FOCUSING DEVICE FOR TELESCOPES.

BY GEO. M. HOPKINS.

Astronomers, both amateur and professional, who use small telescopes find themselves annoyed by the difficulty of focusing when a light portable stand is used, and especially when medium and high power eye pieces are employed.

The difficulty arises from the trembling of the instrument when the milled focusing head is turned by hand.

In the attempt to surmount this difficulty, many devices suggested themselves, among which were an electric motor with a switch for starting, reversing and stopping, worm gearing and a flexible shaft, hydraulic cylinders, and a pneumatic device.

The electric motor necessitates a battery, which is more than likely to be out of order when needed; the worm gear and flexible shaft could be worked only by a roundabout method; the hydraulic cylinders would corrode and stick after long disuse. As the pneumatic device presented the fewest objections, it was adopted and perfected. The first practical application of it was made to the fine five inch telescope belonging to Mr. A. E. Beach, one of the proprietors of the SCIENTIFIC AMERICAN. It has been found to perfectly answer the purpose for which it was designed.

Fig. 1 shows the device applied to the focusing tube of the telescope. Fig. 2 is an enlarged side elevation, with the milled head removed, and Fig. 3 shows a double bulb arrangement for operating the pneumatic cylinders.

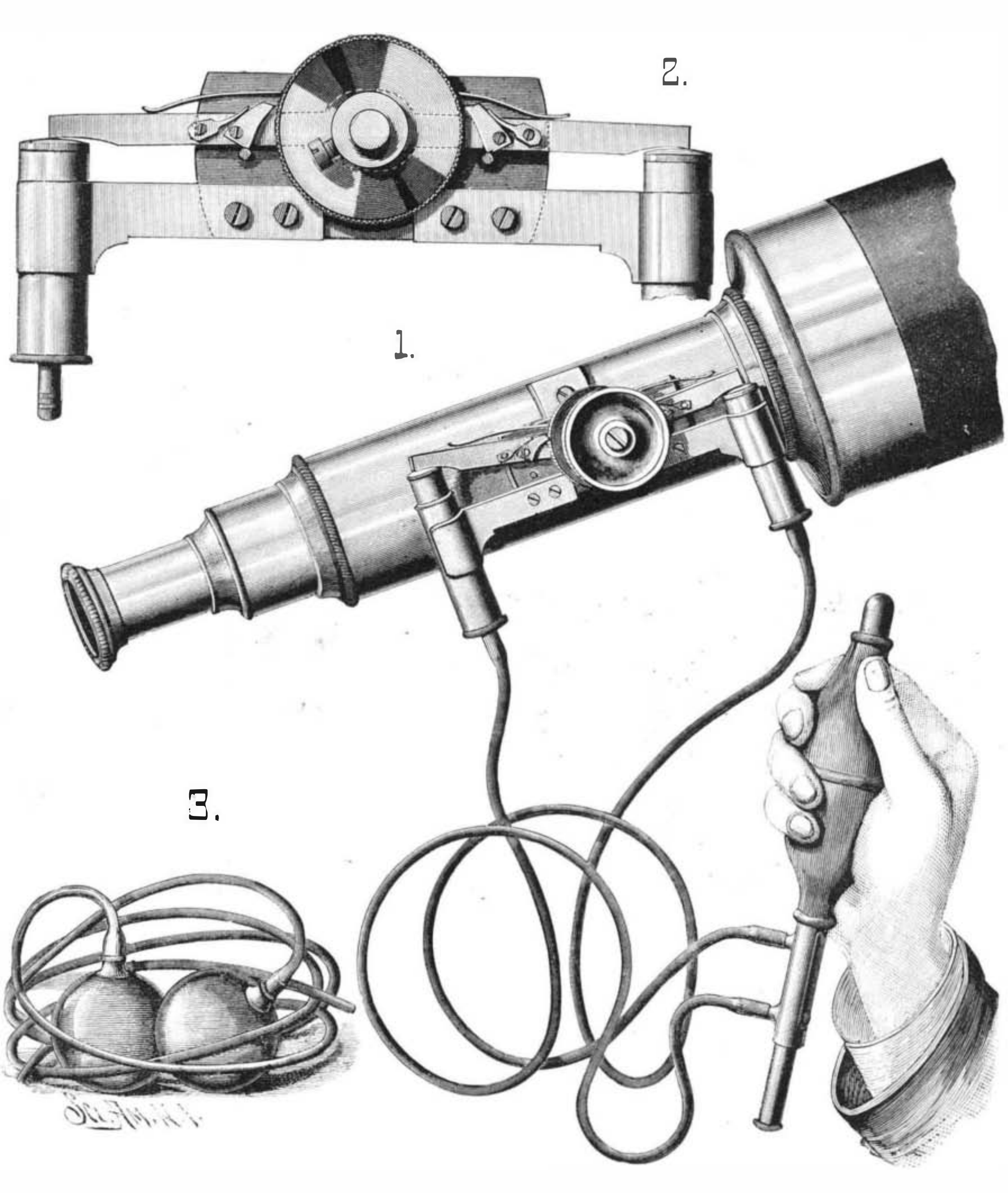
The apparatus is attached to the sleeve in which the spindle of the focusing pinion is journaled, and does not necessitate any change or disfigurement of the instrument, and when not in use it does not interfere with focusing in the usual way. On the sleeve above mentioned is secured the base plate of the apparatus. On a collar projecting from the face of the base plate and concentric with the focusing spindle are fulcrumed two similar levers, one projecting to the right, the other to the left. Both are pressed downwardly by springs attached to the base plate and both carry spring-pressed pawls which may act upon a ratchet mounted on the boss of the milled focusing wheel, but are kept normally out of contact with the ratchet wheel when the apparatus is not in use, by the contact of the lower projecting ends of the pawls with studs projecting from the base plate, as shown in Fig. 2, and when the pawls are in this position the milled focusing wheel may be turned freely in either direction by hand in the usual way.

Pneumatic cylinders are supported under the free ends of the levers by arms attached to the base plate. These cylinders contain pistons, which are capable of acting on the levers.

The pneumatic cylinders are connected by small flexible tubes, with the valve attached to the elastic bulb. The body of the valve passes through the bulb to render the connection rigid. The sliding part of the valve is tubular. It is pressed outwardly by a spiral spring and its motion is limited by a spring-stop attached to the body of the valve. It has a single perforation, which may be made to coincide with either of the branches connected with the flexible tubes. The valve, as shown, is in its normal position. If the elastic bulb is alternately compressed and allowed to expand, the air passing through the lower tube reciprocates the left hand piston. A small upward movement of the lever lifts the pawl from the stud and allows it to engage the ratchet wheel, thus working the pinion and rack in one direction by a step-by-step motion. By forcing in the sliding tube of the valve the air is made to pass through the upper flexible tube, and the right-hand piston is operated and the pinion and rack is moved in the opposite direction.

The focusing may be done as rapidly or as slowly and gradually as may be desired. By substituting the two elastic bulbs, shown in Fig. 3, for the bulb and sliding valve the apparatus is simplified.

The apparatus described may be applied advantageously in other operations, such as focusing cameras, working certain physical instruments at a distance, etc.



PNEUMATIC FOCUSING APPARATUS FOR TELESCOPES.

The Vibrations of Steamers.

An interesting paper on this subject was read lately by Herr Otto Schlick before the Institution of Naval Architects, London.

The apparatus, named pallograph, is founded on the principle of so hanging a weight that, in consequence of its inertia, it takes no part in a given direction in the tremblings and oscillations of the point to which it is suspended. As it appears necessary, for the purposes of the experiments, to take cognizance of the vibrations in both a vertical and a horizontal direction, the apparatus possesses two weights—viz., one which can only move in a vertical and another which can only move in a horizontal direction.

A series of experiments were carried out with the instrument on board the twin screw dispatch vessel Meteor, belonging to the Imperial German navy. The vibrations, both in the vertical and horizontal directions, periodically increase and diminish. The vertical vibrations always attain their maximum when the horizontal are at their smallest, and vice versa. This phenomenon is peculiar to twin screw vessels only, and is explained by the difference in the numbers of revolutions of the two engines, and the reactions of the masses of the moving parts. When, for instance, the relations are such that in the revolutions of both engines the piston of one cylinder of one engine and that of the corresponding cylinder of the other engine are each simultaneously in either the highest or the lowest positions, the greatest number of moving parts of considerable weight of both engines are then moving in the same sense in the vertical direction. Pistons, piston rods, connecting rods, crossheads, and cranks are here taken into account, and the low pressure cylinder, in fact, determines the beat of the vibrations, because its piston is the heaviest. The masses of these parts acting vertically will be added together. The vertical vibrations must, under these circumstances, reach a maximum. The relations governing the vibrations in a horizontal direction are exactly the reverse of the above. The action of the masses of the heaviest moving parts of the engines—viz., the connecting rods and the cranks—neutralize each other, because they are of equal size, and act in opposite directions.

The lateral vibrations registered by the instrument can, only in the rarest cases, be attributed to a horizontal bending of the axis of length of the ship. The stiffness of a vessel in the horizontal direction is so appreciably greater than in the vertical that the period of vibration is too short to permit of a coincidence with the time of a revolution of the engines. The horizontal vibrations shown by the instrument are, therefore, nearly always caused by a torsional vibration. These take place always when the moving parts of the two engines move in the vertical sense, but in opposite directions; when, for instance, the low pressure piston of the starboard engine moves downward at the same moment that the corresponding piston of the port engine moves upward. In this way a reaction pressure upward will be called into existence on the starboard side in the locality of the engine, and a reaction pressure downward on the port side; or, in other words, the transverse section in question of the ship will be forcibly bent over to the port side, and, after half a revolution of the engines, will be again bent over to starboard. In this way the portion of the ship in the neighborhood of the engines will be put into a state of oscillation, which then propagates itself to the parts further forward and aft.

When steaming at full power, the vibrations of the ship were extraordinarily small, which, considering the great engine power and the unusual speed of the ship, must be characterized as a very excellent result.

The cause of vibration, we now know, consists solely in the unison between the number of revolutions of the engines and the number of vibrations of the ship. The older steamers had much smaller dimensions, and the engines, as is well known, ran at much smaller speeds than those of to-day. The smaller the length of the ship the greater is the number, per unit of time, of its vibrations, and the longer the steamer the greater is the corresponding time of its vibrations. There could be no idea of a unison between the number of the vibrations and the number of revolutions of the engines of the older type of steamers, and therefore they did not manifest remarkable vibrations. As progress, however, was made in shipbuilding, the principal dimensions steadily grew, the period of the vibrations became steadily longer, while the necessary greater engine power, which was requisite, compelled the increase of the number of revolutions. We have thus arrived, in the development of shipbuilding, at a period when the time of a vibration and of a revolution of the engines agree, and when for the moment the usual type of ship shows severe vibrations. We find ourselves, therefore, exactly at a critical moment in the development of shipbuilding. But when we go further in this direction and build still larger ships and let the engines run still quicker, these future steamers will either show no vibration or only small ones.

THE new Griffin roller mill, heretofore fully described in the SCIENTIFIC AMERICAN, is being received with great favor by users in a wide variety of pursuits. A miner in Fauquier County, Va., writes that it is "doing more than equal to an ordinary 25 stamp mill in grinding quartz ore, requiring little more than 25 horse power to run mill, rock crusher, amalgamator, and settlers, while the care and attention required to operate it is much less than for the same product by stamps." The mill is made by the Bradley Fertilizer Co., of Boston.