

Nov. 13, 1962

A. V. BARANOFF

3,063,161

SMALL-SCALE GUNNERY PRACTICE APPARATUS

Filed Feb. 9, 1959

4 Sheets-Sheet 1

Fig. 1

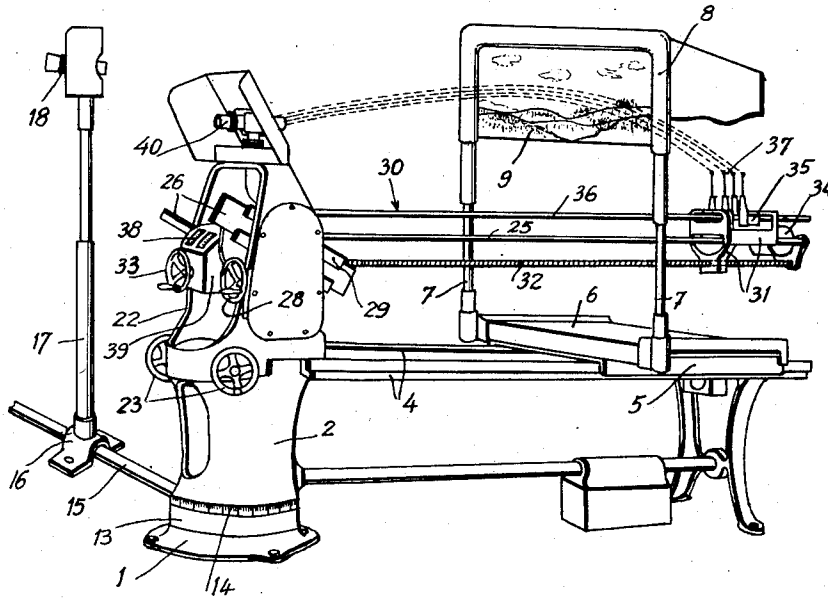
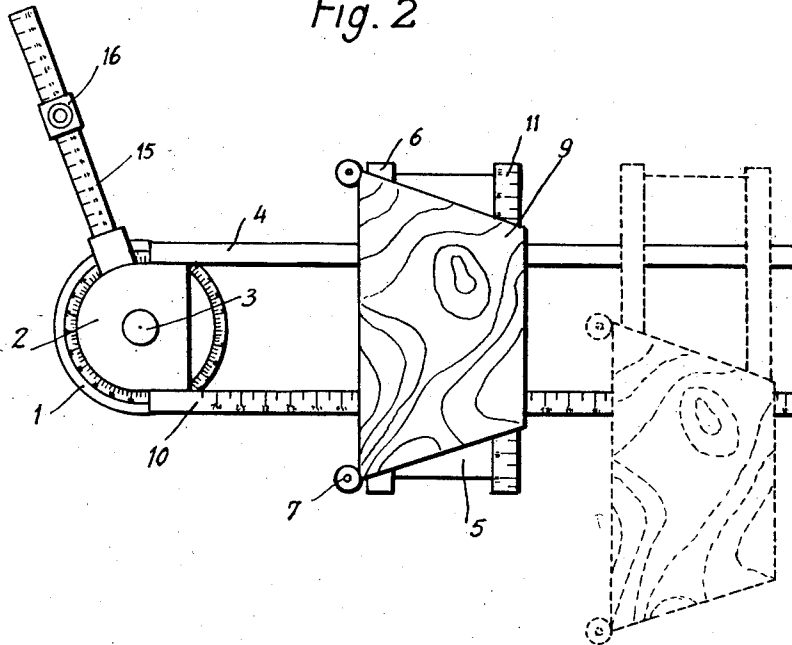


Fig. 2



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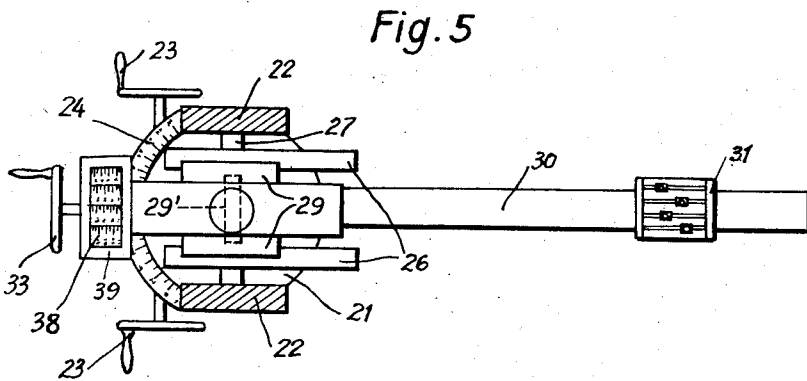
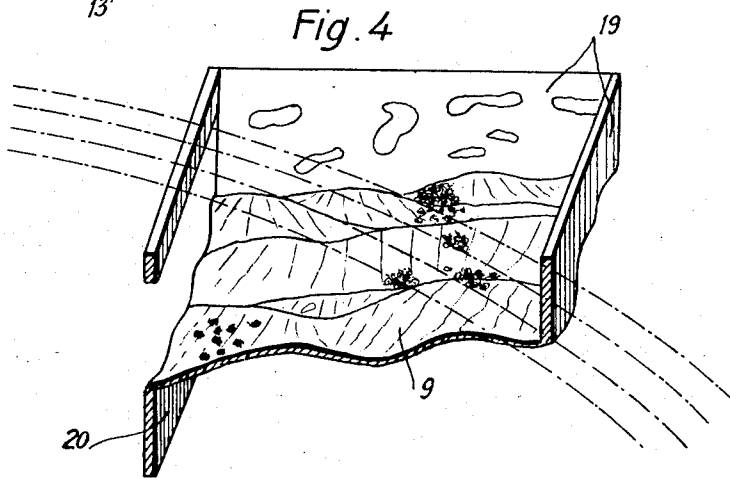
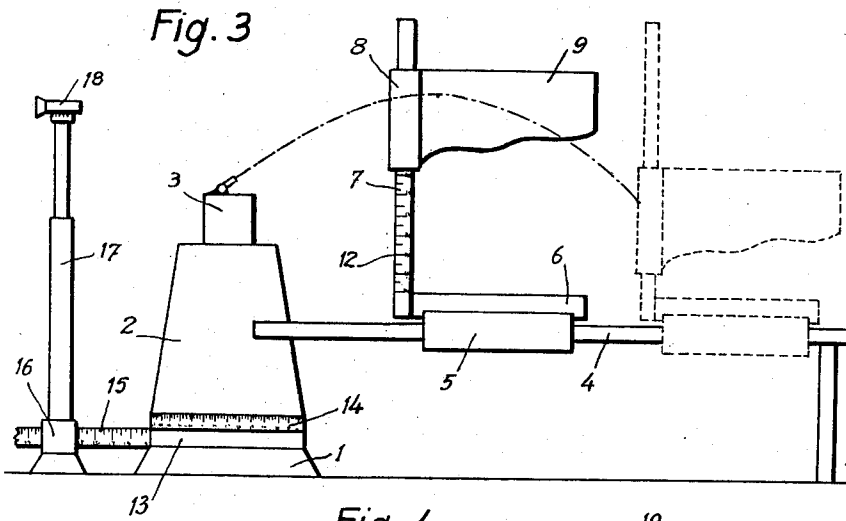
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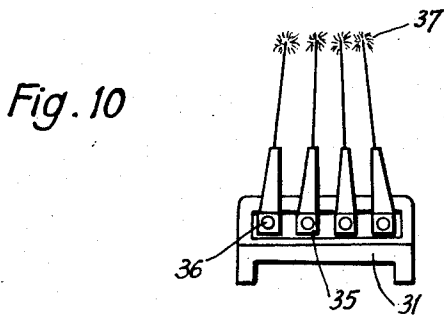
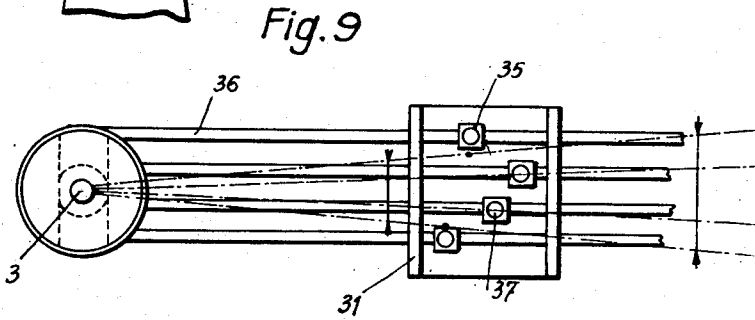
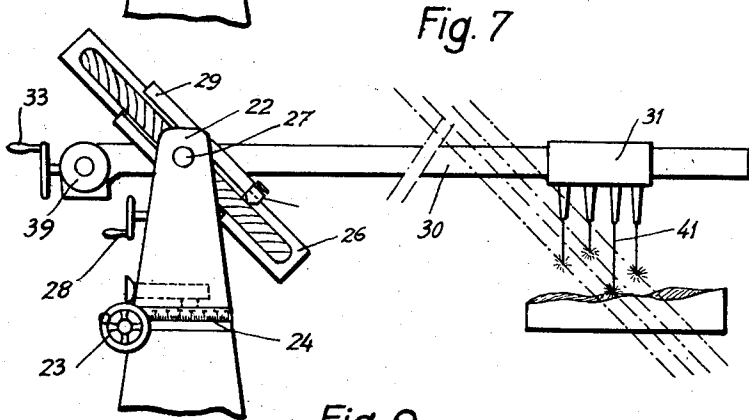
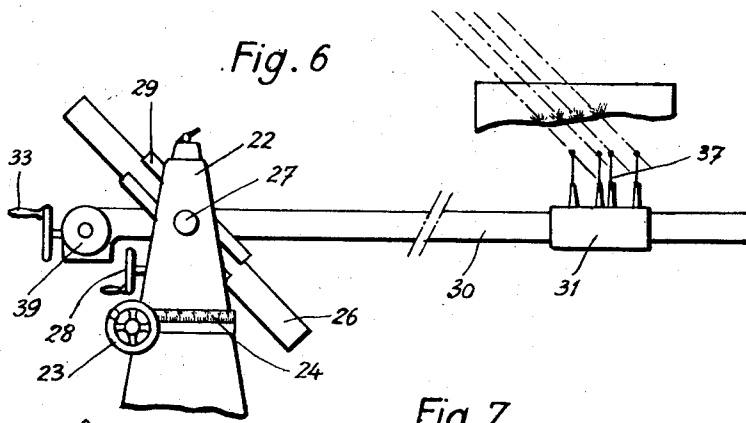
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Fig. 8

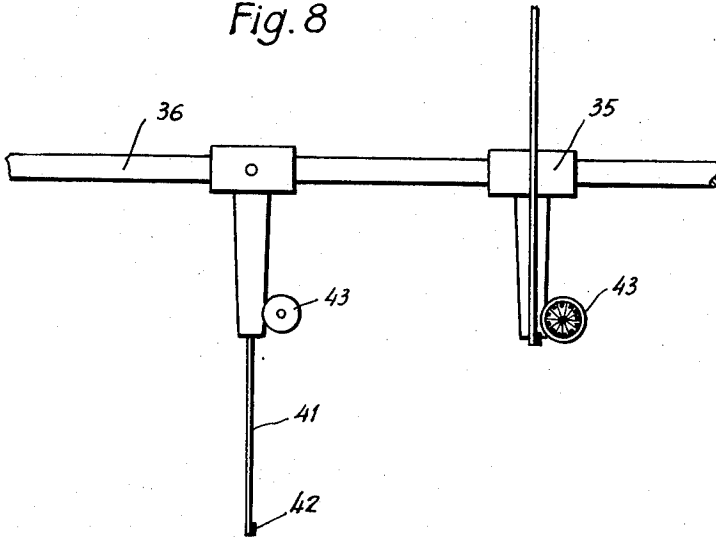
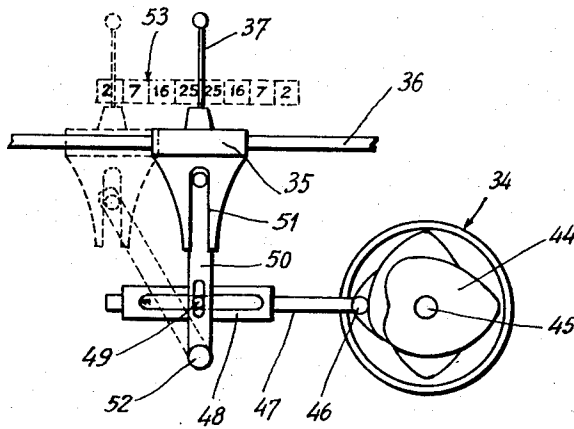


Fig. 11



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SMALL-SCALE GUNNERY PRACTICE
APPARATUS

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9 Claims. (Cl. 35—25)

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displacement of the firing plane of each gun in relation to the director gun (central gun).
Firing: Effected by means of a firing-lanyard like device.

As the following description proceeds it will be seen that the impact points of the battery guns are reproduced simultaneously or separately in the form of real burstings attended by the release of smoke and, if desired, a destructive effect, the smoke flakes or clouds having the exact scale dimensions corresponding to the relief map, model or plan, the traces of all the "shells" fired being preserved so that the firing may be subsequently criticized.

The firing may be performed without the assistance of any personnel, the gunner selecting himself on the relief map or plan, the positions of the battery, target and observation post respectively, and preparing, performing and observing his fire also by himself. No preliminary convention, chart or diagram, no special calculus outside the firing preparation are required for commencing the firing process.

The shot scattering is automatic and naturally effective according to the laws of probabilities as a function of the equipment and of the firing ranges. With this method, without any intervention of the operator, free course is given to the fantasy of chance scattering and it is not possible to modify it at will.

The firing observation is effected through gonio-sights, of which one is situated close to the battery for direct firing purposes, another gonio-sight forming part of the movable or adjustable observation post placed around the battery.

A typical form of embodiment of a small-scale apparatus for reproducing gun fire, constructed according to the teachings of this invention, will now be described by way of example with reference to the accompanying drawings forming part of this specification; in the drawings:

FIGURE 1 is a perspective view of the apparatus;

FIGURES 2 and 3 are diagrammatic plan and elevational views showing the principle of the fixed battery with the target zone and the movable observation post;

FIGURE 4 is a perspective view showing the smoke-producing relief plan, model or map corresponding to the target zone;

FIGURE 5 is a fragmentary plan view of the apparatus which shows the principle of training;

FIGURE 6 is a diagrammatic elevational view showing the principle of the elevation and of the reproduction of the last portions of the trajectories;

FIGURE 7 is a view similar to FIG. 6 but showing the apparatus during its use for time-fuse firing;

FIGURE 8 is a diagrammatic view showing the smoke-producing rod representing a time-fuse firing gun with the charger associated therewith;

FIGURE 9 is a diagrammatic plan view showing the device representing the battery chart to illustrate the principle of the relative echeloning or shifting of the firing planes of the guns in a battery;

FIGURE 10 is an elevational view showing the device representing the battery table; and

FIGURE 11 is a diagrammatic view showing the device for automatically introducing the scattering factor in the firing.

Reference will now be made to FIGS. 1 to 3 of the drawings to describe the general arrangement of the apparatus for mechanically reproducing the conventional triangle: "battery—target—observation post" and varying the relative positions of these three main elements in gun-firing, with the assistance of the topographic frame of the apparatus.

This frame comprises a fixed base 1 supporting a column 2 carrying in its center the vertical pintle 3 of the

This invention relates to apparatus for reproducing gun firing on a reduced scale for practice purposes.

Most small-scale gunnery practice apparatus now in use are characterized by certain drawbacks and defects which limit their usefulness.

Of these known apparatus, some are extremely cumbersome and costly, and require special arrangements and rooms, not to mention a skilled personnel for their operation, so that their use is restricted to military schools and large training centers, and others on the contrary are extremely simple and mostly quite elementary, so that they cannot give a true reproduction of actual firing and put the gunner in the atmosphere of actual command. Most of these simplified apparatus use diagrams, charts, sectional views of the ground in the vicinity of the target, and complicated computations must frequently be made for a single battery position and a single observation post.

In certain known arrangements the target zone itself is represented by a perspective sketch or a photograph projected onto a vertical screen, wherein the impact points are indicated by luminous spots. There are too many conventional rules and preliminary preparations for the proper representation of an artillery fire and very frequently the operation of these devices is based only on the skill and/or imagination of the operating crew.

Now the small-scale gunnery practice apparatus according to this invention is characterized by remarkable improvements in relation to known devices, in connection more particularly with the fire representation, the changes afforded as to the relative positions of the battery, observation post and target zone, its handling facility and its particularly reduced over-all dimensions.

The apparatus of this invention is further characterized notably through the following features: Its principle is based on the use of a fixed battery and of a relief plan in connection with an observation post movable with respect to said battery, the mechanical construction of the apparatus consisting essentially in disposing the battery at the hinge point of a topographic frame arranged to permit the materialization and accurate solution in the space of the triangle defined by the positions selected for the battery, the target and the observation post. Under these conditions, the fire reproduction may be effected with accuracy and therefore on a small scale (for example 1:5,000), so that the firing-range may be relatively large, for example 40 square miles or more on this reduced scale, with target zones of 4 or 5 square miles, consisting of interchangeable relief maps, plans or models, while reducing the over-all dimensions of the apparatus which can thus be easily transported; therefore a space as small as 6'6" x 13' is convenient for its installation. Thus, this apparatus is particularly suitable for training gunners in their military groups (regiments, separate batteries, forts, coastal batteries, etc.).

The apparatus according to the present invention is so designed and arranged that gun-practice maneuvers and operations are similar to, and can be performed as fast as those of a modern gun. Thus:

Training: One handwheel and direct reading of the target bearing on a circular scale.

Elevation: One handwheel and direct reading of the angle of departure of each charge on the tangent scale.

Gun echeloning: Accomplished by angular horizontal

battery, the latter being described presently to illustrate its mechanical structure. It further comprises a longitudinal guideway 4 solid with the column 2 and adapted to carry and guide a longitudinal slide 5 carrying in turn a transverse guideway supporting and guiding a transverse slide 6. The latter has mounted thereon a pair of vertical uprights 7 on which a vertical frame 8 is slidably mounted, this frame 8 supporting the relief map or model 9 corresponding to the target zone.

The three guideways are each provided with a graduated scale 10, 11, 12, respectively, corresponding to the rectangular co-ordinates X, Y and Z of the training zone.

Under these conditions it is clear that a battery may be set in a position well defined after the relief map or model by simply bringing the two slides 6, 5 and the frame 8 in the scale positions corresponding to the rectangular co-ordinates of the battery. Thus, the adjustment is effected as if the battery itself had been shifted.

The observation post is positioned accurately with respect to the battery. To this end, there is provided an annulus 13 concentric to the pintle 3 of the battery column and adapted to rotate relative to a circular vernier 14 solid with the column and carrying a bearing scale. In addition a lateral arm 15 constituting a horizontal guide rod solid with the annulus 13 carries a slide 16 supporting a vertical telescopic post 17 of which the upper element supports in turn the observation or gonio sight 18 to permit the vertical adjustment thereof.

For properly and accurately positioning the observation post (consisting of course of the sight 18) the operator firstly finds on the map the polar co-ordinates: battery, observation post and altitude; this is accomplished by simply rotating the annulus 13 to bring its reference mark or index in front of the line on scale 14 which corresponds to the bearing thus found, and subsequently displacing the slide 16 and the post 17 carried thereby until its position on the scale of the arm 15 corresponds to the distance between the battery and the observation post as read on a scale line of the lateral arm 15. The altitude of the observation post is given by the vertical displacement in the post 17 of the telescopic rod supporting the sight 18. Thus, the geometrical and mechanical problems of accurately positioning in the space the three points defining the firing conditions as in actual training practice are solved very easily.

FIGURE 4 illustrates the relief map, plan or model 9 corresponding to the target zone and reproducing on a reduced scale (the actual firing scale) a real ground made with precision from a map. This plan or model consists of fine-mesh wire gauze moulded on a relief pattern or form and mounted on a frame, the vertical walls of this frame, as shown, reproducing the relief contours. In order to facilitate the access of members materializing the end portions of the trajectories to the lower face of this model, as will be explained presently, the frame consists of three vertical walls 19 secured to the wire gauze above the relief structure and of a fourth wall 20 (the front one) extending downwards from the front edge of the model.

Moreover, the model comprises a thin "earth" film consisting of a layer of smoke-producing paint coating the meshes of the wire gauze; thus, when this paint is hit by electrical rods to be described presently, the smoke flake simulating a percussion fire or burst is produced at the firing scale, which corresponds to one mesh of the wire gauze.

In addition this coat of paint is covered on the upper face of the relief map with a coloured coating reproducing the planimetric details.

From the holes made through the layer it is possible to determine the fire efficiency, and after this examination they are stopped with smoke-producing paint and coloured powder or paint is finally spread on the whole to merge the previously hit points into the landscape. Certain targets like houses, shelters, bridges, batteries,

etc. may be reproduced on the relief map by marking them out on the wire gauze meshing; they consist preferably of small blocks of smoke-producing paste which explode when hit by the electrical rods, thus simulating the destructive action likely to occur during the real firing.

The mechanical battery designed for reproducing the final portions of the trajectories in the firing zone is mounted on the pintle 3 of the battery column.

This battery comprises (see FIGS. 5 and 6) a mounting 21 consisting of a circular plate on which a pair of vertical side plates 22 are mounted, this mounting being adapted to pivot about the vertical pintle 3 carried by the column 2.

The pivoting or swivelling motion of the mounting is controlled in the known way by means of a screw carried by the mounting and meshing with a toothed sector rigid with the column. This screw is actuated by means of a pair of training wheels 23 whereby the battery may be set in the desired direction readable on a circular vernier 24 graduated in bearings.

The mounting carries a cradle consisting of a pair of guide members 26 rotating in a vertical plane about a pair of trunnions 27 rigid with the mounting side plates 22. This cradle may be inclined from 0 to 75 degrees, for example, and carries to this end a toothed sector meshing with a screw solid with the elevating-wheel 28 carried by the mounting. This inclination is read on a cylindrical vernier indicating the elevation corresponding to the different charges.

Moreover, a so-called "inclination" carriage 29 is slidably mounted on the guide members 26 of the cradle and carries in turn in its central region a horizontal trunnion 29'. This carriage 29 is displaceable along the guide members 26 with the assistance of a lever and a lifting chain (not shown) corresponding to the firing lanyard.

A so-called "battery platform" or "bridge" assembly 30 consisting of a compound beam is mounted for pivotal motion in a vertical plane about the aforesaid horizontal trunnion carried by the inclination carriage 29, this battery platform or bridge serving the purpose of materializing the firing planes of the battery guns, there being four guns in the battery of this example.

Slidably mounted on a pair of rods 25 of the battery platform (see FIG. 1) is a slide or carriage 31 of which the longitudinal movements are controlled by means of a screw 32 (a chain also constituting a suitable control means therefor) actuated from a control wheel 33. This carriage is mechanically connected through the scattering device 34 and in the manner to be described presently to four slides 35 carried by four guide rods 36 extending through the carriage and adapted to pivot about a vertical axis of the battery bridge overlying, and in alignment with, the pintle 3 thereof (see FIGS. 9 and 10).

The four slides 35 carry each an electrical rod 37 provided with a heating head, these heating heads being adapted, in conjunction with the smoke-producing relief map, to reproduce percussion burstings. The guide rods 36 are normally disposed at such a relative spacing that the positions of the heads of the rods 37 correspond to the typical chart of the battery concerned, with due consideration for the scale reduction.

The echeloning or shifting operation is extremely simple and consists in causing rods 36 to pivot about the aforesaid vertical axis of the battery bridge with the assistance of separate control knobs (not shown) displaceable in front of graduated sectors indicating the angle of echeloning or shift of each gun. This echeloning may also be obtained by actuating the guide rods in order to cause the slides carrying the electrical rods 37 to pivot in a direction across the battery platform or bridge, so that in this case it will be possible to carry out directly orders expressed in yards or feet.

Further, the gun echeloning or staggering in the firing depth (obliquity of chart setting) may be obtained by

mounting the rods in supporting members adapted to oscillate in the longitudinal direction with respect to the slides.

From the foregoing it will be readily understood that in this battery platform or bridge the control wheel 33 is operated as an elevating wheel since it controls the displacements of the rod-carrying slide 31 which reproduce the firing ranges readable on the elevation verniers 38 enclosed in the elevation case 39 forming an integral part of said bridge, their number corresponding on the other hand to the selected firing charges.

Thus, when the training and range elements have been set, the firing is effected by causing the battery bridge 30 and its carriage 29 to rise on the inclined plane consisting of the guide members 26 of the cradle by actuating the firing lanyard, the bridge remaining horizontal by virtue of its mounting on the carriage 29 irrespective of the variations in the cradle inclination, so that the heads of rods 37 will describe, under the smoke-producing relief map toward which they are moved, the extended final portions of the actual trajectories.

When these heads of the heating rods contact the relief map, the perforate and ignite the smoke-producing paint coating the corresponding meshes, thus creating smoke flakes or clouds as if these were produced by percussion burstings, the heating rods remaining invisible.

All the control and training operations are very similar to those accomplished with a real gun, and furthermore they are centralized on the mounting so that if necessary a single operator may perform and observe a complete firing operation without the assistance of anyone.

The observation of the fire from the battery (direct firing) or from a remote observation post (indirect firing) is effected through gonio-sights, that is, through a sight 40 adjacent to the battery and through a sight 18 at the observation post, respectively.

The electrical mechanism for firing the guns may be synchronized with a sound-producing device to imitate the noise of shell burstings.

FIGURE 7 illustrates a modified form of embodiment of the apparatus wherein the battery bridge overlies the target-containing relief map or model. The electrical rods 41 are lowered, in this case, by the same method onto the target zone according to the form of the last portions of the trajectories, so that it is possible to reproduce either time-fuse burstings along the trajectories, or percussion hits on contacting the ground. To this end small magnetized disks 42 (FIG. 8) coated with black powder or other smoke-producing substance are secured to the lower ends of the rods and adapted to be ignited when electric current flows therethrough to simulate the smoke clouds or flakes of time-fuse burstings. Small charges 43 secured on the rod-carrying slides and containing several magnetized disks as spares are adapted to re-load each rod automatically after the explosion. In the case of time-fuse firing (see FIGURE 7) the latter is effected by means of adjustable time-fuse contact stops 55 disposed on the path of the carriage 29 and beam 30 and carried by the cradle 26 where they are displaceable in front of charts corresponding to the firing flash-holes. The time-fuse scattering proper may be obtained by providing for each gun a stop on the path of the corresponding rod, or by permitting the longitudinal adjustment of the electrical rods with respect to the slides.

This modified form of embodiment of the device is also suitable for a small-scale gunnery practice apparatus for navy and coastal training.

The firing scattering is effective in a continuous, automatic manner for each gun in the battery due to the provision of the device 34 solid with the slide 31 of the battery platform.

This device illustrated diagrammatically in FIG. 11 comprises as many sets of cams 44 as there are guns in

the battery, these cams having a contour varying as a function of the firing range and of the laws of probabilities. These cams are mounted on a common or separate shaft 45 rotatably driven for example between successive firing operations from a small motor associated with the device.

For each gun, the corresponding cam 44 co-acts with a follower 46 carried by a stem 47 and urged by spring means (not shown) against this cam, the stem 47 being slidably mounted in a horizontal guideway 48, fixed in relation to the slide 31.

This stem is also guided by means of a transverse pin 49 in a vertical slot formed in an oscillating lever 50 mounted in a similar fashion at 51 in the lower portion of the rod-carrying slide 35, these levers 50 having their common axis 52 solid with the slide. Thus, and due to the cam configuration, the rod-carrying slides 35 will be displaced by distances proportional to the percentage of distribution of the shots in the conventional scattering rectangle shown diagrammatically by way of example at 53 in FIG. 11. By displacing these cams in a transverse direction (for example by acting upon their shaft) as a function of the firing range, the resulting fire scattering will also be subordinate to this factor.

Of course, many modifications and alterations may be brought to the details, forms, relative proportions and arrangements of the parts and devices constituting the apparatus of this invention, without however departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. Apparatus for small-scale artillery simulating fire comprising a relief map defining the target zone and a battery fire simulating device capable of simulating thereon the shots of guns of a battery, said device being mounted for pivotal movement in the manner of an artillery piece at a point that constitutes the origin of the trajectories, said device comprising a mounting mounted for rotation about a vertical axis, a direction aiming means adapted to actuate the mounting, a cradle mounted on the mounting, means for tilting the cradle into selected inclined positions, a sliding carriage carried by the cradle, a beam, a horizontal pivot means pivotally mounting said beam on the carriage, a slide movable on the beam in accordance with the distance of the shot and carrying elements representing projectiles, said carriage and beam being movable on the cradle upon firing the shot in such a way that the elements representing projectiles then contact the relief map describing substantially the trajectory ends, and a composite frame supporting the relief map and locating it in space in a position that is relatively adjustable with respect to the device.

2. An apparatus as claimed in claim 1, wherein said frame is simulative of a firing observation post and comprises a lateral arm mounted for adjustment about the pivotal axis of the device, a vertical telescopic post positioned on the arm and a sight supported thereby and mounted for vertical adjustment.

3. An apparatus as claimed in claim 1, wherein the relief map comprises a fine mesh wire gauze provided with a layer of smoke producing material, the layer when hit by one of the elements representing projectiles in one of the meshes of the wire gauze simulating a percussion burst at a firing scale.

4. An apparatus as claimed in claim 3, wherein the elements representing projectiles are rods having heating heads capable of igniting the smoke producing material at the mesh which is hit.

5. An apparatus as claimed in claim 1, wherein the frame comprises a supporting column, a longitudinal guideway supported by the column, a longitudinal slide slidably mounted on the guideway; a transverse guideway carried by the longitudinal slide, a transverse slide movably mounted on the transverse guideway, vertical uprights on the transverse slide, a vertical frame slidably

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mounted on the uprights to which the relief map is attached, whereby the relief map is movable in order to modify its position relative to the device.

6. An apparatus as claimed in claim 1, wherein a plurality of slides adapted to carry the elements representing projectiles are provided and are carried by guide rods corresponding to the firing plane of each simulated gun, said guide rods being manipulatable in order to obtain the desired burst pattern. 5

7. An apparatus as claimed in claim 1, wherein means is provided for effecting dispersion in the firing of the shots and includes a mechanical connection between the slide and the elements representing projectiles, said connection being supported by the slide and comprising rotating cams of a number equal to those of the simulated guns and serving to produce in the firing plan a displacement of the elements in accordance with the laws of dispersion. 10 15

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8. An apparatus as claimed in claim 1, wherein said elements representing projectiles are rods having heating heads provided with magnetized discs, said discs being coated with a smoke producing material.

9. An apparatus as claimed in claim 1, wherein said beam overlies said relief map and wherein adjustable stops are provided on said cradle for limiting the downward movement of said beam towards said relief map upon firing.

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