An Improved Type of Back Check for Artificial Legs

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Generally speaking, back checks for the knee joint on an above knee artificial leg are satisfactory and on most people give many years of service without failure. However there are some cases where a powerful man, who attempts to make the artificial leg do as heavy work as the natural leg, will break back checks quite regularly.

Mr. McKnight of National Artificial Limb and Brace Company, Pittsburgh, Pennsylvania, and Mr. A. L. Godbey of Hanger Company, Miami, Florida, sent samples of broken back checks to the Fellowship which were breaking in severe service and requested advice as to how they could be corrected.

One of these back checks was tested with a static load and required 300 pounds to fail. It is difficult to understand how a 200 pound man can break a back check that can withstand 300 pounds.

Anyone who has ever used a pinch bar to pry open a box or to lift a heavy box knows that the longer the bar the heavier the box that can be lifted by any particular man. A child's seesaw acts in a similar manner. If a heavy child wants to seesaw with a light child, the heavy child must move in toward the center of the seesaw until the seesaw balances.

The forces on a back check act the same way as a seesaw, with the knee bolt acting as the pivot point. On one side is the man's weight acting a certain distance in front of the knee bolt, and on the other side is the force applied on the back check by the bumper, approximately 2¼ inches from the knee bolt.

A man's body weight shifts in relation to the knee bolt when he walks, so the distance his weight acts from the knee bolt may be anywhere from ½ inch to 4 inches in front of the knee bolt, depending upon the individual.

Because the particular back check tested can withstand 300 pounds before yielding, and this force acts 2¼ inches from the knee bolt, the back check can withstand 675 inch-pounds. A 200 pound man would have to walk in such a fashion that his body weight acted 3⅜ inches in front of the knee bolt to cause the back check to yield.

There are many possible ways that the back check could be occasionally overloaded. If a man carries a weight in his arms he puts additional load on the back check and also shifts his total weight forward. Stepping down from streetcars and going up and down stairs undoubtedly put additional load on the back check.

On an average, a man will probably put his weight on an artificial leg about one million times a year. This repeated loading probably causes some tiny spot in the back check to be continually overloaded and eventually a small, unseen crack forms. The crack gets larger until not enough metal is left to support the weight of the body and the back check fails. This is somewhat like bending a bar of metal back and forth until it breaks. The less the bar is bent, the longer it takes to break. If the bend-

ing of the bar is small enough, it can be bent back and forth forever and will never break. Back checks should be designed so that the repeated loading will cause so small a bending that they will never fail.

Figure 1 shows a back check designed by the Fellowship to take care of unusually active patients. It should be able to withstand at least five times as much load as the one previously mentioned. This back check was made of 24ST4 aluminum, and is lighter than the one tested. The design is simple enough that it can be made in any shop that has a drill press, a band saw, a grinding wheel and a buffing wheel. A shop that does not have a band saw can grind the back check to shape from a 5/8" x 1¼" x 5⅞" piece of aluminum with an A30-N3E Norton Alundum grinding wheel. The general shape of the back check is cut from five-eighths inch thick aluminum, the two holes are drilled and then the rough edges left by the saw are removed by first grinding and then polishing with a buffing wheel. It is very important that the rough surfaces be removed. If they are not removed, the life of the back check will be shortened. The front surface of the back check that strikes the bumper must be rounded slightly to keep the noise level down to a minimum.

The critical section of the back check is where the bumper strikes.

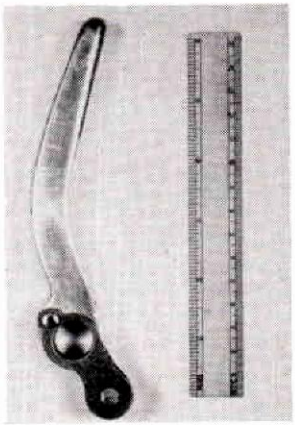

Fig. 1. Back Check designed by the Fellowship.

This should be five-eighths of an inch thick and five-eighths of an inch wide. Measured from the front to the back of the leg, a variation of one thirty-second of an inch will change the load carrying capacity by ten per cent.

This type of back check is currently being tested by patients weighing as much as 250 pounds. One 200 pound patient has carried as much as 100 pounds while working. He has been testing the back check for seven months.

The side plates, rollers, and pins necessary to complete the back check were purchased from the John J. McCann Company, Burlington, New Jersey.

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