No. 785,895. PATENTED MAR. 28, 1905.

J. KRONE.

PORTABLE RECOIL GUN.

APPLICATION FILED AUG. 20, 1902.

3 SHEETS—SHEET 1.

Fig. 1.

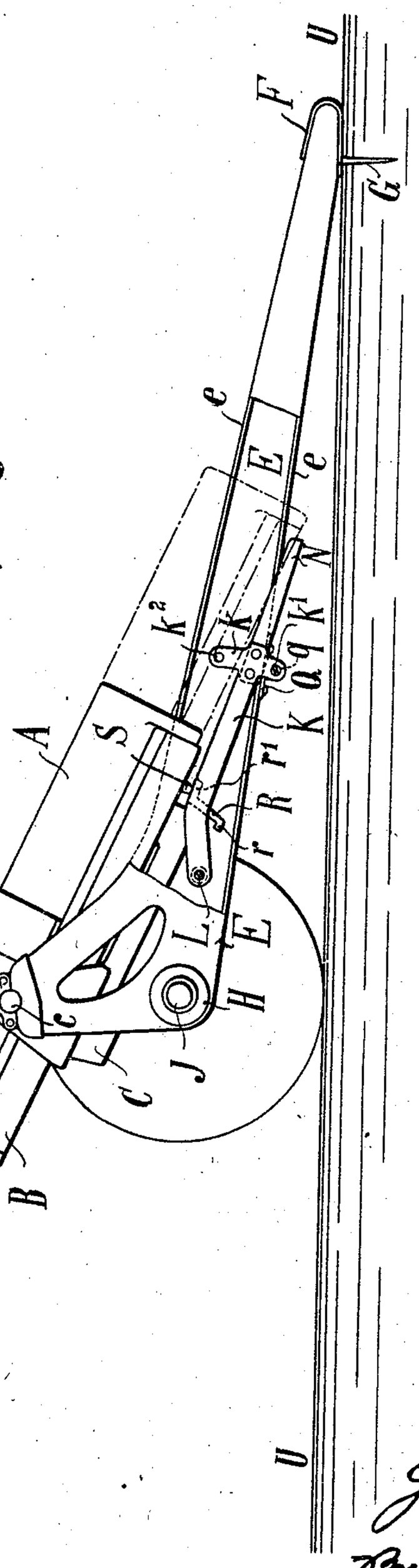
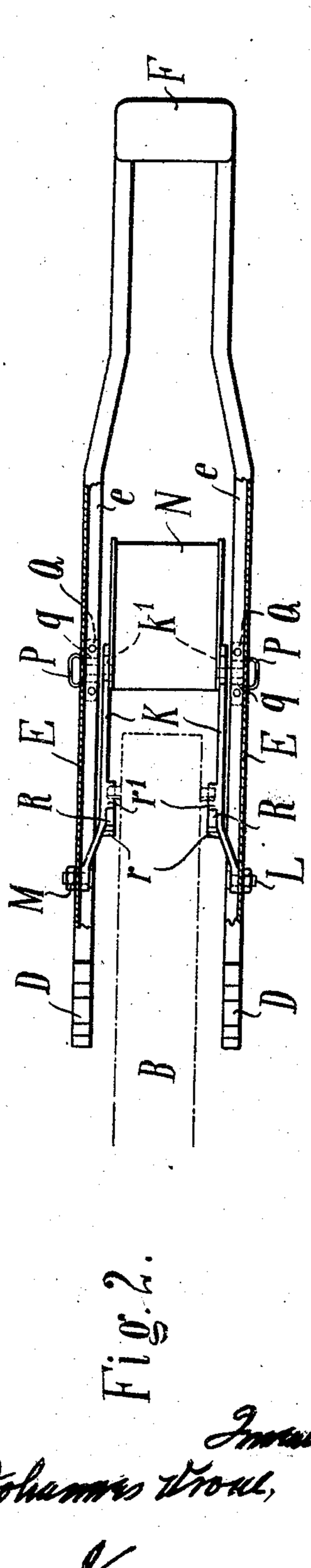


Fig. 2.



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3 SHEETS—SHEET 2.

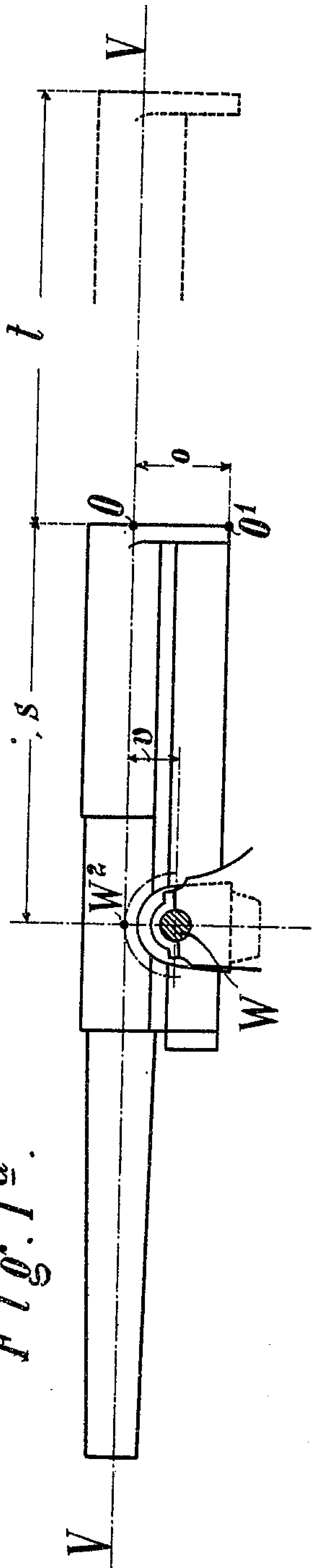

Fig. 1a.

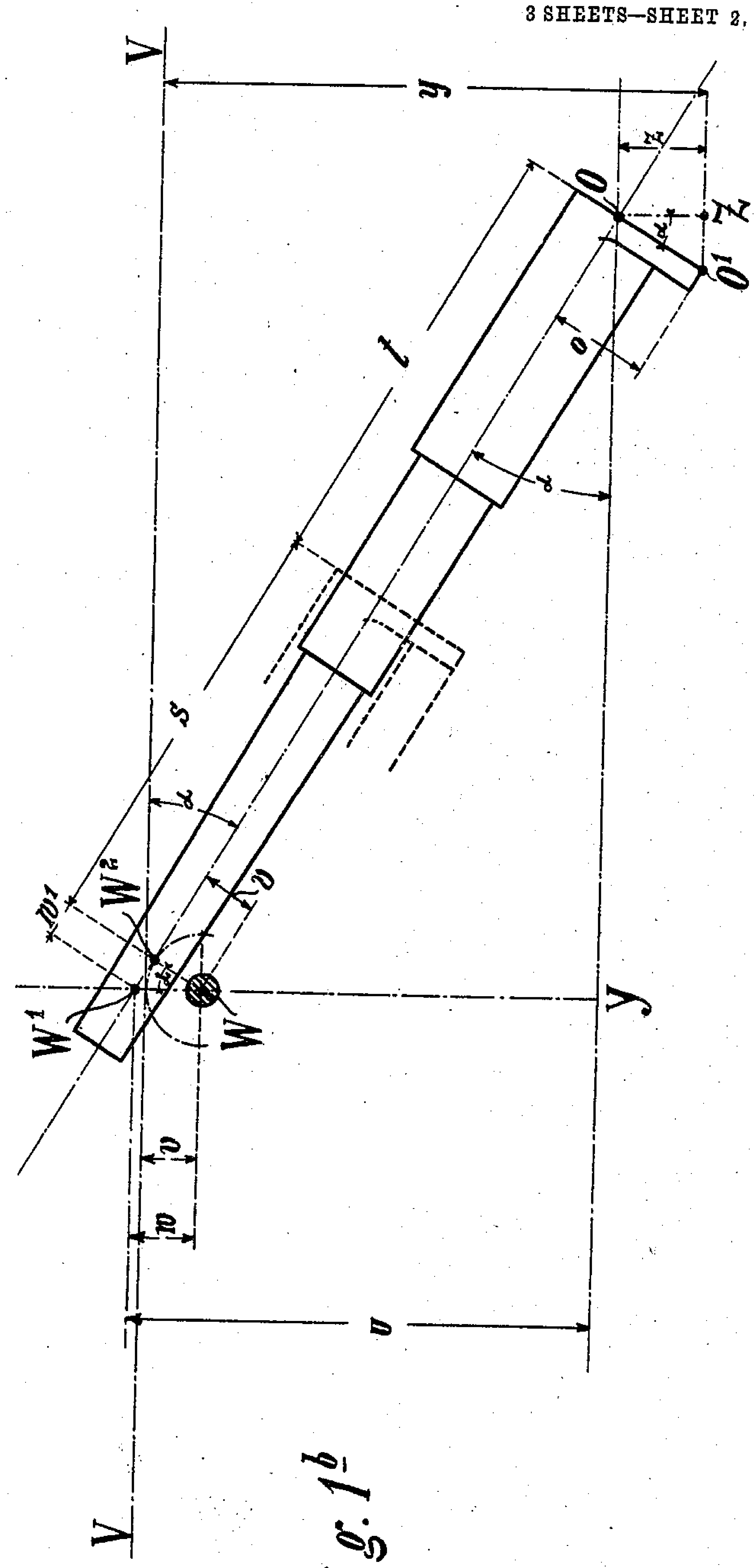

Fig. 1b.

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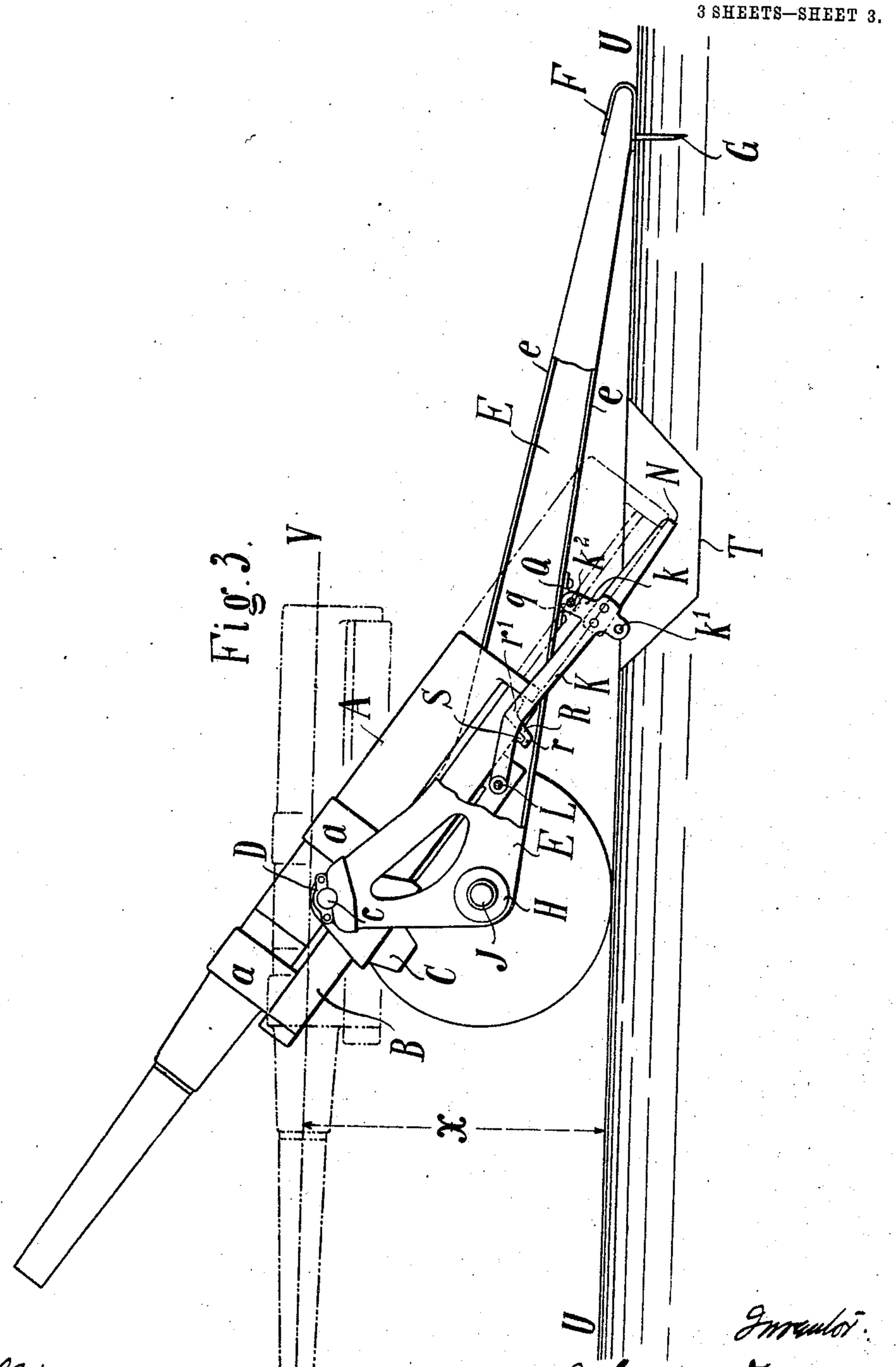
3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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PORTABLE RECOIL-GUN.

SPECIFICATION forming part of Letters Patent No. 785,895, dated March 28, 1905.

Application filed August 20, 1902. Serial No. 120,417.

To all whom it may concern

Be it known that I, JOHANNES KRONE, a subject of the Emperor of Germany, and a resident of 56 Bismarckstrasse, Essen-on-the-Ruhr, Germany, have invented certain new and useful Improvements in Portable Recoil-Guns, of which the following is a specification.

This invention relates to portable guns designed to throw heavy projectiles at very great ranges and which consequently have to be fired at great elevations. To this group of guns siege-guns especially belong, which, as is well known, have heretofore possessed a comparatively great firing height. For consideration of protection, however, and in the interest of increasing efficiency, maintaining stability, reducing weight, and facilitating serving the gun it is also desirable in such guns to get along with the least possible firing height. The accomplishment of these requirements involves very little difficulty with guns in which the barrel has its trunnions resting immediately in trunnion-bearings on the carriage; but it is very difficult or rendered apparently impossible when in order to prevent recoil of the entire gun the gun-barrel is given a comparatively long recoil. The lower limit of the firing height would thus appear to be that at which the gun would strike the ground in recoiling. Contrary to this apparent fact the subject-matter of the present invention comprises a portable recoil-gun the firing height of which is below that at which in its greatest firing elevation the gun-barrel in recoiling would just strike the plane of the surface upon which the trail and carriage-wheels rest. In other words, the gun-barrel is supported upon its mount with the axis of its bore when in horizontal position at a height above the plane of the surface upon which the gun-mount stands less than the vertical distance below said horizontal position of the axis reached by the lowermost part of the barrel in recoiling when fired at an extreme angle of elevation. Means are thus provided permitting the barrel to recoil beyond the plane upon which the gun stands, so that a gun-barrel of a given caliber, while permitted full length of recoil, is mounted so much lower on its carriage than has heretofore been practicable that better protection and facility for serving the gun, increased efficiency and stability, and reduction in weight of the mount are secured.

An illustration of a gun of this character is given in the accompanying drawings, in which—

Figure 1 is a side elevation of a gun with one of the wheels omitted, a part of the forward-lying check of the carriage being broken away, the gun-barrel being shown at such an elevation as will prevent the gun-barrel when at the position of extreme recoil (shown in dotted lines) from reaching the plane of the surface beneath the trail and the wheels of the gun. Figs. 1^a and 1^b are diagrammatic views showing the movements of the gun-barrel. Fig. 2 shows the body of the carriage in plan view, the cradle being shown in broken lines. Fig. 3 is a side elevation corresponding to Fig. 1, in which the gun is shown at the greatest possible elevation, the position of the gun-barrel at the moment of extreme recoil being shown in broken lines.

The gun-barrel A is guided on the cradle B through the medium of rings *a*, which cradle contains a fluid-pressure brake and a recuperator device. The cradle B is mounted in a saddle C through the medium of a perpendicular trunnion. (Not shown in the drawings.) The saddle C carries the horizontal trunnions *c*, which rest in the bearings D of the checks of the carriage. The carriage is of bifurcated form and comprises the checks E of channel-form sections, which are firmly secured together through the medium of a trail-plate F. The trail-plate F carries a fixed spade G. The wheel-axle J is mounted in the checks of the carriage by the bearings H in any well-known manner. The firing height represented by the line X, Fig. 3—that is to say, the perpendicular distance of the axis V V of the bore, when the gun-barrel is in horizontal position, from the plane of the surface upon which the carriage-wheels and trail rest, represented by the line V V—is so small that the gun-barrel will intersect this plane when

recoil takes place at greatest firing elevation. With the gun described it is therefore obvious that firing can take place without further arrangements at an elevation corresponding approximately to the elevation shown in Fig. 1. If, however, it is desired to fire the gun at an elevation materially exceeding this—as, for example, at the greatest possible elevation (illustrated in Fig. 3)—the gun-barrel must intersect in recoiling the plane U U of the surface upon which the wheels from the trail rest—that is to say, the gun breech or base must strike the earth. In order to prevent this, a method is employed, according to the present invention, which consists in excavating a recess in the ground between the carriage-wheels and the trail when firing at extreme elevations, into which recess the gun-barrel may enter in recoiling. In order, on the one hand, to avoid the formation of this recess when it is not necessary, and, on the other hand, to insure against forgetting to provide the recess when the firing elevation of the gun necessitates the same, a device is arranged upon the gun which marks those elevations of the gun at which the excavation would be required. This device, according to this invention, consists in an abutment adjustably mounted on the carriage in the track or path of the cradle in such a manner that it must be shifted from its position before the gun-barrel can be given such an elevation as will require that the recess or excavation be formed for it. For this purpose two angularly-bent lever-arms K are connected to the inner faces of the carriage-checks through the medium of bolts L and nuts M, so as to be capable of swinging in a vertical plane, which lever-arms are securely connected and caused to swing together by a tray-formed plate N. The levers K are offset near their pivotal points from the carriage-checks sufficiently to permit them to swing past the flanges *e* of the carriage-checks E. The ends of the lever-arms K are formed into projections *k*, which are curved concentrically with the pivotal points and each provided with two perforations *k'* and *k²*. On the face of the lower flange *e* of each carriage-wall presented toward the ground is formed an eye Q, the bore *q* of which is of the same diameter as the bores *k'* and *k²* of the projections *k* and located at the same distance from the turning-axis of the parts K N as said bores *k' k²*, so that the latter may be brought to register with the bores *q*. By inserting locking-bolts P through the bores *q* of the eyes Q and through the bores *k'* or *k²* of the projections *k* the swinging member K N may be coupled with the carriage either at its upper or at its lower extreme position. At the angles of the lever-arms K are arranged abutments R of double-angle section, on the ends *r'* and *r* of which the cradle B can rest through the medium of lateral lugs S. The swing K N is of such longitudinal and transverse dimensions that the breech of the gun-barrel when at the greatest elevation and recoiling never overreaches it in a direction perpendicular to the gun's axis.

The minute arrangement of the above-described device is as follows: Ordinarily the swing K N is in its upper position, in which it is held by the engagement of the bolts P in the bores *q* and *k'* of the eyes Q and projections *k*, respectively. The greatest elevation of the gun-barrel attainable with the swing in this position is reached when the lugs S of the cradle B impinge upon the ends *r'* of the abutments R, Fig. 1. This elevation is so selected that the gun-barrel in recoiling will under no circumstances project its rear end beyond the plane of the surface upon which the wheels and the trail of the carriage rest. If, however, the gun is to be fired with an elevation exceeding that permitted by the above restriction, in every case the swing K N, and with it the abutment R, must be shifted to the other position by loosening the coupling P Q *k'*. Owing to the form of the swing K N, this will only be possible when a recess has first been excavated in the surface between the carriage-wheels and the trail, and this excavation will necessarily have suitable depth and form for firing at the greatest elevation, when the swing K N can be depressed, without touching the ground, into its lowest position (indicated by registering of the bores *k²* and *q*) and coupled in such position with the carriage through the medium of the locking-bolt P. In consequence of the differently-bent trajectories which the lugs S of the cradle and the extensions R of the swing run in the movement of the cradle and of the swing the lugs S while the swing is in its lower position do not rest upon the end *r'* of the abutments R, but upon their ends *r*.

The scope within which the invention shall lie, according to the firing elevation of the gun, is calculated for a specific case in the accompanying drawings, having reference to Figs. 1[a] and 1[b]. In these figures the following parts are indicated: *y*, the vertical offset of the point O' from the horizontally-lying sighting-axis V V when the gun-barrel is in the offset of greatest possible elevation and at the same time of extreme recoil, Fig. 1[b]; *s*, the distance of the face of the gun-breech from the trunnion W of the gun-barrel in firing position; *t*, the length of the barrel recoil; *o*, the distance between the points O and O'; *v*, the distance of the point W² from the axis of the trunnion W; α, the greatest elevation, Fig. 1[b]. Furthermore, the following assisting dimensions are introduced: *z* represents the perpendicular offset of the points O and O' at the point of greatest possible elevation and the extreme recoil position of the gun-barrel. *u* is the vertical offset of the point O from the point W', the point of its section of a vertical plane through the trunnion-axis W and the sighting-axis V V when

the gun-barrel, Fig. 1[b], is in the position of greatest possible elevation and extreme recoil. w is the distance of the point W′ from the trunnion-axis W, Fig. 1[b]. w' is the distance of the points W′ and W².

From the above it follows that

$y = z + u - w + v.$

$z = o. \cos. \propto$ (of $\triangle$ O O′ Z.)

$u = (s + t + w') \sin. \propto$ (of $\triangle$ O W′ Y.)

$w = \frac{v}{\cos. \propto}$ (of $\triangle$ W W′ W².)

$w' = v. \, t\, g \propto$ (of $\triangle$ W W′ W².)

$y = o. \cos. \propto + (s + t) \sin. \propto + v. \, t\, g \propto \sin. \propto - \frac{v}{\cos. \propto} + v.$

$y = (s + t) \sin. \propto + o \cos. \propto + \frac{v \sin.^2 \propto}{\cos. \propto} - \frac{v}{\cos. \propto} + v.$

$y = (s + t) \sin. \propto + o \cos. \propto - \frac{v}{\cos. \propto}(1 - \sin.^2 \propto) + v.$

$y = (s + t) \sin. \propto + o \cos. \propto - \frac{v \cos.^2}{\cos. \propto} \propto + v.$

$y = (s + t) \sin. \propto + (o - v) \cos. \propto + v.$

It thus appears that when X indicates the firing elevation of the gun X is to be less than y.

Having thus described the invention, the following is what is claimed as new therein:

1. In a portable gun, the combination of the gun-barrel, a mount for said barrel upon which it may be elevated and recoil means permitting the barrel to recoil beyond the plane of the surface upon which the mount stands when the barrel is elevated to extreme elevation, thereby permitting better protection, increased efficiency and stability, reduction in weight and greater facility for serving the gun.

2. In a portable recoil-gun, the combination with the mount, of the gun-barrel and recoil means permitting the gun-barrel to recoil; the gun-barrel being supported upon said mount, with the axis of its bore, when in horizontal position, at a height above the plane of the surface upon which the gun stands, less than the vertical distance below said horizontal position of the axis, reached by the lowermost part of the barrel in recoiling, when the gun is fired at extreme elevation, thereby permitting better protection, increased efficiency and stability, reduction in weight, and greater facility for serving the gun.

3. In a portable gun, the combination of the gun-barrel, a mount for said barrel upon which it may be elevated and recoil means permitting the barrel to recoil beyond the plane of the surface upon which the mount stands, when the barrel is elevated to extreme elevation, for the purposes set forth, and means preventing the elevation of the barrel to an extreme angle which would cause it to intersect the plane of the surface upon which the gun-carriage rests, said means being adjustable to permit such extreme elevation at will.

4. In combination with a portable recoil-gun, the firing height of which is below that size, at which in its greatest firing elevation, the gun-barrel, in recoiling, would just strike the plane of the surface upon which the trail of the gun and the wheels rest; a swinging member mounted upon the gun-carriage providing an abutment in the path of parts adjusted in elevating the gun, and restricting the elevation within the limit beyond which the breech of the gun will strike the surface of the ground in recoiling; said swing being adjustable to a lower position which permits the elevation of the gun beyond said limit, and projecting below the surface of the ground when so adjusted, so as to compel the forming of a recess within which the breech of the gun-barrel may recoil.

5. In combination with a portable recoil-gun, the firing height of which is below that size, at which in its greatest firing elevation, the gun-barrel, in recoiling, would just strike the plane of the surface upon which the trail of the gun and the wheels rest; the swing K, N, mounted on the gun-carriage and means whereby said swing is fixed upon the gun-carriage in an upper position which limits the elevation of the gun, and in a lower position, which permits the extreme elevation of the gun; said lower position of the swing causing it to intersect the plane of the surface upon which the wheels and trail, of the gun rest.

6. In combination with a portable recoil-gun, the firing height of which is below that size, at which in its greatest firing elevation, the gun-barrel, in recoiling, would just strike the plane of the surface upon which the trail of the gun and the wheels rest; the swing K, N, mounted on the gun-carriage, and means whereby said swing is fixed upon the gun-carriage in an upper position which limits the elevation of the gun, and in a lower position which permits the extreme elevation of the gun; said lower position of the swing causing it to intersect the plane of the surface upon which the wheels and trail of the gun rest, and the longitudinal and transverse dimensions of said swing being such that the breech of the gun-barrel when the latter is in position of extreme elevation, nowhere overreaches the swing in a direction perpendicular to the axis of the bore of the gun.

The foregoing specification signed at Düsseldorf this 8th day of August, 1902.

JOHANNES KRONE.

In presence of—

WILLIAM ESSENWEIN,

PETER LIEBER.