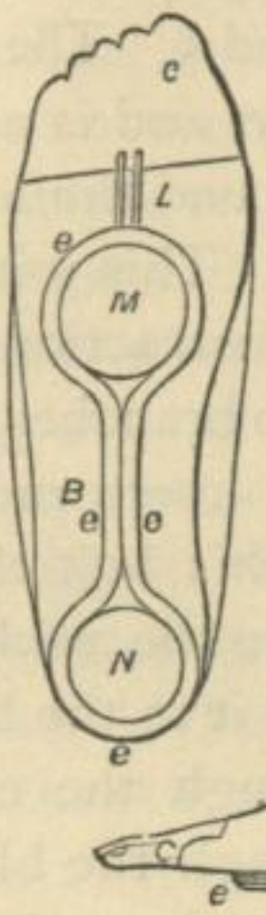


FIG. 1.

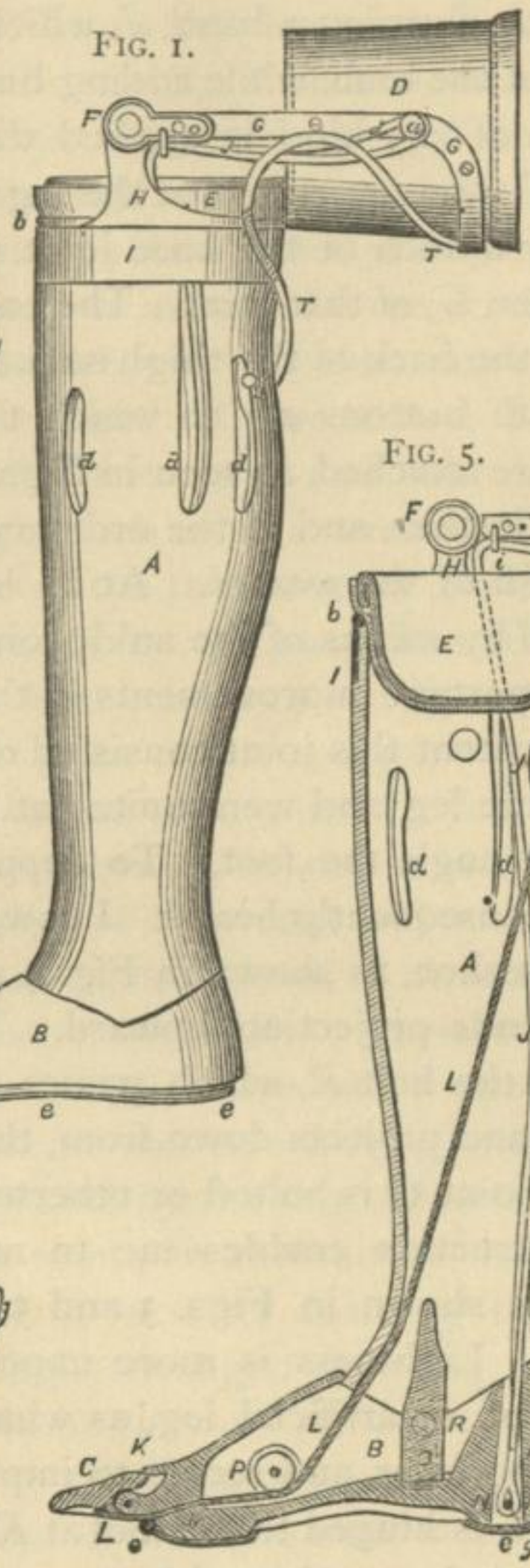


FIG. 4.

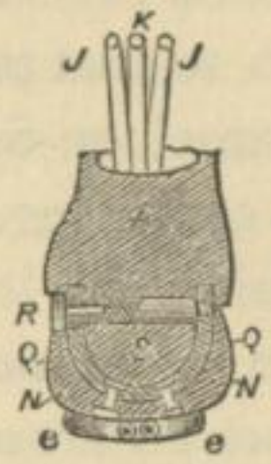


FIG. 5.

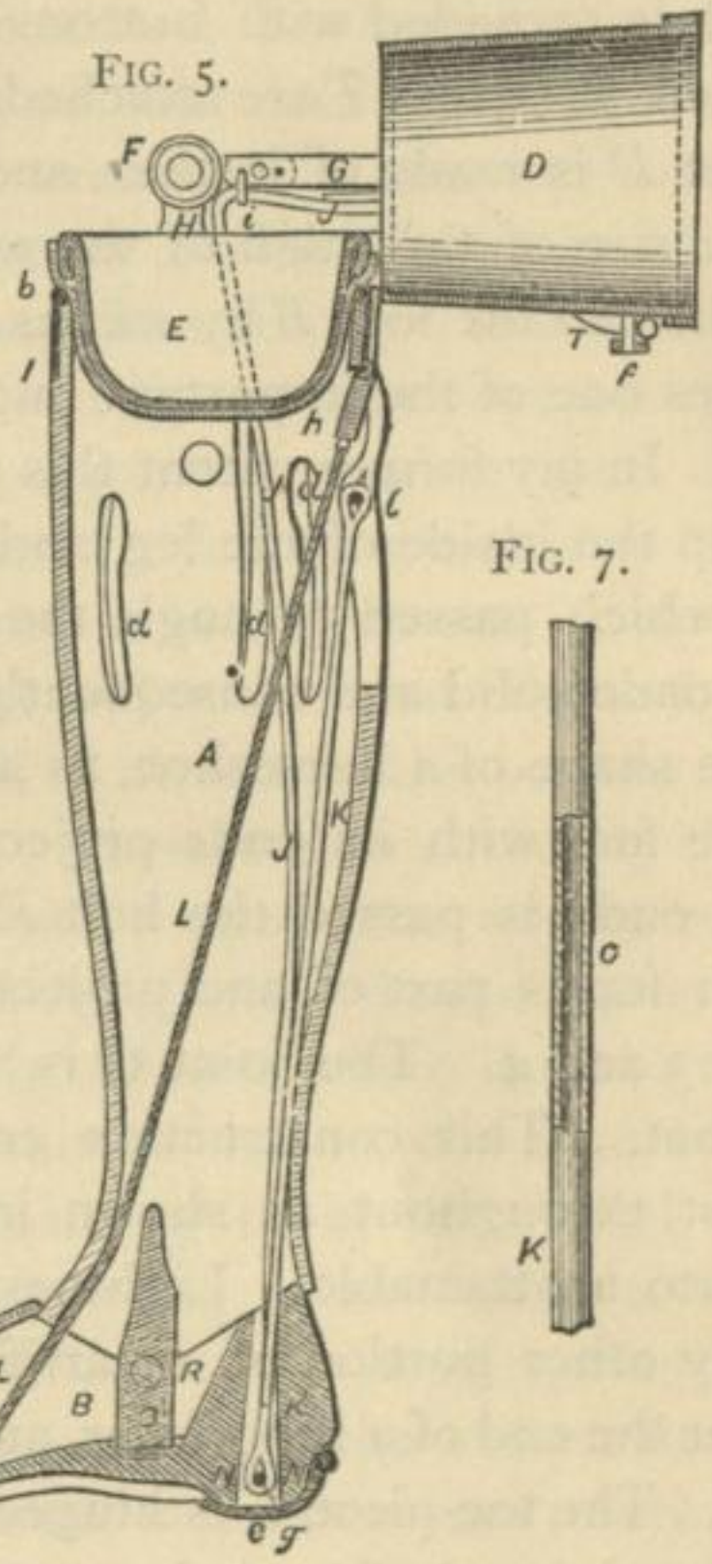
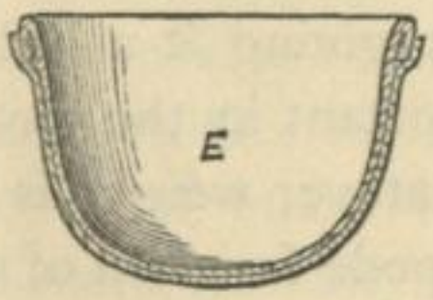


FIG. 7.

FIG. 6.



tion of supplementary or auxiliary tendons in addition to and in aid of the cord or tendon representing the natural tendo-Achillis; to improve the movement of the toe, and to give a fine, external finish to the limb, while dispensing with the hide by which it was formerly covered. In the drawing, *A* marks the leg proper, which is made hollow, as represented. I prefer to use English willow as the material, as long experience has shown it to be so admirably adapted for the purpose. The leg is provided with ventilating openings, *d*, *d*, in

the ordinary manner. Instead of covering it with raw calfskin, as heretofore, I now dispense with that covering at a considerable saving of weight. To compensate for the loss of support resulting from the removal of the hide, I bind the top rim of the leg, the only joint where such support is required, with brass wire wrapped tightly around it and turned off smooth, forming a band, *I*, which gives all necessary strength to that part of the limb, while adding but a trifle to its weight. The enamel or finish of any kind is applied directly to the exterior surface of the leg. To the upper rim of the leg are attached the lugs *H*, forming the lower branch of the knee-joint. These are hinged at *F* to the upper member, *G*, of that joint. The part *G* is formed in one piece, bowed around the back of the thigh-socket *D*, as shown in Fig. 1. It is provided with buttons *a f*, to which the upper ends of the tendons *J*, *J*, and *T* are attached, as seen in Figs. 1 and 5. The thigh-socket *D* is made of leather, and in the ordinary way, and is adapted to the size of the thigh of the wearer. At its lower end the leg *A* is attached to the foot *B* by means of the ankle-joint *Q*. This joint constitutes one of the important improvements in the construction of the limb. In my former patent this joint consisted of two branches, which ran up the inside of the leg and were united at their lower ends by a bolt which passed through the foot. To support this bolt the foot was made solid and consequently heavy. I now make the ankle-joint in the shape of a horseshoe, as shown in Fig. 4, place it in the bottom of the foot with its ends projecting upward. Through the eyes in these ends is passed the bolt *R*, which passes through the block *S*, which forms part of, and projects down from, the leg *A*, as shown in Figs. 3 and 4. The joint *Q* is bolted or otherwise firmly attached to the foot. This construction enables me to make the foot hollow almost throughout, as shown in Figs. 3 and 5, giving it a lightness hitherto unattainable. Lightness is more important in the foot than in any other portion of an artificial leg, as whatever weight is there acts at the end of a long lever, and serves to impede freedom of movement. The toe-piece *C* is hinged to the foot at *K*, and is made with an entering-joint similar to that at the ankle, presenting no break in the surface. The toe-piece is strengthened by wires run transversely through it to prevent splitting. The toe-tendon *L* is made of two cords attached to the under cavity of the toe-piece, as shown in Fig. 5. They run around the under side of the pulley *P*, and are carried up to a point at the top and rear of the leg, where each of the cords is attached to a spiral spring, *h*. The reaction of the spring tends to draw the toe down. *K* is the main heel-cord or tendo-Achillis. It is made of parallel strands of sewing-silk covered with chamois-skin,

as represented in Fig. 7. It is fastened near the bottom of the heel by the pin, and runs up to a point in the back of the calf of the leg, where it is attached by the pin. This main tendon, upon which the greatest strain comes in using the limb, is made larger and stronger than I have heretofore made it, since it is required to be less elastic than formerly, because I now supplement its function by the addition of the two auxiliary tendons *J*, *J* placed one on either side of it, as shown in Figs. 4 and 5. The tendons *J*, *J* diverge at the heel and run up the inside of the leg, and are attached at their upper ends to the buttons *a* on the sides of the bowed joint-piece *G*. These tendons are so regulated in length as to take the strain, ordinarily thrown wholly upon the heel-cord, a little before any part of it is borne by that cord. This relieves the heel-cord, assists it in bearing the strain, and enables me to make it stronger and less elastic than heretofore, as before observed. A black cord or tendon, *T*, is attached to a button, *f*, on the rear side of the thigh-socket *D* (see Fig. 5), and is fastened to the calf of the leg by the pin. The office of this cord is to limit the motion of the knee-joint by a strong and firm yet moderately-yielding attachment in place of the rule-joint heretofore used, which was abrupt in its action, and often caused a 'click,' which was highly objectionable. One of the most important improvements, looking to the ease and naturalness of the tread and movement of the foot, is presented by the protuberances *M* and *N* placed on the bottom of the foot at the ball and heel, respectively. These are most clearly shown in Figs. 2, 3, and 5. They receive and support the weight of the wearer, and allow a lateral movement resembling that of the natural ankle, while unaccompanied by the unsteadiness which has characterized previous attempts to impart this movement into the artificial leg. Around these protuberances, after covering them with felt, I place the elastic rubber tubing *e*, arranged as in Fig. 2, and over all attach a covering of buckskin or chamois leather. This construction gives softness and elasticity to the tread, while securing the utmost freedom of movement to the foot compatible with steadiness and safety. To provide for sustaining the weight of the wearer upon the end of the stump, I receive the stump in a socket, *e*, made of leather, and made to conform accurately in length, size, and shape to the stump which rests in it. This conformity is attained by moulding the socket on a cast. I usually make the stump-socket of two thicknesses. A rim is formed at the top which rests upon an elastic cushion, *b*, formed of rubber tubing placed on the upper rim of the leg. The stump-socket is received in a recess of form corresponding with its own in the top of the leg, so that whatever elongation takes place in walking

is the result of the drawing out of the socket from the recess. The stump is not withdrawn from the socket *e*, and there is no feeling of insecurity and no want of precision in the step. The use of silk covered with chamois leather for the heel-cord is an improvement which I consider important. In my former patents I indicated a preference for the use of catgut for that cord, as I found it much the best material that I had at that time tried; but it is very liable to fray out by friction, is difficult to fasten at the ends, and is greatly affected by changes in the hygrometric condition of the atmosphere. It becomes longer or shorter according to the amount of moisture in the air, and thus introduces an element of uncertainty and insecurity in the use of the limb. Silk I have found to possess the requisite strength, flexibility, and freedom from change. The formation of the upper member of the knee-joint in one piece, bowed as described, renders the joint lighter and stronger, and prevents the lateral spreading which occurs in those made in the old way. As a covering and support I wind the leg and foot, in whole or in part, with thread. A coating of gum shellac is applied to the wood, and the thread is tensely wound into the gum. To this firm and smooth coating of thread and gum the enamel, principally of shellac, adheres immovably. This covering is not affected by water or varying temperature as a skin glued to the wood would be. Thus, with diminished weight, greater durability and an exquisite finish are obtained. What I claim as my improvements in artificial legs, and desire to secure by letters patent, is,—

"1. The double toe-cord *L*, running in the pulley *P*, and attached at the rear and back of the leg, as described and shown.

"2. The toe-piece *C*, strengthened as described, and forming a close joint with the foot as shown.

"3. The protuberances *M*, *N*, on the bottom of the foot, as, and for the purpose, described.

"4. In combination with the protuberances *M*, *N*, the elastic cushion *e*, *e*, formed of rubber tubing, and arranged substantially as, and for the purpose, stated.

"5. The ankle-joint *Q*, made of a curved or horseshoe form, as represented, and placed in the bottom of the foot, with its ends projecting upward to receive the ankle-bolt, all as, and for the purpose, described.

"6. The heel-tendon *K*, made of strands of silk covered with leather, as described.

"7. The supplemental or auxiliary tendons *F*, *F*, arranged, attached, and operating as set forth.

"8. The covering of thread and gum shellac, for the purpose set forth.

"9. The stump-socket *E*, made of leather, moulded to conform to the stump, and resting by a shoulder on an elastic cushion, about the upper rim of the leg, and fitting snugly, but so as to be easily withdrawn, in a recess of corresponding shape in the top of the leg, all constructed and arranged substantially as set forth.

"10. The bowed joint *G*, constructed, arranged, and operating as described.

"11. The confining band or hoop *I*, formed of wire wound tightly around the leg, and turned off on the surface, as, and for the purpose, specified."

The leading peculiarity of this invention is the device, appropriately called the "safety-socket," which resulted from the important discovery by Dr. Palmer that the true principle of support in an artificial limb is, in the great majority of cases, to take the weight of the bearer upon the end of the stump. Occasional instances had indeed been known in which the weight was thus borne, but they were altogether exceptional, and the idea that surgeons, patients, and manufacturers of limbs seemed to entertain in common was to relieve the end of the stump from all pressure and guard it carefully from contact with any portion of the socket of the artificial limb. Dr. Palmer, it is true, had patients supporting their weight on the end of the stump as early as 1850, but, owing to the want of a suitable apparatus, he did not approve the practice, and continued the use of the open socket down to the year 1873. Whenever the suggestion of this method of support has since been made by other inventors, it has evidently been done on theoretical grounds alone, and the only apparatus proposed was a flexible leather sack entirely unsuited to the purpose, and indeed directly calculated to endanger the safety of the stump at every step by forcing back the integuments and tending to bring the entire weight of the wearer upon the end of the bone over which they are stretched, by the elongation of the sack itself. When the sack receives the weight its form becomes that of an inverted cone, the interior apex of which is occupied by the end of the bone, while the soft tissues, which in their natural position surround and cover the bone, are pushed back into the base of the cone. Such an apparatus, far from advancing the establishment of the principle of end support, was calculated to postpone it indefinitely by proving that method to be dangerous if not impracticable. The safety-socket of Palmer, on the contrary, is a box of double leather made to fit the end of the stump exactly by moulding on a cast, and is so held and guided in the interior of the shell of the artificial leg that it is incapable of

changing its form by the changing weight to which it is subjected in walking. It changes its position slightly by slipping up and down in the outer shell, but it keeps its place securely on the stump, and does not allow the integuments of the latter to be subjected to any change of strain, or any change of place, by reason of the movements of the leg in walking. Thus it acts as a shield and protector for the stump, guarding it against shocks by the air-cushion on which the edge of the socket is supported, and by keeping the relation between the bone and the soft parts uniform, promoting the health and development of the muscles of the stump, and preserving the cicatrice from injury or rupture.

This safety-socket is now in use by a large number of patients, whose testimony is uniform that it can be worn even on a short and tender stump, taking the weight on the end not only without inconvenience or pain, but with a new sense of comfort and security. Many of the wearers were before us in person, and the testimony of many others was submitted, leaving no room for doubt as to the great superiority of this apparatus. The wearers describe it as being perfectly comfortable, as affording greater control over the artificial limb, and giving to the end of the stump a sensation much resembling that felt on the heel and bottom of the natural foot, and relieving, in a great degree, the nervous sensitiveness which is usually so great a cause of suffering to the amputated.

TRUSSES.

The selection of an artificial limb is a matter of great importance to the individual who may be so unfortunate as to require its assistance, but its relative importance, when compared with the selection of a truss, sinks into insignificance. Whichever limb may be selected from the many manufactured, however poor its construction and imperfect its mechanical arrangement, it will possess some merit, and be of more or less assistance to the wearer. It is not so with a truss. If it is not constructed upon scientific principles, well fitted and adapted to each individual case, the suffering of the wearer is increased, and, in many instances, life is jeopardized.

The great importance of these instruments may be realized when we reflect that no age, sex, or condition is exempt from the accident of rupture, and that one person in every ten suffers from this calamity. Among the laboring classes the average is nearly one in six.

Requirements of a Truss.—The requisite and essential qualities of a truss are lightness, firmness, and elasticity, so that it shall retain

the required form or shape, suitable adaptation to the configuration of the wearer, and sufficient strength of spring to prevent the escape of the rupture from the abdomen. The instrument consists of a pad, or cushion, attached to a metallic spring with straps, so arranged that its movement during the varied postures of the body may be restrained. The circular spring truss is the most suitable form in the majority of cases. Bandages which are not elastic do not afford sufficient support to the hernia in every position of the body. They are necessarily unsafe on this account, as they become lax in the stooping posture of the wearer,—the position of all others in which the hernia most easily descends, because of the relaxation of the pillars of the external ring. The curve of the opening and the relative position of the pad with it should be appropriate to the configuration of the wearer. A single piece of metal should form the spring and foundation of the pad. As far as practicable, the spring of the truss should pass around the bony rim of the pelvis, fitting closely to the figure, and should lie out of the region of the gluteal muscles; for, unless it is so placed, their alternate action in progression produces a corresponding movement of the pad. If these muscles be largely developed, extending upwards to the very edge of the pelvis, the curve of the spring should be wide at the shoulder, so that its bearing or resting part should be on the base of the sacrum. For a single-pad truss the free end of the metal spring should be beaten out flat and thin, and so ground as to cling around the opposite hip,—an arrangement which materially aids in steadying the truss. The form of the spring may be designed after the French or German pattern. The former resembles the coil of a watch-spring, and is very elastic and clinging; the latter almost exactly fits the outline of the body in its state of repose, is inelastic, and very hard. The French is always pressing inwards when the wearer is at rest. The German scarcely presses at all when the abdomen is soft, but resists with power when any expulsive force makes the abdomen swell. In practice the best shape for the spring is one which forms a medium between the two. The pad, or cushion, should be of moderate dimensions. For the adult it should not exceed two and a half inches in length, and two inches at the widest part; its superior edge should follow the upper line of the spring, which falls a little from the shoulder or bend, where it lies in contact with the hip. The inner surface should be directed slightly upwards, but this inclination must depend upon the prominence, or otherwise, of the abdomen, as well as, in some measure, on the anatomical relations of the pelvis to the spine.

The proper shape of the cushion, or pad, and the material of which

it should be constructed, may be varied to accommodate particular cases, or to accord with the views of the different inventors. Generally, the wearer discovers, after a little experience, which kind of pad is most free from annoyance. That pad, however, is the best which maintains perfect and unintermitting retention of the hernia. Every pad should have attached to it two studs, one near its junction with the spring, and another at its lowest point. To the upper one the transverse strap passing from the free end of the spring is attached. The lower stud is used with the thigh-strap, which should always be worn. It is loosely fastened on the spring of the truss, near its shoulder, and should fall along the hollow beneath the buttock. In the erect posture of the wearer this strap should be moderately tight. It prevents the pad from slipping from its proper position, and should never be discarded.*

The principal advance in the manufacture of trusses, in regard to construction and finish as well as material, has been made within the last twenty years. The old clumsy instruments, made after the Hull pattern, have given place to inventions combining extraordinary lightness and efficiency with comparative cheapness. The substitution of the wooden, ivory, and rubber block for the soft pads, formerly in vogue, marks one of the most valuable additions to the mechanical surgery of the present century. With the old instruments the hernia was imperfectly retained, and a radical cure never effected; with the improved American truss the hernia is perfectly secured, and, in favorable cases, a radical cure is frequently effected.

Of the ninety-four truss-manufacturers in the United States, but thirteen were represented at the Centennial Exhibition, but these embraced all the leading manufacturers, and comprised every truss of recognized merit. Some exhibitors submitted from five to twenty different patterns, modifications of, and improvements upon, leading patents, most of which have expired. Others exhibited only their own inventions. Of the thirteen exhibitors in this specialty, six are deserving of special notice, not only for the magnitude of their display, but for the perfection of construction and beautiful finish of all the instruments they submitted for examination.

W. Horn & Bro. exhibited a large and choice selection of trusses of the most approved patterns. They were all simple in construction and well finished, each and every part giving evidence of unusual care in the manufacture. The distinguishing specialty of this firm is the manufacture of the truss spring, a branch of the business requiring

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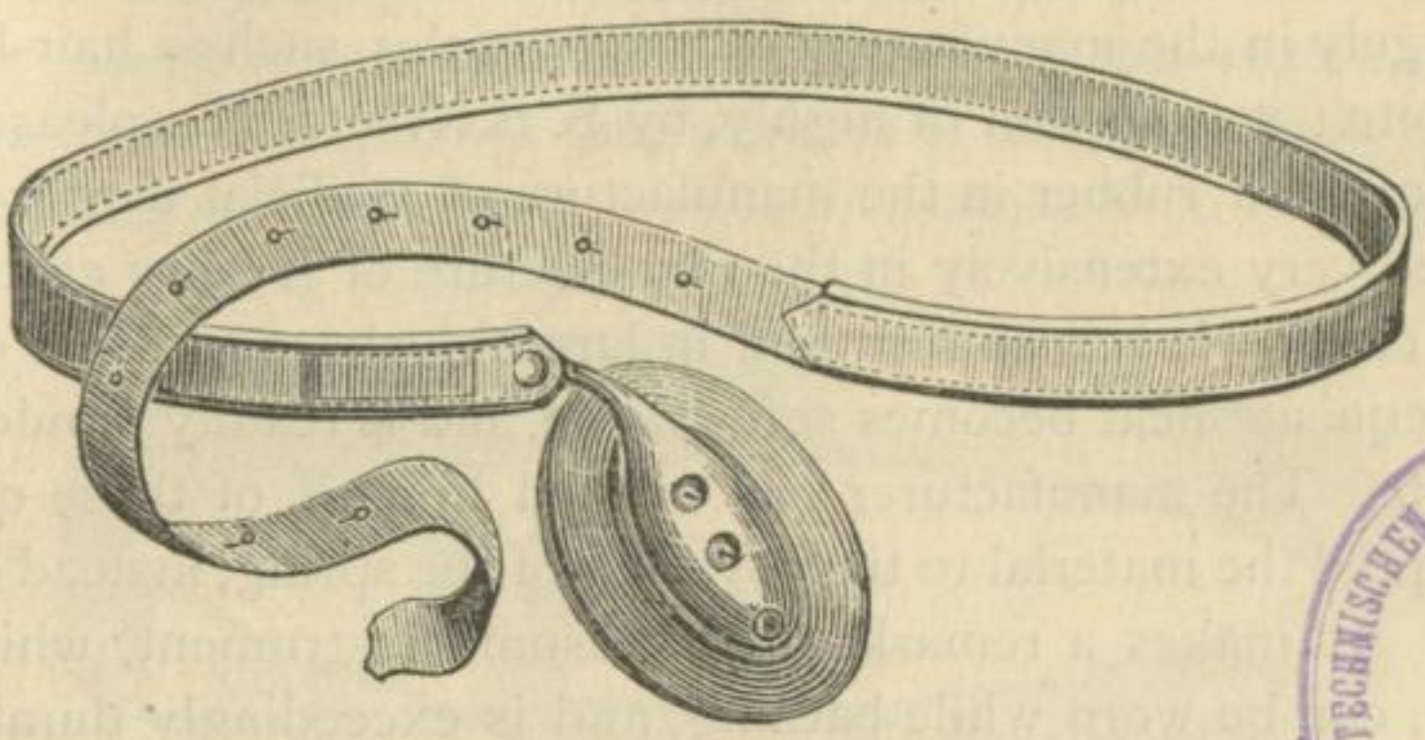
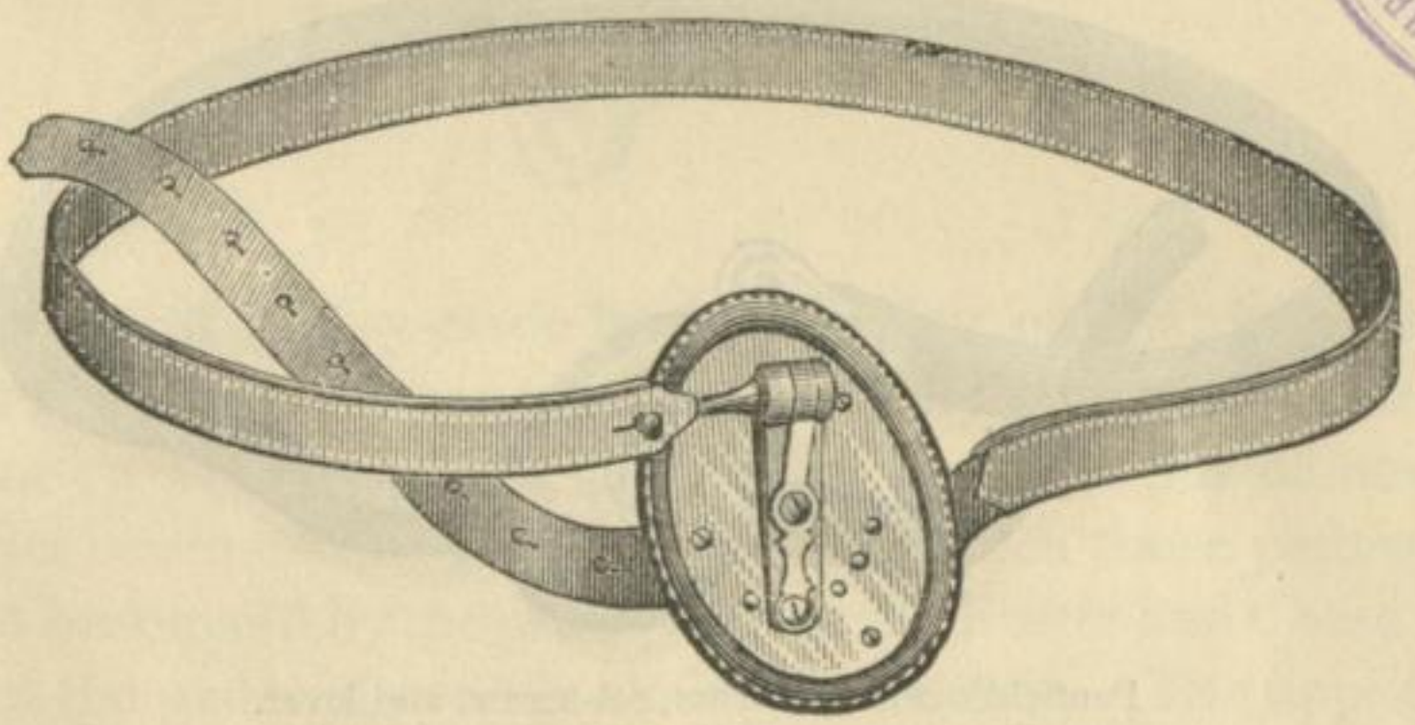
* Holmes.

the utmost nicety in the selection of the material to be used, and great skill in securing the requisite temper. The springs manufactured by Messrs. Horn & Bro. were carefully tested by the Judges, and found to be fully equal to every requirement, and were, certainly, the best exhibited.

The largest assortment of leather-covered trusses was exhibited by Penfield & Co., of Philadelphia. It embraced over thirty different patterns, including Penfield's set-screw, or common-sense truss, Chase's, Phelps', Foster's, and Thompson's original designs and modi-



Chase.

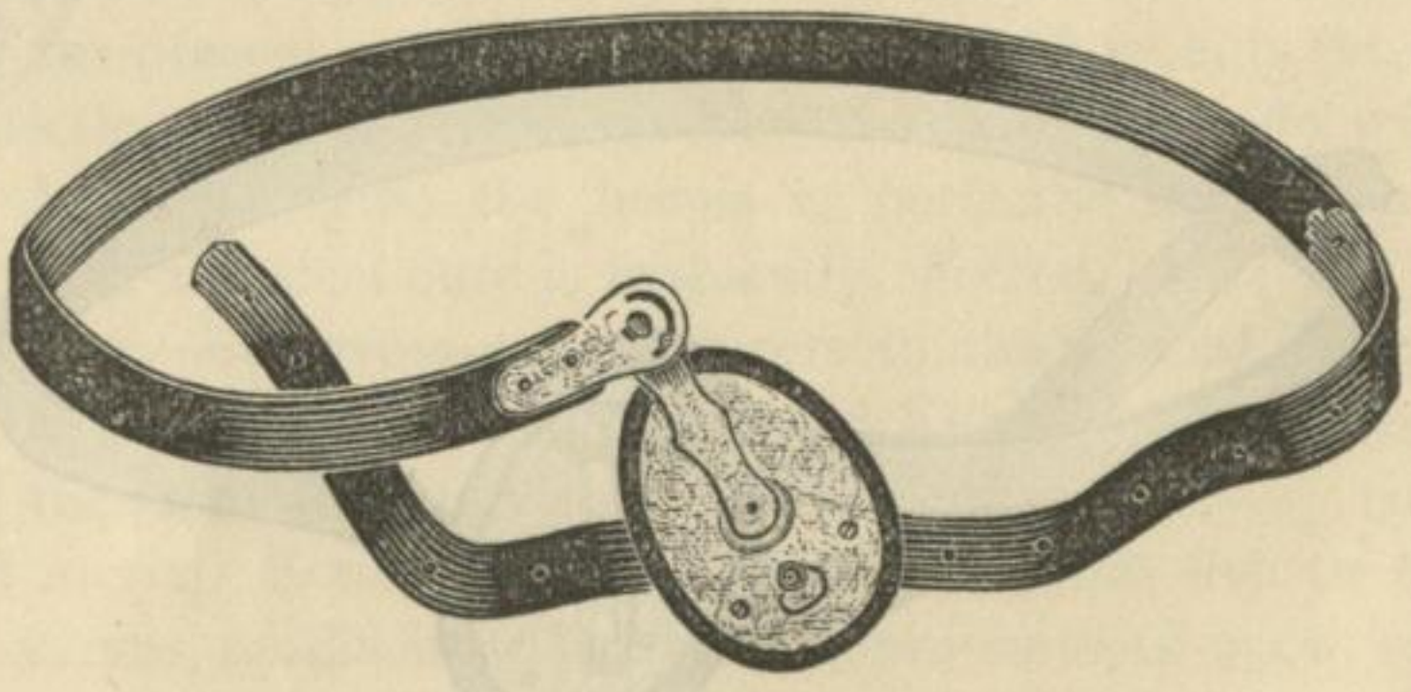


Foster.

fications, as well as a large assortment of French and German patterns, the peculiar features of which have been referred to previously. It would be a difficult task to select any one of those exhibited by these manufacturers as being superior to the others. All were intrinsically good in every respect, only differing in design and the mechanical means employed to secure the desired end. In leather-work they were not excelled. In addition to those covered with leather, this firm presented for competition a large assortment of trusses covered with celluloid. This is a composition which was at first made from

gun-cotton and camphor, but recently white paper pulp has been substituted for the gun-cotton. The material formed by this combination resembles ivory so closely as to deceive, unless critically examined, and when properly colored may be readily mistaken for coral. It is extremely hard, tough, and elastic.

The celluloid truss, in mechanical design and construction, is exactly the same as Penfield's set-screw or common-sense truss, but instead of covering the spring with leather it is covered with celluloid, and the pad is made of the same material pressed into moulds, forming hollow shells. They are light, cleanly, and durable. Celluloid is used very largely in the manufacture of toilet articles, such as hair-brushes, combs, etc.; it is spoken of highly, by S. S. White, as a pleasant substitute for hard rubber in the manufacture of artificial dentures; it is also used very extensively in the manufacture of jewelry as an imitation of coral. It is manufactured in large blocks, and when exposed to the requisite heat becomes soft, pliable, and is readily moulded into any form. The manufacturer has availed himself of these qualities, and adapted the material to the covering of the spring, instead of using leather. It makes a remarkably handsome instrument, which, it is claimed, can be worn while bathing, and is exceedingly durable.

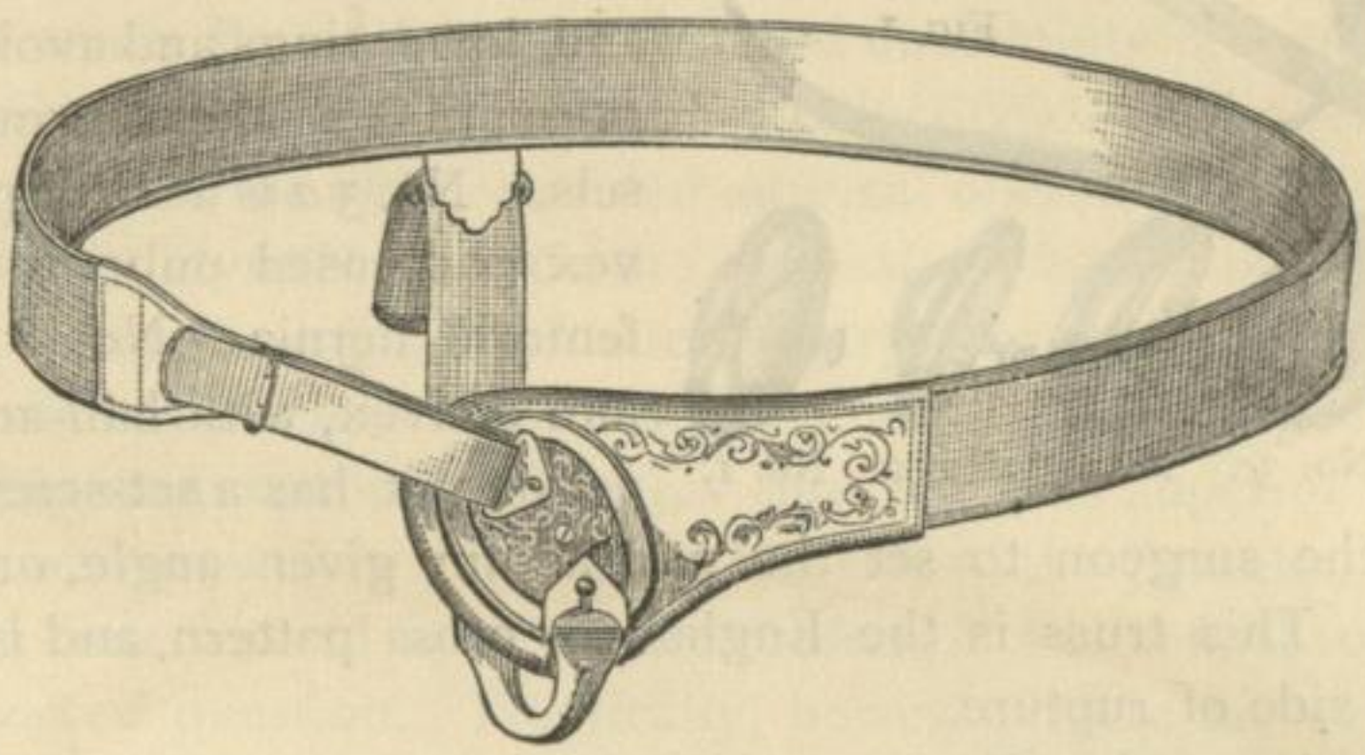


Penfield's celluloid truss, set-screw, and lever.

The annexed cut represents the complete truss. The set-screw secures the pad in any desired position, and, by means of a lever operated by the screw, any desired amount of pressure can be obtained. Perhaps no invention, or special adaptation of an invention, has met with more decided opposition by the trade than this, which is partly owing to the fact that trusses were coated with this material before the invention had been fully matured, and the composition of the material sufficiently tested to insure its durability, freedom from shrinkage, etc. The patentees claim that there has been a decided improvement made, by the substitution of white paper pulp for

gun-cotton, and that it will not contract or crack by age or exposure. The principal and, I think, now the only valid objection, which can be substantiated, is its highly inflammable nature. When brought into contact with a flame, it burns with fierceness and great rapidity. If this decidedly objectionable feature can be overcome, it will prove to be one of the most valuable discoveries of modern science, fully equal to the famous discovery of Goodyear, "hard rubber."

The Elastic Truss Company of New York exhibited a large collection of trusses made entirely of elastic silk webbing, no spring being used in the construction. The annexed cut represents the truss as exhibited. There were a number of imitations of this article exhibited by other manufacturers, but they were all of less merit than the original invention, and necessarily received no notice from the Judges.



The beautiful display made by J. B. Seeley, of what is known in the trade as the "hard-rubber truss," deservedly attracted marked attention; not on account of any peculiarity in design (for he in common with other celebrated manufacturers has adopted those patterns which are most in demand by the profession, as the Foster and Chase models), but from the material used in their construction. The application of hard rubber as a covering for the steel spring, and in the construction of the pad, marked a new era in the manufacture of trusses, and conferred an inestimable boon upon the unfortunate sufferers who are compelled to seek these artificial supports.

The method adopted by the manufacturer is to prepare the spring in the same manner as if it were to be covered with leather; the hard rubber is then vulcanized on the spring, and so perfect is its adhesion to the steel that it is impossible to remove any portion without detaching flakes of the metal, with which it appears to be intimately incorporated. The spring being perfectly protected from moisture, cannot rust, and hence retains its strength and elasticity for many

years unimpaired. The pad being made of the same material, always presents a dry, polished surface to the skin, thus avoiding the irritation, chafing, and blistering which so generally occur when the pad is made of material which absorbs moisture or is affected by perspiration. In durability, cleanliness, efficiency, and perfection of construction in all its minutiæ, this truss had no equal on exhibition. The annexed cuts represent the most desirable patterns exhibited by this manufacturer.

Fig. 1 is best adapted for general cases of single hernia; it will admit of the adjustment of any one of the pads shown in the cut.

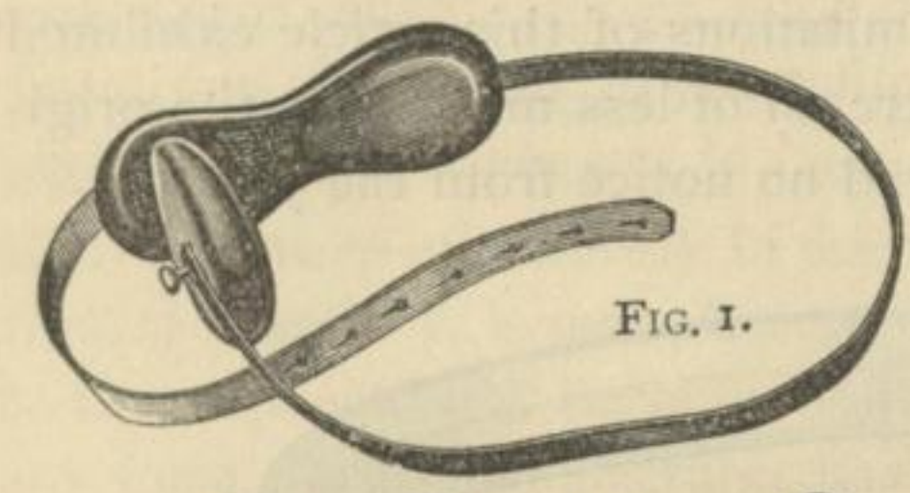


FIG. 1.

No. 3*a*. No. 3*c*. No. 8. No. 4. No. 1.

As represented, the No. 3 pad is used. The No. 1 pad is grooved or corrugated, and is suitable for light cases; it covers the upper and lower rings and avoids direct pressure on the spermatic vessels. No. 3 *a* is a small plain convex pad, used only in cases of femoral hernia. No. 8 is plain and convex, with ball-and-socket action; it has a set-screw, which enables the surgeon to set the pad at any given angle or desired position. This truss is the English or cross pattern, and is applied from the side of rupture.

Fig. 2 shows the Chase model adapted to the hard-rubber pad; it is a pattern which meets with much favor in the profession.

FIG. 2.

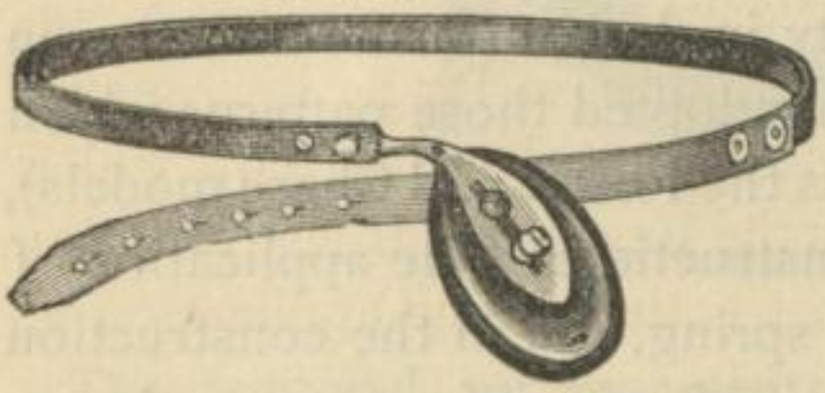


FIG. 3.

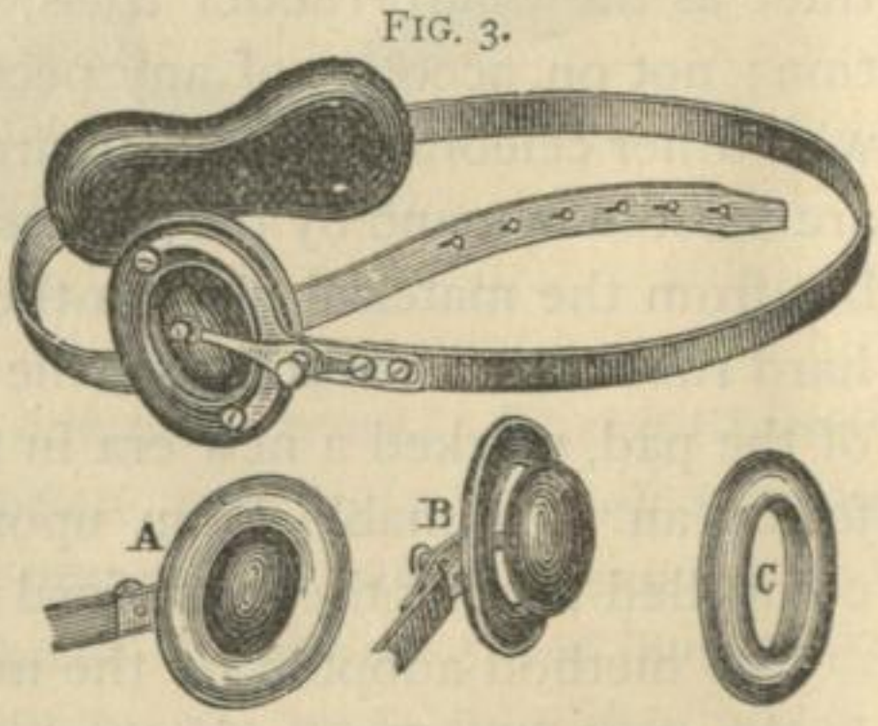


Fig. 3 is the same pattern of truss as Fig. 1, but Seeley's combination pad has been adjusted to the spring. It consists of a hard-rubber oval ring upon which rests an elastic cushion of the same shape; the centre is occupied by a hard-rubber ball. The oval ring is attached to the body-spring by a gold-plated arm; the ball is secured

to a fine steel spring, which is fastened by a button-head adjusting-screw to the metallic arm and end of the body-spring. *A* shows the front view of the pad. *B* shows the oval ball and ring with the cushion removed. *C* shows the elastic cushion, which can be removed when soiled. This truss is especially applicable in cases where it is difficult to retain the rupture, as in omental hernia, or in cases which will justify an attempt at radical cure.

GALVANO-CAUSTIC BATTERIES.

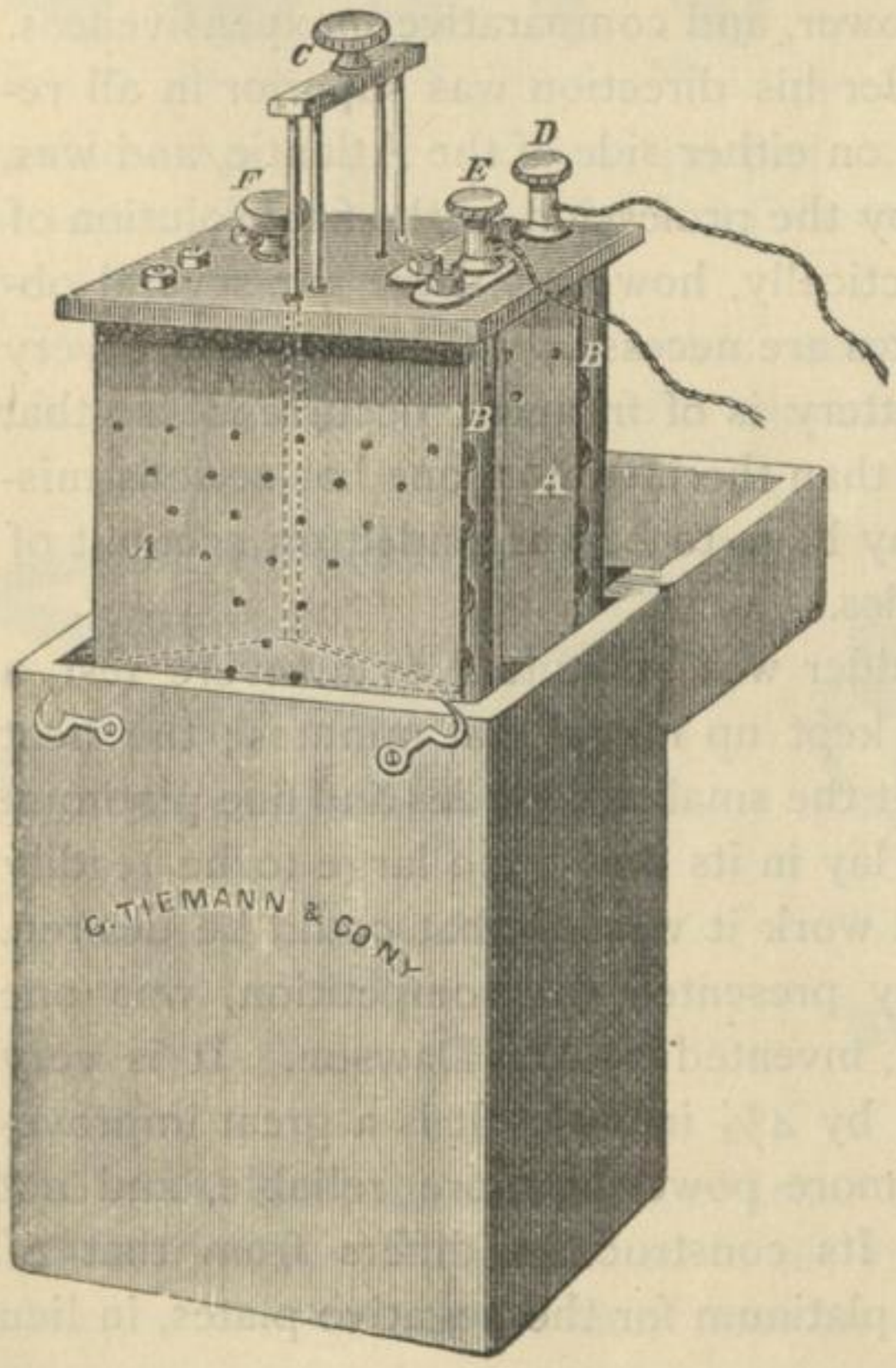
Various and repeated attempts have been made during the last few years to produce a thoroughly reliable and efficient galvano-caustic battery for the use of surgeons. Until quite recently those presented to the profession have been large and costly. With the diminution of size, to meet the essential requirement of portability, there has been a proportionate diminution of power and uncertainty of action, which, combined with many other practical objections, has rendered them almost worthless for any protracted surgical operation. To Dr. John Byrne, of Brooklyn, New York, the medical profession is indebted for the first battery for galvano-caustic surgery that combined the essential requisites of portability, power, and comparative inexpensiveness. The battery manufactured under his direction was superior in all respects to any heretofore made on either side of the Atlantic, and was, for a long time, looked upon by the profession as the final solution of a much-vexed question. Practically, however, there are several objections to it: the carbon plates are necessarily thin, and hence very brittle; polarization of the battery is of frequent occurrence, so that when used by one less expert than the inventor, one has serious misgivings that the operation may have to be suspended on account of deficient power in the electrodes.

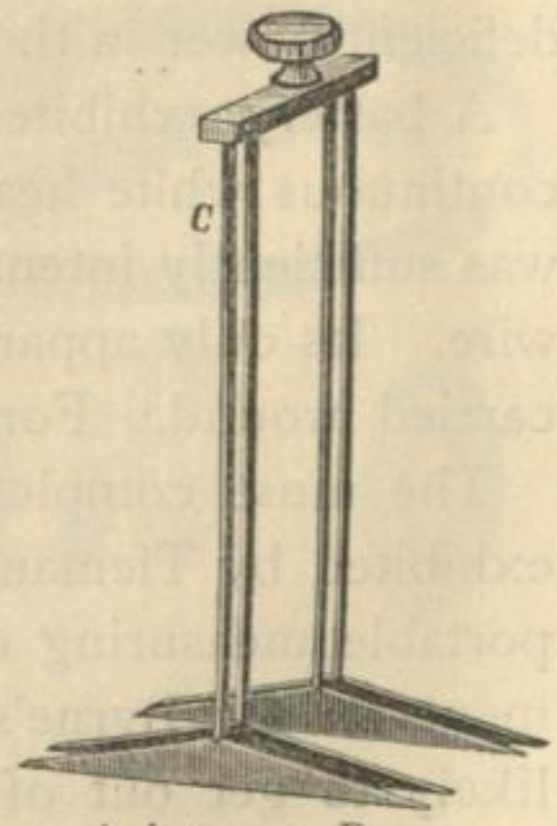
A battery exhibited by Kidder was submitted to a severe test, a continuous white heat being kept up for several minutes; the heat was sufficiently intense to melt the small electrodes and fine platinum wire. Its only apparent fault lay in its being too large to be readily carried around. For hospital work it was all that could be desired.

The most complete battery presented for competition, was one exhibited by Tiemann & Co., invented by Dr. Dawson. It is very portable, measuring only 8½ by 4½ inches. It is a great improvement on Dr. Byrne's, being more powerful, more reliable, and not likely to get out of order. Its construction differs from that of Byrne's in the substitution of platinum for the negative plates, in lieu of carbon.

This substance has long been known as unequaled as a material

for the negative plates of galvanic batteries, excepting that, if used over a certain thickness, it increased the expense of the batteries too much to make them available to the mass of the profession, and, if used too thin (as foil), it had the objection of heating when the battery is in action, thus causing the fluid to become hot and even to boil after a few minutes' action, an objection too great to allow of its use. This heating of the platinum plates Dr. Dawson has succeeded in almost wholly overcoming, by the simple device of bordering thin platinum with pure lead, the latter being cast upon the edges of the plates by means of a mould. By this device the electric current is largely taken up on all sides of the platinum, and thus the latter is relieved of the accumulating current and the heating avoided. Polarization of the battery he obviates by the simple arrangement of perforating the zinc plates and placing agitators between the latter and the platinum plates, by the occasional moving of which the hydrogen bubbles and sesquioxide of chromium are displaced and the exhausted fluid between the plates removed; fresh acid enters through the perforations in the zincs, the outside surfaces of which are protected by an acid-proof covering.



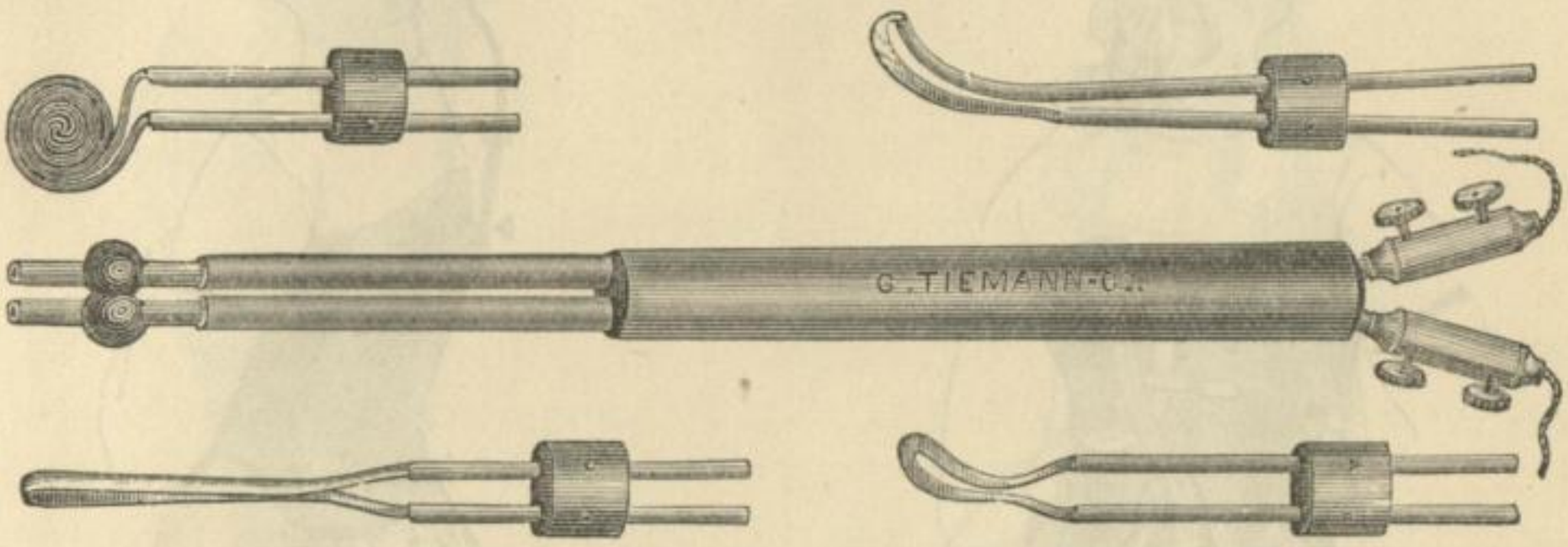


Agitators or Pumps.

The accompanying illustration shows the principle of construction

and represents a two-cell battery. The cells are made of hard rubber and contain each two positive (zinc) and one negative (platinum) plates, each measuring 4½ by 6 inches. The space between the zincs is $\frac{7}{16}$ of an inch. *A* represents the zincs and perforations; *B*, the lead bordering of the platinum plates; *C*, the knob, or handle, to lift and depress agitators; *D* and *E* are the connecting screws for conductors.

The annexed cuts show the electrodes which accompany the bat-



Galvano-cautery Electrodes.

tery. They are strong, and adapted for almost any surgical operation in which the galvano-caustic knife would be selected.

RAW-HIDE ORTHOPEDIC APPLIANCES.

S. A. Darrach exhibited a series of valuable and ingenious contrivances for the treatment of every variety of deformity, but more particularly designed for use in cases of spinal curvature and hip-joint disease. The body of the instruments is manufactured of raw-hide, which, when properly prepared, can be moulded to any shape, and will retain the particular form given. It is light, elastic, and substantial, and can be made sufficiently strong to resist any necessary strain. As a base for the attachment of braces to be applied to the limbs or body, it has no equal. In the treatment of hip-joint disease, or when counter-extension is necessary during treatment of fractures of the lower extremity, the use of this apparatus avoids the necessity for the perineal band.

Fig. 1 represents one of these supports applied to an ordinary case of lateral curvature. The corset is cut, partly separating the section which embraces the projection. A lever connects with this part, having a fulcrum attached at the base of the corset, and is so arranged that the movement of a screw produces three directions of pressure opposed to the position of the deformity. On each side of the corset are attached elastic adjustable crutches which embrace and

support the arms; the counter-extension is supported by a well-diffused bracing over the lower part of the back, assisted by strong

FIG. 1.

FIG. 2.

elastic bands or extensions of the lower and anterior portion of the corset. Elastic cushions are attached inside those portions of the anterior extension which rest upon the crest of the ilium. Various attachments are applied to the corset, when needed to increase the rigidity of any special part.

Fig. 2 shows an attachment to support the head and regulate the elevating tension when the disease is located in the cervical region; it controls the position of the head, permitting a proper degree and direction of motion, at the same time relieving the vertebræ from pressure. A modification of this instrument was exhibited, which was specially designed for the treatment of wry neck. It is simple and efficient, being a very decided improvement upon any hitherto used.

Fig. 3 shows an appliance designed for the forcible extension of the limb in cases of contraction of the knee-joint. The clasps which fit the limb above and below the knee-joint are, like the corset, made of raw-hide. The upper and lower portions are connected at the sides by steel bars, with a suitable joint at the knee. At the back of the upper clasp is a steel plate to which is attached a tube; in this tube a rod telescopes. The lower end of this rod is connected with a stud which slides on a rack attached to the lower clasp. On the

rod is a spiral spring, one end of which rests against the stud, the other against the tube. The stud is moved by a pinion-key, and

FIG. 3.

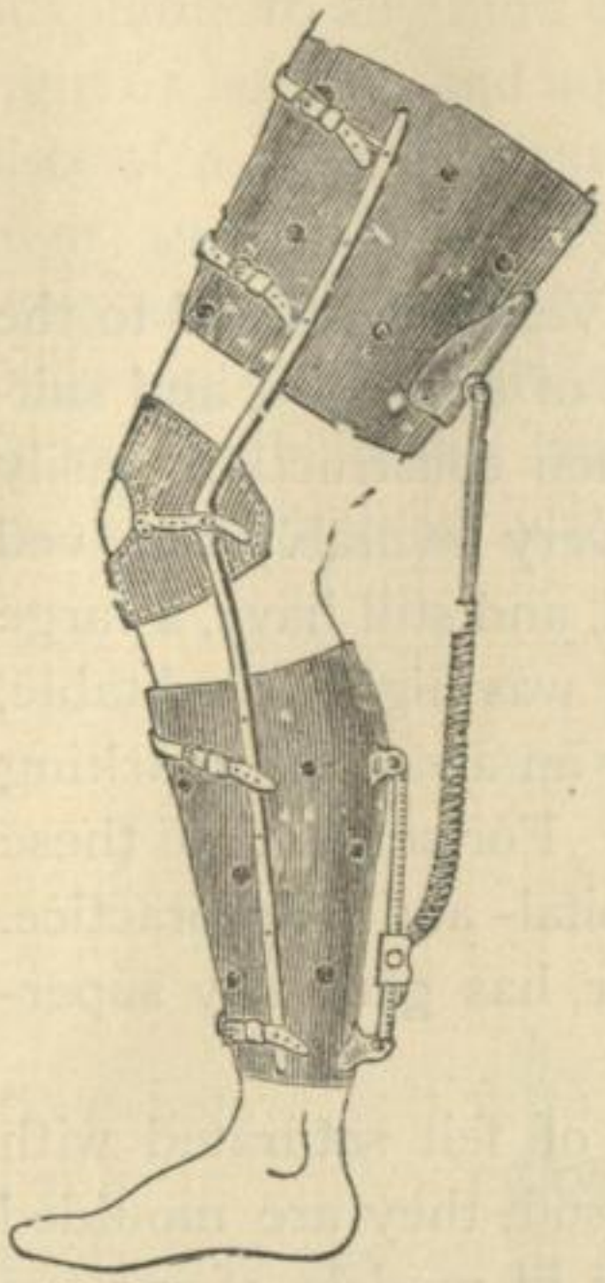


FIG 4.

fastens with a self-acting catch. When the stud is moved upwards, it causes extension, the spring being compressed in proportion to the resistance. When walking, the spring can be arranged to permit partial motion at the knee-joint, or it can be locked, and thus prevent motion. When necessary to produce extension to relieve pressure at the knee-joint, the instrument can be attached to the shoe, and extension made from the thigh, by changing the side-bars.

A very complete apparatus was exhibited for the treatment of hip-joint disease. It is a modification of Fig. 3 combined with the corset; it is designed to remove all pressure from the hip-joint, and, if necessary, retain the limb in a fixed position.

The inventor has placed at the disposal of the surgeon a series of mechanical contrivances of great practical value, by the use of which these distressing diseases can be more easily and successfully treated.

Darrach's wheel-crutch, represented in Fig. 4, is a light, graceful, and substantial frame, made with iron pipe and steel rods, open at the back, and mounted on light metal wheels, the rims of which are covered with sole-leather to prevent noise. The various parts are capable of adjustment to accommodate differences in height and length of limbs. The inventor gave an exhibition of patients undergoing treatment for paralysis of the lower extremities, hip-joint dis-

ease, and other ailments which preclude the possibility of unassisted locomotion, who could and did travel in every direction with considerable rapidity and ease when using these crutches.

SPLINTS.

Several years since Mr. G. Day, of Hayden, Vermont, offered to the profession a complete set of splints carved out of soft wood, and suitable for every variety of fracture; simple in their construction, easily adapted, and of moderate price. They were very favorably received by the profession in this country, and obtained, and still have, a large sale. The exhibit made by this manufacturer was highly creditable, and very justly received a recommendation for an award as marking a decided advance in this branch of prothesis. For some time these splints were the only ones relied on in hospital- and field-practice. The introduction of Ahl's invention, however, has generally superseded them.

Ahl's Adaptable Porous Splints are made of felt saturated with gums, which are insoluble in water. While soft, they are moulded on blocks which have been cast from a series of models of various sizes taken from the limbs of soldiers of the United States army. Their principal advantages are:

1. By dipping them in hot water they can be moulded to every inequality of the limb, rendering padding unnecessary, even in the most complicated cases.

2. Their shape and firmness being unaffected by cold water or heat under 150° Fah., cold water can be freely applied to the limb without disturbing the adjustment of the splint.

3. Being porous, the limb can be completely incased with the material, and yet kept cool, there being abundant opportunities for evaporation.

4. The adaptation of the splint to every part of the limb being perfect, a fracture, when well adjusted, can be transported any distance without disturbing the fractured limb, or incommoding the patient, a most important consideration in field-practice.

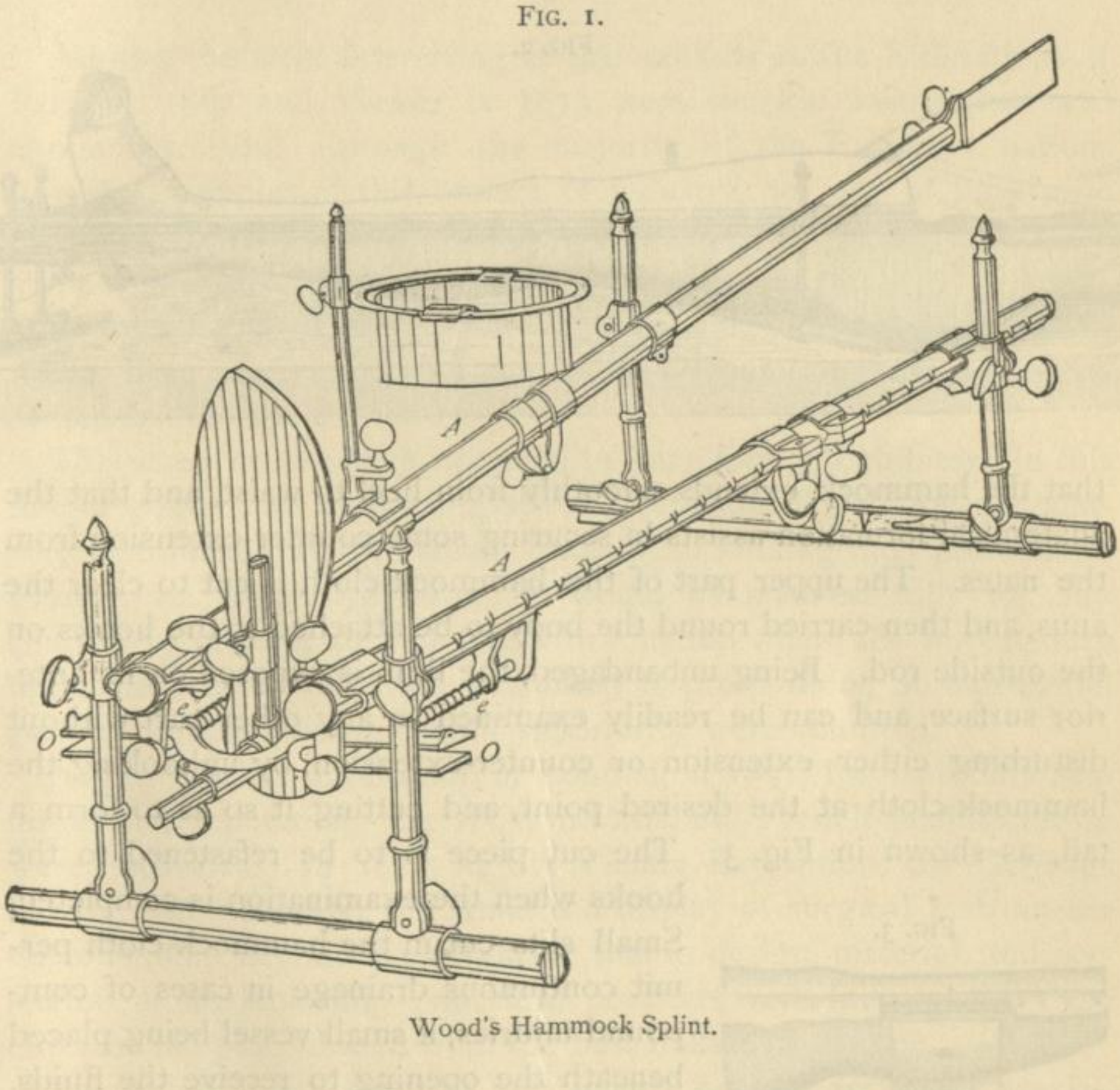
5. Their cheapness, compactness, simplicity, firmness, combined with lightness and almost indestructibility.

The Judges examined these splints with great care and interest, testing them to their complete satisfaction, and were unanimous in the opinion that they supply a necessity in the treatment of fracture, deformities, and the diseases of the joints which has long been felt,

but never before filled, and mark decided progress in this important branch of prothesis.

Wood's Hammock Splint is an apparatus so constructed as to be adaptable to any kind of fracture of the leg or thigh, either on the right or left side, and adjustable to any length or size of limb. It consists of a light substantial frame-work, readily adjustable in all directions, supporting an internal and external rod, corresponding to the long and short splint of Desault and Physick. On the outside of these rods are closely-set hooks for the attachment of the hammock-cloth in which the fractured limb is to be suspended. Fig. 1 represents the features of the splint closely ; *A*, *A* are the rods referred to ;

FIG. 1.



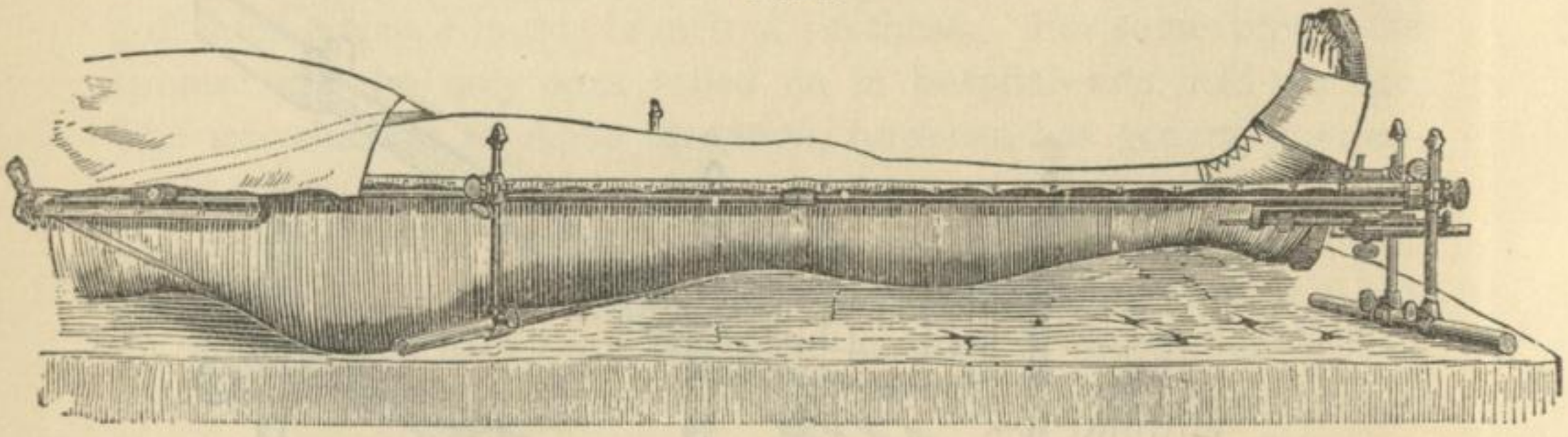
Wood's Hammock Splint.

at 4 is shown a double clamp and ratchet combination by which the apparatus may be readily and securely adjusted in any desired position, from the straight line to the right-angled double-inclined plane.

The attachments for extension are ordinarily made to the limb by adhesive plaster. Tapes thus secured to the limbs are carried to the crossbars and made fast at *O*, *O*, Fig. 1, the bar having been previously pushed back against the coiled wire springs *e*, *e*. These springs, by forcing the crossbar forward, carry the distal fragment with it, thus slowly but persistently exerting an extending force, that lessens as the desired result is nearer attainment. The foot-piece is movable in all directions, and may be securely fastened at any point. It is only used to secure the position of the foot, extension being effected from the crossbar only.

Fig. 2 shows the apparatus applied to the right leg, as for fracture of the thigh, the straight position being selected. It will be observed

FIG. 2.



that the hammock extends smoothly from heel to waist, and that the anatomical formation assists in securing some counter-extension from the nates. The upper part of the hammock-cloth is cut to clear the anus, and then carried round the body to be attached to the hooks on the outside rod. Being unbandaged, the limb is exposed on its anterior surface, and can be readily examined in any other part without disturbing either extension or counter-extension, by unhooking the hammock-cloth at the desired point, and cutting it so as to form a tail, as shown in Fig. 3. The cut piece is to be refastened to the hooks when the examination is completed. Small slits cut in the hammock-cloth permit continuous drainage in cases of compound injuries, a small vessel being placed beneath the opening to receive the fluids. The free use of water, medicated or otherwise, will be facilitated by the use of the movable siphon irrigator, Fig. 1, *K*.

FIG. 3.

Although somewhat complicated, the apparatus is little liable to derangement in the hands of an accomplished surgeon. Taken as a

whole, it is unqualifiedly the most perfect instrument yet designed. Its principal points of excellence are: 1. Its readiness for immediate use; 2. Its ready adaptability for every conceivable fracture of the lower limbs, and for every size and length of limb, one splint being all that the surgeon requires; 3. The facility afforded for the examination of every part of the limb without disturbing it, or interfering with the union of the fractured part; 4. The perfection of the arrangement for securing any desired extension, or counter-extension, without inconvenience to the patient.

SURGICAL INSTRUMENTS AND APPLIANCES.

Among the most interesting of the exhibits at the Exhibitions of Paris in 1867 and Vienna in 1873, were surgical instruments and appliances. But although the majority of the European nations furnished samples of this branch of industry, not one of those who exhibited in 1867 could dispute with France the palm for variety, number, and finished workmanship of the instruments.

At the Champs de Mars, however, England, whose surgical instruments have always enjoyed the highest reputation, was not represented by a single collection.

The same cause which operated to keep foreign exhibitors in this line of goods from competing at our Centennial Exhibition undoubtedly restrained English manufacturers from sending their products to France, viz., excessive duty. It would be manifest folly for any country to attempt to compete with a nation where the import duty upon the articles exhibited amounted to prohibition; no substantial gain could be expected, even if superiority were admitted.

At the World's Exhibition in London, in 1851, England fully sustained her reputation. In 1867, in Paris, the French manufacturers were unrivaled. In 1873, at the Vienna Exposition, the Germans led the van. In 1876, the American display of surgical instruments demonstrated beyond peradventure that in design, material, and perfection of workmanship American products were fully equal to the choicest samples selected from the best houses in Europe.

The exhibition of surgical instruments, both general and special, was in reality an American display. With the exception of one exhibit from Russia, one from England, and one from Italy, there was no competition.

The exhibit from Russia was from the manufactory of the Ministry of War of Russia. The collection was large and complete, and was

mainly confined to selections required for army service. The instruments were well finished, and appeared to have been made after the latest American and French patterns.

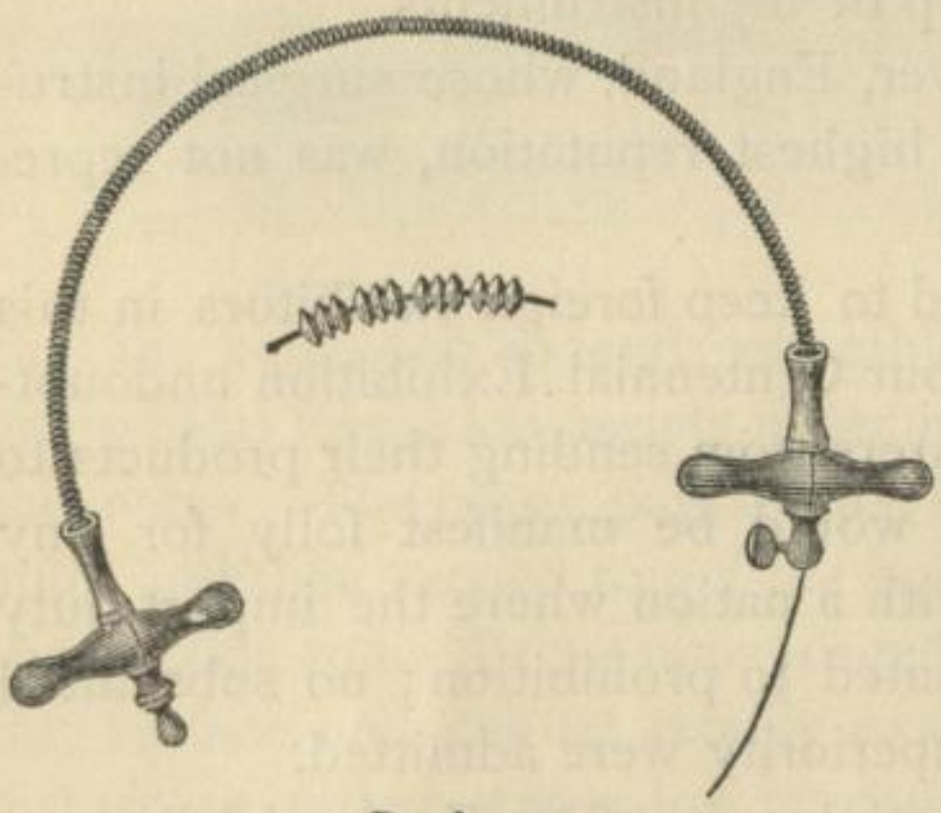
The largest collection of instruments was exhibited by Messrs. Tiemann & Co., of New York. It embraced almost every instrument used by the surgeon in general or special practice, and some few entirely new, simple, but valuable, the manufacture of which is confined to their house.

In material, workmanship, and exquisite finish they could not be excelled; they were complete in the minute detail so essential to the formation of a perfect instrument, and gave evidence of scrupulous care and a nice appreciation of the wants of the surgeon.

Most of the steel instruments were nickel-plated, which is a great improvement, preventing rust and enabling the operator to keep his instruments clean with comparatively little care.

Among the novelties was an improvement upon the old "chain-saw," in which all the objections to that useful but treacherous instrument have been overcome. Who has not experienced the annoyance, in the middle of an operation, of the saw breaking, or becoming wedged in the bone so tightly as to be disengaged with difficulty? By a very simple device these objections have been overcome. Fig. 1 shows the substitute, made of steel beads serrated and strung on a strong wire. The little instrument works smoothly, rapidly, and efficiently. The automatic suture (Fig. 2) is useful in enabling the surgeon to approximate the edges of wounds upon which it would

FIG. 1.



Bead saw.

FIG. 2.

Automatic suture.

be difficult to use the needle; the serrefin is compressed and placed in the holder, pressed into position, and by pushing the ring near the handle forward the metal suture is liberated.

Fig. 3, A and B, represents an instrument devised for the removal of foreign bodies from the œsophagus. Fig. 3, B, shows the instru-

FIG. 3, A.

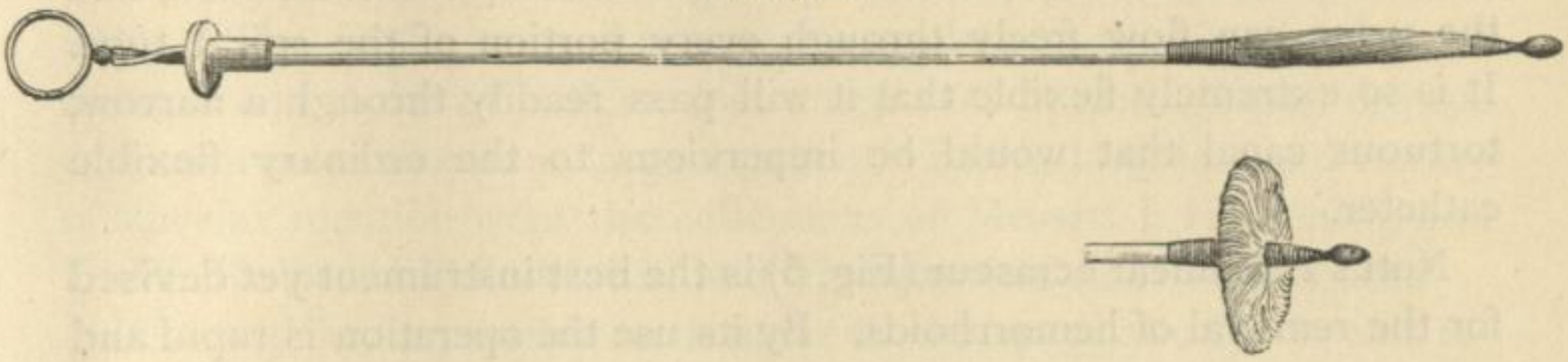
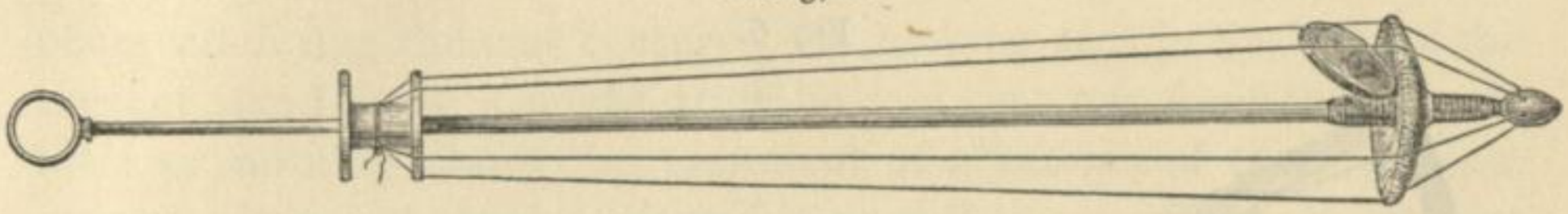


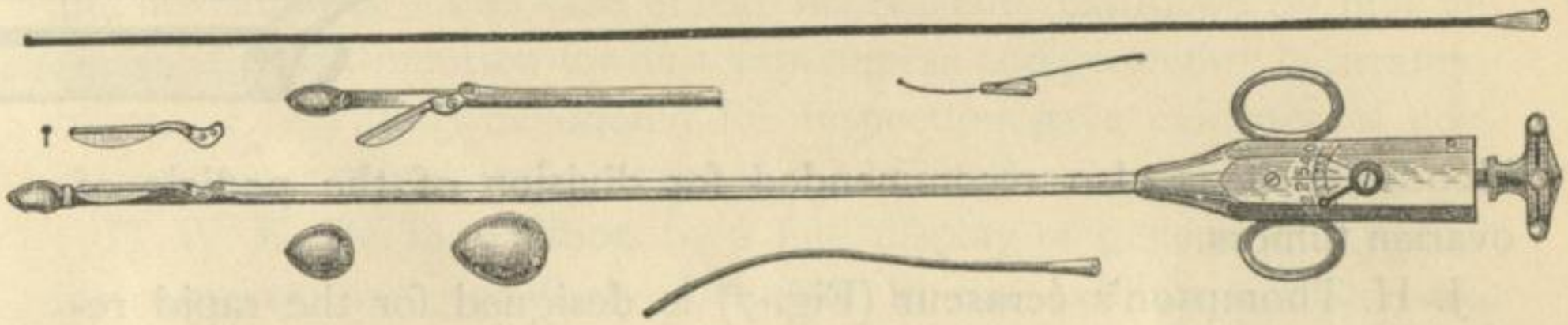
FIG. 3, B.



ment opened with the foreign body caught in the bristle disk; the handle is of whalebone.

Kinlack's new stricture-cutter will be appreciated by all surgeons who specially interest themselves in diseases of the genito-urinary system. The annexed cut (Fig. 4) explains itself.

FIG. 4.



There were many other instruments entirely new in design, among them an elastic metal catheter without eyes. The base of the catheter is a hollow silver tube; this continues for about four inches; the

FIG. 5.

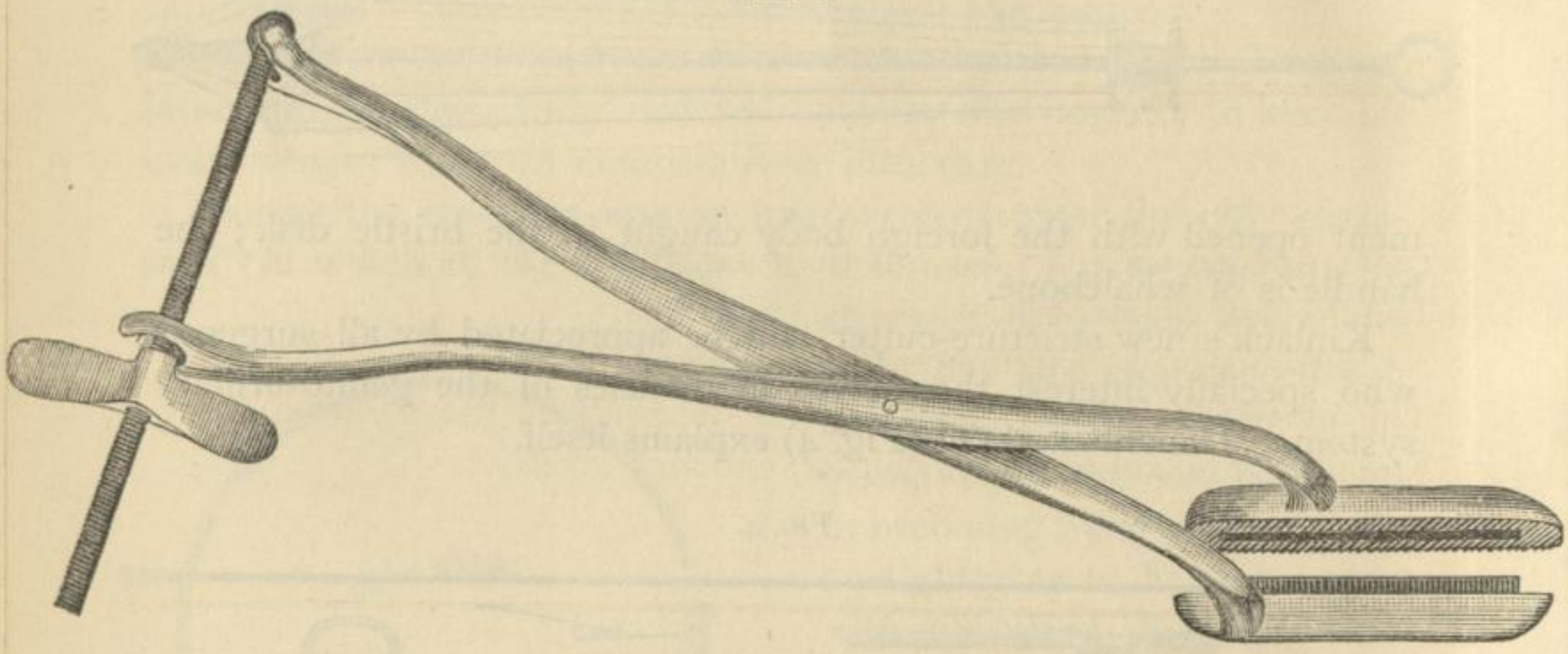
Flexible metal catheter.

metal is then twisted spirally, diminishing gradually until it terminates in a point not more than the thirty-second of an inch in diameter; through the centre a strong wire is passed, the point terminating in a

small steel bend, which is riveted to the wire. When the instrument is to be introduced the wire is drawn tight, bringing the bend up to the point and protecting the membranes as the catheter passes through. After the bladder has been entered the wire is pushed forward, and the urine can flow freely through every portion of the spiral tube. It is so extremely flexible that it will pass readily through a narrow, tortuous canal that would be impervious to the ordinary flexible catheter.

Nott's rectilinear écraseur (Fig. 6) is the best instrument yet devised for the removal of hemorrhoids. By its use the operation is rapid and

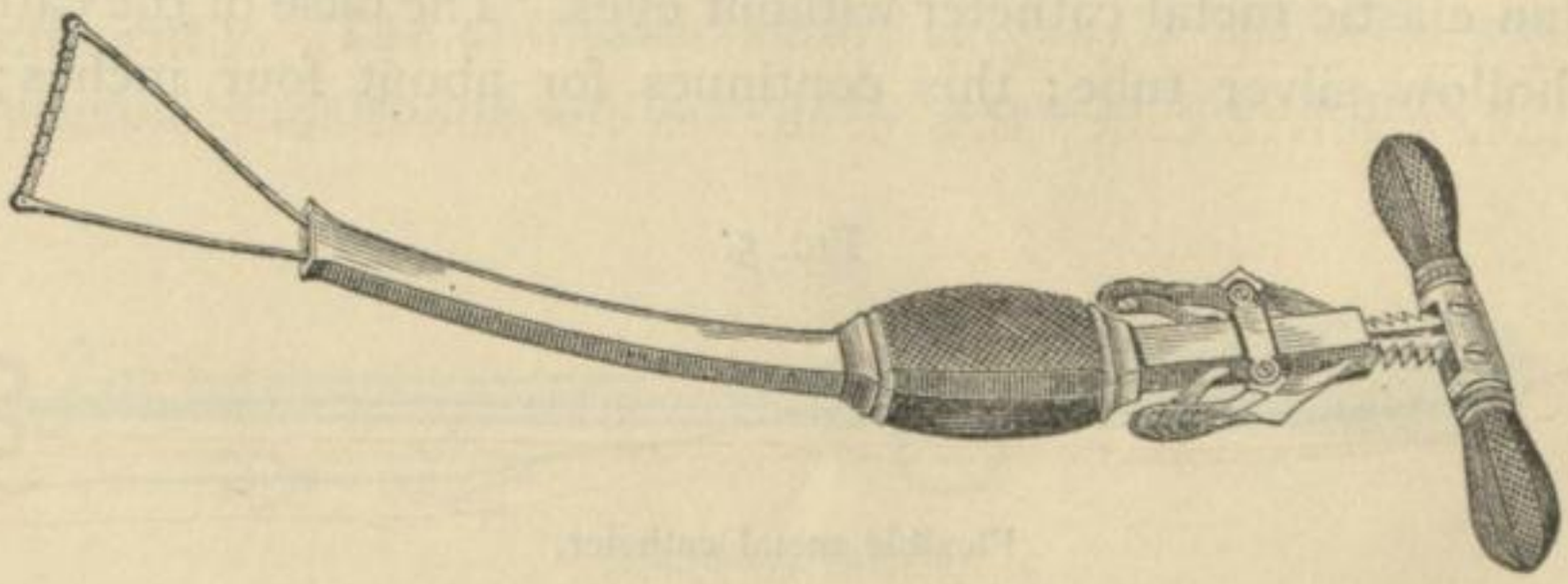
FIG. 6.



bloodless; it is also recommended for division of the pedicle of ovarian tumors.

J. H. Thompson's écraseur (Fig. 7) is designed for the rapid removal of uterine polypoid growths. It enables the operator to pass

FIG. 7.



the chain around the tumor with the greatest ease, the steel springs accompanying the chain keeping it taut until the tumor has been completely encircled.

A few instruments for operations upon the eye were to be seen in the departments of Italy and Japan, but they were of coarse finish, heavy, and unfit for delicate operations. All the instruments of real value for ophthalmic and otological purposes were exhibited by Americans. The display was of the most complete and perfect kind. All manner and styles of delicate instruments for operating upon the eye and ear were exhibited in large numbers. Particularly fine and worthy of special mention were the collections of Messrs. J. H. Gemrig and D. W. Kolbe, of Philadelphia, and Tiemann & Co., of New York.

It would be impossible to describe in the space allotted to this report the great advancement in this special branch of surgery that has occurred during the past century. On looking at it in the light of the present stand-point, it might truly be said that our forefathers knew little or nothing about the treatment of affections of these delicate organs. It would also be impossible as well as superfluous to attempt the description of the many new instruments, with their uses, that have been invented by the host of industrious and ingenious surgeons. Suffice it to say that great strides have been made towards the amelioration of the distress caused by diseases of the eye and ear.

After a careful examination, the special award for eye instruments was given to J. H. Gemrig, not only for his splendid display in this line, but for the fineness and delicacy of finish and perfect balance of his instruments. The case of ear instruments exhibited by him deserves especial mention for its completeness and perfection of arrangement. Everything he offered for inspection gave evidence of conscientious care and jealous regard for his national reputation.

D. W. Kolbe, in addition to a fine display of general and special instruments, was peculiarly fortunate in his exhibit of orthopedic appliances, which embraced every approved design for the relief of spinal curvatures, deformed limbs, etc.

Codman & Shurtleff, of Boston, made a creditable display of general instruments and dental furniture. Their improved inhaler is a valuable instrument, and received the recommendation for an award. The finest displays of dental forceps were made by Horatio G. Kern and Jacob T. Teufel, of Philadelphia; that made by the last-named manufacturer being the most extensive and elaborate. Both, however, were equally perfect in what they exhibited, and both received awards.

In the exhibition of artificial eyes, there was one in the German department from the manufactory of Ludwig Müller, represented in the United States by Dr. Theodore Roth, of Philadelphia; one in the Austrian department by F. A. Müller, whose agent here is Mr. Waldstein. James T. Davis, of New York, also entered into competition.

The display of Ludwig Müller was remarkably full and fine. The eyes were considered the finest in shape and finish and most natural in color of all the exhibits, for which he received the award. Those of Davis were very good in finish, but lacked the beauty of shape and natural coloring of L. Müller's. F. A. Müller had an ingenious exhibit of some of the diseases and appearances of the eye after operations. They were blown in glass, were very interesting and instructive. For this display an award was granted.

It is really astonishing to see to what perfection this branch of industry has been brought. Every variety of shades and points of color in the iris was depicted, as perfect and as beautiful as in nature. Müller's were particularly noticeable in this point, as well as in a peculiar arrangement of the pupil, which appeared to dilate and contract on movements of the eye in the rays of light.

In the examination of all instruments required in ophthalmic surgery the Judges were assisted by the advice and counsel of Dr. P. D. Keyser, the oculist, of Philadelphia, who was appointed by the United States Centennial Commission as a special expert on the unanimous request of the Judges of Group XXIV., and whose extensive experience at home and abroad pre-eminently fitted him for that duty.

PHARMACEUTICAL PREPARATIONS.

The display of pharmaceutical preparations, drugs, and chemicals was large and interesting, and was of itself a treatise on the immense advance made in medicine during the last century.

The magnificent exhibits of Powers & Weightman and Rosengarten & Sons attracted general admiration, not only from the profession, but from the general visitor. None but a manufacturing chemist had ever before seen such immense masses of the salts of quinia and morphia: thousands of ounces massed in pyramids, flanked by a gorgeous display of the salts of iron, whose glittering crystals of every shade and hue made the whole look like a fairy scene. Particularly fine was the large display of the sulphate of cinchonidia, one of the cheap salts of cinchona, which, through the efforts of Powers & Weightman, is now being largely and successfully used throughout the United States as a substitute for the sulphate of quinia.

Competition in sugar-coated pills was close and warmly contested. The finest displays, and unqualifiedly the best-made pills, were those of W. R. Warner and Bullock & Crenshaw. The priority belonged to Warner, who claims to have manufactured pills for Bullock & Crenshaw for some years before they manufactured for themselves.

In compressed pills, which should be made without any excipient, the contestants were Wyeth & Bro. and Dunton. Dunton's pills were excellent, and upon examination were found to be exactly what he claimed for them, but the Wyeth Brothers proved to the satisfaction of the Judges that they had the prior right as to date of manufacture.

The finest medicinal elixirs were exhibited by Wyeth & Bro. and Fred. Brown, of Philadelphia, to each of whom an award was given for the general beauty and reliability of all the preparations they exhibited.

The *pharmacopœia elegans* of Parisian pharmaceutists was well represented, and that nation earned and received full credit for beautiful display. It would be useless to enumerate all the articles exhibited; suffice it to say the materia medica of nations was exhausted: articles crude and manufactured, simple and compound, in endless variety and in the greatest profusion, met the gaze whichever way you turned; probably no previous Exhibition has ever received within its walls such a varied and valuable collection of exhibits belonging to this class.

REPORTS ON AWARDS.

GROUP XXIV.

1. McKisson & Robbins, New York, N. Y., U. S.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for a beautiful and instructive collection of medicinal roots and barks; also for the general excellence of all the pharmaceutical preparations exhibited by this firm.

2. John Wyeth & Brother, Philadelphia, Pa., U. S.

PHARMACEUTICAL PREPARATIONS.

Report.—In order to satisfactorily test the value of the above articles, and ascertain if they contained the quantity of drugs as stated on their labels, samples were obtained and a number of experiments and assays were made; the results in some instances varying slightly, which may have been caused by the difficulty in separating the active agents from their combinations, evidently consisting of sugar, alcohol, aromatics, salts of iron, etc.

The following is a tabulated statement of the principal preparations assayed, which will show a remarkable accuracy in their preparation, and displaying a pharmaceutical skill worthy of special encomium. I found in the elixirs where iron was combined with the alkaloids of Peruvian bark and other ingredients, the following proportions, taking the average of several assays:

	Amount of Alkaloid required in Oj.	Amt. Alkaloid claimed in Oj.	Amt. Alkaloid found in Oj.	Salts of Iron found in Oj.
Elixir Iron, Quinia, and Strychnia.	$130\frac{2}{15}$	$130\frac{2}{15}$	Grs. 106 Alkaloid equiv. to 128 Grs. Sulp. Quin. and Strych.	
" Bark, Iron, and Bismuth.....	19.20	19.20	$20\frac{1}{2}$	233
" " " " Strychnia...	21.76	21.76	20	250
" Cinchona Ferrat.....	19.20	19.20	21	253
" " Calisaya.....	19.20	19.20	20	
Wine Calisaya.....	19.20	19.20	19	
Bitter Wine of Iron.....	19.20	19.20	18	246

A number of other preparations were treated, and gave very satisfactory results and evidences of strict adherence to the quantity of drug contained in them as claimed by this firm. Among those tested were:

Elixir Ammonio-Cit. Bisulph.
" Bismuth and Strychnia.
" Valerian Ammon.
" Gentian and Tinct. Ferri Chlor.
Syrup Hypophos. Comp.
" Lacto-Phosp. Lime.

These elixirs seem to be a real advance in pharmacy, as they represent strength and

virtues with comparatively much less disagreeable taste than the same ingredients as usually made and extemporaneously prepared.

In the combinations containing alkaloids of Peruvian bark, the absence of intense bitterness is evidently due to quinia being used instead of sulphate of quinia, as is usually the case; consequently the addition of acid is not requisite to insure solution, and the bitterness of the salt is not fully developed.

Saccharated Pepsin fully proved its value by testing a small sample of 30 grains, which, at a temperature of 100° F. in eight hours, dissolved over 400 grains coagulated albumen. It is only equaled by that made by Mr. Scheffer, of Louisville.

Samples of butter of cacao suppositories were examined, and for precision in admixture of drug, regularity in size of cone, and nice skill in incorporating the various ingredients, are worthy of special mention. Butter of cacao alone was used.

The very large variety of pills exhibited by this firm and others precluded the assay of any varieties other than those containing the alkaloids of Peruvian bark. The compressed pills as manufactured by this firm appear to be of most uniform character in size, weight, and quality, and in all instances contained the amount represented.

The important feature in the pills appears to be their reduced size, and the absence of any excipient. The five-grain pills quiniæ sulp. are smaller than the three-grain pills as made usually in the shops.

In our judgment, these compressed pills are for above reasons, viz., smaller size, absence of excipients, and speedy solubility, superior to any other pills manufactured.

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3. Rigand & Dusard, Paris, France.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for the excellent preparations of chloral-hydrat and pancreatin.

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4. Rovul, Bravais, & Co., Paris, France.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for the very good preparations of dialized iron.

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5. Valby, Dijon, France.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for the excellent capsulated preparations.

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6. Vie-Garnier & Co., Paris, France.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for their beautiful collection of dragées, showing a remarkable perfection in manufacture.

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7. Ch. Torchon, Paris, France.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for the very beautiful preparation of chloral-hydrat.

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8. A. Beslier, Paris, France.

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for his very good plaster of cantharides and thapsia; also for his revulsive and epispastic papers.

9. **Antonio José Rodrigues d'Araujo, Rio de Janeiro, Brazil**

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for fine exhibits of beautifully prepared pharmaceutical preparations, showing marked progress.

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10. **Leão & Alves, Porto Allegre, Province of Rio Grande do Sul, Brazil.**

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for a remarkably fine collection of medicinal oils. The castor oil exhibited by this firm is the finest on exhibition.

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11. **Ferreira, Maia, & Co., Pernambuco, Brazil.**

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for his fine preparations of jurubeba and other pharmaceutical preparations indigenous to the country.

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12. **Dupuy Barthelemy, Brussels, Belgium.**

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for the variety and extent of exhibit, and for carefulness of preparation.

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13. **Ernst Jebens, Baden-Baden, Germany.**

PHARMACEUTICAL PREPARATIONS.

Report.—Commended for the beauty and variety of pharmaceutical products, especially the salicylic acid preparations.

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14. **Joseph Bosisto, Richmond, Melbourne, Victoria, Australia.**

CHEMICAL AND PHARMACEUTICAL PREPARATIONS FROM THE EUCALYPTUS GLOBULUS.

Report.—Commended for variety and extent of the collection of medicinal preparations, for the capacity and industry shown in developing the indigenous materia medica, and for the scientific benefit arising from the opportunity afforded for accurate experiment upon the medicinal properties of the eucalyptus.

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15. **Boericke & Tafel, Philadelphia, Pa., and New York, N. Y., U. S.**

HOMŒOPATHIC PREPARATIONS.

Report.—Commended for extent, completeness, and general beauty of the exhibit.

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16. **Wilhelm & Co., Vienna, Austria.**

DRUGS.

Report.—Commended for the completeness of the exhibit of drugs and pharmaceutical preparations.

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17. **I. Bernhardi, Leipsic, Germany.**

DRUGS.

Report.—Commended for completeness and variety.

18. Della Suda (Fayk Pasha), Constantinople, Turkey.

DRUGS.

Report.—Commended for the completeness of the display of many different kinds of scammonium and opium, and for the other pharmaceutical preparations.

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19. E. F. Houghton & Co., Philadelphia, Pa., U. S.

COSMOLINE.

Report.—Cosmoline is a heavy, paraffinous, oleaginous hydro-carbon, without affinity for oxygen or moisture. The specimens exhibited by this firm are absolutely pure, and as a vehicle for the administration of medicines in the shape of ointment it is invaluable.

Commended for absolute purity, great utility in pharmacy, and for cheapness.

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20. Emil Scheffer, Louisville, Kentucky.

PEPSIN.

Report.—Commended for purity of the pepsin obtained by the process originated by this manufacturer, efficiency, and reliability, rendering it a valuable article of the materia medica.

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21. A. Hottot & Co., Paris, France.

PEPSIN.

Report.—Commended for the exhibit of remarkably pure pepsin.

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22. Prof. Modeste Kittary, St. Petersburg, Russia.

DISINFECTING POWDERS.

Report.—Commended for the good composition of the exhibited powders, which avoids waste of carbolic acid and renders its odor less disagreeable, and for the impalpability of the powder, which secures its perfect diffusion in the air and upon surfaces.

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23. Bobœuf (Société Anonyme d'Exploitation de Produits Hygiéniques), Paris, France.

PHENOL.

Report.—Commended for the fitness of the exhibited phenol preparations for the purpose of disinfection.

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24. Marvin Brothers & Bartlett, Portsmouth, N. H., U. S.

COD-LIVER OIL (PHARMACEUTICAL PREPARATION).

Report.—This oil has been examined with all the usual tests, and it is found that in every respect the reactions give indications of its containing all the constituents and therapeutic properties of pure cod-liver oil.

It is a very light straw color, not so white as to show the use of chemicals, nor so dark as to give evidence of being manufactured from livers kept for days before being expressed. The oil is perfectly sweet, entirely free from any disagreeable odor, and the claim of Messrs. Marvin Brothers & Bartlett, that it is prepared from fresh livers only, is well founded.

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25. Peter Möller, Christiania, Norway.

COD-LIVER OIL.

Report.—Commended for a very fine and perfectly pure specimen of cod-liver oil.

26. Christian Johnsen, Christiansand, Norway.

COD-LIVER OIL.

Report.—Commended for a very fine and perfectly pure specimen of cod-liver oil.

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27. José Duarte Dias, Rio de Janeiro, Brazil.

DRUGS AND OILS.

Report.—Commended for fine preparation of balsam of copaiba, medicinal oils, and tinctures.

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28. Henry Bower, Philadelphia, Pa., U. S.

GLYCERINE.

Report.—The finest exhibit of glycerine presented for examination; pure and inodorous.

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29. Robert Shoemaker & Co., Philadelphia, Pa., U. S.

DRUGS AND FLUID EXTRACTS.

Report.—Commended for the general excellence of every article exhibited.

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30. Robert A. Hance, Philadelphia, Pa., U. S.

FLUID EXTRACTS (MEDICINAL).

Report.—Commended for the excellent quality of the medicinal fluid extracts exhibited.

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31. Mellor & Rittenhouse, Philadelphia, Pa., U. S.

EXTRACT OF LICORICE IN MASS AND ROLLS.

Report.—Commended for its cheapness as compared with foreign brands of the same quality, its purity, and excellence of manufacture.

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32. Frederick Brown, Philadelphia, Pa., U. S.

ESSENCE OF JAMAICA GINGER, AND OTHER PHARMACEUTICAL COMPOUNDS.

Report.—Commended for excellence of the preparation of ginger, which is free from any adulteration, low price of the article, and general excellence of all his pharmaceutical preparations.

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33. Wallace Brothers, Statesville, N. C., U. S.

INDIGENOUS PLANTS USED IN MEDICINE.

Report.—Commended for the extent, variety, completeness, and general perfection of the exhibit.

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34. B. O. & G. C. Wilson, Boston, Mass., U. S.

PRESSED MEDICINAL HERBS, LEAVES, AND FLOWERS.

Report.—A beautiful collection; the dried leaves and flowers retaining the color and odor of the fresh plants.

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35. W. R. Warner & Co., Philadelphia, Pa., U. S.

SUGAR-COATED PILLS.

Report.—The sugar-coated pills of W. R. Warner & Co. are soluble, reliable, and unsurpassed in perfection of sugar-coating, thorough composition, and accurate subdivision. The pills of phosphorus are worthy of special notice; the element is thoroughly diffused and subdivided, yet perfectly protected from oxidation.

36. Limousin, Paris, France.

MEDICATED CAPSULES.

Report.—Commended for the very good preparations of chloral-hydrat and for the *cachets de pain* exhibited.

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37. H. Planten & Son, New York, N. Y., U. S.

GELATINE CAPSULES FOR LIQUID AND SOLID SUBSTANCES.

Report.—Commended for general excellence in manufacture.

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38. H. Ledger & Co., London, England.

EXTRACT OF MEAT.

Report.—Commended for the perfect preservation of the qualities of meat, and for its good flavor.

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39. H. Naumann-Burkhardt, Basle, Switzerland.

EXTRACT OF MEAT.

Report.—The extract of meat exhibited is excellent in taste, well manufactured, and stands every comparison with other products of that kind.

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40. Mann S. Valentine, Richmond, Va., U. S.

VALENTINE'S MEAT JUICE.

Report.—Commended for excellence of the method of its preparation, whereby it more nearly represents fresh meat than any other extract of meat; its freedom from disagreeable taste, its fitness for immediate absorption, and the perfection in which it retains its good qualities in warm climates.

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41. J. H. Gemrig, Philadelphia, Pa., U. S.

SURGICAL INSTRUMENTS.

Report.—Commended for the finest assortment of eye instruments. The eye instruments manufactured by this exhibitor are perfect in every respect. The lightness, exquisite finish, and perfect balance of the instruments place them at the head of all competitors. The same may be said of the ear instruments.

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42. Merino & Co., Rio de Janeiro, Brazil.

SURGICAL INSTRUMENTS.

Report.—Commended for the marked improvement in the manufacture of surgical instruments.

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43. Mayer & Meltzer, London, England.

SURGICAL INSTRUMENTS AND GALVANIC BATTERIES.

Report.—Commended for a large display of surgical instruments of excellent material and finish; for new instruments for the surgical treatment of the urethra; and for the practical efficiency of their galvano-caustic apparatus.

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44. George Tieman & Co., New York, N. Y., U. S.

SURGEONS' INSTRUMENTS.

Report.—Commended for a fine display of general instruments, especially for amputating and gynæcological cases.

45. **Rondeau Brothers, Paris, France.**

RUBBER SURGICAL INSTRUMENTS.

Report.—Commended for the very good workmanship of the exhibited rubber catheters and bougies.

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46. **Vergne & Chose Brothers, Paris, France.**

RUBBER SURGICAL INSTRUMENTS.

Report.—Commended for good workmanship.

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47. **Jean-Pierre Benas, Paris, France.**

RUBBER SURGICAL INSTRUMENTS.

Report.—Commended for good workmanship.

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48. **Morris Mattson, New York, N. Y., U. S.**

HARD RUBBER SYRINGES.

Report.—Commended for invention of syphonic application by his syringe of dry heat or cold to either rectum or vagina; for his vaginal irrigator, and good manufacture in general.

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49. **National Surgical Institute, Indianapolis, Ind., U. S.**

ORTHOPEDIC AND OTHER SURGICAL APPLIANCES.

Report.—Commended for originality of inventions in orthopedic appliances, beauty of workmanship, adaptability for all the purposes designed, and variety of appliances for meeting different indications; also for a very ingenious bath chair for administering hot air and medicated vapors.

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50. **E. Weiskopf, New York, N. Y., U. S.**

OPHTHALMOSCOPES AND LARYNGOSCOPES.

Report.—Commended for superiority of design, excellence of construction, and admirable adaptability for all purposes of physical examination by reflected light.

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51. **D. W. Kolbe, Philadelphia, Pa., U. S.**

ORTHOPEDIC INSTRUMENTS.

Report.—Commended for the most practically constructed and best finished orthopedic instruments, combining durability and adaptability with moderate cost.

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52. **W. A. Hirschmann, Berlin, Germany.**

ELECTRO-THERAPEUTIC APPARATUS.

Report.—Commended for the small apparatus in which a thermo-electrical battery is used as the source of the inducting current.

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53. **W. G. A. Bonwill, Philadelphia, Pa., U. S.**

ELECTRO-MAGNETIC MALLET.

Report.—Commended for originality and great practical usefulness.

54. Dr. Jerome Kidder, New York, N. Y., U. S.

GALVANIC APPARATUS.

Report.—Commended for the scientific basis and the excellent workmanship of all the exhibited apparatus; for the introduction of a new method to obtain very rare interruptions from a self-acting interruptor; for the fitness for the purpose of changing the quality and quantity of the galvanic current; and for the very good construction of galvano-caustic apparatus.

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55. Galvano-Faradic Manufacturing Co., New York, N. Y., U. S.

GALVANIC APPARATUS.

Report.—Commended for the completeness of the supply of apparatus in the large electro-medical case; for the simple and ingenious way in which the frequence of interruptions of the inducting current can be changed; for the fitness of the electrodes for applications to the different parts of the body; and for the effectiveness and simplicity of construction of the galvano-caustic battery with agitator.

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56. Flemming & Talbot, Philadelphia, Pa., U. S.

GALVANIC APPARATUS.

Report.—Commended for the good construction of large and transportable galvanic batteries, for the simplicity of construction of induction apparatus, and for the excellent workmanship of the whole exhibit.

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57. Prof. L. Waldenburg, M.D., Berlin, Germany.

PNEUMATIC APPARATUS.

Report.—Commended for the invention and introduction of a simple and exact physiological principle into medical practice, and for the ingenious construction of an apparatus which is well suited to secure the purposes desired, namely, the inhaling either condensed or rarefied air, and exhaling into rarefied air.

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58. Geo. Tieman & Co., New York, N. Y., U. S.

THERMOMETERS AND GALVANO-CAUSTIC APPARATUS.

Report.—Commended for excellent construction, workmanship, and applicability of clinical thermometers and Dawson's galvano-caustic apparatus.

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59. James Joseph Hicks, London, England.

THERMOMETERS AND URINOMETERS.

Report.—Commended for the excellent workmanship of urinometers and thermometers. In the instruments the scale is protected by a thin layer of glass.

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60. Samuel Adger Darrach, Newark, N. J., U. S.

RAWHIDE APPARATUS FOR SPINAL CURVATURE; ALSO HIP- AND KNEE-JOINT AND BOW LEG APPARATUS.

Report.—Commended for originality of this use of the material, the ease and perfection with which it can be moulded to deformed shapes, its subsequent lightness, firmness, perfect support afforded, and its comfort to the patient; for the simple, firm, and effective mode in which proper and needed force can be applied and maintained in any direction, and for the permanent security and comfort of the counter-extension secured.

61. Vyvodzef, M.D., St. Petersburg, Russia.

APPARATUS FOR EMBALMING BODIES.

Report.—Commended for the invention of a very ingenious apparatus for the purpose of injecting liquids into blood-vessels; for the general applicability of this apparatus for every kind of liquids and blood-vessels; for the introduction of a thymol solution as an excellent preserving substance, which makes parts of human bodies injected with it half a year ago look like fresh ones.

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62. B. Frank Palmer, LL.D., Philadelphia, Pa., U. S.

ARTIFICIAL LIMBS.

Report.—Commended for the marked superiority in all the qualities which should characterize instruments of this class. They are capable of adaptation to every form of mutilation of the lower limbs; are light, strong, of admirable workmanship in every part, exquisitely modeled and finished, and provide in their mechanism for the most natural imitation of the movements of the living limb, while affording adequate and assured support to the wearer.

The first patent was granted to B. F. Palmer in 1846, since which time, with great perseverance and skill, he has added many improvements, which have found expression in a variety of patents; but the last is by far the most important, being what the inventor calls a "safety socket." It is designed to receive a part or the whole of the weight of the wearer upon the end of the stump, a mode of treatment so radically different from the existing ideas and practice as to merit the rank of a discovery. The testimony offered and examined of the complete adaptation of this invention to its application leaves no room for doubt that this last contribution to the comfort and relief of the mutilated is the most important of his beneficent labors.

A production which embodies the intelligent effort of a lifetime, and which affords the utmost compensation for one of the direst forms of human misfortune, entitles its author to a position in the front rank of the inventors and mechanics of the age. The artificial arms of the same maker are ingenious and well made, but, from the necessities of the case, cannot bear comparison with the admirable invention of the leg. The limitations of human art in the attempt to supply the loss of hand or arm are obvious to the slightest reflection. Beyond the improved appearance given to the wearer, they are comparatively of little service.

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63. Samuel Adger Darrach, Newark, N. J., U. S.

WHEELED CRUTCHES.

Report.—Commended for originality of design, perfection of mechanism, general suitability to the purposes desired, and demonstrated usefulness.

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64. Crandall & Son, New York, N. Y., U. S.

CRUTCHES.

Report.—Commended for strength, lightness, convenience and ease in use, cheapness, and durability.

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65. J. T. Woods, M.D., Toledo, Ohio.

SPLINT FOR LEG AND THIGH.

Report.—Commended for facility of application to simple or compound fractures of the lower limbs of persons of different sizes or ages, and upon either side of the body; for subsequent firmness of support, convenience of making examination or dressings, or effecting and securing changes of position of the limb desirable for comfort or treatment.

66. **G. Hayden Day, Bennington, Vt., U. S.**

FRACTURE SPLINTS.

Report.—Commended for the most complete, durable, and efficient set of wooden splints on exhibition. Their simplicity renders them equally valuable for hospital and private practice.

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67. **Dr. David Ahl, Newville, Cumberland County, Pa., U. S.**

ADAPTABLE POROUS SPLINTS.

Report.—Commended for lightness, firmness, flexibility, and cheapness.

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68. **Hippolyte Guillery, Brussels, Belgium.**

ZINC SPLINTS.

Report.—Commended for general applicability and fitness and cheapness of the exhibited perforated zinc splints.

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69. **Elastic Truss Co., New York, N. Y., U. S.**

TRUSSES.

Report.—An admirable invention, doing away with the necessity of springs or back support for many varieties of rupture.

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70. **E. C. Penfield & Co., Philadelphia, Pa., U. S.**

TRUSSES.

Report.—Commended for general beauty of finish, excellence of spring, and adaptability for every variety of rupture.

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71. **Wm. H. Horn & Brother, Philadelphia, Pa., U. S.**

TRUSSES.

Report.—The neck is of Swedish or Norway iron, allowing easy adaptation of position of the pad and direction of the force of the spring to each case. Commended for good workmanship and materials, extreme simplicity of construction, cheapness of original cost, and proved effectiveness and durability.

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72. **Philadelphia Truss Co., Philadelphia, Pa., U. S.**

TRUSSES.

Report.—Commended for their combination giving all necessary and possible movements of the pad upon the steel spring for fitting each person, combined with entire firmness and stability; also for general display of trusses of excellent material and workmanship.

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73. **I. B. Seeley, Philadelphia, Pa., U. S.**

TRUSSES.

Report.—Commended for perfect and enduring coating of steel spring by vulcanized rubber, preventing rust, allowing also change of shape of spring without injury to rubber coating, which assists in maintaining the spring in its modified shape; for excellent material and workmanship, and general suitability to secure the ends desired in this class of instruments.

74. Bartlett, Butman, & Parker, Chicago, Ill., U. S.

COMMON-SENSE TRUSS.

Report.—Commended for originality in the use of the mechanical arrangement for securing proper place and permanency of position to the pad, and direction of the retaining force of the spring; for excellent workmanship and quality of materials, general fitness for the purposes intended, cheapness of original cost, and durability.

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75. Seabury & Johnson, New York, N. Y., U. S.

PLASTERS.

Report.—Commended for originality of the invention for the combination of medicinal agents with india rubber in the form of plasters, reliability, and general excellence in manufacture.

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76. Paper and Chemical Factory, Helfenberg, Saxony, Germany.

ADHESIVE PLASTER DRESSING SUBSTANCES AND ICE BAGS.

Report.—Paper has been used for many and not common purposes in surgery,—principally for ice bags. It is superior to animal substances, as it does not decompose, and is much cheaper. The ice bags of the paper and chemical factory of Helfenberg are the only ones here exhibited. The exhibits for the appliance of plasters are of practical importance, and show good workmanship.

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77. Dr. A. Matthijsen, Budel, Netherlands.

PLASTER AND BANDAGES.

Report.—Commended for the original invention, and for the great practical value thereof.

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78. Rigollot & Co., Paris, France.

MUSTARD PLASTER.

Report.—Commended for effectiveness.

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79. Alfred William Gerrard, London, England.

SUPPOSITORIES AND MUSTARD PLASTERS.

Report.—Commended for excellence of workmanship and materials.

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80. Dr. Port, Surgeon in the Bavarian Army, Munich, Germany.

DRESSING FOR FRACTURES CAUSED BY SHOOTING.

Report.—Dr. Port exhibited a set of dressings for fractures from shot wounds. He only uses for them willow whips, iron plate, and twine. They are very easily made and applied. They fix the limb perfectly, allow many changes in position, and application of other bandages, and are of great value for field service.

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81. Surgical Clinic of the University of Königsberg, Königsberg, Germany.

GYPSUM HEMP BANDS.

Report.—The gypsum hemp bandages for the treatment of fractures and inflammations of the joints represent a new material for that purpose. They can be readily adapted in every position of the limb, easily made and detached; for transport they are of great value. The material is very cheap, and can be had everywhere.

82. **Dr. Bernhard Beck, Surgeon-General 14th Corps of Army, Carlsruhe, Baden, Germany.**

ARTICLES FOR FIRST DRESSING AND FOR TRANSPORTATION IN THE WAR.

Report.—Dr. Beck exhibited straw splints and stretchers for the first dressing and transporting wounded soldiers from the field. The great value of such bandages as first means of help lies in the readiness of manufacture by unprofessional men.

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83. **International Bandage-Shiff Factory, Schaffhausen, Switzerland.**

DRESSINGS, LINT, AND APPLIANCES FOR THE DRESSING OF WOUNDS.

Report.—The dressings and appliances for the dressing of wounds consist of carbolized material in connection with splints, etc. Medical knapsacks are composed from that material, for the use of fire companies, railways, etc. The whole exhibit was intended for a sanitary pavilion, and is the worthiest and most complete one of all those made in that direction. The material is a very good one..

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84. **Paul Hartmann, Heidenheim, Germany.**

PREPARED MEDICAL DRESSING MATERIAL.

Report.—Commended for a complete set of all dressing materials as they are in connection with Lister's method. The material of the dressings itself is very good; equally so the impregnation with carbolic acid.

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85. **Prof. Dr. Friedrich Esmarch, Kiel, Germany.**

HOSPITAL DRESSINGS AND DRAWINGS.

Report.—Dr. Esmarch exhibited drawings of his method for bloodless operations. The dressings and apparatus for nursing the sick are excellent in their close manner of packing and the completeness of the contents, the use of which is well and clearly explained in his books.

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86. **Vincent Perry, Germantown, Pa., U. S.**

ELASTIC BANDAGES FOR SURGICAL PURPOSES.

Report.—Commended for general excellence in manufacture.

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87. **H. D. Justi, Philadelphia, Pa., U. S.**

ARTIFICIAL TEETH.

Report.—Commended for strength and natural life-like appearance.

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88. **Samuel S. White, Philadelphia, Pa., U. S.**

ARTIFICIAL TEETH.

Report.—1. That, while equal to all others in color, texture, and translucency, they are decidedly superior in a faithful reproduction of the physiological characteristics of the natural organs, both to the individual teeth and relatively to the entire set.

2. Their conformation with reference to close and easy adaptation to the maxillary arch shows careful study of needs of both patient and operator.

3. For the various and numerous deviations from uniformity of arch and outline simulating the irregularities of nature, which thereby disarm suspicion of their artificial nature.

4. For the skillful distribution of tooth material in such manner as to secure the greatest

amount of strength with the least bulk and weight, and for the peculiar form and insertion of the platinum pins.

For the maintenance of these good qualities through an immense variety of size, color, and form of each class of teeth, excelling any other exhibit.

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89. Dr. Adolf Zsigmondy, Vienna, Austria.

MODELS OF TEETH, MADE OF PLASTER AND GYPSUM DRESSING.

Report.—Commended for exactness and neatness of workmanship; especially for their great value in exhibiting certain very serious deformities of the teeth and jaw, and the marked relief from such deformities which can be effected by the scientific uses of surgical and mechanical appliances.

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90. E. Parmly Brown, Flushing, Long Island, N. Y., U. S.

SPECIMENS OF OPERATIVE DENTISTRY.

Report.—Commended for careful and thorough workmanship.

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91. Dr. F. A. Berghammer, Vienna, Austria.

MECHANICAL DENTISTRY.

Report.—Commended for the general display of different methods of mounting artificial teeth, all of excellent workmanship. For continuous gum work, showing careful manipulation, with a due regard to facial expression.

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92. John Spencer, Sydney, New South Wales, Australia.

MECHANICAL DENTISTRY.

Report.—Commended for excellence of workmanship

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93. Noel Winderling Brothers, Milan, Italy.

DENTAL MUSEUM.

Report.—Commended for its absolute completeness and perfection, displaying the anatomy of the teeth from early fœtal life to their total disappearance, giving a complete view of dental physiology and pathology, of dental anomalies, and of dental orthopedic operations; also for the patient and skilled labor of years necessary to create this admirable exhibit.

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94. Samuel S. White, Philadelphia, Pa., U. S.

DENTISTS' INSTRUMENTS.

Report.—Commended for their strength, temper, finish, and suitability of form for the purposes for which they were designed.

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95. Codman & Shurtleff, Boston, Mass., U. S.

DENTAL INSTRUMENTS, FURNITURE, AND INHALER.

Report.—Commended for the extent, comprehensiveness, and variety of the exhibit, the skillful adaptation of the instruments and furniture to their several purposes, and for superior quality and finish; also for novelty of design of the inhaler, perfection of its execution, and general suitability to the rapid and safe administration of anæsthetics.

96. **Horatio C. Kern, Philadelphia, Pa., U. S.**

DENTAL EXTRACTING FORCEPS.

Report.—Commended for their construction, the beaks of the forceps being adapted to the anatomical forms of the various teeth to be extracted. For the excellence of material and workmanship.

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97. **Jacob J. Teufel, Philadelphia, Pa., U. S.**

DENTAL FORCEPS.

Report.—An elaborate display of dental forceps, well finished and admirably adapted for their purpose.

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98. **Samuel S. White, Philadelphia, Pa., U. S.**

DENTAL CHAIRS.

Report.—Commended for the ease and rapidity with which the chair is changed from a low to a high position, and the reverse movement; for the facility with which the chair and seat may be thrown from a horizontal to an inclined position, being securely held at any desired point; for the ease and rapidity with which the back of the chair may be raised and lowered, and the angle changed so as to give support as may be desired; for novelty and value of arm and body of chair; for variety of movement of the head-rest, with but one locking lever; for swinging movement of the whole body, and yet secure locking in any position.

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99. **Samuel S. White, Philadelphia, Pa., U. S.**

DENTAL ENGINES.

Report.—As a whole, they are valuable adjuncts to the practitioner of dentistry. In particular for the flexible shaft and sheath, the plate spring pitman, the hand piece, and the extension treadle, are valuable improvements. The water dental engine is commended for its neatness, compactness, and power, is simple in its management and completely under control; commended also for excellence of material and construction.

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100. **Quincy A. Scott, Pittsburg, Pa., U. S.**

ATMOSPHERIC DISC; DENTAL WORK.

Report.—Commended for invention and application of atmospheric disc for retaining artificial teeth in place, a valuable acquisition to dentistry in certain conditions of the mouth; also for excellence in finish of general dental work exhibited.

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101. **William Valleau, Jr., New York, N. Y., U. S.**

DENTAL GOLD-FOIL.

Report.—Commended for purity, brilliancy of color, and variety and convenience of forms for the use of the operator.

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102. **Charles Abbey & Sons, Philadelphia, Pa., U. S.**

GOLD-FOIL.

Report.—Commended for its uniform purity, softness, and strength.

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103. **Ludwig Müller-Uri, Lauscha, Germany.**

ARTIFICIAL HUMAN EYES.

Report.—Commended as being the most perfect and natural artificial eyes in form and finish.

104. Dr. Adam Politzer, Vienna, Austria.

ANATOMICAL PREPARATIONS.

Report.—A splendid exhibit of many very carefully made and most instructive preparations on the labyrinth of the human ear, and a very fine atlas on otology.

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105. H. W. Hechelmann, M.D., Allegheny City, Pa., U. S.

ANATOMICAL PREPARATIONS.

Report.—Commended as the most instructive preparation on the muscles, nerves, and blood-vessels of the human eye, and for the very fine collection of preparations on the labyrinth of the human ear.

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106. Bavarian Association for Aiding Wounded and Sick Soldiers, Munich, Germany.

MODEL OF A FULLY-DRESSED MEMBER OF THE VOLUNTARY SANITARY CORPS.

Report.—The Central Committee of the Bavarian Association for Nursing and Aiding Wounded and Sick Soldiers exhibited a model of a fully-dressed and completely equipped member of the volunteer sanitary corps. The arrangement is very complete and easily carried.

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107. N. Plambeck, Hamburg, Germany.

MODEL OF A HOSPITAL CAR.

Report.—An arrangement for making use of freight cars for the first transport of wounded and sick before the regulation trains arrive. The idea is a very good one. The system is such that it can be used in any car on all railroads. The whole material can at any time be transported in one car, so that it can be used on the place when it may be needed.

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108. Lower Silesian and Markish Railway, Berlin, Germany.

MODELS OF A SANITARY TRAIN.

Report.—The models of railway cars for the transport of sick and wounded and kitchen car are very good in their manufacture as well as plan of construction. It is clearly shown thereby in what manner the sanitary trains of the German army are now arranged.

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109. Emile De Jean, Brussels, Belgium.

COLLECTION OF MODELS OF HORSESHOES.

Report.—A most interesting collection of small iron models of horseshoes for the different physiological and pathological conditions of the hoof.

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110. Edward Lipowsky, Heidelberg, Germany.

APPARATUS FOR TRANSPORTING SICK AND WOUNDED.

Report.—The exhibit comprises a set of stretchers, beds, mattresses, etc., for the transport and treatment of sick and wounded. These articles distinguish themselves by originality of invention, good work, and cheapness.

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111. T. McElroy, New York, N. Y., U. S.

INVALID BEDSTEADS AND OPERATING CHAIR.

Report.—Commended for special value of the inventions to invalids, and those suffering from fractures, and to the surgeon for the facility with which the patient can be placed and retained in any desired position.

112. Dr. Krassinsky, Novo-Mirgorod, Kherson, Russia.

MICROSCOPICAL PREPARATIONS.

Report.—A large collection of very well finished and most instructive microscopical preparations of normal and diseased human tissues and organs.

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113. Chas. Fayette Taylor & Thos. M. Ludlow Christie, New York, N. Y., U. S.

ORTHOPEDIC AND LOCAL EXERCISES APPARATUS.

Report.—Commended for capability of modification of the orthopedic apparatus by the professional attendant to indications as they appear during the progress of the case, illustrating that the treatment of joint diseases is the business not of the mechanic but of the surgeon; for number and completeness of working models of apparatus well suited to secure passive motion in all directions, the force being completely under control and easily modified to suit the necessities of each case.

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114. Gustaf Zander, M.D., Stockholm, Sweden.

APPARATUS FOR MECHANICAL GYMNASTICS.

Report.—Dr. Zander applies engine power to gymnastic purposes, and secures a very useful way for active and passive movement. His engines, being of the best workmanship, can be managed very easily.

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115. Dr. W. Zuelzer, Berlin, Germany.

REPRESENTATION OF SANITARY STATISTICS.

Report.—Dr. Zuelzer has drawn up a graphical representation of the sanitary statistics in Germany for the years 1872–1874. Hygienic lines and curves illustrate the course of phthisis, enteric fever, and cholera in Germany during 1872–1874. The work is one of great labor, and deserves much credit for the compilation and the information arising from the graphical representation of the result. Such important works can only be of benefit if worked up in the different countries on a large scale.

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116. German Association for Aiding Wounded and Sick Soldiers.

REPORTS OF HOSPITAL ASSOCIATIONS.

Report.—The central committee of the German associations has exhibited a full set of reports on the activity of the associations, and a photographic album of the sanitary objects in the Vienna Exhibition. The completeness of the collection gives a full idea of the service done by the voluntary help during the last war, and deserves to be awarded as a source of information for all interested in those matters.

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117. Conrad Brandel, Warsaw, Russia.

ATLAS.

Report.—An atlas containing a number of pictures, admirably executed, illustrating different diseases of the human body.

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118. Alfred A. Gilbert, Philadelphia, Pa., U. S.

MEDICINE CHESTS AND MEDICAL SADDLE BAGS.

Report.—Commended for general excellence in manufacture, combining strength, economical arrangement of space, and beauty of finish.

119. Hance Brothers & White, Philadelphia, Pa., U. S.

CONICAL PLATE DRUG MILL AND PERCOLATOR.

Report.—A remarkably simple and well constructed drug mill, cheap and efficient; also an excellent percolating apparatus.

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120. Pedras Salgadas Mineral Water Co., Oporto, Portugal.

MINERAL WATERS.

Report.—Waters from springs Penedo and Rebordechão, having alkalinity and sparkling qualities bearing a favorable comparison with the well-known Vichy waters of France.

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121. R. Blackwood & Co., Montreal, Canada.

MINERAL WATERS.

Report.—Commended for the excellent quality of their Belfast ginger ale and lemonade.

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122. Charles Wilson, Toronto, Canada.

MINERAL WATERS.

Report.—Commended for the excellence of his soda and potash waters.

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123. Royal Prussian Administration of Mineral Waters, Ems, Germany.

MINERAL WATERS.

Report.—Commended for the variety of mineral waters exhibited of approved value in a large number of human ailments.

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124. Municipal Direction of the Bitter Water, Püllna, Austria.

NATURAL MINERAL WATER.

Report.—Commended for good method of preparation for exportation, and admirable and well-known medicinal qualities of the water.

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125. Vedago Mineral Waters Co., Lisbon, Portugal.

NATURAL MINERAL WATERS.

Report.—Commended for antacid and soothing properties to the mucous membranes from the presence of bicarbonate of soda and free carbonic acid gas in large quantity.

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126. Bolen & Byrne, New York, N. Y., U. S.

MINERAL WATERS AND SIPHONS.

Report.—Commended for excellence and variety of waters exhibited, for the method of keeping them unaltered by chemical action or by loss of carbonic acid gas; a valuable addition to the means of preserving and restoring health.

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127. Inman & Brothers, Huddersfield, Yorkshire, England.

AERATED MEDICINAL WATERS.

Report.—Commended for variety, perfect imitation, and beautiful preparation of aerated medicinal waters.

128. William Corry & Co., Belfast, Ireland.

AERATED MEDICINAL WATERS.

Report.—Commended for a very fine exhibit of aerated medicinal waters, careful preparation, and imitation of the natural springs.

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129. Zanni, Constantinople, Turkey.

MEDICAL PREPARATIONS.

Report.—Commended for the excellent quality of the syrup of sarsaparilla and of ferro-manganate.

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130. Bewley & Draper, Dublin, Ireland.

GINGER ALE AND LITHIA WATERS.

Report.—Commended for general excellence, possessing in a high degree all desirable qualities.

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131. F. A. Müller, Wiesbaden, Germany.

MODELS OF DISEASED EYES.

Report.—Commended for the extent and variety of the series representing abnormal and diseased eyes, for accuracy and truth to nature, and for its general scientific value.

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132. Annie D. Ramborger, D.D.S., Philadelphia, Pa., U. S.

MECHANICAL DENTISTRY.

Report.—Commended for thoroughness of workmanship and excellence of finish.

SIGNING JUDGES OF GROUP XXIV.

The figures annexed to the names of the Judges indicate the reports written by them respectively.

J. H. THOMPSON, 1, 2, 11, 19, 20, 24, 25, 26, 28, 29, 30, 34, 35, 37, 41, 44, 50, 51, 62, 66, 75, 76, 86, 111, 118, 119, 127, 128.

ERNST FLEISCHL, 3, 4, 5, 6, 7, 8, 12, 13, 16, 17, 18, 21, 22, 23, 27, 32, 36, 38, 42, 45, 46, 47, 49, 52, 54, 55, 56, 57, 58, 59, 61, 68, 78, 104, 105, 112, 117, 123, 129.

C. B. WHITE, 9, 14, 15, 31, 33, 40, 43, 48, 53, 60, 63, 64, 65, 67, 69, 70, 71, 72, 73, 74, 79, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 113, 120, 121, 122, 124, 125, 126, 130, 131, 132.

W. A. ROTH, 10, 39, 77, 80, 81, 82, 83, 84, 85, 103, 106, 107, 108, 109, 110, 114, 115, 116.

SUPPLEMENT TO GROUP XXIV.

REPORTS

OF

JUDGES ON APPEALS.

JUDGES.

JOHN FRITZ, Bethlehem, Pa.
EDWARD CONLEY, Cincinnati, Ohio.
CHARLES STAPLES, JR., Portland, Me.
BENJ. F. BRITTON, New York City.
H. H. SMITH, Philadelphia, Pa.
COLEMAN SELLERS, Philadelphia, Pa.
JAMES L. CLAGHORN, Philadelphia, Pa.
HENRY K. OLIVER, Salem, Mass.
M. WILKINS, Harrisburg, Oregon.
S. F. BAIRD, Washington, D. C.

1. D. W. Kolbe, Philadelphia, Pa., U. S.

ARTIFICIAL LIMBS AND SURGICAL INSTRUMENTS.

Report.—Commended for superior workmanship, quality, and fitness for purpose of limbs; also for surgical instruments of superior quality and workmanship.

2. A. A. Marks, New York, N. Y., U. S.

ARTIFICIAL LIMBS WITH RUBBER HANDS AND FEET.

Report.—Commended for utility, workmanship, and adaptation to purpose intended.

3. James A. Foster, Philadelphia, Pa., U. S.

ARTIFICIAL LIMBS.

Report.—Commended for utility, workmanship, and fitness for purpose, especially his artificial arms.

4. Dr. J. Allen & Son, New York, N. Y., U. S.

ARTIFICIAL DENTURES.

Report.—A seamless roof of the mouth, with a natural appearance, and an arrangement of the gums by which the sunken portion of the cheeks is restored. Commended for good workmanship and finish.

5. Isaac M. Rhodes, M.D., Hancock, Mich., U. S.

COMBINED INVALID AND FRACTURE EASY-CHAIR AND BED.

Report.—Commended for invention, utility, quality, and fitness for the purpose intended, being especially useful in hospitals.

6. O. A. Frees, New York, N. Y., U. S.

ARTIFICIAL LIMBS.

Report.—Artificial arms and hands of artistic finish and adaptation to purpose intended, and artificial legs, of excellent adaptation to general use in walking, the motion of the ankle joint and foot being very good.

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7. J. Condell & Son, New York, N. Y., U. S.

ARTIFICIAL ARMS.

Report.—Useful and well-finished artificial arms and hands, of good workmanship and utility.

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8. Dundas Dick & Co., New York, N. Y., U. S.

SOFT CAPSULES OF GELATINE.

Report.—Commended for finish, flexibility, and adaptation to purpose intended.

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9. William Holzer, Philadelphia, Pa., U. S.

DRUGGISTS' GLASSWARE, AND CHEMISTS' AND PHILOSOPHICAL GLASS.

Report.—Commended for fine quality, skill, workmanship, and adaptation to purpose intended, especially in chemistry and physics.

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10. William P. Wright, Philadelphia, Pa., U. S.

OILED SILK AND MUSLIN.

Report.—Commended for superior quality and adaptation to general use. This silk has been exposed all summer without softening.

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11. Joshua Whittemore, Wakefield, Mass., U. S.

CRUTCHES.

Report.—Commended for elasticity of wood composing crutch, and for attachment of rubber pads and sharp point to prevent slipping on ice, etc.; utility, and fitness for the purpose intended.

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12. Thomas G. Morton, M.D., Philadelphia, Pa., U. S.

HOSPITAL WARD CARRIAGE.

Report.—Commended for utility and adaptation to purpose intended.

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13. McIlvaine Brothers, Philadelphia. Pa., U. S.

GROUND AND POWDERED DRUGS AND DRY PAINTS.

Report.—A good exhibit of powdered drugs and dry paints, finely and evenly powdered.

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14. Noel & Co., Seville, Spain.

EXTRACT OF LICORICE PREPARED IN PASTILES, STICKS, ETC.

Report.—Commended for very good quality.

15. Angelo Menici, Leghorn, Italy.

EGRO-LEVER LIFT AND APPLIANCES FOR HOSPITALS.

Report.—Commended for utility and adaptation to purposes intended, especially in hospitals.

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16. Professor Enrico Gennari, M.D., Milan, Italy.

SURGICAL INSTRUMENTS.

Report.—Commended for good quality and adaptation to purpose intended.

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17. G. Piltz, Stockholm, Sweden.

GELATINE SHEETS MEDICATED.

Report.—Commended for utility and especial fitness for purpose intended.

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18. Dr. Samuel S. White, Philadelphia, Pa., U. S.

ARTIFICIAL TEETH.

Report.—Commended for superior quality and fitness for purpose, and especially for their great strength, as shown by careful tests in the presence of the committee.

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19. Dr. E. D. Hudson, New York, N. Y., U. S.

ARTIFICIAL LIMBS, AND APPARATUS FOR PARALYSIS.

Report.—Well-made, useful arms and apparatus for paralyzed muscles. Commended for utility, workmanship, and adaptation to purpose intended.

SIGNING JUDGES OF SUPPLEMENT TO GROUP XXIV.

The figures annexed to the names of the Judges indicate the reports written by them respectively.

HENRY H. SMITH, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19.
COLEMAN SELLERS, 14.

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