

A PNEUMATIC TOURNIQUET.*

BY FRANK E. BUNTS, M.D.,
OF CLEVELAND, O.

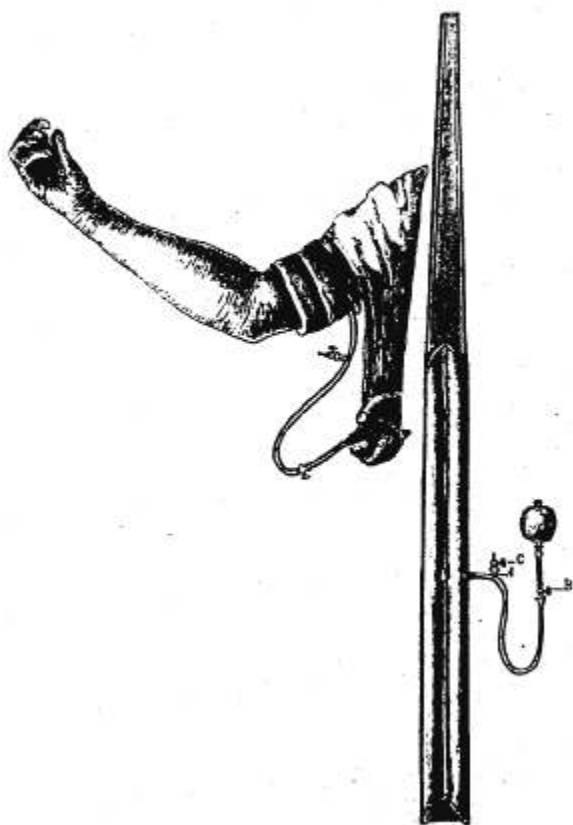
IN "Ashhurst's International Encyclopedia of Surgery" may be found an interesting account of the introduction of the tourniquet, which I venture to reproduce, viz.:

Next to the introduction of the ligature, the most important improvement in the operation of amputation was the invention of the tourniquet or "gripe-stick," as it was called by the English translator of Le Clerc. In its original form, this instrument, which was also known as the garrot or Spanish windlass, seems to have been devised about the same time (1674) by Morel, a French military surgeon, during the siege of Besançon, and by Young, of Plymouth, England, as described in his "Curus Triumphalis e terebintho," published in 1679. Morel's apparatus consisted of a thick compress, which was placed around the limb, and surrounded with a cord or small rope, under which were slipped two short sticks, by twisting which the cord was drawn very tight. Morel's tourniquet was improved by Le Dran and other surgeons by placing an additional pad immediately over the vessels and below the circular compress, by using only one stick for twisting the cord, and by placing beneath this a piece of paste-board—or, according to Garengeot, of horn or leather—so as to render the pressure on the skin less severe, and thus avoid the risk of sloughing, which sometimes followed the use of Morel's instrument. But the greatest improvement in the tourniquet was that made in 1718 by the illustrious J. L. Petit—le grand Petit, as he has been sometimes called to distinguish him from other less famous surgeons of the same name—and though, with its wooden plates and screw, we should think it but a rude contrivance, it was in all essential points the same instrument as the tourniquet employed at the present day.

Many other tourniquets have found their way into the armamentarium of the surgeon, such as Signoroni's, Lister's Cartes, Higgenbottom's, Tuffnell's, Skey's, and Esmarch's and their modifications. Some have had in view direct pressure upon the main artery of the limb but most have been, after all, but a slight improvement upon the garrot or Spanish

* Read in the Clinical and Pathological Section of the Cleveland Academy of Medicine, March 4, 1910.

FIG. 1.



The pneumatic tourniquet.

windlass. The one most commonly used is the Esmarch rubber band and chain or a simple rubber tube. These are certainly sufficient so far as controlling hemorrhage is concerned but are often so applied, either through ignorance, carelessness or perhaps unavoidably, as to cause very serious results, among which nerve palsy may particularly be mentioned. Thus when applied tightly above the elbow, musculospiral palsy may result and, if below the knee, peroneal nerve palsy sometimes follows.

In children particularly the need of some more suitable and more safely regulated pressure is manifest and, with this especially in view, I present for consideration a pneumatic tourniquet which, I think, will do away with some of the more obvious dangers of the older form of tourniquet.

In the *Medical News*, March 26, 1904, Dr. Harvey Cushing calls attention to a pneumatic tourniquet, which he had devised, based upon the well-known armlet of the Riva-Rocci blood-pressure apparatus and described as being a similar armlet though broader, of less distensible rubber and of such quality that it would stand boiling and, by connecting it with a bicycle pump of sufficient size, one or two quick strokes of the piston would fill it. This form of tourniquet has never become very popular, partly through lack of interest or information on the part of the profession, and partly because of the difficulty of keeping it from rolling when inflated and the necessity of a somewhat cumbersome apparatus (a bicycle pump) for its inflation.

I have devised an apparatus which is made of rubber and linen and consists virtually of two long rubber bags fastened together along their inner margins but connected at the middle by an opening through this fastening which permits the air to circulate simultaneously in both tubes when inflated. This obviates one of the greatest difficulties experienced in the construction of a practical pneumatic tourniquet. If it be made of a single rubber bag, the inflation will cause the superimposed turns of the tourniquet to roll off of each other and thus relieve the constriction. With the double tubes this cannot occur and it remains exactly where placed. The first one

constructed for me was made of pure rubber and enclosed in a linen bag to prevent its overdistention but, as it was somewhat inconvenient to remove it and replace it in the bag for cleansing or sterilizing purposes, I have had the present one made of much the same material as the familiar obstetrical pad, which is sufficiently elastic, very strong and durable and can be readily sterilized. It has a tapering end which, after the tourniquet is in place, is tucked under the inflatable part and becomes fixed as soon as pressure is applied. From the middle of one of the bags projects a rubber tube with an off-shoot, *A*, two stop-cocks, *B* and *C*, which permit respectively inflation by means of an attached bulb, and gradual diminution or total abolition of pressure by opening and allowing the escape of the air. If done slowly, undoubtedly venous engorgement would take place, but the inflation may be rapidly accomplished by a few pressures upon the bulb, and if still greater precaution against congestion is needed, the limb may be elevated or a Martin bandage applied before compressing with the tourniquet.

It can be applied uninflated to the limb prior to its preparation for operation and then, when needed, the circulation can be shut off by compression of the bulb without any disarrangement of the preparations about the field of operation. If, for any reason during the operation, it be desired to restore the circulation or to see whether the vessels have been secured, the air may be slowly allowed to escape by the anæsthetist or nurse by opening the stop-cock *C*, and controlled instantly by the re-inflation of the tourniquet, without having to readjust it. The advantage of this is apparent to any one who has been obliged to re-apply the ordinary tourniquet which has for any reason been removed when dressing the wound or at the close of an operation. The necessary disarrangement of towels and sheets and the pulling and jerking of the limb during this procedure are only too well known.

There are many practical applications of this tourniquet that suggest themselves, but it seems to me that one of the most beneficial would be its adoption by those engaged in the

ambulance service or wherever it may require application by those not skilled in the use of tourniquets in general or not familiar with their dangers. Where the amount of visible hemorrhage is the only indication, certainly there could be no excuse for the viciously tight tourniquets and Spanish windlasses that we only too commonly see applied. A smaller one could be readily made which might be used for operations upon the scalp or skull, and it might find a most useful application in replacing some of the more cumbersome forms of armlets used in blood-pressure apparatus.