

Philadelphia's Tear Bombs and Mobs

By William A. McGarry

A DEMONSTRATION that might have been billed as the re-enactment of a brisk raid through no man's land on the western front was held recently under police supervision on the meadows of South Philadelphia, serving to introduce the bluecoats of the Quaker City to a new offensive weapon against bandits and mobs—a weapon developed out of the poison gas warfare that was so bitterly denounced when it was first introduced. By actual tests against fifty stalwart members of the police "rookie squad" who courageously volunteered for the test, it was shown that tear gas bombs of a type recently invented are quite as effective as rifle or revolver fire, and far less deadly.

Two types of these bombs are now or shortly will be on the market for use not only by the police, but also by banks, storekeepers and paymasters. One contains the familiar lachrymose gas, the other what is known as "stunnic" gas. As its name indicates, the latter stuns one who inhales it, leaving him virtually unconscious and utterly helpless for some minutes. The chemical constituents of the mixtures used in the bombs for the Philadelphia demonstration are withheld by the inventor. Experts of the chemical warfare section, however, are authority for the statement that this service has worked out several formulas for both types of bombs, all of which may be used without permanent injury.

This feature of the new gases and particularly of the lachrymose gas led Superintendent William B. Mills of the Philadelphia police to determine, after the demonstration, to establish five gas bomb squads. It is what makes highly probable the adoption of the bombs by banking institutions. Few persons care about the bandit or the bank burglar and it is a matter of little concern whether or not he is permanently injured. But gas clouds are no respecters of persons and under many conditions where their use might be advisable to stop crime innocent bystanders also would be caught.

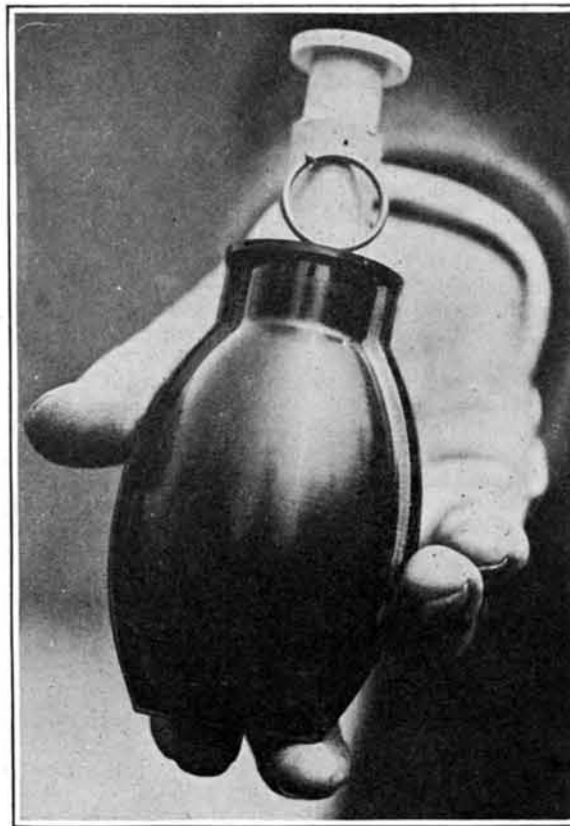
According to a physician who handled thousands of cases of all kinds of gas poisoning on the Western front in France and who is now in charge of convalescents at the United States Public Health Service Hospital in Philadelphia, the effect of the tear bombs shown to the police in that city is identical with that caused by the lachrymose gas used by the Germans during the last few months of the war, although the chemical formula may be different. The gas causes irritation of the conjunctiva, the mucous membrane of the lining of the eyelids and of the anterior part of the eye itself. This disturbance is so intense and painful that it is impossible for the victim to keep his eyes open, and he is rendered helpless for from five to twenty minutes, depending on the concentration of the vapor when it makes contact with his eyes. In no case is there any permanent ill effect.

Knowing that the results would be exceedingly painful, the rookie squad nevertheless volunteered to be the victims of the demonstration. It was given on the "model farm" which Philadelphia operates on the meadows near the League Island Navy Yard. Major Stephen J. De Lanoy, formerly connected with the Chemical Warfare Service, was in charge. He and his aides first taught a group of "bomb throwers" the proper method of hurling the missiles to the best advantage. Then the rookies formed themselves into a "mob" about one hundred yards away from the police, and charged. They were permitted to cover about half the distance before the bomb throwing started.

Four bombs then were hurled in the path of the charging men. The seven-inch rubber containers bounced once or twice and then exploded one after another, with sharp reports. Dense clouds of white vapor rose, spreading slowly in all directions to almost unbelievable volume. This soft white vapor, shifting before the light breeze, might have been a stone wall. It brought the "mob" to a dead stop within fifteen feet.

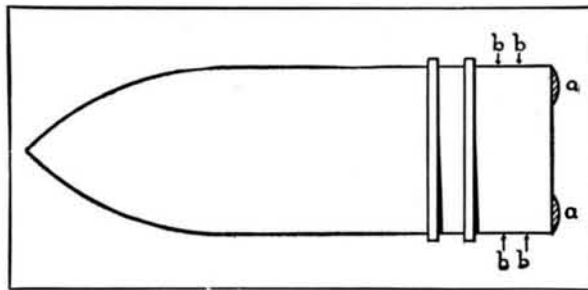
The mechanism of the bombs is extremely simple, and this is the feature that is expected to make them popular with the police and with paymasters who must travel lonely roads. They are exploded by a spring detonator that is generally set for five seconds, although this may be regulated to suit. This mechanism fits into a tube which is inserted into the top of the seven-inch rubber container after the latter has been filled with the charge of chemical compound. The spring is released by pulling a ring in the neck of the tube, so that, it is claimed, the bomb cannot go off until this ring is pulled, even though it is accidentally dropped.

When the bomb is to be thrown the ring is pulled with one's finger. But it is claimed that with a little practice a bank teller, for instance, could learn to snatch up one of the bombs with either hand and set



The police tear-bomb, showing its size in relation to the human hand

the spring with a slight pull of his thumb. He will then have five seconds to don a mask, or to jump for cover, unless in order to be doubly sure he has set the detonating mechanism to function at one second. A demonstration of the stunnic gas within a building was given at the same time as the tear gas exhibition, four bluecoats offering themselves up for sacrifice. They



Two modes of applying the tin-lead alloy

were unconscious from five to ten minutes each, as only sufficient chemical was used to show its effectiveness.

The police are particularly hopeful that the bombs will be of value in chasing motor bandits. In every large American city this type of highwayman has been able to elude arrest again and again even when police

(Continued on page 209)



75-millimeter shell, "metallized" by the Dagory process, and recovered after firing. The action of the metal is clearly indicated

Copper-Fouling of Ordnance Materials

By A. Dagory

THE importance of the phenomenon known of artillerymen under the name of "copper fouling" or "encoppering" was not revealed before the war. It was only after the heavy firing that took place on the French battle front from 1915 that it proved to be so important and that its serious consequences were fully realized.

We give a brief statement on this phenomenon and a description of the remedy that was adopted after long and fruitless attempts suggested by several inventors. The simple process by which the difficulty was overcome was presented in 1916 by the author of this article.

After a number of shells have been fired, said number being variable according to type of gun, a certain amount of copper scraped off the copper driving-bands of the projectiles adheres both to the grooves and walls of the gun tube. Such deposits firmly stick to the bore and if the gun goes on firing, their thickness soon becomes so great that they affect the behavior of the shells and this to such an extent that their influence is most injurious. The effects of said injury can be summed up as follows:

(a) Part or total impairment of the rifling giving rise to considerable irregularities in firing ranges.

This defect is so great that with copper-fouled 32 mm. guns there is a serious shortening of the range. Sometimes, even, the shell "tumbles" along its trajectory.

(b) Bursting of the shell in the gun bore, due to a premature working of the fuse caused by the retardation of the shell speed, as it passes through the most copper-fouled portion of the bore.

In this case the bursting of the projectile generally involves the bursting of the gun itself.

(c) Increase of the gun wear due to the increase of friction of the driving-bands.

During the war it often happened that big guns were put out of service through encoppering after having fired but 350 or 400 rounds. The output of ordnance materials was thereby considerably impaired. At a certain time this situation became very serious.

The principle of the solution suggested in October, 1916, is the following:

A metallic mixture formed of a tin and lead alloy, in the proportions of 63 per cent tin and 37 per cent lead, is applied on the face of the bottom part of the shell. This composition is laid in a circular manner near the circumference of the base as shown at a, a; or, if preferred, it can be fixed around the shell to the rear of the copper driving band at the place marked b, b. This tin-lead alloy can be applied in the form of rings fixed into place by soldering or better still by means of the Schoop spraying system.

Under the influence of the high temperature generated by the powder gases (this temperature exceeds 3500 deg. Fahr.) the tin-lead alloy immediately melts, its melting point being 370 deg. Fahr., and, owing to the extremely rapid rotation (several hundred revolutions per second) imparted to the shell by the grooves, this liquid alloy is thrown on to the walls of the bore in the form of thin drops.

When it comes into contact with the copper already deposited in the grooves, etc., tin forms with this latter an alloy melting at the temperature of the gun, this alloy being readily expelled by the passage of the following shells. Copper is thus dissolved by the tin. As to the lead, which is a plastic metal, it adds a lubricating effect to the chemical action of tin.

A few shells (3 or 4 for big guns and 15 to 20 for field guns) are sufficient to remove the entire copper obstructing the grooves of a fouled gun and by continuing firing shells provided at the bottom with a tin-lead composition, copper-fouling is definitely avoided. It is, of course, the same when this process is applied to new guns.

The photograph annexed hereto shows the base of a projectile which has been covered, purposely, with a thicker coating of tin-lead alloy than necessary. This shell, unloaded, has been fired on a proving ground and found after firing; tin-lead alloy melting is clearly visible, as well as traces of the projection of the thin drop of melted metal.

The fixing on the shell of the tin-lead alloy can be carried out in several ways. For instance, suitable rings or collars can be made in advance to the proper size with the above alloy and welded into place on the projectile. It should be noted however that the most rapid process and the one giving the best results is that known as the Schoop spraying system.

This process has now been used for years in industrial practice as far as zinc, lead and copper plating

(Continued on page 210)

RECENTLY PATENTED INVENTIONS

(Continued from page 208)

Machines and Mechanical Devices

CENTRIFUGAL PUMP.—L. A. MYERS, Box 5, Seabright City, Cal. One of the foremost objects of the invention is to provide a self-balancing runner for centrifugal pumps, the object being obtained by the use of a baffle plate for isolating the impeller disk from the reduced pressure at the pump inlet, thereby leaving the runner to float freely in the pump case, and relieving end thrust thereon.

SEWING MACHINE.—A. A. BOUTON, c/o Jennings Lore Works Corp., Park Ave. and Hale St., Brooklyn, N. Y. Among the objects of the invention is to provide a sewing machine in which the work is presented to the needle upon a traveling carriage in straight lines without any sidewise wobbling. The invention has particular reference to the carriage construction and its associate parts.

WATER FEED FOR STEAM BOILERS.—W. A. WHITMORE, Nelsonville, Ohio. The prime object of the invention is to provide a receiver to which the feed water is delivered by a supply pipe and so associated with the trap that with each operation of the trap, the water will flow to the boiler from both the trap drum and the receiver, whereby any predetermined amount of water may be fed to the boiler with each operation of the trap.

TIME CONTROL.—J. L. WINKLER, 28 Goss St., Hempstead, N. Y. The invention relates more particularly to a time control for use in connection with the operation of a photograph printing machine, although not necessarily limited to this adaptation. An object is the construction of a device which will automatically release the parts and extinguish the source of illumination upon a predetermined amount of time having elapsed.

TURBINE.—L. R. GUTHRIE, Bellflower, Mo. An object of the invention is to provide a turbine embodying but relatively few parts which renders the device of simple and cheap construction. A further object is to provide a turbine rotor having an arrangement of disks having concentric annular corrugations. A still further object is to provide an automatic arrangement of governor for controlling the valves in accordance with the direction of the flow of steam.

APPARATUS FOR RECORDING MOTION AND SOUND.—R. D. GRAY, Midland Park, N. J. The invention relates to apparatus for producing a moving picture film and a sound record in synchronism. The object is to provide an apparatus for recording motion and sound arranged to encompass a number of performers, say actors, players of musical instruments or other sound-producing media, distributed on a stage or other support for producing both a kinetoscopic record and a sound record.

REVERSIBLE FAN.—R. M. MURRAY, Billings, Mont. The purpose of the invention is to provide means controllable by the operator for changing the pitch of the blades, and for reversing the direction of such pitch. By the aid of this device a fan or a propeller can be so manipulated as to produce an infinite number of variations in the volume of air, gas or liquid controlled so that the velocity and volume of the currents may be regulated without changing the speed or rotation.

Medical Devices

FALSE TEETH ATTACHMENT.—B. ELISBERG and W. SHEFF, address B. Elisberg, 1390 Clay Ave., Bronx, N. Y. The invention has particular reference to an attachment adapted to secure false teeth in the mouth of the wearer. It comprises elements hinged to the opposite sides of the plate and means for normally effecting the movement of said elements to cause the same to grip the gums and to prevent the teeth falling when a person coughs or sneezes.

Musical Devices

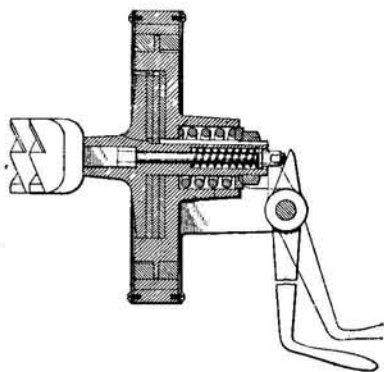
TUNING SLIDE FOR TRUMPETS AND THE LIKE.—E. B. STEINDORFF, Stillwater, Minn. The invention relates to an adjustable stop by which to determine the position of the slide to produce a note of desired pitch from the instrument. The object is to provide a construction embodying threaded engaged parts and stop members whose relative movement takes place without danger of impairment of the threads.

SOUND POST.—W. E. LEIGHTON, West Pembroke, Maine. The invention relates to string instruments, and more particularly to violins. The object is to provide a post which may be positioned directly under the bridge and by means of which the amplitude of the sound

waves are given more carrying power, together with a more resonant tone quality. The post may be conveniently utilized in connection with different types of stringed instruments.

Prime Movers and Their Accessories

SAFETY CRANK.—C. GREEN, Cornwall Landing, N. Y. The invention has for its object to provide a safety crank particularly adapted for use in turning an internal combustion engine over for starting the same, but



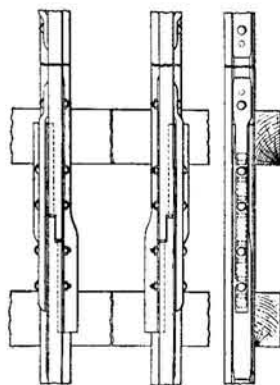
SECTIONAL SIDE VIEW OF THE INVENTION

which is not necessarily limited to this adaptation, and by means of which, upon a back fire occurring, a retrograde movement will result through an arc of such smallness as to be well-nigh imperceptible so that no injury to the operator may result.

VULCANIZER.—W. R. YOUNGER, Alexandria, La. This invention has for its object to provide a device of the character specified, which may be attached to the exhaust pipe of an internal combustion engine, as for instance, that of a motor vehicle to support the vulcanizer in position for use, and to heat the vulcanizer by the heat of the exhaust gases.

Railways and Their Accessories

RAIL JOINT.—G. J. MURPHY, Baradero, F.C.C.A., Buenos Aires, Argentina. The general object of the invention is to provide joint elements to insure the free expansion and



A PLAN AND SIDE VIEW OF THE JOINT

contraction of the rails under changes of temperature, and the maintaining automatically of the joint bolts at right angles to the rails without straining the bolts, and to prevent jars or shocks as the car passes over the joint.

DOOR OPERATING MECHANISM.—J. M. POMBO, 58 W. 91st St., New York, N. Y. An object of the invention is to produce a power-operating door mechanism for railroad cars, coaches, street cars, and subway trains where it is essentially necessary to handle crowds and fill and empty coaches as fast as possible. Another object is to provide a door operating mechanism which may be operated by one man, such as the motorman or engineer.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject-matter involved, or of the specialized, technical or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

MUNN & CO., Solicitors of Patents
Woolworth Building, NEW YORK
Tower Building, CHICAGO, ILL.
Scientific American Bldg., WASHINGTON, D. C.
Hobart Building, SAN FRANCISCO, CAL.

best. If a hit is made it is mere accident. Then, too, the police take all the risk of collision. Not long since a gang of youths too, the police take all the risk of collision. Not long since a gang of youths was arrested in Philadelphia for automobile stealing and the leader, a seventeen-year-old, boasted of the tricks used by motor car thieves to escape the police. He explained that a series of left-hand turns at forty miles an hour will invariably distance the fastest motorcycle if it is carrying a side car, as is usually the case. Even without the side car, according to this expert, a motorcycle cannot turn with safety at as high speed as an automobile, so that escape is only a matter of continual turning.

Some months ago a Trenton motorcycle policeman was shot and killed by a boy automobile thief fleeing from that city. He had overtaken the car and rode along-side, or within a few lengths, for nearly a mile before he was struck with the fatal bullet. It is contended that had he been equipped with a tear bomb his life would have been saved, in all probability, as he had plenty of opportunity to throw it into the car. Another advantage of the bomb for this kind of work is that it makes a stain on motor varnish by which the car may be recognized by police elsewhere, if the driver escapes his first pursuers.

"These bombs will not be used against every crowd that creates trouble," says Superintendent Mills. "They are for use only against mobs bent on destruction; mobs that assume dangerous proportions and that cannot be dispersed by ordinary methods. A bomb squad is being formed for each police division, and these men will be trained in the use of the new weapons. Only men who can keep their heads in emergencies will be appointed to these squads."

Copper-Fouling of Ordnance Materials

(Continued from page 197)

of sheets, bridges, tanks, piping, etc., are concerned.

Without giving a detailed description I merely recall that the metal to be applied, that is to say, in the present case the tin-lead alloy, is introduced in the form of 1 mm. to 2½ mm. diameter wires in the central part of a blow-pipe nozzle (oxyhydrogen or oxy-acetylenic blow pipes). This thin wire is drawn longitudinally through the nozzle by means of a turbine actuated by compressed air. When the blow-pipe is properly adjusted the melted metal is transformed, as it comes out of the nozzle, owing to the momentaneous depression that occurs at that very place, into comparatively low-temperature particles which are expelled with extreme violence by the blast of air.

These particles stick to the surface to be covered, which can, in this manner, receive a thick or thin coating as desired. In order that such coating may firmly adhere to the surface on which it is projected it is most indispensable that this surface should be properly cleaned by means of the sand blast.

The Schoop metal spraying pistol is recommended on account of its facility of working. Its dimensions are 15 x 15 x 10 mm. and it weighs 1½ kilos (a little over 3 lbs.); it enables projecting about 8 kg. (16 lbs.) of tin-lead alloy per hour. Now, the quantity of metal required for each shell is very small as shown by the following table:

75 mm. gun	6 to 8 gr.
155 mm. gun	25 to 30 gr.
320 mm. gun	80 to 100 gr.

Therefore, shells can be coated in a very short time. Besides, the coatings obtained in application of this Schoop process adhere most firmly to the surface and never detach themselves from the shells during their handling and transportation.

The brief statement given above illustrates the usefulness of this invention.

"The use of this process," writes Colonel Mercier, Inspector General of the heavy Artillery material and training, "provided an immediate solution to a situation that became most serious. Moreover, it brought back to life guns of the largest calibers, that were considered as definitely out of use after 500 shots, while they have exceeded 1000 shots and still give an accurate firing." And in another note he again says "that as far as facility of adoption is concerned this process is not to be compared to any other since it is most reliable while being hardly noticeable."

A Problem in Levels

(Continued from page 198)

when it was found that the water level had been lowered only 3 inches. But this meant that the one skip was able to offset the inflow and do a little unwatering in addition. The second skip was now installed, the work being done in 8 hours this time. By the following day the two skips had reduced the level about 2 feet. The pump room was now accessible from the air shaft, and the skips were kept at work intermittently until the pump could be started up again. The skips were, in fact, able to keep the water from rising again by being worked one-half or one-third of the time. With a single skip at work a trip could be made in 75 seconds. But, by an effort, this time could be reduced, it was found, to 60 seconds. When two were working simultaneously, a skip would discharge every 31 to 38 seconds. It took 20 seconds to hoist a skip and its load through 700 feet, and about 14 seconds were consumed in slowing down and dumping. The dumping was done in 5 seconds. Mr. Brackett calculates the capacity of the combination of two skips at 2120 gallons per minute. The coal consumed in making steam for the hoisting engine is estimated at 19 gross tons per day of 24 hours. This estimate relates to the fuel properly charged against the hoisting of the water.

The electrically operated hoists are now entering the field in competition with those operated by steam. Local conditions naturally play a part here. Where electricity is already used by a mine or group of mines, a hoist will likely prove most economical when made a part of the prevailing system. Whether the control is better with electricity I cannot say. If so, this would be a strong point, as loaded skips constitute more or less of a menace in vertical shafts. Thirty-eight thousand pounds free to fall 700 or 800 feet might do some damage.

Group Medicine

(Continued from page 201)

generally done for thirty or forty dollars. There is hardly any question of exploitation of the patient here. Well organized and self-respecting Groups adhere as closely to ethical practice as though each man stood singly.

Probably it is due to the influence of the Mayo Clinic at Rochester, Minn., that so many of the groups already organized are to be found in the West, and it is only recently that the more conservative East has become the center of the advance.

Clinics are now actively operating in Duluth, Minn.; Minneapolis, Minn.; La Crosse, Wis.; Madison, Wis.; San Diego, Cal.; Little Rock, Ark.; South Bend, Ind.; Rockford, Ill.; Cleveland, Ohio; Detroit, Mich.; Lexington, Ky.; Memphis, Tenn.; New York City; Rochester, N. Y.; Buffalo, N. Y.; and Syracuse, N. Y. There are undoubtedly others which are not so well known, but this list will serve to show how widespread the movement has become, and these clinics are only pioneers in a development which promises to supersede the old-fashioned form of medical practice. Group Medicine is one of the outgrowths of our complex life. The same spirit is abroad in other professions and we find the lawyers forming partnerships with regard to criminal and corporation law. The architect now affiliates with the