same time. This must be carefully guarded against in setting up the instrument, as otherwise it becomes nearly impossible for one man to maintain proper adjustment during operation.

When receiving a message the operator must be careful to remain in position at his instrument so that he may interrupt the sending station if necessary. He must also keep his heliograph in adjustment constantly both when sending and receiving.

Section 108—Maintenance of Adjustment

The importance of careful attention to adjustment arises from the fact that the light from a heliograph mirror is projected in the form of a cone, the lateral range of which theoretically bears the same proportion to the distance between stations as the diameter of the sun bears to its distance from the earth; that is approximately 1:107. Thus with the mirror aligned correctly on the distant station, the light will be visible on either side of the station up to one-half of the distance between stations divided by 107; for example, if the stations are six miles apart, the flash theoretically will be visible about 50 yards on either side of the station. In practice, owing to imperfections of mirrors, the lateral range is somewhat greater and the intensity of the light is less at the outer edge of the cone than at its axis. This fact together with the very small lateral distance in which the light is visible, makes it essential that for the best results the alignment be made carefully so as to have the axis of the cone of light strike the distant station, and the adjustment maintained constantly. Perfect adjustment is secured only by keeping the shadow spot uninterruptedly in the centre of the paper disk, and, as this spot continually changes position with the apparent movement of the sun, when two men are at a station, one should be in constant attendance on the tangent adjusting screws. When working alone, operators must watch their adjustment very closely to ensure that the light reaches the distant station. A little practice will soon show how far the spot may move from the exact centre of the paper disk before the flash becomes invisible at the other station. Extra care bestowed upon preliminary adjustment is repaid by increased brilliancy of flash. Remember, the distant observer is unquestionably the better judge as to the character of the flash received; and if, therefore, adjustment is called for when the shadow spot is at the centre of the disk, the alignment is probably at fault and should be looked after at once.

Section 109—Opening Communication

In forest protection the locations of all permanent heliograph stations will be known to all members of the force. To attract the attention of a station once the heliograph is aligned on it, send a succession of flashes until answered. The heliograph flash is strikingly noticeable, but attempts to attract attention, to be successful, must be persistent. They should never be abandoned until every device has been exhausted. When acknowledged, each station will then turn on a steady flash and adjust. When the adjustment is satisfactory to the station called, it will cut off its flash and the calling station will proceed with its message.

The exact location of semi-permanent stations, especially when placed at a low level, is sometimes difficult. The compass bearings of all such stations from the heliograph stand should always be taken by each permanent station operator. A still better method is to set two stakes about twenty yards apart with the tops directly in line with the distant station, marking on the far stake the name of the station that it indicates. Where stations are so located that smoke from forest fires is likely to obscure them, a whole series of such guide-line posts should be permanently erected showing the line to each station within the range of communication. With such stakes accurately aligned it is then possible to call any station within range even though the station may be temporarily obscured by smoke. To call under these circumstances, loosen the catch on the underside of the mirror bar and rotate one of the mirrors by hand until the flash is