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ON

SURGICAL SWINGS AND PULLEYS

AS AIDS TO

REST AND MOTION,

BY

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1878.

This paper is reprinted from the *Lancet*, with very few alterations. Since the M.S. was sent to press, experience has confirmed the practical utility of the appliances described.

It is due to Messrs. Salt and Son of this town to acknowledge, that they have carried out the suggestions submitted to them, for the design and manufacture of the apparatus herein described, in the most painstaking and skilful manner.

22, Broad Street, Birmingham,

15th July, 1878.

ON

SURGICAL SWINGS AND PULLEYS

AS AIDS TO

REST AND MOTION.

The value of principles in surgery, as in every-day life, depends not merely upon their abstract truth, but upon the manner in which they are applied. Of all surgical principles of treatment, none is more important than REST. Physiologically it is sound, practically safe; but the benefits derivable from it are only partial when its application is not precise and thorough.

Rest is something more than a mere negation of motion. A patient with a broken leg, a punctured or an inflamed knee-joint, cannot, without proper appliances, enjoy rest on the best adapted mattress; because the least irritation and the slightest movement of the body give rise to muscular action, which displaces and further irritates. In those, and in many other cases of injury and disease, the question which presents itself to the surgeon's mind is, how to give effect to the therapeutic indication of *perfect rest;* how to construct an apparatus which shall completely restrain motion and be perfectly comfortable—rest being impossible without comfort. In the solution of this problem, the practical surgeon at the bedside learns, as the experimental physiologist does in the laboratory, that precision and thoroughness are essential to success in the use of appliances, however nicely adapted to give effect to scientific principles.

Valuable as rest is in the treatment of all surgical injuries,

it is in the management of fractures that it admits of the clearest, the most conclusive, and the most frequent illustration. Discussing, in 1856, the relative merits of the different methods of treating fractures, I published some observations from which I beg leave to make a brief quotation.[1]

"Theoretically considering the principle of action of an immovable apparatus, closely fitting as it does to the elevations and depressions of the limb after the fragments have been brought into accurate apposition, it may be said to act the part of an outer skeleton, whilst the solution of continuity in the bone is being repaired, giving to the soft parts that support which the internal skeleton once afforded. The surgeon applying an apparatus of this kind closely follows nature's example. The soft parts of the animal frame are supported upon two principles—by an outward shell, as in the crab; by an interior skeleton, as in man When a part of the interior bony framework is broken, what more rational than, during its repair, to support the soft parts by nature's other scheme—an investing shell? This is precisely what the surgeon does in treating a broken leg or thigh with an immovable apparatus. Once applied, it effectually prevents displacement of the fragments and its consequent attendants —injury to the soft parts, pain, and deformity."

SAYRE'S TREATMENT OF SPINAL CURVATURE.

The literal application of the simile sketched in the preceding passages impressed me forcibly, when I first had the advantage of witnessing Professor Sayre apply his plaster-jacket for spinal curvature. When the spinal stem yields, he supports the bending trunk with an investing shell. In his endeavour to secure immobility of the spine, he acts on accepted principles; but, to do him justice, the distinguished American has reconciled ingenious originality with traditional conservatism.

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[1] Researches in Pathological Anatomy and Clinical Surgery. By Sampson Gamgee. p. 155 et seq. London, 1856.

We had been accustomed to think that the spinal column yielding at a softened spot became consolidated in an angular position, as the result of nature's curative effort, which it was desirable, within certain limits, to favour and not to thwart. Sayre teaches us how best to prevent the curvature of the softened spine, and, when it has become bent, to straighten it and keep it straightened by suspending the patient and fixing the trunk in a plaster-jacket.

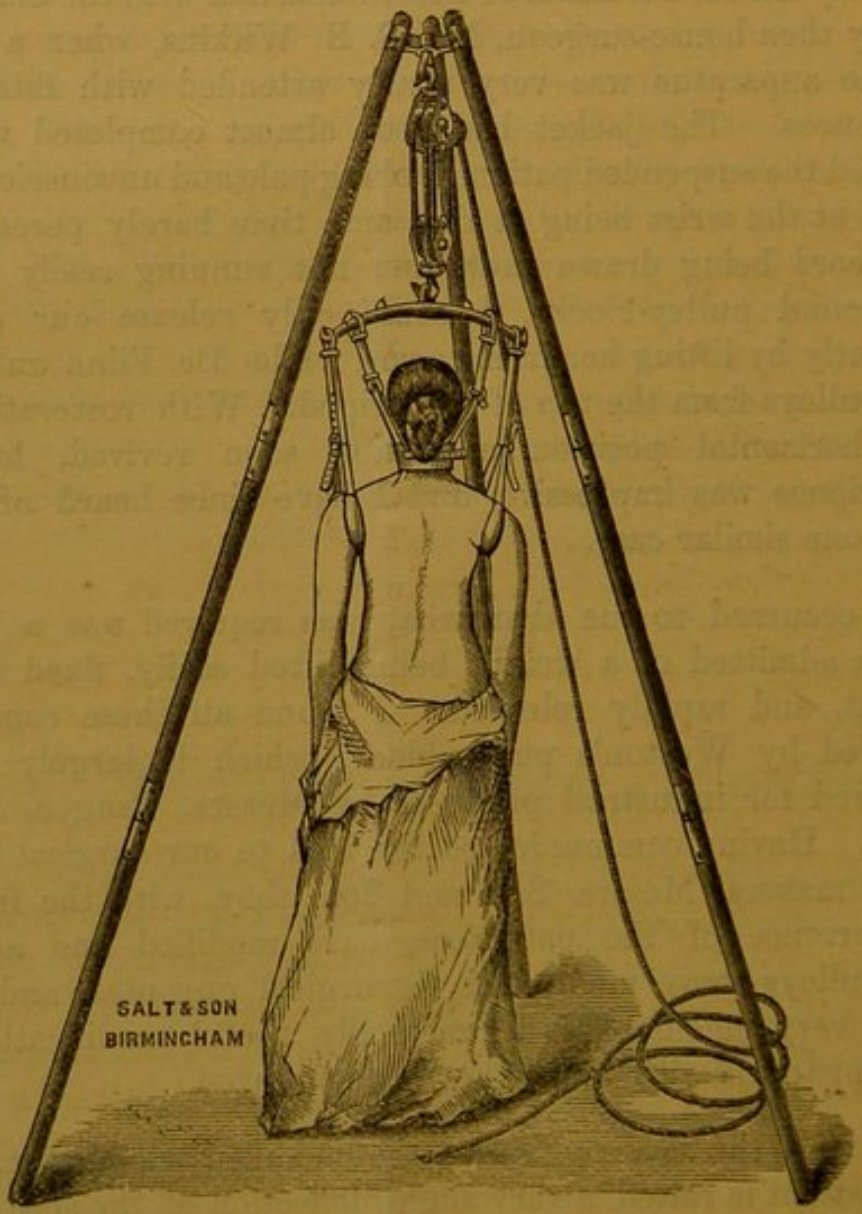
This plan of treatment proves to be an excellent one in very many cases. I was putting it into practice, in consultation with my friend, Dr. Flinn of Brownhills, and with the assistance of my then house-surgeon, Mr. R. B. Wilkins, when a defect in the apparatus was very nearly attended with fatal consequences. The jacket had been almost completed when I noticed the suspended patient looking pale and unconscious, the pulse at the wrist being at the same time barely perceptible. The cord being drawn taut, and not running easily in the compound pulley-blocks, I could only release our patient instantly by lifting her in my arms, while Dr. Flinn unhooked the pulleys from the top of the tripod. With restoratives in the horizontal position animation soon revived, but the experience was impressive, and I have since heard of more than one similar case.

It occurred to me that what was required was a pulley which admitted of a weight being lifted easily, fixed at any height, and rapidly released. I found all these conditions fulfilled by Weston's pulley-block, which is largely manufactured for industrial purposes by Messrs. Tangye, of this town. Having communicated the idea to our surgical instrument makers, Messrs. Salt and Son, they, with the friendly concurrence of the patentees, have modified and adapted the pulleys above mentioned to surgical purposes, and made some very ingenious and practically useful modifications in the apparatus with which they are employed.

Such is the construction of the modified tripod that, when the patient is raised, a very slight deflection of the cord to the right or left causes the pulley to become instantly self-retentive; that is to say, the body, whatever its weight, cannot possibly descend, although the force which raised it be suddenly

withdrawn. But immediate release is possible at any moment. A pull in a downward direction instantly releases the catch, and allows the patient to descend without jerk. A further improvement in the apparatus consists in the whole of the parts being made easily portable. The necessary jackets, bandages, plaster, shears, tripod, tin strips, and well padded chin and axilla supports, are contained in a box which can be conveniently carried in a brougham. (See Fig. 1.)

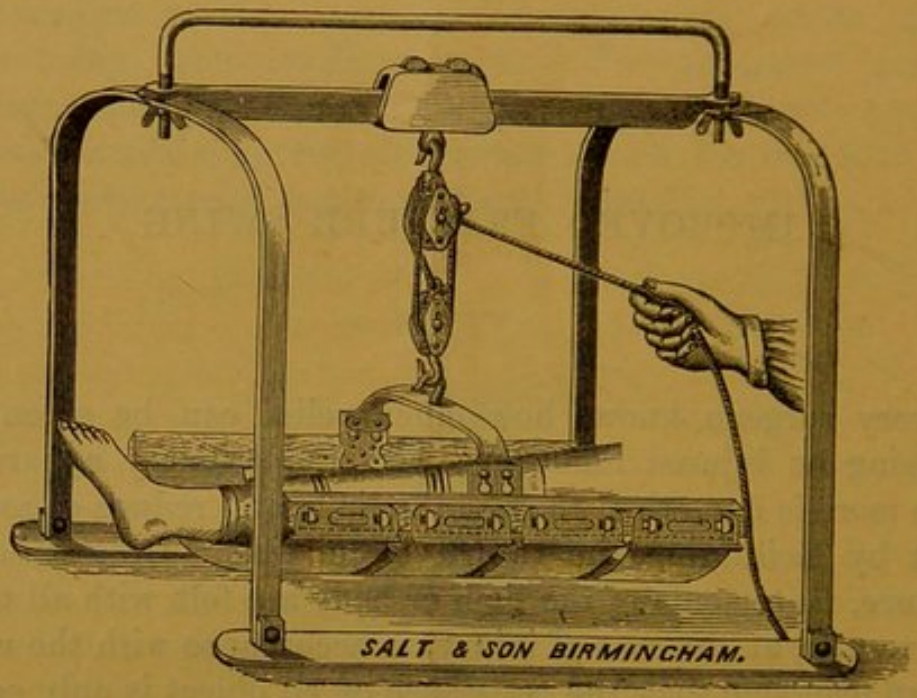
Fig. 1.



IMPROVED FRACTURE SWING.

Every surgeon knows how much relief can be given by swinging an injured limb; but with the ordinary apparatus little more is done than to raise the limb, and reduce engorgement by facilitating the return circulation. In a case of fracture, movements of the limb or body are felt, with all their evil results, at the seat of injury, in accordance with the well-known principle that the resistance of an object is only equal to that of its weakest point. When the limb is slung, if the medium of suspension be, as it should be, very easily movable, it, and not the fracture, becomes the weakest point; and any disturbing force is expended in the suspending medium, while the limb remains at perfect rest. It follows that to ensure this great desideratum—the communication of the least possible impulse to the point of fracture—a swing should be as movable as possible, so as to exhaust in its undulations the motive power communicated to the limb, and thereby render impossible a jerk in any part of its length. This object is very imperfectly attained by the swing in general use; the chain is stiff, and to lengthen or shorten it with the suspending hook involves discomfort and often pain. These evils are all removed by the substitution of a fine rope for the chain, and by using the pulley-blocks as adapted by Messrs. Salt and Son. By means of this appliance, the *modus operandi* of which is clearly illustrated in the drawing (Fig. 2), the fractured limb may be raised or lowered to any desired extent (within the limit of the height of the frame), without the slightest possibility of any jerk or strain, and a very desirable relief afforded to the patient during the enforced period of inaction. The pulley, being self-supporting, requires no fastening; it

Fig. 2.



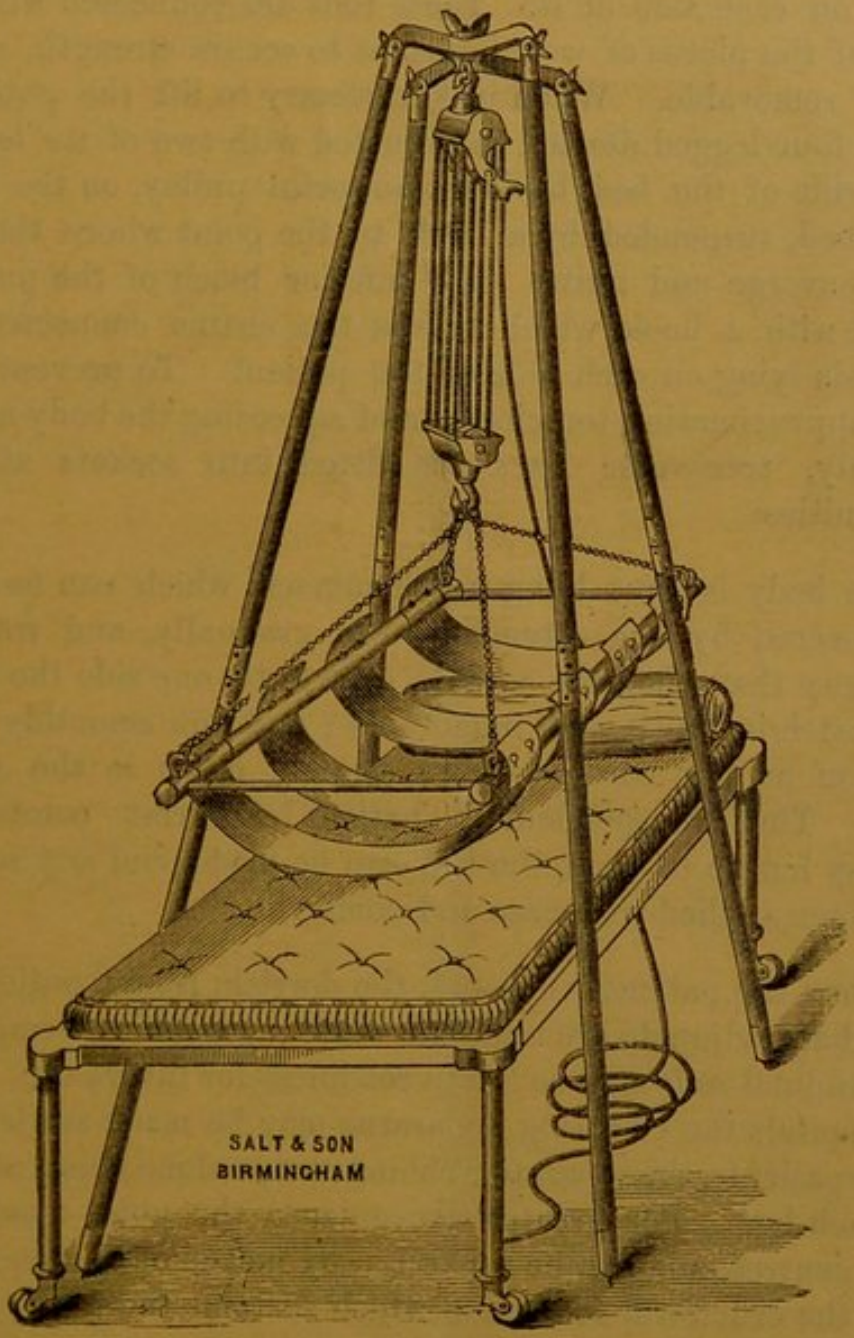
cannot become entangled, and admits of an unskilled attendant raising or lowering the limb for the patient's comfort, without the possibility of displacing the injured parts. *

A SURGICAL HAMMOCK.

The fracture-swing illustrates the apparent paradox, that the possibility of easy motion is necessary for the enjoyment of perfect rest. What is true of a limb is equally true of the whole body. In cases of injury or disease of the spine or pelvis, it is very difficult to raise or move the body without

* Since writing the above, additional experience has convinced me of the value of this improved swing. S, G.

Fig. 3.



displacement or pain, and even worse results. On my suggestion, Messrs. Salt and Son have constructed an apparatus (Fig 3) in which the pulley blocks already described play a very important part. By these means a hammock and lifting apparatus can be put together over the bed, so that one person can raise the heaviest patient, retain him in an easy swing for any length of time, and lower him on to the bed whenever required without jerk or effort.

Under the patient, and next the night-dress, are to be placed some soft wide pieces of webbing, of sufficient length to allow scope for the movements of the body within the rods lying on each side of it. These rods are connected with the ends of the pieces of webbing so as to secure strength, and be easily removable. When it is necessary to lift the patient, a stout four-legged derrick is adjusted with two of its legs on each side of the bed, having a powerful pulley, on the model described, suspended by a hook to the point where the four legs converge and unite. The inferior block of the pulley is armed with a hook, which grasps the chains connected with the rods lying on each side of the patient. To prevent these rods approximating too closely and squeezing the body uncomfortably, transverse bars are fitted into sockets at their extremities.

The body is thus hung in a hammock, which can be raised or lowered by one attendant very gradually, and with the certainty that when the cord is drawn to one side the pulley will catch instantly and immovably; and run smoothly again, as soon as the cord is drawn straight down in the middle line. Thus suspended, a patient can rest comfortably for any length of time, the bed can be made, and any surgical dressings applied with ease and comfort.

When the patient is lowered, the derrick, frame, pulleys and subsidiary adjuncts are removed, while the webbing, straps, and longitudinal rods may be left in readiness for future use. Thus in hospitals the elevating apparatus may be made available for many patients, the separate webbing straps alone being required for each bed. For greater convenience the poles unscrew in their centres, and can be separated by means of thumb screws from the cruciform connexion which sustains the pulleys.

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