Bloody Ballistics

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Introduction:

The heart is a mechanical pump that is used to move an incompressible fluid (i.e., blood) through a very elastic closed network of tubes. With each cycle of the "pump," the whole system expands and contracts.

Construction:

None is required. All you need is an ordinary (probably cheap) bathroom scale and a barefoot volunteer. Bare feet may be optional, but it's the only way I have done this.

Operation:

When you stand on the scale in bare feet, you will be able to observe a periodic movement of the dial. This movement corresponds to your pulse rate.

I do not have an explanation for this effect. This gives opportunity for discussion and perhaps some experimentation. I believe one of the following explanations applies:

* a shift in the centre of mass of the body during each heart beat as the volume of blood changes in different parts of the body (Fig. 1.);

* a slight swelling of the feet and straightening of the legs as blood pressure increases during part of the heart beat cycle.

Notes:

1. There is a diagnostic procedure that uses this principle. I am not sure what it measures, perhaps the elasticity of the artery walls.

2. It should be possible to measure the energy transferred to the scale during each half cycle and hence the power expended. This could be compared to the power output of the heart. (The reason for using the half cycle is that, when the scale rebounds, it does not do work on the circulatory system.)

3. A laser beam could be used to amplify the motion optically by fixing a mirror to the scale (Fig. 2).

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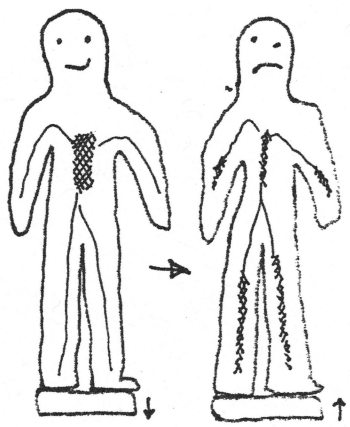
Submissions describing demonstrations will be gladly received by the column editor.

Fig. 1



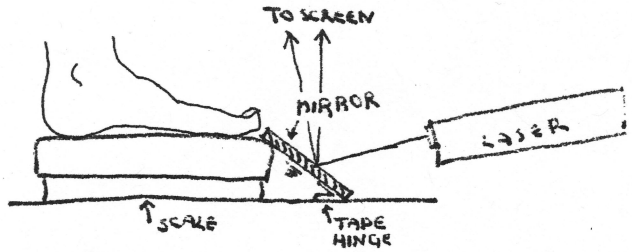


Fig. 2