

tinuity, consequently preserves the contour of the face, is understood by observing the dotted line.

The manner of making a section of the lower jaw, as here shown, is one always to be selected when circumstances permit. The circular-saw is not, of course, a necessity for accomplishment of the performance, but it is a help only to be appreciated by a surgeon familiar with its use. In the absence of an engine, Hey's saw is to be used. An exsection thus made leaves no deformity.

Fig. 532, taken from the practice of the writer, shows the use of engine and saw used on front of lower jaw.

Fig. 533, shows manner of applying circular-saw in removal of small epulic growths. The diagrams explain themselves.

In doing operations upon the jaw-bones consideration is demanded by any undeveloped teeth that may happen to be present. To cut through a tooth with the Hey saw is impossible. It is difficult, and in cases cannot be done, where the circular instrument and engine are used. Caution is to be observed as reference is had to making the horizontal cut as near the base of the jaw as safety permits.

Addendum. SURGICAL ENGINE.—A surgical engine differs from the instrument used in dentistry proper principally as power is concerned. The invention is by Wm. G. A. Bonwill, D.D.S., and the introducing of it into general surgical practice is claimed with much satisfaction by the writer.

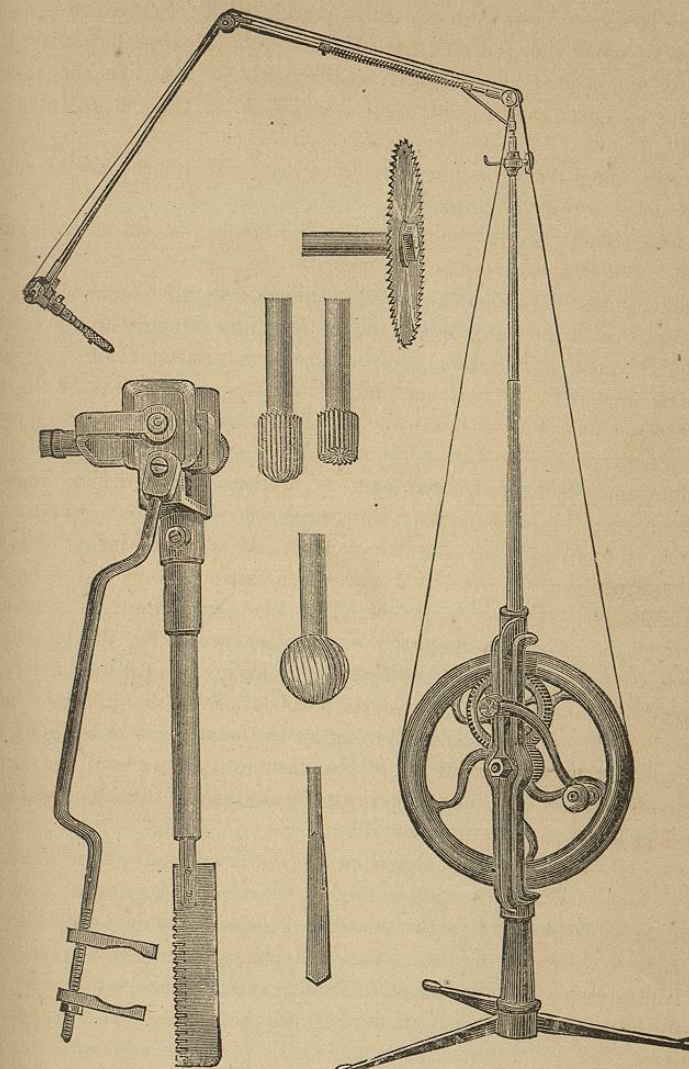
The reader, by referring to the cut (Fig. 534), will obtain correct understanding of the apparatus, and of the tools used with it. While a dental engine is worked with the foot, or by an electric, steam, or water motor, and possesses but a single driving-wheel, the surgical machine is driven by means of a hand-crank, and is intensified in motion by the addition of a cog adjunct. The shaft of the latter is always of arm fashion; the cable of the former, as at present constructed, being too weak to accomplish other than operations demanding little mechanical power.

The middle pieces in the engraving show a circular-saw, three sizes and forms of burs, and a drill. These are the principal instruments used with the engine, and they possess the capability, individually and collectively, of doing a great variety of service. The contrivance to the left is a reciprocal-saw; it possesses a latitude of motion to the extent of one-quarter of an inch, and runs back and forth with an unrecognizable rapidity; its use applies in exsections.

In oral practice the surgical engine is a convenience above praise. By means of the capability furnished by the apparatus operations of magnitude and danger are accomplished with all ease and at greatly diminished risk. Instruments are used precisely as one handles a pen; saw, burr, or drill slipping, by means of a shank, into a hand-piece, or handle, and made to perform revolutions to the extent of several thousand to the minute, while, at time of greatest movement, a thumb and two fingers controls the cutting tool with all

the facility of an act in drawing. (See for illustrations in practice various diagrams showing operations.)

FIG. 534.



Surgical engine and appliances.

CHAPTER LVI.

ANCHYLOSIS OF THE JAW.

ANCHYLOSIS of the jaw (*αγκυλος*, crooked), trismus (*τριζω*, to gnash), finds its general nature and characteristics exhibited in the condition as seen in the common articular system. A special study is therefore to be beneficially preceded by a limited review of the subject at large.

By ankylosis is meant stiffness in an articulation, such stiffness varying from an expression of simple inconvenience to absolute immobility. The terms true and false, complete and incomplete, are employed to express two common groups under which a variety of forms are classed; the first being applied to a state of fixedness in the joint, the second where more or less motion exists. A clinical division, one the practical utility of which every practitioner is soon found to recognize, relates with the lesion as reference is had to an intra- or extra-articular character; that is, whether the disease be within, or without, the joint.

Intra-articular ankylosis implies change in the articular relations,—arthritic inflammatory action leading to plastic effusion, which effusion has necessarily a varying history. Imprimis, a stiff joint may depend on a simple synovitis. It may associate, again, with lengthened disuse of the joint, as compelled in fracture-treatment, such fixedness acting as the abstraction of the natural stimulus of the part found in its motion, thus resulting in a dryness which becomes in time the excitant of an inflammatory exudate, with tendency to organization favored by the immobility. Arthritic inflammatory lesion is the history of all inflammatory action, and is to have consideration from such common stand-point. (See chapter on *Inflammation*.)

In any inflammation, a matter which first calls for consideration is the character and nature of the disturbance. Such a consideration applies particularly to arthritis; for whether the action arise from local or constitutional causes makes great difference in such prognosis as one may incline to offer.

Local arthritis is explained by any cause of local character that may be discovered to have provoked the lesion; of such offences we may instance blows, luxations, fractures, immediately neighboring lesions, inter-articular bodies.

Arthritis of constitutional relation finds its diagnosis in the absence of local sources of offence, and in the presence of cachexia: scrofulosis, syphilis, rheumatism, gout, cancer, and the sang calciné. Rheumatic, gouty, and scrofulous arthrosia are familiar exhibitions in such direction.

Complicated Arthritis.—This refers to a provocation into action, by some direct irritant, of an abeyant cachexia. Enough instances of such complications are found in the hip diseases of children arising from falls, and of cancers located through immediate injuries.

Inflammation in a joint has primarily a double diagnostic signification of concern to the surgeon; that is, it may involve the joint proper, the bones, cartilages, and synovial membrane; or it may be confined to the latter exclusively.

In synovitis proper, the prognosis is much more favorable than in true arthritis, provided the attack be acute in character and the treatment timely. Synovitis, in its incipiency, is attended by excess in the natural secretion of the membrane; such excess, by producing overfulness of the articular cavity, interfering markedly with freedom of motion. Passing into a chronic state, the neighboring parts are soon involved, and what is to be the result depends as much on the circumstances of the case as on the care and skill employed in the treatment. Effusions in synovitis are readily distinguished, the serous, associated with all the phenomena of acute inflammation,—the parts being red, heated, painful, elastic, and fluctuating. The plastic, appearing after the acute action has passed, this being dull, doughy, and pitting, and divested of active associations.

An attack of synovitis may be, and indeed commonly is, subacute in character, that is, it may be a long while in developing itself, and this, even when it is the result of local injury. The first symptom attracting notice is apt to be a sense of stiffness after rest, this being most observed in the morning; succeeding this is pain, with the stiffness prolonging and fixing itself; swelling will now perhaps be first observed, the heat of the part increasing with the distention; suffered to progress, suppuration of the membrane may be the result, and with it the complete destruction of the joint. A better and, happily, more frequent result is found in a cure of the inflammation through the exudative process, such exudation seeming to afford the necessary relief to the over-distended vessels. With such a result obtaining, the care of the surgeon becomes directed alone to the exudate, absorption is to be compelled, and through passive motion and the judicious employment of the sorbifacients, the plastic lymph will not be able to associate its bands with parts that shall afford it the capability of organization.

Acute synovitis, if disassociated with cachexia, may commonly be quickly resolved into a subacute condition; to obtain such result, however, treatment is to be directed with much judgment; if purely local, the attention required will most likely be one vigorously antiphlogistic;* if conjoined with cachexia, local sedation is to have associated with it a constitutional specific medication, or, stimulation and invigoration may be indicated. A common treatment for

* A cure almost magical in the rapidity with which it results is sometimes secured by cauterizing the surface with the solid nitrate of silver.

an acutely inflamed joint, whatever the parts involved, may be laid down as follows: Put the feet and legs of the patient in water, as hot as can be borne; administer a full saline cathartic, or a diaphoretic; apply a lead-water and laudanum lotion to the inflamed part; bleed with the lancet, or, locally, by leeches; depress the circulatory force by the administration of arterial sedatives, aconite or veratrum viride, and restrict to a low diet; use counter-irritants; any or all of these means being employed according to the indications of the case, an exception to the use of the pediluvium existing in inflammation of the inferior joints. An inflammation, once having its acuteness broken, is often happily terminated by painting the parts with the tincture of iodine, or with the muriated tincture of iron combined with quinine and the tincture of cinchona, as recommended on another page for erysipelas, and afterwards, if deemed necessary, enveloping the part in the lead and laudanum lotion. Where structural change is feared as the result of effusions, the mercurials may be administered and pushed to the least perceptible evidence of their impression. It is seldom the case, however, that a result is not better without than with these: it is not to be doubted that through the injudicious use of mercury many joints have been depressed to suppuration, which, without it, would have escaped.

When, in defiance of treatment, suppuration occurs in a joint, the pus formed is to be got clear of as speedily as possible. To effect this, aspiration is to be resorted to. At this stage it is that stimulation is directed with prospects of good results. Yet what is to be the precise nature and extent of such medication is not so easy to suggest, each case having, most likely, some special indication. The principle of the means, however, is to be found in anything that shall arouse the parts to a higher and healthier grade of action; embrocations, hot or cold douches, strapping, painting as before suggested, passive motion, or even, it might very well be, injections into the joint itself,—a means, this last, that might save an articulation where all others should fail.

Synovitis of systemic origin demands that the treatment consider the specific indication. If syphilitic, gouty, rheumatic, or strumous, medicines which experience characterizes as most antagonistic to the particular condition are to be conjoined with the local means. Thus, while giving every attention to the affected joint, we direct a medication to the cause at large.

Arthritis.—By arthritis is meant the inflammation of the common structures of the joint; here the danger of ill results is proportionally greater than synovitis as extent of parts is involved. An arthritic inflammation may be general, involving all the components of a joint, and of such severity of grade as to run quickly into suppuration and destruction of the parts; on the contrary, it may prove so slight as to amount to nothing more grave than a temporary congestion resolvable by a few hours of rest and sedation. Between these two extremes are found all the phenomenal associations of inflammatory action. An arthritis in the fulness of its history is thus to be

described: First, a sense of stiffness in the joint, with increasing uneasiness,—the stage of simple vascular excitement. Second, the development of the sense of heat, the parts swelling and becoming intensely painful on the slightest motion,—the stage of active congestion. Third, fixed engorgement, the pain persistent and of a heavy character, skin a dull red or white, according as the inflammation may or may not have travelled to the surface,—the stage of stagnation. Fourth, the destruction and breaking down of the involved parts,—necrosis, as evidenced in morbus coxarius,—the stage of suppuration and devitalization. Fifth, hectic fever from exhaustion, or pyæmia from poisoning. Sixth, death.

The treatment of arthritis proper is precisely that indicated and employed in synovitis. To limit and control inflammatory action is the principle of the cure. The vigor with which such a treatment is to be directed depends, of course, on the indications of each special case, these presenting, as suggested, every shade of character. If an inflammation, in defiance of the immediate antagonists employed for its control, pass onward in its grade to the effusion of lymph, as recognized by the doughy, pitting character of surrounding parts, then the danger of ankylosis, on the one hand, or of the degeneration of this agent into pus, on the other, is the matter which presses for attention and concern. Passive motion of the gentlest character is to be resorted to, together with the employment locally of sorbefacients, combined with such general medication as the particular case may appear to demand. If the mercurials seem essential, the practitioner will seldom find himself at fault in combining tonics with them. This will most certainly be found to hold true in all cases associated with asthenia. The character of cases in which it would seem to the writer's judgment that mercurials are admissible, and, indeed, in some instances, positively necessary, is where the trouble occurs with the robust and vigorous. In cases of this class their good effects are occasionally markedly observed; but even here, if employed too freely, the harm done quickly overbalances the good. When a mercurial is used, the effects produced are to be watched with the closest attention, and never is it to be inferred that, because good results are observed from the gentlest of ptyalisms, pushing the medicine will expedite a cure. No greater error than this can arise; a result is not unapt to be pus, and destruction of the joint. Another matter, not to be overlooked in the employment of the medicine, is its cumulative nature. A man may take a mercurial for a week or a month without apparent effect, when suddenly most profuse ptyalism exhibits itself.

Rheumatoid Arthritis.—For a medical paper treating most fully on this condition, the reader is referred to Reynolds's System of Medicine.

Trismus.—This term has its application alone to the ankylosis of the temporo-maxillary articulation; it expresses the simple locking or fixing of the jaw. As there are many causes or conditions involved in such locking, so, of course, are there conjoined terms expressive of such different lesions: tris-

mus traumaticus, including tetanus,—the locked jaw from wounds and other local external injuries: trismus dentium, arising from associative dental lesions; trismus nascentium, or trismus neonatorum,—infantile tetanus. In strictness of application, the term trismus, however, applies only to gnashing, spasmodic, or nervous lockjaw, and is without true expression or meaning when applied to other forms. It might be best viewed as referring to the medical rather than to the surgical aspect of the lesion.

Tetanus—from *τενω*, to stretch—is a disorder of the nervous system, presenting its manifestations in spasms, and affecting in nearly every instance the muscles of mastication, thus producing gnashing, or, it may be, locking of the jaw. Tetanus is decidedly a nervous disease, and is primarily confined to the true spinal system, being produced in some individuals by the most trifling injuries, many cases being on record where the simple extraction of a tooth has sufficed to provoke it. A bath, unduly prolonged, produced it in one of the author's surgical students. The terms *opisthotonos*, *emprosthotonos*, and *pleurosthotonos* are employed, together with trismus, to designate the groups of muscles implicated in the derangement.

Tetanus is divided into traumatic and idiopathic, and into acute and chronic; the first following wounds and other injuries, the second arising without assignable cause. The first form is usually acute in character; the later is likely to be chronic, and, to the extent of its chronicity, amenable and responsive to treatment.

As predisposing causes of tetanus, the experience and observations of Baron Larrey would seem to give cold and dampness prominent positions. Dr. Kane, in his *Arctic Explorations*, alludes to the death of two of his men from tetanic spasms, after being exposed to intense cold. Extreme heat is certainly another of such predisposing causes, tetanus being as common in very hot as in very cold temperatures, both extremes acting, most likely, by provoking centric nervous irritation.

SYMPTOMS.—Tetanus, although sometimes coming on suddenly, has more commonly a premonitory history. Instances are recorded where the spasms have arisen almost simultaneously with the reception of a wound. Such cases are, however, exceedingly rare, and indicate a predisposition which renders the disease almost necessarily fatal. On the other hand, it is exceedingly common to find the condition remaining in abeyance until the external wound has completely healed. A case of this latter character came only a short time back under the author's own observation, where a lady, while searching in a barn for eggs, accidentally ran a rusty nail into her knee, not, however, involving the articulation. Four days after the reception of the injury, with the break fairly healed, *emprosthotonos* supervened; yet the spasms quickly disappeared on opening the wound with a bistoury and the introduction of a delicate tent, thus compelling a filling up of the parts from the bottom. The irritation of a nerve radicle by its being caught and compressed in a cicatrix is a reasonable explanation of neuralgia and tetanus supervening on the heal-

ing of a punctured or lacerated wound, and seems to have had an example in this case.

Commonly, tetanus exhibits its approach, as suggested, in a gradual manner. Attention is first directed to a sense of general malaise; then stiffness of the movements of the lower jaw supervenes, as though the muscles were exhausted. This stiffness, increasing to soreness, extends to the muscles of the neck. The mouth becomes dry and sore; mastication grows painful, and swallowing difficult, a sense of spasm and suffocation resulting when these offices are attempted. Eventually the masseters, temporals, and pterygoid muscles become stiffened and bulging; the orbicularis puckered and contracted; the eyelids are closely approximated; the zygomatici are liable to become fixed, thus giving a peculiar expression known as the *Risus Sardonius*. Following these symptoms, almost any of the voluntary muscles may become implicated, the abdominal group, particularly the recti, corrugating and knotting themselves. Colicky symptoms soon supervene, induced by spasms of the muscular coat of the bowels; or difficulty in respiration may arise, from spasms of the diaphragm. *Opisthotonos*, *emprosthotonos*, *pleurosthotonos*, or, it may be, a most unyielding trismus now develops, according as the force of the irritant may select special groups of the muscular system on which to expand itself. That tetanus does not implicate the ganglia of special sense, but is confined to the spinal cord, medulla oblongata, and cerebellum, is demonstrated in a clearness of the intellect which continues during the attack.

The bowels, in tetanus, are commonly found obstinately constipated, depending on the general derangement of the alimentary canal; and motion, when it does obtain, is commonly accompanied with fetor of a most offensive character and of great persistence. The bladder may be closed by spasm of the muscular fibres of its neck, or these may be so relaxed that complete incontinence exists. The tongue, when involved, tends to be thrust forward, and is thus often lacerated in the spasmodic occlusions of the teeth.

Acute tetanus seldom has a greater duration than four days, the patient perishing either from asphyxia in a spasm, or otherwise from exhaustion. Chronic tetanus, on the contrary, runs on day after day, most frequently eventuating favorably. One is impressed with the sense of a battle, in which nature properly supported may reasonably be expected to win.

PATHOLOGY.—Because of the absence of definite pathological lesions, more or less diversity of opinion exists concerning the conditions of this disease. Sporadic or traumatic cases, where tetanus has shortly supervened upon injury to a nerve, naturally direct attention in such direction. Investigations into nerve-relations, however, prove so unsatisfactory that there seems now quite a tendency to revive the humoral origin, a view maintained with all earnestness by Rose, and favored by both Billroth and Dr. Richardson, the latter suggesting that it may eventually prove to be the result of the absorption of some septic material. "In the disease," says this author, "the poison, in my opinion, is first developed in the wound as the result of decomposition.

Thence carried into the circulation, the new substance, without any necessary increase of its own parts, excites a zymosis, ending in the production of an alkaloidal or alkaline body, which has all the power of exciting the symptoms of spasm as much as strychnine itself." Billroth inclines to ally the condition with the infectious phlogistic. "It is known," he says, "that, by blood-poisoning with strychnia, severe spasms, and with alcohol, psychical disturbances (drunkenness), may be induced; hence it is very possible that this disease may result from poisoning with a peculiar substance, only very rarely formed in wounds, and thence absorbed."

The symptoms of tetanus indicate irritation of the spinal medulla. Rokitsky describes, from autopsies made by him, evidences of vascular relations of this substance as exhibited in the development of young connective cells. Other observers, however, have failed to find these expressions.

The reviewer of the article Tetanus in Reynolds's System of Medicine (see *British and Foreign Medico-Chirurgical Review*, vol. xiii.) says, "The author does not attempt to trace any connection between the acknowledged causes, cold and damp and wounds, and the production of such a fearful consequence in only a few cases. With regard to its relation to hydrophobia and analogy of the latter to that of snake-bites, may not the connecting link between chilled wounds and spasmodic paroxysms be an animal poison generated in the wound during the process of healing? and being an animal poison, therefore poisonous in extremely minute doses? and being an animal poison, therefore latent in the system for long periods? and being an animal poison, therefore specially fatal to the nervous system? The greater tendency in punctured and closed wounds to cause tetanus is very suggestive of the needle-like serpent's fang, and the frequent triviality of the dog's bite, which are more deadly the less blood flows."

Holmes (in his chapter on Tetanus; see vol. i. p. 330), after a review of the morbid anatomy, as referred to by various observers, remarks the obscurity in which the pathology is involved. "Some," he says, "are seen to affirm tetanus to be an irritation of a peculiar kind, affecting the excitatory apparatus; that the irritating cause may be eccentric at the extremity of, or in the course of, the afferent spinal nerve, or it may be centric within the spinal canal itself. Some consider it to be an exaltation of the polarity of the cord and medulla. Others, again, maintain it to be identical with inflammation of the spinal cord and medulla oblongata, and adduce cases of inflammation of such structures as inducing symptoms of tetanus."

PRINCIPLES OF TREATMENT.—"If the difficulty of ascertaining pathological conditions, on which all rational indications of cure should be based," says Dr. Copland, "be so great in this malady as not to have hitherto been overcome, can it be a matter of surprise that the means which have been resorted to, by both physicians and surgeons, in this treatment, have been most opposite in their effects, the most different in their nature, and in every respect most empirical and uncertain? In this state of our knowledge it would be

better to leave nature to her unaided efforts, to observe closely and accurately what is the true procession of changes and of their manifestations, and to ascertain the seats and the extent of lesion as soon after death as may be attempted with propriety."

The treatment that has most commonly suggested itself seems to be that of anaesthesia; opium and chloroform being much depended on. Of the former medicine as many as twenty or more grains have been used in the course of a day, or a correspondence in the subcutaneous use of morphia. The greatest gain in treatment seems to be to prolong the disease into chronicity, thus wearing out, as it were, the force of the active cause. Billroth refers to the use of warm potash baths, and the application of strong irritants along the spine, large blisters, moxæ, but does not feel that experience tends to indorse any of them. On the contrary, referring more particularly to the chronic cases, he suggests that the patient be allowed to remain as quiet as possible, guarded against all injurious influences, especially from physical or mental excitement, the general aim of the treatment, he thinks, being to alleviate the acute course and make it more chronic, as this adds to the hope of recovery.

Of the internal remedies that have been employed, almost every class and description has been tried, without, as yet, any result in the way of a specific or an approach in such direction. "Alteratives, in the shape of the varied preparations of mercury, large doses of fixed alkalies, solutions of arsenic, etc.; diuretics, in the form of tincture of cantharides, oil of turpentine, given in frequent and large doses so as to irritate the urinary passages or to occasion bloody urine; sedatives, such as digitalis, tobacco, nicotina, hydrocyanic acid, aconitina; anodynes and narcotics, as opium, morphia, belladonna, colchicum, cannabis indica, ether and chloroform internally and by inhalation; stimulants and antispasmodics, including musk, ammoniacum, camphor, turpentine, assafœtida, castor, wine, and other stimulants; tonics, such as quinine, bark, strychnia, iron, zinc, etc.; hygienics and dietetics, as support, milk-diet, etc.; injections into the veins of solutions of opium, stramonium, etc.; tracheotomy and laryngotomy. The calabar bean in sufficient doses to paralyze the voluntary muscles has been affirmed to be attended with marked success, although it has, on the other hand, failed very frequently." (Alfred Poland, Holmes's System of Surgery.) The writer directs attention to belladonna as a remedy with which he has resolved tetanus. The dose of the tincture as employed by him is half a teaspoonful repeated *pro re nata*.

The treatment of tetanus by woorara has of late excited some attention, mainly through the work of Mr. Morgan. According to Demme, this most powerful poison has out of twenty cases resulted in eight cures. It is recommended by Spencer Wells, Broca, Chassaignac, and others; the dose is given as from one-eighth to one-half grain to an adult. To one not familiar with the action of woorara, it would seem necessary to recommend great caution in its employment. Most interesting experiments have been performed with