Feb. 28, 1939.

H. O. DONNER

LIGHT MORTAR

Filed June 2, 1936

2,148,808

2 Sheets-Sheet 1

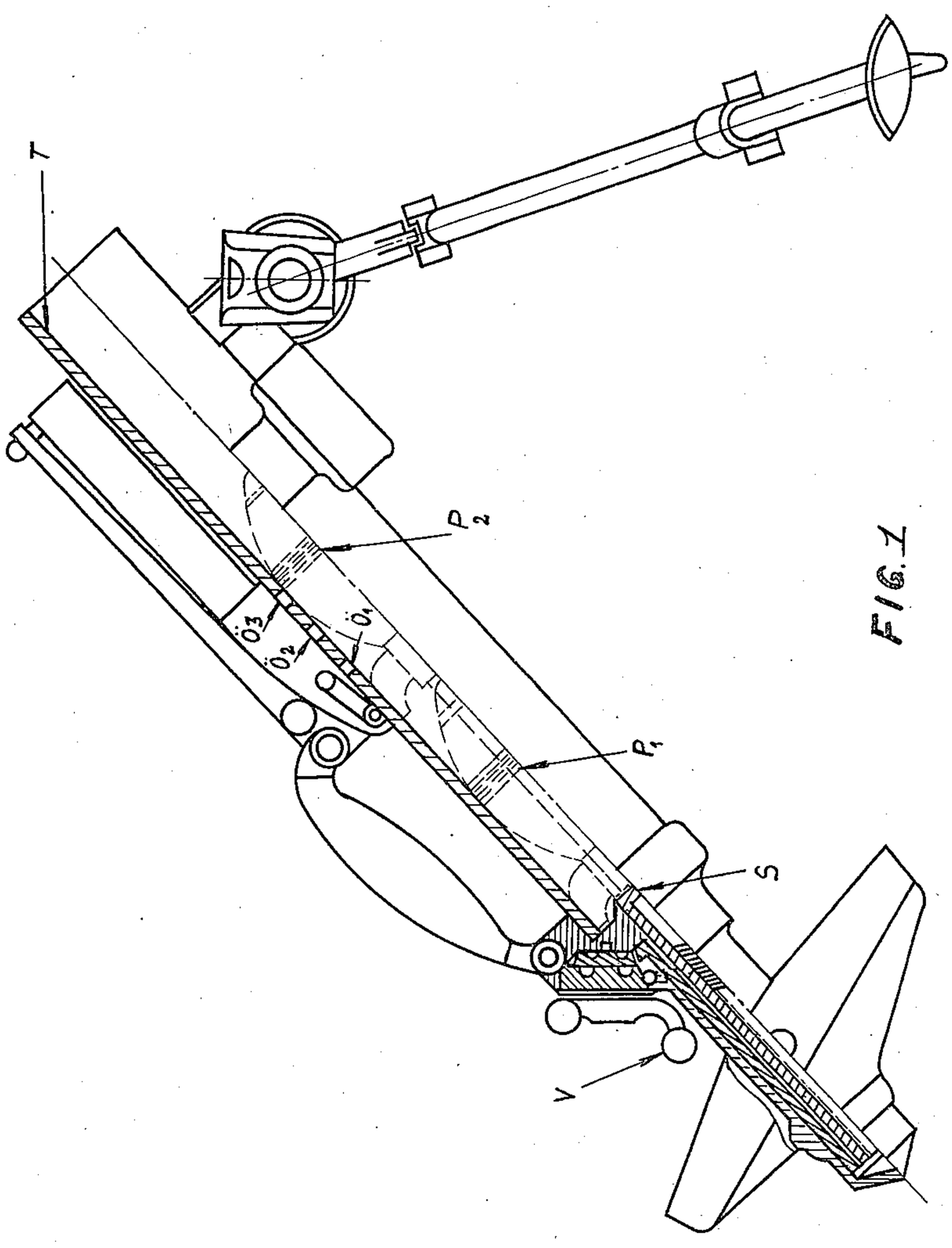

FIG. 1

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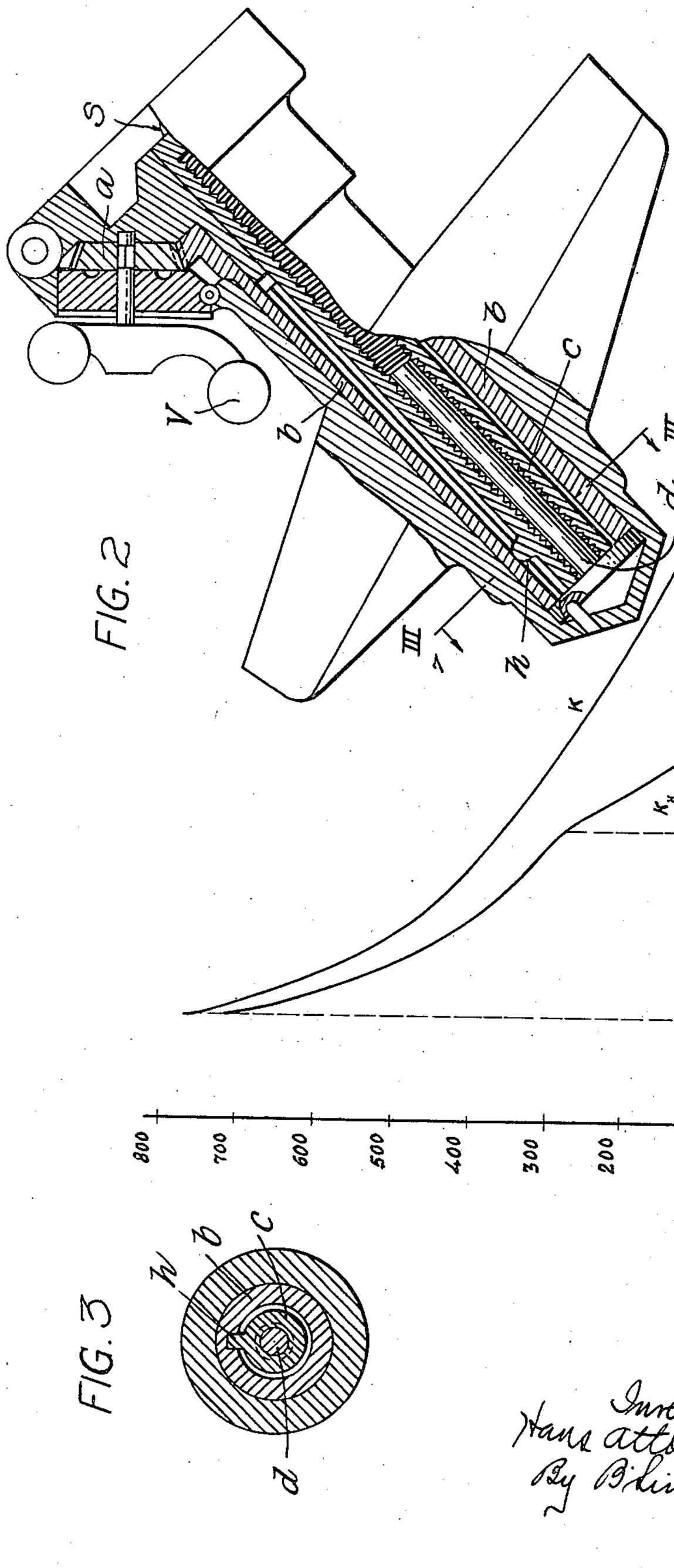

FIG. 2

FIG. 4

FIG. 3

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LIGHT MORTAR

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In Finland March 28, 1935

2 Claims. (Cl. 89—1)

My invention relates to ordnance, and particularly to mortars.

It has for an object to produce a mortar of light weight, quick and simple in its operation and having an adequate shooting range.

In the drawings, which illustrate one embodiment of the invention,

Fig. 1 is a part side elevation and part vertical longitudinal section of mortar embodying the invention.

Fig. 2 is an enlarged detail view of a portion of the structure shown in Fig. 1.

Fig. 3 is a cross section on the line 3—3 of Fig. 2.

Fig. 4 is a diagram illustrating the action that takes place when my mortar operates.

In most armies the need of a light 40 to 65 millimetre mortar has been long felt. To fulfil the requirements of practice the operation of a gun of this kind on the battlefield should, however, be extremely simple and quick. For this purpose efforts have been made, although with poor success, to fire a winged shell by the use of one single propellant charge placed in the base of the shell. It has, however, been found extremely difficult to obtain the large variety of shooting ranges simultaneously required and varying between 65 and 750 metres. On regulating the shooting range by changing the angle of elevation it is necessary to direct the gun almost vertically for short shooting ranges. An elevation range of 75°, corresponding to half of the maximum shooting range, offers considerable practical drawbacks and in such constructions, in which the shooting range is regulated by changing the elevation angle of the tube, one has to fall back upon the use of four different auxiliary propellant charges or relays, in which cases the shooting ranges are 800, 650, 350, 200 and 100 metres respectively. Various efforts have been made to simplify the operation of the gun by using a constant elevation angle. A deviation of 10° or less of the angle of elevation from the 43° which correspond to the maximum shooting range is not of material consequence because of the very small change in the shooting range caused by this deviation. In this case it is sufficient to direct the gun in the direction of the target and as, on this shooting range, the transversal inclination of the pointing device has a considerably smaller influence than for large elevation angles, the operation of the gun is thus considerably simplified while its accuracy in practice is greatly improved.

Leaving, therefore, the regulation of the shooting range by changing the angle of elevation and by using a variable propellant charge out of consideration as being impracticable, there is still available regulation by the aid of the gas leakage opening and by varying the volume of the gas chamber behind the shell. The regulation by the leakage of the gas was in use, among others, in the British and Polish armies, but after a short period the use of this construction was abandoned. The cause for this was that so far it has not been possible to construct the rather complicated mechanism required for the closing and opening of the openings made at fixed points along the tube so that the same would operate accurately in practice, even with frequent cleaning. Regulation by the use of a variable volume of the gas chamber behind the projectile has likewise been employed in a construction, in which the starting point of the projectile was pushed slightly forward to obtain a larger gas chamber.

As a slightly enlarged gas chamber reduces considerably the gas pressure, this system has certain advantages, among others, by reducing the dispersion in firing at medium shooting ranges. Although a slight displacement of the starting point of the projectile has, at the beginning, a relatively great influence on the shooting range, the continued displacement of the same is of less importance. As, to obtain a certain accuracy, a certain expansion allowance will further be required and as the placing of the starting point of the projectile too near to the mouth of the tube offers other considerable drawbacks, the regulation according to this method has been used only in connection with a variable propellant charge.

The present invention relates to a construction by which the possibilities of regulation by the aid of the gases for largely different shooting ranges are combined with the advantages of a variable volume of the gas chamber, of a low pressure and of the accuracy obtainable on medium shooting ranges without requiring any mechanism for the opening and closing of the gas openings and the drawbacks adhering therein. In principle the invention is based upon the fact that the starting point of the projectile in the tube may be changed, for instance, by the aid of an adjustable percussion pin. During the first stage of this movement the shooting range is regulated chiefly by enlarging the gas chamber. When the projectile is further displaced, the girdle of the same will close one or more of the gas openings which are, generally, con-

stantly open. If the starting point is near to the rear end of the tube, the speed of the projectile on passing the openings will be great and the period of time during which the gases may leak through the openings will be relatively short; further, the gases are to some extent cooled by the work effected by them. The influence of the openings is, in this case, relatively small.

On the other hand, when the starting point of the projectile is near to the first opening, the speed of the projectile is smaller and the influence of the openings many times greater. When, finally, the starting point of the projectile is still more advanced, the girdle of the projectile will, from the start of the movement, bare the opening or openings so that the projectile as a whole will operate in the same manner as a plunger vane in a gas regulating device and thus enable the attaining of the shorter shooting ranges.

In the drawings T designates the tube of the mortar which is provided with the various leakage openings, O^1, O^2, O^3, etc. The percussion pin is indicated by S, while V is a crank to turn the bevel gear *a* and thereby turn the bushing *b* through meshing gear *g*. P_1 and P_2 designate the various starting points of the projectile in the tube. The pin S has a sleeve *c* which is caused to rotate by means of a stud and slot connection *h* between the sleeve *c* and the bushing *b*.

A fixed screw spindle *d*, having threaded engagement with sleeve *c* causes the rotation of said sleeve *c* to move the percussion pin and sleeve backward and forward, accordingly as the crank V is turned in one direction or the other.

In Fig. 2 the curves K illustrate the effect of the change of the starting point of the projectile upon the shooting range, starting from a point, at which the volume of the gas chamber is 15% of the total volume at the moment when the projectile leaves the tube. The curve K_0 illustrates in similar manner the effect of the change of the starting point of the projectile when leakage openings are provided in the tube according to this invention so as to obtain shooting ranges between 70 and 700 metres.

I claim:

1. In a light mortar of the character described, a barrel, means closing the lower end of the barrel, said means including a longitudinally shiftable firing pin and sleeve, said barrel having a series of leakage openings located normally in advance of the shell to be fired, and means to advance said firing pin and sleeve to position the shell so that its accurately ground belt will act to close selected leakage openings, said means comprising a rotatable bushing, a crank operated device for rotating said bushing, means to connect said bushing and said sleeve together in virtue of which the sleeve may be turned about its axis and yet be free to move longitudinally and a fixed screw spindle in threaded engagement with said sleeve, in virtue of all of which the starting position of the projectile can be varied with respect to said openings to affect the shooting range.

2. In a light mortar in which shooting is generally effected with one simple principal powder charge and using a constant elevation angle of approximately 45° corresponding to the maximum range, a barrel, means closing the lower end of the barrel, said means including a longitudinally shiftable firing pin and sleeve, said barrel having a series of leakage openings located normally in advance of the shell to be fired, and means to advance said firing pin and sleeve to position the shell so that its accurately ground belt will act to close selected leakage openings, said means comprising a rotatable bushing, a crank operated device for rotating said bushing, means to connect said bushing and said sleeve together in virtue of which the sleeve may be turned about its axis and yet be free to move longitudinally, and a fixed screw spindle in threaded engagement with said sleeve, in virtue of all of which the regulation of the range is effected in the barrel by displacement of the starting point of the projectile in the barrel in cooperation with said openings substantially as described.

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