Normal micturition is controlled primarily by a neural system. Certain physical effects become evident when neural control is destroyed, and the automatic or autonomous bladder phenomena occur. It is shown in this paper that a physical system simulating the alternating periods of continence and voiding of the automatic bladder may comprise only passive elastic components, and that periodic voiding does not per se imply neural control.

The act of micturition is usually described primarily in terms of neural control systems. There are, however, certain purely physical effects which would appear to deserve consideration, especially in clinical situations in which the higher neural controls are inoperative. Thus, in specific types of spinal injury the neural control is destroyed, but alternate periods of continence and voiding are observed. Depending on the kind of injury, these clinical conditions are called the automatic or autonomous bladder.

It is shown in this paper that a system simulating the autonomous bladder can occur in a non-physiological system comprising only passive elastic components, and that periodic voiding, therefore, does not per se imply neural control at any level.

The model discussed here is highly simplified, but it may be related to the extremely complicated urinary system with the help of Figures 1 and 2. In Figure 1 are represented in diagrammatic form the "energetic" elements of the physiological bladder-urethra system, where, by this term we mean the
elements of which the primary function is the handling of mechanical energy
to do useful work. In Figure 2 are shown in schematic form the "informational" elements of the system, or those primarily involved in control of the energetic elements. Thus Figure 1 shows muscles, fluids and the like, while Figure 2 outlines the principal neural paths.

For the present discussion we consider the bladder as a fluid-containing surface (Fig. 1) into which fluid enters at a roughly constant rate by way of the ureters descending from the kidney. The lower portion of the bladder wall is extended as a small tube, the urethra. Since the male urethra is surrounded over part of its length by the prostate, our comments will be directed to the mechanically simpler female urethra.

The bladder and urethra are enveloped in a sheath of smooth muscle of which the upper part surrounds the bladder and is called the detrusor. The lower portion of the sheath surrounds the urethra and is called the urethral sheath. The entire sheath is composed of three layers of muscle fibers, of which the inner and outer layers contain fibers generally arranged longitudinally, while the middle layer of fibers is circular or circumferentially oriented. We shall be