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TENTATIVE INSTRUCTIONS FOR THE INSPECTION & ASSEMBLING OF THE FOLLOWING FUZES

M-48 M-51 M-52 M-53 M-54 M-55 M-56
M-103 M-106 M-20 & M-21

PICATINNY ARSENAL, 1941

. . . RESTRICTED . . .

E. G. Neumiller

PICATINNY ARSENAL

TENTATIVE INSTRUCTIONS

INSPECTION OF LOADING AND ASSEMBLY

M-48, 51, 52, 53, 54, 55, 56, 103 AND 106 FUZES

M-20 AND 21 BOOSTERS

Prepared under the direction of the Chief of Ordnance for the use of Ordnance Inspectors

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TENTATIVE INSTRUCTIONS FOR THE INSPECTION AND ASSEMBLING OF THE FOLLOWING FUZES

M-48 & M-51	COMBINATION SUPERQUICK AND DELAY P. D. FUZE	
M-52	SUPERQUICK P. D. FUZE)	TRENCH MORTAR FUZES
M-53	DELAY P. D. FUZE)	
M54 & M-55	COMBINATION TIME AND SUPERQUICK P. D. FUZES	
M-56	P. D. FUZE, SUPERQUICK	
M-103	NOSE BOMB FUZE	
M-106	TAIL BOMB FUZE	
M-20 & M-21	BOOSTERS	

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INSPECTION

Where the variations of machines and the uncertainty of the human element enters into the manufacture of fuzes on a production basis, it becomes necessary that a careful inspection be given to insure proper assembly and functioning of the completed fuze.

Because there are certain points that cannot be determined by the use of gages, the following list of suggestions are offered to help the Inspector to make a complete check of the component parts and completed fuze.

The Inspector should check the weights used in pressing powder, the scoops used in measuring powder and the dimensional requirements for height and diameter frequently to prevent the production of materials that do not conform with the drawings and specifications.

INTRODUCTORY

This manual is supplementary to and must be used in conjunction with the General Ordnance Manual. The provisions of the General Manual will apply to inspection materials and parts entering into the manufacture of this fuze unless otherwise noted herein.

The object of this Manual is to furnish detailed information and guidance for U.S. Army Ordnance Inspectors.

Proper functioning and accuracy of this fuze depend largely on the care exercised in its manufacture and assembly. If all component parts are machined within the tolerances allowed, the assembled fuze should meet the tests required and be acceptable.

It is necessary that the Inspector become familiar with and acquire a thorough knowledge of the action and function of the various components and assemblies.

LOADING OF PRIMER ASSEMBLY FOR M-48 P. D. FUZE

The primer housing is given a visual inspection preparatory to loading for burrs, grease or oil, and dirt. A drop of shellac is put into the bottom of the housing by means of a dropper and a .002" copper disc, which has been miked to be c ertain that only one is used, is inserted and seated. A handful of housings are then put on a cloth and dipped into analine dye and placed on a wire screen to be air dried. The housing is then given another visual inspection to see that it is completely coated with dye, that only one disc has been used and that it has not come loose from the dipping operation.

The housing is then placed on an anvil and held in position by two small pins on the anvil which fit into the holes in the bottom of the housing. The wet primer mixture is inserted by means of a bakelite stick into the housing and a press, rotating at 6300 R.P.M., presses the mixture into the corners of the housing and gives the mixture a concave surface. The loose and excess primer mixture is then cleaned off the housing with a rag dampened with alcohol. The primer is then inspected to see that arc of the concave surface is flush or below the outside rim of the housing and that the excess powder has been removed. The housing is then gaged 10% for diameter and height, after which the primers are dried in an oven 100° to 110°F for 48 hours.

LOADING OF RELAY CUP FOR M-48 P.D. FUZE

Before loading and assembly, a visual inspection is given each cup to make sure that it is not bent and is free from dirt, burrs and other foreign matter. The cup is then gaged for proper height by placing it on the loading anvil which is the correct height.

A sleeve for holding the cup during loading is placed on the anvil and a cup inserted and loaded with lead azide. For precaution the barricade door is closed in front of the press while the pressure is applied at 115# dead weight. The excess powder is removed from the cup with a cloth dampened in alcohol and an onion skin disc and aluminum disc inserted in the cup. The cup is then placed in a fixture and a 45° angle crimp made around the top of the cup 360°. A second operation flattens the top of the cup down 360°. The cup is then removed from the sleeve. The bottom of the cup is coated with shellac and the cork cushion set in place.

The completed cup is then inspected for any powder on the exterior of the cup, if the aluminum disc has been cut, or the crimping operation has loosened the disc or cracked the wall of the cup. The height of the cup is gaged 100% and the diameter gaged 100%. The cork washer is inspected to see that it is in place and tight.

LOADING OF M-48 DELAY ELEMENT

Delay holders are dipped into analine dye and placed on trays where they are agitated for 10 to 12 minutes until dry, to prevent their sticking together.

Before loading and assembling, a visual inspection is given each delay holder, especially on the inside, for false shouldered burrs, and foreign matter; the baffle is inspected for burrs in and around the flash groove.

The holder is then placed in a fixture, located by the flash hole, and one black powder pellet inserted and consolidated at 702# dead weight. Delay holder is then visually inspected for presence of the pellet. The baffle is inserted into the delay holder and pressed in with a mandrel press, locating from the flash hole and pressed enough to make up tight on the shoulder in the holder.

The completed delay element is again inspected for presence of the pellet and excess powder is brushed off, make sure the top of the groove in the baffle is clear for the passage of the flash from the primer. The body elements are then placed 1700 in a mason jar and sent to the Gordon Drier for at least 72 hours.

LOADING OF M-48 DETONATOR

Before loading, a visual inspection is given each detonator cup to make sure that no foreign matter or burrs are present, and that no tool marks appear on the inside. The cup is then inserted into the cylinder sleeve and made flush with the bottom and then placed on the anvil. After the detonator disc (.002") is miked to make certain that only one is used, it is placed in the cup and seated with an arbor press. Friction powder is measured and poured into the cup and pressed at 282# dead weight. Lead azide is measured and poured into the cup and pressed at 282# dead weight. The detonator washer and detonator retainer are assembled and pressed into position. The sleeve, containing the cup, is then moved to another fixture which pushes the top of the cup above the top of the sleeve so that the forming tool can come down and form the top of the cup down 45°around the top of the cup 360°. It is then moved to another fixture and the top of the cup flattened down over the retainer. The cups are then forced from the sleeve in the direction that they were pressed to make the cup pass through the same point in the sleeve and give it uniform diameter. This eliminates any difference in the diameter of the cup from top to bottom caused by the pressing operation.

The detonator is then inspected for cracks in the crimping wall and damage to the disc. The completed detonator is gaged for height and diameter and placed in fiber boards, with holes drilled the size of the detonator and holding 100 detonators. The detonators are then removed to the rumbling building.

The board holding the detonators is set in a fixture in the rumbling machine and emptied into a canvas bucket and a measured amount of sawdust poured in over the detonators and another board of detonators emptied in. This sawdust acts as a cushion for the next layer of detonators and is the cleaning agent in the rumbling machine. The canvas bucket is then carried to the rumbling machine and emptied into the rumbling machine by remote control through a hopper. The rumbling machine is operated by remote control and the detonators are rumbled until they are clean. The excess powder on the outside of the cup and the graphite, used in the sleeve to keep the cup from sticking during pressing, are removed by this rumbling operation.

HEAD:-

The head is visually inspected for foreign matter, and in the completion of all operations.

Firing pin support is then inserted in head, firing pin, washer, and closing disc. A rolling tool operated in a drill press, rolls closing disc into head. Give precaution in this operation so as not to distort disc Visually inspected 100% for cracks in radius of crimping edge, and punctual closing disc.

Before detonator is inserted into head the position and condition of firing pin is examined, if firing pin extends into detonator cavity this brings the point of the pin in direct contact with detonator and may cause an instantaneous explosion, the detonator is then inserted; washer added; detonator retainer screwed into place and staked.

The tube is checked by the operator for excess plating and then assembled into body; then staked with a double staking tool in order that it will not be driven out of line, the body with tube is inserted and placed in arming machine for arming test; the operator can determine the results of the arming test (at 2000 R.P.M.) by a light flashing through the tube, and reflection is caught by a mirror which is mounted over machine; then insert in non-arming machine (1500 R.P.M.) to test for results

Setting sleeve is set at Super-Quick position before packing.

Identification:-

Following data is placed on one side of each part:

Lot No.
Manufacture identification
Date, on,
P. D. M48

On opposite side, Ogive staked to head (25 lbs. pressure).

Spot check is made by inspector, for proper alignment of head ogive and body.

PLUNGER BODY ASSEMBLY & INSPECTION

Visual inspection:- Cork washer is attached to relay cup; relay cup is then inserted into plunger body - washer end down. Delay element is inspected 100% by operator for proper flash hole, sharp corners, and baffle; then inserted into plunger body, small dia. down; delay washer, inspected for burrs then inserted - angle down. Primer visually inspected for clean surfaces, placed in delay cavity (flat side down). Primer cover is checked by indicator for thickness to insure that not more than one cover is assembled on primer; the plug is then screwed into body and staked.

Plunger head, plunger support and supporting spring are placed on work pin; centrifugal pins, springs, and spring retainers are held in place by spring clamp.

Work pin with plunger, head, and support spring - placed through plunger support cavity; and nut screwed on opposite end of pin, until housing is placed on body over centrifugal spring retainers before removing clamps.

It is then placed in a fixture for drilling lock pin hole; lock pin is then inserted and staked.

Care must be taken with depth of the hole, that pin will not penetrate body too deep and allow housing to spring off.

M-48 FUZE

Plunger is then placed in arming machine for arming test (2000 R.P.M. to arm) (1500 R.P.M. not to arm). Before plunger is assembled in body, operator gages overall length compressed, and free height 100%.

Closing screw is assembled with 25 lbs. tension and staked.

After complete assembly, body is gaged for height from flange, where fuze makes up on projectile, and from this same point to bottom of fuze.

Body threads are gaged 10% before packing, if tight threads are found, 100% check is made.

55 bodies are taken from lot for test, 25 are sent to Aberdeen Proving Ground, 10 jolt and jumble test, 20 burning time and sensitivity test. This is covered by Specification 50-17-15.

The complete fuze is inspected for cracked or damaged Ogive, stamping, staking, closing screw alignment of parts, and S.Q. setting.

All stamping on plated surfaces must be lacquered. When packed in individual containers, M-48 Fuze - M-47 Container, one inch adhesive tape is placed around complete circumference of container where lid and container join, with 1/2 inch tab overlap.

When packed in 25 lot boxes:-Box made of wood with metal container inside, wooden spacers holding 25 fuzes. Bottom spacer has holes drilled to hold bottom of fuze. Top spacer has tapered holes to fit angle of head.

Cover soldered on metal container and tested with 2 lbs. air pressure for 15 seconds to withstand atmospheric conditions.

M-51 FUZE

Same as M-48 with exception of locking device of centrifugal pin in plunger body, locking device assembled same time as centrifugal pins and inspected for free movement. When arming test is run, locking device has to be released before making non-arming test.

Booster is assembled to fuze with friction wrench. Body held by fixture, then set screw hole spotted in body, set screw inserted and staked in center to spread metal tight in booster.

M51 is packed in container M-43. Cardboard disc placed in container to separate fuze from metal bottom of container and on top of fuze if loose in container, add more discs until fuze is held tight.

Container holding M51 fuze is large enough to pack M21 with booster attached.

LOADING OF M-52 & M-53 P. D. FUZES

Before loading any component part it is inspected visually for dirt, oil, burrs, foreign matter, etc. because the presence of any one of these will set up hazardous conditions in the loading.

DETONATOR FIXTURE

Whereas the detonator is a very important part of the fuze a brief discussion of the fixtures used in the loading will be given. This fixture consists of three parts: cylinder sleeve, anvil and guide. The cylinder sleeve has a hole all the way through the center. This hole houses the detonator cup for loading and is slightly above the maximum size of the cup. This sleeve fits into the anvil. The anvil has a locating pin which fits into the small diameter of the cup. This makes it necessary that the small hole in the cup be concentric with the outside diameter. The guide houses the anvil and sleeve and also guides the punch into the detonator cup and away from the sides.

LOADING OF DETONATOR

After determining that the cup is clean it is inserted into the cylinder sleeve and made flush with the bottom and then placed on the anvil. After the detonator disc (.002") is miked to make certain that only one is to be used, it is placed in the cup and seated with an orbor press. Friction powder is measured out in a scoop and poured into the detonator and pressed at 282# dead weight. Lead azide is then measured in a scoop and poured into the cup and pressed at 282# dead weight. A tetryl pellet is then inserted and the explosives re-consolidated to a fixed height given in the specifications This height should be checked at intervals by the Inspector to insure the proper height and amount of powder. The detonator closing disc is inserted into the cup with the painted side up. The sleeve is then set on another fixture which raises the cup above the top of the sleeve so that the forming tool can form a 45° angle crimp 360° around the top of the cup. The sleeve containing the cup is then moved to another fixture where the cup down flat or 90° around the top of the cup. The cups are then forced from the sleeve. The completed detonator is then visually inspected for excess powder on the outside, breaks in the detonator disc, condition of the crimp, overall height and the outside diameter is frequently checked to catch wear on the sleeve so that the detonators do not get over-size. The detonators are then placed in a fiber board which holds 100 detonators and removed to another building for cleaning by rumbling in sawdust.

This cleaning consists of placing the fiber board containing the detonators into a fixture which dumps the detonators into a canvas bucket, after which a measured quantity of sawdust is emptied onto the detonators. This sawdust acts as a cushion for the next tray of detonators which is dumped in the same manner. After the correct number to be rumbled at one time, usually 200 to 300, are in the bucket it is dumped through a hopper into the rumbling machine. (All controls for dumping and operating the rumbler are outside the room where the rumbler is located). The rumbler is operated until the detonators are thoroughly clean and they are then removed and placed in the fiber boards and placed in a fiber container and a cardboard separator placed over this layer and another fiber board with detonators placed over this until the container is filled.

The detonators are then removed to the assembly building or to storage magazines.

The purpose of this rumbling of the detonators is to remove any excess powder and the graphite which came out of the sleeve. The graphite is placed in the sleeve to insure easy removal of the cup after pressing.

LEAD CUP

After determining the cleanliness of the cup they are placed into a fixture. This fixture consists of: (1) a block of fiber or some pressed composition which has holes the size of the cups equally spaced. (2) a hopper over another fiber board with holes which coincide with the holes in the first block, over a plate which can be removed, The block containing the cups is inserted under the plate and the hopper is filled with tetryl pellets and vibrated until two pellets are in each of these holes. The excess pellets are removed and the plate removed and the two pellets are allowed to fall into lower block into the cups. The cups are then taken from the tray or block and placed on the fixtures of the press which are located around a revolving table. The pellets are consolidated into the cup by the press and then removed from the fixture and allowed to run down a chute into sawdust. The sawdust is stirred around the cups by hand to remove excess tetryl. The cups are then inspected for cracks in the pressed tetryl, height of the powder in the cup and to determine if the pressing operation has distorted the flange of the cup.

DELAY ELEMENT M-53

After being visually inspected the delay housing is placed into a fixture which has a locating pin that fits into the small hole in the bottom of the housing. A guide is inserted into the top of the housing to guide the punch of the presses.

Before inserting the relay cup into the delay housing the bottom of the cup is dipped into N.R.C. and inserted into the delay housing and seated with a small fiber or rawhide rod. The fixture is then set under the press and the cup pressed in at 702# dead weight. This operation completes the crimping of the cup, which comes to the loading with a 45° angle crimp around the top Two black powder pellets are inserted into the housing through the guide and pressed in separately at 702# dead weight. A plug is then inserted with the small diameter down and pressed in on the pellets and staked into position. The weight used for this staking is 1000# dead weight. The primer is placed on a fixture and the primer cover pressed down over it. This screw is then screwed onto the housing and tightened over the copper washer which goes inside to give a good seating of the housing and screw. The top of the primer is sealed into the primer cover by running a pointed stick covered with N.R.C. around the hole and on the primer. The completed assembly is gaged for overall height.

LOADING OF M-52 & M-53 TRENCH MORTAR FUZES.

DETONATOR FOR M-53

After determining that the cup is clean it is inserted into a cylinder sleeve and made flush with the bottom and placed on the anvil. After the detonator disc (.002") is miked to make certain that only one is used, it is placed in the cup and seated with an arbor press. Lead azide is then weighed and poured into the cup and pressed at 282# dead weight. A tetryl pellet is inserted and the explosives re-consolidated to a fixed height, given in the specifications. This height should be checked frequently by the Inspector to insure the right height and correct amount of powder. The detonator closing disc is then inserted into the cup with the painted side toward the outside. The sleeve is then set on another fixture, which pushes the cup up so that part of it is sticking above the surface of the sleeve so that the forming tool can come down on the top of the cup and form it down to a 45° angle around the top of the cup. The sleeve is then placed on another fixture and the top of the cup flattened down to a full 90° crimp. The cups are then forced from the sleeves in the direction that they were pressed so that the entire cup has to pass through the bottom diameter of the sleeve, thereby assuring the same diameter of the cup throughout its length.

The completed cup is then inspected visually for any cut or punctures in the detonator disc, cracked walls of the cup, condition of the crimp and gaged for overall height and diameter. The completed detonators are then placed in holes in a composition board which carries 100 detonators and transferred to the rumbling machine. The rumbling operation is the same as that used for the M-52 detonator.

HEAD M-52

The head is visually inspected to see that there are no shoulders, dirt or foreign matter in the striker cavity. The lot number, date, and loading plant initials are stamped onto the head. The stamping must be legible but not extend into the wrench hole or distort the striker cavity.

The firing pin assembly and head are placed in a fixture up-side-down, this fixture supports the head and by spring action forces the firing pin through the head making the insertion of the retaining pin possible. Releasing of the spring of the fixture allows the firing pin to draw down seating the retaining pin into the bottom of the counter-bore of the head. Firing pin must not extend below the surface of the bottom of the head and still be within maximum overall length after assembly.

HEAD M-53

The head is inspected for foreign matter and presence of all holes and threads. The firing pin and striker assembly are then inserted into the head and the shear wire put in place and bent around the groove in the head. The shear wire hole must be in the center of the groove for correct assembly. The distance from the end of the firing pin to the primer is determined by the position of the shear wire and should be carefully checked to see that the firing pin does not extend too far down after assembled.

The stamping for M-53 head is the same as for the M-52 head and the same points of inspection should be noted on it as are noted above for the M-52 head.

BODY

The bodies are usually received at the loading plant with the slider lock pin and spring safety pin and spring, set back pin and spring and plug assembled and staked. The safety wire (cotter pin) is also inserted but the ends are not spread.

The first operation consists of inspection for dirt and the gaging of the slider cavity. This gage is composed of a slider, .0012" larger than the maximum size of the slider, which is pushed into the slider cavity by the pressure exerted by a spring which is the same as that used in the completed fuze. The plunger of the gage must be flush or below the feeler surface. This gage must move freely to check the position and length of the slider lock pin and position of the safety pin across the slider cavity, also denotes any burrs within the slider cavity.

The slider is given a visual inspection for foreign matter and a cork washer inserted. No defective washers are to be used. The detonator is then inserted and crimped 360°. The detonator must be tight and not stick above the surface of the slider. This crimping operation locates from the small hole in the detonator cavity. The slider is then pushed through a broaching machine to remove the metal that might have been distorted by the crimping operation and to insure correct size of the slider. If the slider is pressed through the broaching machine there is danger of exploding the detonator if it sticks above the top of the slider.

The lead cup is then inserted and crimped into the body and inspected to see that it is flush or below the surface of the bottom of the booster cavity. The slider cavity is inspected after this crimping operation to see that the lead cup does not extend into the slider cavity and foul the slider, when it is assembled.

The slider is then inserted and the operator rolls the body from one side to another to see that the slider works freely in the slider cavity. This is very important, since there is no arming test given this fuze and the slider must move over by spring pressure alone to arm the fuze. The slider spring and plug are inserted and the plug tightened finger tight. The plug is then tightened with a pneumatic screw driver to a fixed tension.

The head is then engaged into the body two or three turns and the booster cup engaged two or three turns and the booster cup threads coated for about 1/4" wide 360° with Pettman cement to seal the booster cup against moisture. The fuze is then set in a vise and the head and body and booster cup and body tightened together in one operation. The fuze is then placed in a fixture which locates from the wrench hole in the body and the head staked to the body and the slider plug staked to the body in one operation.

The ring is then inserted into the cotter pin and taped up along the top of the fuze to keep it out of the way while packing the fuzes. A small piece of adhesive tape is used for this purpose.

The fuze is then visually inspected for stamping, dirt, staking, and gaged for overall height and distance from the booster cup to the projectile shoulder of the body. Any excessive Pettman cement is wiped off at this time also.

The fuzes are then inserted into wooden separators in a wooden box with the booster cup down in the holes in the separator. Another separator is set in place and filled with fuzes and the data card inserted in the box and the box sealed with two car seals. The box is stenciled according to the specifications on the drawings.

M-53 ASSEMBLY

The assembly of the M-53 is the same as the M-52, except that the delay element is screwed into the head and staked before it is assembled to the body. There is a slight difference in the charge in the M-53 detonator, since it has no friction powder in it. The length of milled flat and no firing pin safety hole in 53 Slider.

THE LOADING INSPECTION OF THE M-54 AND M-55 TIME AND SUPERQUICK FUZES.

Before the loading or assembly of this fuze, the Inspector should carefully read and understand the specifications pertaining to the loading, assembly and packing of this fuze. The Inspector should also assure himself that the proper powder is being used for the loading of the rings, that the pellets specified are being used in the rings and body and that the drying treatment is adhered to strictly to insure the proper conditioning of the ring so that the burning time will be uniform when the ring is assembled into the completed fuze. He should also check the weights used to tension the fuze and rings during process of manufacture and check the weights of the powder being measured into the different component parts. The Inspector should check with the Foreman periodically to be certain that the powder loading room and dry houses are operating at the correct temperature and relative humidity.

LOADING AND ASSEMBLY OF M-54 TIME AND SUPERQUICK FUZE.

LOWER RING

The loading plant usually carries a sufficient supply of machined rings to have on hand for each day's production rings that have been in the assembly room long enough to eliminate the possibility of any moisture being on the rings caused by condensation of moisture from the room.

The rings are then given a visual inspection to determine that the rings are dry and free from dirt, oil and other foreign matter. The ring is also inspected for the presence of graduations and setting slot. The powder grooves of the rings are then coated with a solution of shellac and aniline dye and the excess solution cleaned from the surface of the ring. The coated rings are inspected to be certain that the groove is coated with as light a coating as will completely cover the groove. After the shellac solution is thoroughly dry the rings are moved to the powder loading room, where they are kept until they reach the temperature of the loading room. During this period the block numbers, showing the date and blend of powder used, are stamped on the outside angle of the ring. The stamping should be legible and not close enough to the top surface of the ring to distort the metal towards the top of ring and cause closing cap to ride on one side of the ring when assembled. The stamping should be in such a position on the ring that it will not interfere with the drilling of the vent hole.

Before loading, the rings are inspected to be sure that the shellac is thoroughly dry. This is very important, as rings that are not dry and at room temperature will cause an increased dispersion in the burning time of the complete ring.

LOADING OF LOWER RING

The ring is placed into a special fixture placed into the ring and pressed to 68,000#/in^2. They are then inspected to insure that the powder train is above the face of the ring. If the powder does not extend above the surface of the ring it indicates that the powder has soft spots in it, which affects the burning time.

The flash hole is drilled into the powder train and counter-bore for the safety disc drilled. The safety disc is inserted and crimped 290° around the disc with 1900# dead weight. The end of the crimping should not break into the powder train so as not to crack the powder train. The surface of this disc, after crimping, must be flush or below the surface of the ring so that the facing tool will not pull it out in subsequent operations. The metal of the ring and the excess powder are faced off and the undercut is made for the seating of the ring into the body. The upper surface of the ring is scored to make a better adhesive surface for the felt washer. The ring is gaged for diameter and depth of undercut and thickness of ring.

A hardness test is taken four times on each turn. An .081" punch is pressed into the powder at 250# dead weight in eleven places and must not penetrate more than .006".

The rings are then given a visual inspection for chipped and cracked powder trains, crimping of safety disc and cracks in the ring itself. It is then coated with special shellac, placed on a rod with separators between each ring and sent to a dry house, which is kept at 100 to 110°F, for not less than three days and not more than six days. The rings are then taken to the operating room and buffed with a wire brush and lacquered.

The exterior vent is drilled and counter-bored. The pellet hole on top of ring is drilled. The ring is then inspected for presence of the holes and cracks or chips in the powder train from the drilling operations. The powder groove is then coated with shellac and the groove cover set in position and put on a board covered with talc to set. The powder pellet is inserted and the fuze cloth washer glued to the top surface of the ring. The hole in the ring must be over the powder pellet. No glue must touch pellet or pellet hole and all excess glue is wiped from the ring. The exterior vent is filled with black powder and the disc and washer inserted and crimped 360° at 1350# dead weight. The vent disc is then coated with lacquer to make it moisture proof.

The rings are then placed on rods with rubber separators between the powder surfaces and tensioned at 12½# and sent to dry room, which is kept at 100 to 110°F for not less than three days and not more than six days. The tension is removed after 24 hours to allow the air to circulate over the powder face of rings. After second period of 3-3 treatment, the rings are transferred to a standby storage at 80 to 90°F for 24 hours before final assembly into fuze.

UPPER RING

The loading usually carries a sufficient supply of machined rings to have on hand for each day's production rings that have been in the assembly room long enough to eliminate the possibility of any moisture being on the rings caused by condensation of moisture from the room.

The rings are then given a visual inspection to determine that the rings are dry, free from dirt, oil and other foreign matter. The ring is also inspected for the presence of graduations, and setting slot. The powder grooves of the rings are then coated with a solution of shellac and analine dye and the excess solution cleaned from the surface of the ring. The coated rings are inspected to be certain that the grooves are coated with as light a coating as will completely cover the groove. After the shellac solution is thoroughly dry, the rings are removed to the powder loading room, where they are kept until they reach the temperature of the loading room. During this period the block numbers, showing the date and blend of powder used, are stamped on the outside angle of the ring. The stamping should be legible and not close enough to the top as to distort the metal toward the top surface of the ring so that the closing cap will ride on one side of ring when assembled. The stamping should be in such a position on the ring that it will not interfere with the drilling of the vent hole.

Before loading, the rings are inspected to be sure that the shellac is thoroughly dry. This is very important, as rings that are not dry and at room temperature will cause an increased dispersion in the burning time of the completed ring.

LOADING OF UPPER RING

The ring is placed into a special fixture and powder placed in the groove of the ring and pressed at 68,000#/in^2. They are then inspected; that the powder train is above the face of the ring. If the powder does not extend above the surface of the ring, it indicates that the powder has soft spots in it, which affects the burning time. The ring is then placed in a lathe and the face of the ring and excess powder cut off to the final size of the ring. The undercut for the seating of the ring is also made on this operation. The ring is then inspected and gaged for diameter and depth of undercut and thickness of ring. A hardness test is taken four times on each turn. An .081" punch is pressed into the powder at 250# dead weight in eleven places and must not penetrate more than .006".

The pressed rings are then given a good visual inspection for cracks or chips in powder train, soft powder train or cracks in the ring itself. The surface and the powder train of the ring is coated with a special shellac solution. The coated rings are then placed on a rod with spacers between each ring and placed in a dry room, kept at 100 to 110°F, for not less than three and not more than six days. After this drying treatment the rings are taken to the operating room and the outside surface of the rings buffed with a wire buffer and coated with lacquer and allowed to dry.

The center hole is reamed to final diameter so it will fit drill fixtures. The powder vent hole is drilled. The exterior vent is drilled and counter-bored and the interior pellet hole drilled. The cross-vent hole is drilled from pellet hole to exterior vent hole. All drill holes are percentage gaged and the holes and powder train given a visual inspection to see that the holes are present and that the powder train has not been cracked or chipped by the drilling operations. The cross-vent hole must break into the center of exterior vent hole and interior pellet hole.

The interior pellet is inserted, making certain that no broken or soft pellets are used, and crimped in 360° and 500# dead weight. The disc and washer are inserted into the exterior vent and crimped 360° and 1350# dead weight.

The powder face is inspected and given a coat of shellac and the groove cover placed in position and inspected to see that it is tight. The vent hole is lacquered and the ring inspected for lot number. The groove cover is dipped into talc and the rings placed on rods with rubber separators and tensioned at $12\frac{1}{2}$" and placed in the dry room at 100 to 110°F, for not less than three and not more than six days. The tension is released after 24 hours to allow the air to circulate across the surface of the rings. The rings are then moved to a lower temperature room, 80 to 90°F, for not less than 24 hours.

BOTTOM CLOSING SCREW ASSEMBLY

Bottom closing screw, disc, washer and eyelet are assembled and coated with analine dye and shellac before they are shipped to loading plants.

Visual inspection of bottom closing disc for puncture, crimping of washer and coating of analine dye, before loading. Black powder is then loaded into the holes and agitated to be sure that it will hold a specific amount of powder. The rim and hub of the screw are coated with shellac and an onionskin disc is attached to retain the powder. Then surface of bottom closing screw is dipped in talc. The paper washer and shellac are allowed to dry at room temperature for four hours.

The Inspector makes an occasional check for the weight of powder being used in the bottom closing screw. This must not vary over one grain, plus or minus the requirements shown on the drawings.

LOADING OF BODY

The body is received at loading plant with interrupter assembly assembled and staked into position. The body pellet is inserted into the body and the platform surface of the body is coated with glue and the felt washer set in place so that it coincides with the pellet. No glues should be permitted to get on the pellet or into the pellet hole. The pellet must be flush or slightly below the surface of the pellet hole. Rubber washers and wooden rings are placed over the washer and a nut to pull the wooden ring down onto the washer is tightened in place. The bodies are then moved to the dry room at 90°F and dried for four hours, to dry and seat the washer. The specified amount of powder is measured and poured into the flash hole in the body from the bottom side so that it makes a continuous powder train from the body pellet to the bottom closing screw cavity and an onionskin paper disc is shellacked into place to hold it in.

The primer cavity is inspected to see that it does not bulge on the outside of the body and the primer inserted and checked for fit. The primer must fit snug but not be pressed in with too great a pressure because of the hazard to the operator. The primer must not be loose after assembly.

The primer striker is assembled and fastened into place with the dowel pin. The dowel pin must not bulge the outside threads on the body. The striker is inspected to see that it is lined up over the primer and not around to one side.

The loaded closing screw assembly is then screwed into the body and staked in four places. The closing screw must be flush or below the bottom of the body, after which it is painted with a heavy solution of shellac to make it water-proof.

LOADING OF DETONATOR

Before loading a visual inspection is given each detonator cup to make sure that no dirt, oil or foreign matter has accumulated on the inside and that no tool marks appear on the inside. The Inspector should here give a percentage check, by gaging, all parts of the detonator assembly.

After determining that the cup is clean it is inserted into the cylinder sleeve and made flush with the bottom and then placed on the anvil. After the detonator disc (.002") is miked to make certain that only one is to be used, it is placed in the cup and seated with an arbor press. Friction powder is measured out in a scoop and poured into the detonator and pressed at 282# dead weight. Lead azide is then measured and poured into the detonator and pressed at 282# dead weight. The detonator retainer and washer are inserted and pressed in and the cup moved to another fixture which presses the top of the cup up above the surface of the sleeve and the forming tool comes down and crimps the top of the cup over 45° around the top of the cup. It is then moved to another fixture and the top of the cup flattened down 90° over the detonator retainer. The cups are then forced from the sleeve, from the crimping side to make sure that the completed cup has passed through the same part of the sleeve. This last operation gives a uniform size to the cup and eliminates any large or small diameters by distortion from the punching.

The completed detonator is then visually inspected for any cracks or bulges in the detonator disc, gaged for height and diameter and placed in holes drilled in a composition board, which holds 100 detonators. They are then moved to the rumbling building. Here they are placed in a fixture which empties the detonators from the board, along with a given amount of sawdust into a canvas bucket. The sawdust is over the first layer of detonators and serves as a cushion for the next layer of detonators. Usually 200 or 300 detonators are emptied into the bucket and the bucket emptied, by remote control, through a hopper into the rumbler. The rumbler is set in operation by remote control and rumbled until the detonators are clean. This process is to remove any excess powder which may have been left on the outside of the cup and to remove the graphite which comes from the inside of the cup sleeve used in the pressing to keep the cup from sticking to the sleeve.

After loading the Inspector should look for any egg-shaped detonators, bad crimp, cracked crimping edges, burrs from crimping operation, improperly sealed cups due to disc being out of position, and under or over-size in diameter or length. There should be no loose powder on the outside of the finished detonator.

ASSEMBLY OF CLOSING CAP

The plunger is placed into the sleeve and two shear wires inserted and staked, located in a fixture from the locating plunger pin. Care must be taken that the staking does not distort the inside diameter of the sleeve and bind the plunger.

The closing cap is visually inspected 100% by the operator for foreign matter and the firing pin support, firing pin and striker, washer and closing disc assembled in order named. The crimping wall of the head is then rolled over. The completed head is inspected to see that crimping has not cut the washer or cracked the crimping wall.

The closing cap is then inverted and examined to see that the firing pin does not project down into the detonator cavity. The detonator is then inserted and the cork cushion inserted, making certain that no cracked cushions are used, and the retaining screw set in place and tightened with a pheumatic screw driver. The retaining screw is inspected to see that it is flush or below the detonator cavity so that the crimping operation can flush the metal from the crimping wall over to hold the screw in position.

The plunger assembly is then inserted and the cotter pin placed through the cap and plunger body. The plunger assembly must line up with the cotter pin holes in the closing cap to make certain that the shear wires are not damaged by the assembly of the cotter pin.

ASSEMBLY OF THE COMPLETE FUZE

The body is given a 100% inspection for overall length, presence of primer, presence of and location of primer striker, body pellet, set line, stamping, staking and sealing of closing screw, flash hole and set screw hole for top ring, and staking of interrupter.

The groove covers of the rings are coated with caranuba wax and allowed to dry before assembly. Rings are then inspected for loose groove covers, loose fuze cloth washers and block numbers to make certain that the same blend is being used in both rings of the fuze. The graduated ring is assembled to the body with the letter "s" at or near the set line on the angle side of the body. The set screw is then screwed into the upper stem of the body and the upper ring placed on the body with the slot in the ring over the set screw. The tension ring is placed over the upper ring in a convex position. The set screw is inspected to see that it is below the upper surface of the upper ring and does not hold the tension washer away from the upper ring. This is important in setting the tension of the rings for the use of the fuze-setter in the field.

The closing cap is then screwed in place on the body and the cotter pin removed to allow freedom while tightening and setting fuze on safe. The closing cap is tightened at 40# dead weight and the graduated ring is tensioned at 35 to 65# torque. This operation tends to break any glue that might have the graduated rings stuck and also seats the fuze cloth washer into the scoring on the surface of the ring and body. It has been found advisable to apply the maximum tension to overcome any release of tension after the fuze has been assembled for a while.

The set screw, which holds the cap onto the body is screwed into position and staked.

The fuze is then set in a fuze-setting device and set in a safe position by setting the marking "s" on the graduated ring over the set line on the body of the fuze. The cotter pin is then placed through the cap and plunger assembly and the end spread for withdrawal resistance of 10 to 35#. The fuze is stamped with the lot number, date, and loading plant initials. The completed fuze is then check weighed to make certain that no parts have been left out and if found satisfactory in weight is inspected 100% for overall length, for distance from surface that makes up on projectile to the bottom of the body, and body threads checked 10%; and if found tight a more thorough inspection is given.

The fuze is inspected visually 100% for vent discs tightness, closing screw disc tightness and tightness of the closing disc. None of these discs must be punctured. The staking is checked and stamping inspected to see that it is legible and that the fuze is set in safe position, also, distortion or marring of the surface of the fuze.

The completed fuze is then placed in an M-47 fiber container, gum label attached and coated with white shellac. The cover and body of the container are sealed with a 2" strip of adhesive tape wound 360° around the box with a 1" tab left for pulling the tape off the box. Fifty (50) fuzes are packed into a wooden box with the data card. The metal strips which hold the box should be in such a position that none of the stenciling on the box is covered up. The box is then sealed with a car seal.

TESTS USED ON M-54 TIME FUZES

Blend Test:- To determine the correct proportions of the fast and slow burning powders. All blends are verified as to burning time and dispersion and known as the "dry blend test".

Forty samples are taken from widely separated parts of the blending barrel. The powder is exposed in trays to conditioned air for a period of 5 hours. One set of rings is loaded from each sample and faced and operated in conditioned air without application of shellac to the powder face. The fuze is completely assembled with felt washers and groove covers dry in conditioned air room. Complete fuze is then fired to determine the burning time and dispersion.

Loading Test:- After the rings have been in the standby storage (80 to 90°F) for at least 24 hours, ten sets from each block combination are assembled to test fuze bodies and fired statically all on the same day. After being assembled for this test the fuzes are stabilized for at least 3 hours at a temperature of 75°F. These rings are taken from standby storage after the last rings of a lot has had at least 24 hours of this lowered temperature. This test determines the satisfactoriness of average burning time and dispersion for different days' loading, and the overall dispersion and mean dispersion that can be expected in the final Inspector's Static Test.

Assembly Test:- After several blocks from each blend have completed the 3-3 treatment, 10 sets of rings are withdrawn for this test. Each block of rings should burn approximately the same if care and uniform treatment has been taken in the loading and drying of the rings.

When the lot is completed, 5 fuzes are selected and fired statically for acceptance. In case of failure, the blocks causing failure are withdrawn and the balance is used for selection of ballistic samples for the final test which is conducted at the Proving Ground at Aberdeen. If fuzes are found acceptable in the original static test, no retest is required and fuzes are forwarded to proving ground immediately.

Jumble and Jolt Test:-

To insure that fuzes will withstand handling and transportation shocks, ten fuzes are selected and given the Jumble and Jolt Test. The fuzes must withstand this test:

No explosive elements explode
No fuzes come apart
Fuze must not arm or partially arm
No inner parts, including explosive elements be broken, deformed or displaced in such a manner as to make the fuze unsafe to handle or dangerous to fire.

General:- It may be stated that the relationship of all mechanical operations with one another and the graduations are vital factors affecting the uniformity of burning time of the fuzes. Pellet holes, if large, will result in battering of the pellet. These relations hips should be closely checked with gages made especially for this purpose. Likewise, the loaded components are inspected. After the mechanical operations have been completed, the ring is cleaned of powder dust and burrs removed. The rings are fitted with the required pellets, three pellets used in the rings and one in the body. They are of compressed black powder and are tubular in shape. A wick of nitrocellulose is inserted into the hole in the pellets and extends out on each side. This wick makes the pellets easier ignited.

After the rings from the last day of loading on a lot of fuzes has been in the standby storage at a reduced temperature for at least 24 hours, 10 sets of rings from each block combination are assembled to fuzes and fired statically all on the same day as the assembly test. The fuzes should be stabilized at 75°F for at least three hours. The results of this test indicate the satisfactoriness of the lot in regard to variations in average burning time for different days of loading and overall dispersion and mean deviation that can be expected in the final static test.

LOADING AND ASSEMBLY OF M-56 P.D. FUZE

SLIDER

The slider is inserted into a fixture which stops it on the under side of the large diameter. This should align the slider so that the pellet hole is directly in line with the fixture hole which guides the punch for pressing the tetryl into the slider. One tetryl pellet is inserted and pressed with 47# dead weight, and another inserted and pressed to the same weight. The powder, after pressing, should be flush or above the outside diameter of the slider. If the powder is below this outside diameter it is rejected; if it is above the outside diameter it is removed in the cleaning operation which follows. This cleaning consists of wiping the excess tetryl off the slider with a dry rag. If the punch has hit on the side of the slider and marred it the slider is also rejected.

BODY

The body is stamped with the date, kind of fuze, loading plant initials and lot number. The body is then placed into a fixture with a pin running into the slider cavity to serve as an anvil in the pressing operation. A tetryl pellet is inserted and pressed into the flash hole between the slider cavity and the booster cup cavity. After the pellet is pressed in it is inspected to see that it does not extend into the slider cavity and is flush or below the surface of the booster cavity.

LEAD CUPS

The lead cups are inspected for cleanliness and a tetryl pellet inserted into them. The cups are then placed on a fixture of the press which rotates on a table under the punch, where the punch presses the powder in at a fixed weight. The pressed powder must be flush with the top of the cup and should have no cracked edges; this indicates that the powder is not tight in the cup. The cup is inspected to see that the flange has not been cut or distorted by the pressing operation.

ASSEMBLY

The half blocks fit into a fixture which has a slot in it like that in the nose of the fuze. This slot is so arranged that the assembling of the spring will not be too far down onto the half blocks so that they might bind in the fuze. The springs are taken up on a mandrel that fits down onto the half blocks and the spring pushed off on the half blocks and located. This spring must be located so that the ends are on the corners of the half blocks to keep from having two thicknesses of the spring between the half block and the inner diameter of the half block cavity. This is important and must be checked frequently by the inspector. All springs should be examined before assembling to make certain that there are no loosely wound springs or springs with bent corners at the ends. Bent corners would tend to bind the half blocks and keep them from arming.

The half blocks are placed in the nose while it is held upside down. The radius of the blocks is placed toward the bottom of the groove. The head is then screwed on the nose and the whole assembly turned right side up. After the nose is tightened to the head the assembly is rolled from side to side to make certain that the half blocks move freely in the assembly. The firing pin is then inserted so that it rests in the grooves in the half blocks and the half blocks are tested for non-arming at 10,000 R.P.M. with a dead weight pressing on the firing pin. This weight is 2# and is moved up and down to relieve the firing pin so that the half blocks can move out if they will. A periodic check is made on the arming machine, which operates at 32,000 R.P.M. to make certain that the half blocks will arm. Not all half blocks are tested for arming, only a percentage.

The closing cup washer and closing cup are inserted and the closing cup crimped by rolling the crimping wall on the nose of the fuze over onto the closing cup. The closing cup is inspected to see that it is tight but not cut by the washer when crimped. The nose is then staked to the head. The assembled head and nose is then gaged 100% from the top to the bottom. The lead cup is given a visual inspection and inserted into the detonator holder. A cork washer cushion is inserted, making certain that no broken washers are used, and the detonator inserted over the cushion with the colored side toward the cushion. This leaves the side of the detonator with the thin disc toward the firing pin. The detonator should be slightly above the top of the detonator holder, so that when assembled it will fit down tight into the head and hold the detonator tight.

The head is inspected to see that the firing pin does not stick down below the bottom surface of the head. This must be carefully checked to keep the firing pin from coming down on the detonator when it is assembled. The detonator holder is then screwed into the head and staked in two places. This complete assembly is then gaged 100% from the flange to the bottom of the lead cup and overall length from the bottom of the lead cup to the top of the nose.

The slider is inspected to see that the tetryl is present and then inserted into the slider cavity. The slider spring is inserted and the retainer screwed in and staked. The body is then placed in an arming machine and tested for arming at 8,000 R.P.M. and then tested for non-arming at 4,000 R.P.M.

The booster cup is inspected to see that the wrench holes do not bulge the inside. A felt washer is inserted and the tetryl pellet inserted. The booster cup is then screwed into the body with a hand wrench. The booster cup is then staked to the body and must be flush or below the bottom of the body for the height gage used on the completed assembly. The body and head are screwed together and staked in two places. The metal from the head is flushed into the staking notches in the body.

The Completed assembly is then inspected 100% for the crimping of the closing cup; cup must be tight, no cuts or impressions from the washer caused by the crimping. The staking of nose to head, head to body and booster cup to body are also inspected. The stamping is also inspected and the projectile threads gaged 10%. The alignment of the nose, head and body is also checked.

The sides and bottom of the cardboard boxes for packing M-56 are sealed with gummed binder paper. A separator is inserted in the bottom of the box and a layer of 25 fuzes set in point up. A cardboard with holes to fit over the noses of the fuzes is placed over this layer and another separator inserted with another cardboard above it. Another layer of fuzes is placed in point down and a cardboard filler inserted and the box top glued and sealed as the bottom. The whole box is then dipped in parafin wax.

LOADING AND ASSEMBLY OF M-103 NOSE BOMB FUZE

LOADING OF DELAY ELEMENT

The delay holder is inspected for dirt, chips, or other foreign matter. If clean, the holder is placed on a fixture for the pressing of the delay powder. This fixture locates from the relay cavity with a pin sticking into the small diameter between the delay cavity and relay cavity. Two black powder pellets are inserted and pressed according to the specifications given on the drawing. The holder is then taken from the fixture and a cork cushion inserted into the relay cavity. No broken cushions should be used. The relay cup is then inserted and the delay washer set in place and the crimping wall crimped down 360°.

The completed delay holder is then inspected for tight washer under the crimping or that the crimping wall does not extend above the top surface of the delay holder. The outside diameter is checked to see that the holder has not been distorted by the pressing operation. The crimping wall must be flush or below the surface of the holder so that it will not extend into the slider cavity and foul the slider and keep it from arming.

LOADING OF DETONATOR

After a visual inspection to determine that the cup is clean it is inserted into a cylinder sleeve and made flush with the bottom of the sleeve. The sleeve and cup are then placed on an anvil. After the detonator disc (.001") is gaged 100% to make sure that only one is used, it is inserted into the cup and seated with an arbor press. Friction powder is then measured and poured into the cup and pressed at 191 lbs. dead weight. The cup is then placed into another fixture and lead azide is measured and poured into the cup and pressed at 191 lbs. dead weight. One tetryl pellet is then inserted and pressed at a fixed stop, a second tetryl pellet is inserted and re-consolidated to a fixed height, as given in the specifications. This height should be checked frequently by the Inspector to insure the correct amount and height of powder after pressing. The detonator disc (.020") is then inserted with the painted side out and crimped down 45°. The cup is then moved to another fixture and the top of the cup flattened down over the disc. The cups are then forced from the sleeve in the direction that they were pressed to insure that all parts of the cup pass through the same point in the sleeve to give a uniform diameter all along the length of the cup.

The cup is then visually inspected to detect any cuts or punctures in the disc, cracks in the wall of the cup, condition of the crimp and is then gaged for height and diameter. The completed detonators are then placed in a cardboard cuspidor filled with sawdust, 100 detonators to the cuspidor and taken to another building where they are rumbled to clean them.

The finished detonator is then ready for assembly into the slider. The slider is placed on a fixture, locating by the small diameter of the detonator cavity, and the detonator is then inserted and crimped 360°. The slider is then inspected to see that the detonator is flush or below the surface of the slide so that it will not foul the slider. The detonator must also be tight in the slider after crimping.

LOADING OF RELAY CUP

The relay cup is placed into a fixture and lead azide measured and poured into the cup and pressed at 232 lbs. dead weight. The cup is then placed in another fixture and the onion skin disc inserted and the top of the cup crimped down 45°. The cup is moved to another fixture where the top of the cup is flattened down over the disc. The completed cup is then gaged for overall height and diameter 10%. The cup is inspected to see that the paper disc is not torn and is properly seated, that the crimping wall is not cracked from the crimping operation.

LOADING OF CLOSING CUP

The closing cup is inspected visually to see that it is free of dirt and other foreign matter and then placed into a fixture and one tetryl pellet inserted and pressed at 191 lbs. dead weight. Another tetryl pellet is then inserted and re-consolidated to a fixed height as given on the drawing. The completed cup is then checked visually to see that the pellets are not cracked, or loose in the cup. The cup is also inspected to determine if the cups are cut or distorted by the pressing operation. The diameter and overall length are gaged 10%. The completed cups are placed in the slider and crimped 360°. The crimped cups must be flush or below the surface of the slider plate so that it will not foul the slider and keep it from arming.

ASSEMBLY OF STRIKER ASSEMBLY

The striker is visually inspected for dirt, burrs or foreign matter and presence of all holes. The instantaneous and delay firing pins are then inserted and tightened down to approximate height and then gaged for height until they are within the limits on the flush pin gage. The pins are then staked in. They are then gaged 100% for height and straightness along the axis of the striker, after which the stake marks are coated with lacquer to prevent rust.

ASSEMBLY OF VANE CUP

The vane cups come to the assembly building with the drive gear and vane cup eyelets riveted in. The drive gear is assembled through the bearing and the vane holder assembled and a small pin inserted and staked. Then the vane lock is turned several revolutions by the operator to see that the drive gear will turn freely. The eccentric gears are then assembled and the external gear assembled and the vane lock checked by turning to see that the gears are in line and that the gears will turn freely.

BODY

The body is inspected to make sure that all holes are present and that the body is clean and free of foreign matter. The body lugs are then pressed in, making sure that they are in straight, since loading fixtures locate from these lugs. The setting sleeve assembly is inserted and the body drilled with a small hole down along side the setting pin assembly. A small pin is inserted and staked in place to hold the setting pin assembly. This operation must be checked to insure against distorting the setting sleeve and binding the setting pin. After the staking operation the stake marks are coated with lacquer to prevent rust. The arming screw is soldered into the internal gear and then a hole drilled and pin inserted and staked to hold the arming screw and internal gear together. The arming screw and internal gear assembly are tested by pressing down on the internal gear assembly to try to push the arming screw out of the gear. After this checking, the arming screw is coated with light oil to make it operate freely. The internal gear is then assembled to the striker and run down against the striker face. The internal gear must move freely in the striker and must be parallel with the surface of the striker.

ASSEMBLY OF STRIKER ASSEMBLY VANE CUP ASSEMBLY AND BODY

The striker and internal gear are assembled to the vane cup assembly and the vane cup key set in place and fastened with a screw. This keeps the vane cup from turning around on the striker when the fuze is arming. The vane cup screws are then inserted and screwed tight. All the screws are then soldered to the vane cup to keep them from working out. A vane is then placed on the vane holder and the whole assembly placed inside a barricade and the vanes turned by air from a small pipe to test the arming of the arming screw. The arming screw is then run back into the striker by reversing the direction of the air currents on the vane. The air is stopped before the arming screw jambs down and the vane is run down right by hand and then backed off several rounds to keep the arming screw from binding so that it will not arm in service. A safety cotter pin with tag attached is inserted into the vane cup eyelet and vane lock. A safety wire is then inserted into the hole in the vane holder, through the vane lock and through the vane cup eyelet and sealed with Ordnance seal.

Thirteen safety discs are then placed inside the vane cup over the bottom face of the striker and the body assembly placed over this while the cup assembly is held upside down. The setting pin is pulled out until the striker moves down far enough into the body for the setting pin to engage it and hold the striker and vane assemblies to the body. These units are then moved to the loading department for complete loading and assembly.

The Inspector should assure himself that the arming screw will arm, that the correct number of safety discs are present, that the setting sleeve is neither too deep or too shallow and that the setting pin is neither too long or too short. If too long it will extend into arming stem cavity and not allow fuze to be set on superquick. The height of delay and instantaneous firing pins should be checked and the instantaneous firing pin should be checked to insure that it is not bent or the point damaged.

ASSEMBLY OF M-103 TAIL BOMB FUZE

BODY

Primers are received at the loading plant from commercial sources and are placed in a dry house for 48 hours at 90 F. A small number are then subjected to sensitivity test. They are gaged 100% for diameter and the shoulder of the primer must seat on the gage flush.

The body is placed in a fixture and a primer is inserted into the primer cavity and the body located under the punch of the press. The primer is then pressed in at 250 lbs. dead weight. It is then gaged 100% for height and crimped 360°. After crimping the primer into the body it is gaged for the depth of the primer cup. The top of the primer must be flush or below the surface of striker cavity, according to drawing.

The sealing washer for the delay cavity is inserted into the body, care being taken that the washer is properly seated. The delay holder assembly is inserted and screwed down about two threads. A coating of N.R.C.

is placed on the remaining threads and the delay holder screwed down tight with $3\frac{1}{2}$ lbs. dead weight and staked. The body is located from the striker cavity for this operation. Care must be taken that the delay holder assembly does not extend from the bottom of the body into the slider slot as this will foul the slider when the fuze is going into the armed position.

The body is placed in a fixture that locates from the body lugs and the slider plate placed on the body with the open ends of the closing cups facing outward. The slider plate screws are inserted and tightened at $1\frac{1}{2}$ lbs. dead weight.

STRIKER HEAD

The discharge spring is wiped with light oil and one safety disc inserted into each end of the spring. Then this spring is placed into the vane cup with the looped ends of the spring turned out. Then the remaining eleven (11) safety discs are inserted. Care must be taken that the striker head is kept in an upright position until assembled to the body to prevent the discs falling out.

The arming stem spring is placed on the large end of the arming stem and the arming stem inserted into the body cavity. The setting pin sleeve is then pulled out and the body assembled to the vane cup assembly. Setting pin inspected to see that it does not extend in arming stem cavity on super quick setting. The shear pin is inserted into the body and staked. The arming stem must move freely in the body and not be bent. The vane cup assembly must be securely fastened to the body.

The steel sleeve is placed on a fixture which is an ordinary slider plate mounted, and two tetryl pellets are inserted, a filler disc is placed on top of the second pellet. No cracked or chipped pellets are to be used. The booster case is then slid over the assembly.

The body is placed in a fixture and the slider is inserted with colored side of detonator facing slider plate, and slider spring cavities of slider facing outward. The slider lock and spring are inserted and the booster case is screwed on just enough to cover slider lock spring. This must be watched closely to see that the slider lock spring is held in place and not fouled by screwing the booster cup over it. The slider springs are inserted into the spring cavities of slider and slider spring cups assembled over the free ends of the springs. The booster case is then screwed on the body threads finger tight, care being taken that the slider springs are held in place. The fuze body is then placed into a fixture and an assembly ring placed over the booster case so as not to mar the brass casing, and the case tightened with a toggle wrench.

This series of operations must be carefully checked to insure proper functioning of the fuze in service. The slider must work freely within the slider cavity and the slider springs must not be bent or bound by the assembling operations. The slider lock pin and spring must not bend after the booster case is assembled and tightened.

The booster case is staked to the body, located in the fixture by the body lugs.

INSPECTION OF COMPLETED FUZE

The completed fuze is gaged 100% from the bottom of booster case to the first body thread, gaged 100% for concentricity of the booster case with the body, and weighed 100%. The completed fuze is visually inspected for presence of shear pins and staking, staking of booster case, and that the setting pin is set on delay, legibility of stamping, presence of tag seal, tag assembly, car seal and all other general conditions.

PACKING

A metal support is placed over the head of the fuze so that the lugs on the body will engage the holes in the support. A cardboard disc is placed in the bottom of the container and the fuze inserted vane cup down one more cardboard disc is placed over booster cup to pack the fuze securely. The top of the container is assembled and sealed with a strip of adhesive tape around the joint of top of container and a three quarter inch tab is left for easy opening of the container. This operation must be watched to see that the tape is properly applied so no paint can get into the container in the next operation.

The container is then painted with black acid-proof paint and a gummed label applied to the outside of container which is coated with clear shellac varnish.

The fuzes are then packed 25 to a wooden box with cover end of container up. Twenty-five vanes are inserted into the box in units of five wrapped in kraft paper. A data card and enough fillers to pack the fuzes securely are inserted and the lid is then assembled and tightened down with screws. The seal recesses are coated with shellac and the ordnance seal inserted, two on top and two on bottom. The box is then inspected for stencilling date, weight, and lot number as required by specifications and drawings.

LOADING AND ASSEMBLY OF M-106 TAIL BOMB FUZE

LOADING OF PRIMER CUP

The primer cups are visually inspected to see that they are free of dirt, grease and other foreign matter and inserted into a fixture. The primer mixture is then measured and poured into the cup and pressed to the specifications given on the drawing. The primer disc is then inserted and the cup moved to another fixture where the top is crimped down 45 . The cup is then taken to another fixture where the top of the cup is crimped down flat over the disc and sealed with water-proofing wax.

The completed primer is inspected visually for seating of primer disc, tears or cuts in the disc, cracks in the crimping wall from the crimping operation and presence of water-proofing wax. The cups are also gaged 10% for height and diameter.

The primer holder is inspected for cleanliness and located on a fixture from the small diameter of the primer cavity. A black powder pellet is inserted and a primer retaining washer placed over it. The primer is then coated with N. R. C. compound around the peripheral surface and inserted into the primer holder. Another primer retaining washer is inserted over the primer, and the wall of the primer holder crimped down over it before the N. R. C. compound dries.

The completed primer holder assembly is inspected to determine tightness of primer and sealing of primer into holder. The crimp must be 360°and not damage the primer cup.

LOADING OF DETONATOR

The firing pin holder is inspected for tool marks and rust in cadmium plating and then put into a fixture and the firing pin inserted lining the arming pin hole in the firing pin with the arming pin hole in the firing pin holder. The arming pin and spring are inserted from the bottom and the foot pedal pressed down to compress the arming pin spring and push it up to the other side of the firing pin holder. The safety cotter pin and tag with instructions is then inserted into the outer hole of the arming pin and the pressure released. This assembly is inspected to see that the arming pin will move freely through the firing pin and the firing pin holder and not bind. The top of the firing pin is inspected to see that it does not extend high enough for the firing pin holder plug to screw down on it in assembly and bind the arming pin. The point of the firing pin in inspected 100% for bent firing pin points and for presence of flat.

ASSEMBLY OF M-106 TAIL BOMB FUZE

The plugs are stamped, showing date, loading plant initials and the lot number. This stamping must not distort the shape of the plug or the threads so that it won't assemble into the complete fuze. The firing pin holder is set into a fixture and the plug started by hand then tightened by a wrench to a slippage of the belt on the drill press. The assembly is then located in a fixture from the wrench holes in the plug and a hole drilled for a small pin through the firing pin holder into the plug. The plug locking pin is then inserted and staked.

The firing pin spring is assembled into the firing pin holder, small end first. The spring is compressed by screwing the primer holder assembly into the firing pin holder finger tight.

The miner's fuse is then cut to length (21 inches), care being taken that no asphalt gets on the cutting knife or guides so that it could possibly cover the opening of the fuse. The fuse retainer is then placed over the upper fuse collar and the collar is placed over the fuse. The fuse is then crimped to the collar and the width of the crimp gaged about 10%.

The fuse assemblies from the crimping operation are placed in a wooden rack and some of the quick match mixture applied to the end of the fuse with a pointed stick. This daub of quick match mixture must completely cover the end of the fuze in a round daub. The quick is then allowed to dry at room temperature for at least four hours.

The fuse is then twisted around a steel bar mandrel and then the body closing plug assembled over the free end. Care must be taken that the fuse is not broken or it will burn through in service and cause fuze to fail to function. A dummy primer holder is then screwed into the other end of the fuse body, to keep the fuse coiled. The lower fuse collar is placed over the free end of the fuse. A black powder pellet is inserted into the detonator, making certain that no broken or cracked pellets are used. A half inch is cut off the free end of the fuse to make certain that the fuse is solid and loaded to the end, and the detonator placed over the end of the fuse. The lower fuse collar is then pushed over the detonator and the collar crimped around the detonator. The closing plug is then tightened tight by hand. The dummy primer holder is removed from the fuze body and the primer holder, with threads coated with Pettman cement and the detonator holder slipped over the exposed detonator and the threads engaged into the body threads. The body assembly is tightened to the primer holder assembly, body closing plug tightened to the body and the body cap tightened to the body closing plug on a hand tension machine. The body cap and body plug are staked to the body closing plug and a hole drilled through the body and firing pin holder into the primer holder. A small pin is inserted and staked.

The completed fuze is then gaged 10% for outside threads and 100% for overall length. The detonator holder is gaged for depth below shoulder 100%. The angle of the spread on the cotter pin is inspected and the crimping and staking inspected. The stamping is also inspected for correct date and lot number.

PACKING

The fuzes are inserted into the containers with the bottom end first after the bottom support has been set in place over the detonator holder. The top support is then inserted over the fuze in the container so that the clips hold the fuze firmly. The container covers are then placed on the containers and sealed with a piece of adhesive tape which is wound so as to leave a tab on the end for opening the container. The whole container is then sprayed with black acid-proof paint and dried four minutes at 165 F. The label is then applied to the container and coated with clear shellac. Fifty of the fuzes in containers are packed in wooden boxes with a data card and the boxes closed with screws and the necessary data stencilled on the outside of the box.

LOADING OF M-20 DETONATOR

After determining that the cup is clean it is inserted into a cylinder sleeve and made flush with the bottom of the sleeve. The sleeve and cup are then placed on an anvil. After the detonator discs (.002") are miked to make sure that only one is used, it is inserted into the cup and seated with an arbor press. Lead azide is then measured and poured into the cup and pressed at 282# dead weight. A tetryl pellet is then inserted and the powders re-consolidated to a fixed height, given in the specifications. This height should be checked frequently by the Inspector to insure the right height of the completed detonator. The detonator disc is then inserted with the painted side up. The sleeve is then inserted in a fixture [illegible]
[illegible]
A forming tool then comes down and forms a 45° angle around the top of the cup. The cup is then moved to another fixture and the top of the cup flattened down. The cups are then forced from the sleeve in the direction that they were punched to insure all parts of the cup passing through the same point of the sleeve to insure uniformity of diameter along the length of the cup.

The completed cup is then visually inspected to detect any cups that have cuts or punctures in the disc, cracks in the wall of the cup, condition of the crimp and then gaged for height and diameter.

The completed detonators are then placed in composition boards with holes drilled to carry 100 detonators and taken to another building where they are cleaned by rumbling. This rumbling consists of emptying the detonators from the board into a canvas bucket and a measured amount of sawdust is poured over the detonators and another hundred detonators emptied over the sawdust and the bucket removed to a chute over the rumbling machine and the bucket emptied into the rumbler by remote control. The rumbler is operated by remote control and the detonators rumbled until they are free of excess powder on the outside, and the graphite from the sleeve which is used to make the detonator slide out of the sleeve easily after the pressing.

LOADING OF M-20 LEAD CUP

After determining the cleanliness of the cups they are placed into a fixture. This fixture consists of (1) a block of fiber or some pressed composition which has holes the size of the cups drilled into it; (2) a hopper over a board with holes in it the size of the pellets. Below this board is a baffle which holds the pellets in the board until it is removed. The tray containing the cups is inserted below the baffle and the pellets in the upper board are allowed to drop into the cup. Two pellets go into each cup. The cups are taken from this tray and placed in the fixture of the press which are on a revolving table. The table indexes around until the cups come under the press and the cups are pressed. The cups are removed from the press fixture and slide down a chute into sawdust to remove the excess tetryl from the cup.

The cups are then visually inspected to see that the top of the pressed tetryl is not cracked and that the correct diameter is not distorted or the flange of the cup distorted.

ASSEMBLY OF M-20 BOOSTER AND M-21 BOOSTER

The rotor is inspected visually for burrs, dirt, chips or other foreign matter. A cork detonator cushion is inserted into the detonator cavity, making sure that no defective cushions are used, and the detonator inserted with the painted side down. It is then placed in a fixture which locates from the bottom of the rotor in the small diameter of the detonator cavity. The detonator is then crimped in 340°. The 20° not crimped is opposite the pivot pin hole and is not crimped because of possible distortion of the pivot pin hole which would bind the rotor when it is arming.

The rotor is then inspected to see that no metal has been pushed into the pivot pin hole by the crimping operation, that the detonator is tight and that the crimping has not extended above the surface of the rotor.

The rotor lock pin is inserted in the lock pin hole and the rotor lock pin lock inserted in its cavity. This assembly is then inspected to see that the lock and lock pin lock do not extend out of the rotor so that they might bind the rotor.

BODY

The body is visually inspected for dirt, chips or other foreign matter. The body is then placed in a fixture which locates the body from the wrench holes and a staking tool cut slots into the body below the fuze threads. The lead cups are then inserted and the body placed on a fixture, locating from the rotor cavity and the lead cup crimped 360°. It is then inspected to see that the lead cup does not extend into the rotor cavity and that the lead cup does not extend above the booster surface.

The rotor assembly is assembled into the body by holding the body upside down and inserting the rotor by means of a pair of tweezers. Care must be taken that the rotor lock pin and lock pin lock do not fall out, as there is no other way to check their presence after the rotor is inserted.

An onion skin disc is shellacked over the flash hole of the rotor cover, making sure that no shellac is in the flash hole or the rotor cover by wiping the excess shellac off with a rag dipped in solvent. The date, lot number and kind of booster and loading plant initials have previously been stamped into the rotor cover. Care must be taken in this operation that the covers received at the loading plant do not have a dish shape which would make them not seat in the booster properly.

The rotor cover, with disc in place, is then inserted into the body of the booster and is staked in four places by pushing metal from the cover into the staking notches made in the body and flushing the metal from the body down over this part of the cover which is flushed into the staking notches. The staking is then inspected to make sure that the cover is tight and that the cover disc is in place. It should also be inspected to see that the metal from the body does not extend too far into the fuze cavity and interfere with the seating of the fuze.

A paper washer is placed in the booster cup and the tetryl pellet inserted. The booster cup is then tightened into the body with 43# dead weight. The completed body is then gaged 100% for overall height.

The completed body is placed on a fixture on its side and a tool comes, stabs the cup into the body. It is then turned 180° and staked again. The body is then gaged for concentricity of the body and cup. Body threads are gaged 10% inside and out. If the threads are found tight they are given a more thorough inspection to determine the cause.

The completed booster is given a visual inspection for staking, presence of the cover disc, that the detonator is not under the cover disc, which would mean that the rotor is in an armed position.

The completed booster is then placed in a cardboard container and another cardboard disc inserted between the bottom booster and the other booster which goes on top of the first. The lid is then screwed on the box and the whole box dipped in parafin wax to seal out moisture. One-half of the box is dipped and allowed to cool and solidify, then the other end of the box is dipped in parafin. These containers are packed in wooden boxes which hold 25 containers or 50 boosters and sealed with car seals.

PHYSICAL TESTING LABORATORY

(1) Tensile test: for determining yield point, tensile strength, elongation, and reduction of Area.

Yield point and tensile strength is computed in lbs./ sq. in. $= \frac{\text{Load}}{\text{Area}}$

test piece .505" in dia. is turned from a piece of rough stock, approximately 3" in dia., half way between outside and center so as to obtain a uniform piece for test.

.505" dia.

turned to this size and shape so that it will not break in or near the grip in the Testing Machine; and for simplicity of computation.

(2) Hardness test:

(a) Vickers Pyramid - diamond penetration. Especially adapted for thin metal (1 Kg - 120 Kg in dia.)

(b) Rockwell-used for obtaining hardness of general metals. Characteristic-leaves small test mark.

(c) Rockwell Superficial especially fitted for determining the hardness of case hardened material.

(d) Brinell

(3) Micro photograph: An indicator of grain size and micrographic structure of metals.

(4) Impact test: A Shock Resistance test.

INSPECTION PROCEDURE

300# and 500# Demolition Bombs

PRELIMINARY INSPECTION

1. Inspect cavity with light for roughness, laps, seams, die scores, and other defects.

2. Apply Overall Length Gage.

3. Apply Rear Thread Gage.

4. REAR THREAD. Visual inspection for flat threads, bad threads, poor machining.

5. REAR THREAD. Thickness of wall.

6. Apply Rear Thread fin cup.

7. Apply Nose Thread Gage.
   a. For thread b. For depth c. For square face of nose.

8. Apply thickness of Nose Gage.

9. Apply width of Undercut Gage.

10. Apply Plug Gage for Bore.

11. Visual inspection on Nose Thread for poor thread, poor machining, and poor thread welds.

12. Apply Width of Nose Gage.

13. Apply Nose Profile Gage.

14. Roll Bomb for visual inspection, at same time check for thin wall and deep pockets.

15. Stamp with Flaming Bomb for completion of preliminary inspection.

INSPECTION PROCEDURE

300# and 500# Demolition Bombs

LUG AND LACQUER INSPECTION

1. Visual inspection inside of lacquer with light.
2. Visual inspection outside for tags, welds, looking for weld splashes and other defects.
3. Check for stamp of Lug testing operation.
4. Apply Thickness of Lugs Gage.
5. Apply Distance between Lugs Gage.
6. Apply Alignment of Lugs Gage.
7. Inspect for flaming bomb and stamp with personal stamp for lug and lacquer inspection.

FINAL INSPECTION

1. Visual inspection for stenciling, Data cards, paint. This is done after Lug Protector is attached so that bomb can be rolled.
2. Check Rear and Nose for grease.
3. Check Rear Cap for proper fit.
4. Inspect for personal stamp and bomb stamp, then stamp with Final Acceptance Stamp.
5. Check Loading of Car.

BOMB MANUFACTURING PROCEDURE

"A" - FORGING

1. Nicking Billets
2. Heat to forge temperature (2200 deg.) for Upset and Pierce
3. Upset and Pierce
4. Re-heat to forge temperature (2200 deg.) for Draw
5. Draw to finish forge length

"B" - MACHINING BEFORE HEAT TREATMENT

6. Nose centered. Body chucked on outside, mandrel inside
7. Nose turned and cut to length. Chucked inside

"C" - SHAPING OF REAR OF BODY AND NORMALIAING

8. Heat rear of body to forge temperature (2200 deg.) for closing in
9. Close in rear of body
10. Normalized 1600 deg.
11. Cooled by air blast to 800 deg. in 6 to 8 minutes
12. Shot blasted

"D" - MACHINING OPERATIONS

13. Bore nose and thread. Chucked on outside
14. Cut off rear of body and thread. Face inside. Chucked on outside
15. Bethlehem Steel inspection
16. U.S. Army Inspection - Preliminary

"E" - OPERATIONS PREPARATORY TO FINAL INSPECTION

17. Lugs welded to body. 50 bombs in 8 hours
18. Stress relieve area around welded lug
19. Pull test on lugs
20. Lacquer inside of body
21. Stamp bomb identification on body
22. Bethlehem Steel inspection
23. U.S. Army inspection (lugs and lacquer)
24. Paint body and stencil nose and body
25. Attach wooden lug protectors
26. Grease threads on nose and rear
27. Assemble metal parts to nose and rear
28. U.S. Army inspection. Final acceptance and final stamp
29. Data cards attached to forward lug
30. Bombs loaded in car and final Government inspection in car

INSPECTION AT MELT LOADING AND COMPLETE ROUND DIVISION

Read Expenditure Order, study Drawings and Specifications, also see that all the gages needed are available.

Check for the following:

Cleaning shell, grease in threads, foreign material in shell, also condition of coating on inside of shell, there should be no rust in shell.

Lot number.

See that T.N.T. comples with Spec., when Ammonium Nitrate is used see that a sample is taken and tested for Moisture Determination.

Lot number of T.N.T.

Pouring temperature of T.N.T. Pour a split shell and check for cavitation. Conduct water weight test to obtain density.

To see that the booster cavity is drilled to the proper depth.

Threads to see that all excess T.N.T. is removed, also look for cavitation.

Depth of Fuze well cup.

Depth from top of shell to top of rotor cover.

Staking of set screw which holds booster in place.

Fuze assembly, lot number, staking and tightness. (Fuze must seat tight against edge of shell).

Condition of paint on shell.

Lot number of cartridge case and condition. Case must not be dented or dirty.

Lot number of primers, assembly of primers to case must be flush or below top of case.

Weight of propellent charge, scales and lot number of powder.

When increment loading is used check condition of increments, lot number of powder when received.

Distance to obterating tube to see that the distance from bottom of shell to top of tube is in accordance with drawing.

Assembly of shell to cartridge case, edge of cartridge case must seat up under rotating band.

Crimping of cartridge case to shell on fixed ammunition.

Semi fixed ammunition is not crimped.

See that all rounds are chamber gaged 100% by the operator. Round must enter gage freely.

When Fuze covers are used, see that they are properly assembled and sealed.

Stenciling on side and base of cartridge case, also on shell to see that it complies with drawing.

Stenciling on Fiber containers to see if it complies with drawing.

When boxes are used, also check stenciling on them.

Identification and shipping plates to see that the marking complies with the drawing.

Bundle packing to see that it complies with drawing.

See that operator inserts the data cards where called for.

Check Data Cards. Select Ballistic sample.

Report completed lots.

Assure yourself that the proper amount of gaging and inspection is being done throughout the job.

See that all work complies with the Expenditure Order, the drawing and Specifications.

INSPECTION OF BOMB LOADING

Inspect bomb for condition.

Inside must be properly coated, if any bare spots are found they should be recoated before pouring.

Check pouring temperature of T.N.T.

T.N.T. must comply with Spec.

See that T.N.T. is properly kept broken down between each pour while it is solidifying, this prevents cavitation. A 600 lb. bomb requires approx. 5 pours.

Load a split bomb, remove the T.N.T. and sectionalize, then Inspect for cavitation.

Conduct Water Weight Test to obtain density.

See that drilled booster cavity is proper depth.

See that all excess T.N.T. is removed from bomb.

Inspect painting, see that grease is applied to shipping plug.

Inspect stenciling and crating of bombs to see that they comply with drawing.

Report completed lots.

Check Data Cards.

Select Ballistic Sample.

PICATINNY ARSENAL

TENTATIVE INSTRUCTIONS

INSPECTION OF METAL COMPONENTS

M-20 & 21; M-52 & 53; M-48 & 51; M-54 & 55.

Points of Visual Inspection

Instruction on Cleaning and Cadmium Plating.

Prepared under the direction of the Chief of Ordnance for the use of Ordnance Inspectors.

Authors: E. B. Holley
R. J. Lynch

Officer in Charge: Lt. W. L. Kimball

TENTATIVE INSTRUCTIONS FOR THE
METAL PARTS INSPECTION OF THE FOLLOWING FUZES

M-20 & M-21	BOOSTERS	
M-52 & M-53	SUPERQUICK P.D. FUZE DELAY P. D. FUZE	TRENCH MORTAR FUZES
M-54 & M-55	COMBINATION TIME AND SUPERQUICK P.D. FUZES	
M-48 & M-51	COMBINATION SUPERQUICK AND DELAY P. D. FUZE	

Important Points of Visual Inspection

1. Make sure fuze is complete.

2. Stamping must be readable, and has not distorted any dimension or thread.

3. The concentricity of parts that make up the outside diameter of the complete fuze (eccentricity will cause wind resistance and throw fuze off balance, if any overlap, it should be from nose end of fuze).

4. Watch for unevenness of flat on threads, see that last thread is complete, not damaged.

5. The location and alignment of cavities (where one part depends upon the alignment of the other the location of these cavities is of most importance to the functioning of fuze).

6. All parts that go to make up complete fuze shall be clean and free of all burrs.

E. B. Holley

Points of Visual Inspection

Burrs and foreign matter
Shoulders ruined by threading tool
Surfaces ruined by threading tool
Flat Bottom in cavities
Irregular shaped holes
Correct stamping
Proper crimp and staking
Flat on major or minor diameter of threads
Surfaces straight
Surfaces in the bottom of cavities straight
Finishes according to drawing
Proper chamfer or radius
Shoulders on bottom radius of cavities
Latent defects - cracks, pipes, etc.
Plating
Hob thread check overlap

M20 BOOSTER

BODY

Outside Body Threads:
To insure proper assembly of the booster body in the projectile, these threads should be closely checked for size and concentricity with the axis of the body.
Booster Thread:
As the alignment of the booster cup with the diameter above this thread is gaged 100% after being loaded, it is important that this thread and shoulder be concentric with the axis of the body. Care must be taken that burrs from first thread do not extend above the bottom surface of the body. The bottom surface of the body should be straight and of good finish, as booster pellet bears on this surface when the booster cup is assembled to the body. If this surface is convex the booster pellet may crack, or if it is concave the closing cup may extend into the rotor cavity.

CLOSING CUP HOLE

The inside finish must be kept free of tool marks or scratches. The concentricity of this hole is important on account of the crimping operation. The crimping wall of this hole must be concentric with closing cup hole and correct depth. If the crimping wall is too deep the closing cup may extend in the rotor cavity and interfere with the action of the rotor, and if shallow it may extend above the bottom surface of the body and crack the booster pellet when it is assembled to the body.

CENTRIFUGAL PIN LOCK PIN CAVITY

This <u>must</u> enter the centrifugal pin hole in the center so the lock pin will assemble with the centrifugal pin. The diameters must be concentric to insure freedom of action of the lock pin and spring. Depth of the large diameter must be such that it will allow the plug to be brought down flush with the surface. The dimension must be held between the center of body and center of lock pin hole to insure the locking of the centrifugal pin which in turn locks rotor.

CENTRIFUGAL PIN CAVITY

All diameters must be concentric to insure free movement of the centrifugal pin and spring. It is important that the dimension from the center of the body to the bottom of this cavity be held to insure locking of rotor and functioning of the centrifugal pin lock pin. The dimension from the bottom of centrifugal pin cavity to the bottom of the counter bore must be held so the centrifugal pin screw will not bind on the centrifugal pin lock pin.

BODY PLUG CAVITY

The location of this hole determines the position of the rotor when in an armed position. Sharp corners and diameters should be maintained where plug seats in cavity for correct crimping.

ROTOR

Have top and bottom surfaces parallel and make the bottom surface flat. The drawing calls for FF finish on the bottom so the rotor will turn freely.

The important parts of the profile are the surfaces next to the stop pin in both the armed and unarmed positions of the rotor. In the unarmed position the centrifugal pin slot must be free to center with the centrifugal pin without binding. In the armed position the rotor lock pin must center with the lock pin cavity in the body and not be held out of position by the surface which bears against the stop pin. The relative positions of the pivot pin hole lock pin hole and detonator cavity must be held to insure proper arming.

The thickness of the wall at the bottom of detonator cavity must be held for proper assembly of the detonator. The detonator cavity must be concentric with the flash hole and be free of burrs and tool marks. Care should be taken in burring not to remove metal needed for crimping of detonator cup in rotor. Care should be taken when reaming detonator hole that bottom does not bulge.

Pivot pin hole must be concentric and straight with the axis of rotor and have good finish (FF) shown on drawing.

The rotor lock pin and lock pin lock holes must be clean and free of burrs. The lock pin lock hole must break in the center of the lock pin hole.

DETONATOR CUP

The inside diameter, if small, will cause the punch to stick in the cup or otherwise distort it, thereby setting up an extremely dangerous condition in the loading operation. The outside diameter if too large prevents the cup from fitting the loading fixture which makes it useless. The cup must be absolutely without draw marks, scratches, cuts inside or outside. The small hole must be concentric with the inside and be free of burrs which may cut the detonator disc allowing the powder to seep out.

The radius on the inside of the bottom of the cup must not exceed the maximum drawing size. The bottom of the cup must be flat. The open end of the cup must be flat and without chamfer or radius and must be free of burrs.

CENTRIFUGAL PIN

For the proper functioning of this pin with the lock pin it is important that dimension from shoulder to center of lock pin hole be maintained. This hole should be in the center of the pin to avoid any binding with the lock pin.

CENTRIFUGAL PIN LOCK PIN

There should be no burrs on either end of this pin.

CENTRIFUGAL PIN SCREW

The length from the end of screw to the underside of flange is important because if this is too long it may bind the centrifugal pin lock pin. The inside diameter must be free of shoulders so spring will not be fouled in arming of rotor. Check for bulge on inside caused by putting screw driver slot operation.

BOOSTER CUP

Bottom surface inside and outside should be straight and have the proper radii. Guard against collet squeeze when threading the cup. Perfect threads are necessary and no burrs should be left below last thread as this will interfere with booster pellet. Check closely for cracks in the material.

BOOSTER CLOSING CUP

There must be no die cuts or draw marks on either the inside or outside of the cup. Check the outside diameter especially near the flange. The dimension under the flange to the bottom of the cup is important as a long cup may extend into the rotor cavity. The radius on the inside of the cup must not exceed the maximum dimension shown on drawing for loading reason. The radius under the flange must be held for proper fit with the crimping wall in the body. The outside diameter of flange must be concentric with the inside of the cup. There must be no cracks resulting from forming the flange angle.

LOCK PIN CLOSING PLUG

Over-all length must be held so the plug will not extend above the bottom surface of the body. The inside diameter should be concentric with outside threads and have specified radius to prevent spring from fouling.

ROTOR CAVITY

By the locking of the rotor in the armed and unarmed position and the alignment of the detonator cavity in the rotor and the closing cup when armed, the position of the rotor cavity is determined by the relative position of the center of the cavity and the center of the body; this dimension must be held. For following reasons the depth of the rotor cavity must be maintained; if this cavity is shallow the rotor may bind with rotor cover, and if deep, the closing cup may extend in this cavity. The bottom must have good finish (FF) with the specified crown and the sides should be parallel with the axis.

PIVOT PIN HOLE

This hole must be concentric with the rotor cavity and be parallel with the axis of the body. The diameter of the pivot pin hole must be held within the drawing tolerance for a press fit of the pin. If this hole is large it will not stand the jumble and jolt test, and if small the pivot pin may bend in assembly. The chamfer on the top of the pivot pin hole is for the removal of any excess plating or burrs which may be found after the pivot pin is assembled. The pivot pin must not bulge the bottom surface of the body.

ROTOR STOP PIN CAVITY

The location of the stop pin cavity is important in determining the armed position of the rotor and should be held according to drawing; the diameter of stop pin cavity must be held for press fit of stop pin; if diameter is large pin will drop out in jumble and jolt test, if small, pin will bend in assembly. The chamfer at top of stop pin cavity is for the easy removal of any excess plating or burrs which may be found after the stop pin is assembled. The stop pin cavity must not bulge the bottom surface of the body.

Rotor Pivot Pin

Outside diameter very important and must be held for press fit in body. Length of pin with no burr on end important that it does not interfere with rotor cover.

Stop Pin Hole

Outside diameter must be held for press fit and not bend in assembly.

Rotor Cover

Cover must be straight and flash hole concentric with outside diameter.

Rotor Lock Pin and Lock Pin Lock

Length and diameter must be held for the proper assembly in rotor. Care must be taken that no burr on chamfer on end of these pins to insure free movement.

Detonator Disc

Care must be taken as burrs on these discs are dangerous from the loading standpoint. Heavy disc must be colored on one side for proper assembly reasons and if made with sharp corner or very small burr, the burr would be on painted side and not be in the powder chamber of the detonator.

Body Plug

The diameter must be held and free from burrs for proper crimping. These are the important points of this component.

Assembly M20 Booster Body

Body visually inspected for burrs and any foreign matter. Rotor Pivot Pin and stop pin inserted, care must be taken that pins are not bent or marred and are securely tight. Gauged 100% for height.

Rotor placed in body, visually inspected for location of safety slot in relation to Body Centrifugal Pin hole.

Rotor removed and Centrifugal Pin and spring inserted, Centrifugal Pin Screw screwed in Body.

Chamfer around pivot pin and Stop pin cleaned of any scale or excess Plating found from pressing Pin in holes.

Centrifugal Pin screw Staked. Centrifugal pin should be tried for free movement to insure staking has not distorted inside diameter of Screw.

Non arming test	100%	1500 R P M
Arming test	100%	2000 R P M

Centrifugal lock Pin and spring inserted, closing Plug screwed in Body. Centrifugal Lock Pin Lock tested for set back 100%.

Closing Plug staked

Body Plug inserted and crimped, care must be taken that Rotor Cavity diameter is not distorted.

Body must be packed securely that threads will not be damaged during transportation to loading Plant.

M-54 AND M-55 TIME AND SUPERQUICK FUZES

METAL COMPONENT PARTS

Closing cap
Closing disc
Closing disc washer
Firing pin
Firing pin support
Detonator cup
Detonator disc (.002")
Detonator retainer
Retainer washer
Detonator cushion
Detonator retaining screw
Set screw
Cotter pin
Cotter Pin ring

PLUNGER ASSEMBLY

Plunger
Plunger sleeve
Shear wires (2)
Dowel pins

BODY

Upper ring
Vent closing disc
Crimping support vent washer
Graduated ring
Safety disc
Vent closing disc
Crimping support vent washer
Groove cover, onion skin (2)
Fuze cloth washer (2)
Set screw
Primer striker
Primer striker dowel pin
Primer
Interrupter
Interrupter spring
Interrupter closing plug
Tension washer
Body charge disc
Safety disc
Bottom closing screw
Bottom closing screw disc, cloth
Bottom closing screw washer
Assembly of Body Assembly.

CLOSING CAP

The plunger cavity in base of cap must be straight with the axis of the cap for alignment of the plunger with the inside diameter of the primer striker. If this cavity is not concentric and threads straight it may bind plunger and prevent it from striking the primer striker.

The tension washer cavity (shallow cavity at the base of the cap) should be parallel with the bottom of the cap. Detonator cavity should be concentric with the plunger cavity and must be concentric with the firing pin hole. The depth of detonator cavity is very important. If deep, a dangerous condition is set up by allowing the detonator to come too close to the firing pin. Also, the detonator cavity must not be bell-shaped which would allow the detonator, when assembling the retainer, to tip the detonator throwing the small hole in the bottom of the cup out of line with the firing pin hole.

The position of the locating hole that aligns the plunger assembly with the cotter pin hole in the cap must be such that the cotter pin can be assembled without binding.

Detonator retainer cavity threads should not chamfer more than to take care of burrs extending into the plunger cavity as this thread is staked in assembly.

The striker cavity and firing pin support cavity must be concentric with the firing pin hole. The crimping wall at the top of cap should be concentric to prevent cracking or making a shoulder on outside radius in crimping operation.

Outside surface should be good finish. Lower diameter of cap must be held and concentric so that cap overhangs upper ring when fuze is assembled.

PLUNGER SLEEVE

A careful inspection must be made on this sleeve. The overall length to assemble between closing cap and body. Inside diameter must be concentric with outside diameter to align with inside diameter of primer striker when assembled into complete fuze. The dimension from center of shear wire hole and cotter pin hole to the bottom of the sleeve must be as specified so that when the plunger assembly is made and inserted in the cap with the cotter pin there will be no pressure on shear wires, as if this condition does exist the shear wire will partially shear in jumble and jolt test. Inside diameter must have good finish and be free of burrs, resulting from the drilling of shear wire and cotter pin holes. Any burrs on the inside would hamper the action of plunger.

PLUNGER

Shear wire holes and cotter pin holes must align with these holes in sleeve. Outside diameter of plunger must be good finish and be free of burrs around drilled holes, so that the plunger can move freely in the sleeve in service.

DETONATOR RETAINER

Threads must be made for free assembly in cap and not too much chamfer on screw driver end of plug for crimping. The bottom surface must be straight and have a good finish so in assembly it will not cut and distort the detonator cushion.

FIRING PIN SUPPORT

The overall length is very important as this is one of the contributing factors controlling the distance the firing pin is held away from the detonator. Thickness of metal on side wall must be even. No draw cuts or small shoulder on the top outside radius of the cup should be allowed. The bottom should be trimmed square and not have any chamfer.

FIRING PIN

Care must be taken that the flat on the end of the firing pin is as specified with no burr. Point must be concentric with the diameter of pin. Diameter of pin must not taper toward the striker to a smaller diameter. If this diameter is smaller or the pin has an undercut under the striker, the firing pin will be weak at this point. If firing pin is made separate of striker, the outside diameters should be held toward the min. to take care of the spreading of the striker when the firing pin is riveted into the striker.

CLOSING DISC AND WASHER

Thickness and diameter must be held for proper assembly.

SHEAR PIN

Diameter of this pin is very important to withstand the shear wire test and jumble and jolt test.

DOWEL PIN

Diameter must be held for proper assembly and length held for proper seating of the plunger assembly into the closing cap.

PRIMER STRIKER

The outside diameter of the flange and body of the striker must be concentric. The location of the locating hole in the flange of the striker in relation to the firing pin must be as specified, for the functioning of the firing pin with the primer. The dimension from the inside of striker to the center of the firing pin is also important for this same reason. The radius on the firing pin is very important for the sealing as well as the firing of the primer.

A close check should be made on the metal, especially the narrow neck between the firing pin and side wall of the striker. There should be no cracks or defects in this part of the striker that might cause the firing pin to break off in service rather than bend over onto the primer.

There should be no punch burrs or distortion of the outside diameter of the primer striker as this would cause the primer striker to pull up out of the body when the closing cap is assembled and move the firing pin away from the primer and cause the fuze to fail in service.

BODY

The closing cap threads should not extend down too far on the stem of the body or they will break into primer hole. Also the small chamfer on the end of this thread should be kept just small enough to remove the burr or this chamfer will lead the drill off when the hole for the dowel pin for primer striker is drilled. The location of this hole is very important so that the striker will locate the firing pin directly over the primer so it will seal primer as well as fire primer. The dowel pin hole must not bulge into the minor diameter of the closing cap threads or it will keep the cap from assembling.

The primer striker cavity must be concentric with the threads. The depth and angle at the bottom of this cavity must be held to insure correct action of the firing pin and assembly of primer. The primer cavity should not bulge on the outside of the body. The superquick flash hole through the body should be concentric with the axis of the body so that the interrupter will cut off the flash hole when in unarmed position.

The angle at the bottom of the stem of the body must be held so that the graduated ring will seat down on the scored surface and not hang up on the angle of the body. The scored surface must be straight and square with the axis of the stem. This ring seat must have sharp corners (.005" max.). If not, the ring will ride on this radius and not seat properly on the flat surface of the body.

The set screw hole in the stem of the body must be held within limits since the upper ring is located by this screw and if the screw is too high it will foul the assembly of the closing cap.

Both diameters of the interrupter cavity must have a good finish and be concentric for free movement of the interrupter. The interrupter cavity retainer threads must be straight with the interrupter cavity to prevent the spring from slipping to one side of the cavity and fouling which would prevent the arming of the fuze.

Pellet hole depth and diameter must be held. If large, will cause battering of pellet and if small, the graduated ring will seat on pellet and smash it.

Whereas the burning time of the fuze determines the acceptability of the completed fuze, and the setting slot in relation to the set line determines the time setting, it is very important that a careful inspection be made for position of these points.

The flash hole leading from the pellet hole to the bottom closing screw cavity should break into the pellet hole.

Outside surface of the body should have a good finish and stamping and set line be legible.

The body closing screw cavity must be straight across the bottom with no shoulders at the bottom so that the closing screw can make up flush or below the surface of the bottom of the body. The closing screw threads must be concentric with the axis of the body. The flash hole from the body must break into the center of the closing screw cavity so that the flash can pass through the closing screw into the booster. There should be very little chamfer on the closing screw threads, since this metal is needed in staking the closing screw to the body.

Booster threads must be in line with the axis of the body, so booster and completed fuze will properly assemble into the projectile. The dimension from the bottom face to the booster shoulder must be held within limits so that the fuze screws down to the rotor cover of booster rather than make up on the shoulder of the fuze. The dimension from the bottom face of the body to the shoulder that makes up on the projectile must be held within limits so that there will not be too much of a gap between the fuze and booster when assembled into the projectile. This would be caused by the shoulder making up on the projectile before the end of the fuze reaches down far enough into the booster.

The shoulder which makes up on projectile and booster threads must be concentric for fuze to assemble in line with the axis of projectile and seat all around. The shoulder should overhang the projectile evenly 360°.

INTERRUPTER

The interrupter must have a good finish so that it will work freely in the interrupter cavity. The large diameter and small diameter must be concentric so that interrupter will not bind and fail to go into armed position. The spring seat in the interrupter must be concentric with the axis of the interrupter so that the spring will line up straight and not bind the interrupter to one side. The small hole in the bottom end of the interrupter must be held to balance the weight of the interrupter and insure its arming.

INTERRUPTER CLOSING PLUG

The threads must be concentric with the axis of the plug so that the plug does not screw in to one side and bind the spring to one side and prevent its arming. This plug must be held to length so that it does not extend too far into the interrupter cavity and keep interrupter from clearing flash hole. The bottom face must be straight so that the spring will not walk to one side when the plug is assembled.

BOTTOM CLOSING SCREW

Bottom of powder cavity must be straight. The inside diameter must be concentric to meet the flash hole from the body. No burrs should be in powder holes or groove. There should be no burrs on crimping shoulder or on crimping wall so that bottom closing screw disc will not cut or tear cloth disc when crimped in place. The threads must be concentric with the axis to insure closing screw fitting up against bottom of cavity in body, and not extend from the end of the body. Wrench holes must not bulge minor diameter of the threads. Overall length must be held to limits so that screw will make up flush or below the bottom surface of the fuze.

BOTTOM CLOSING SCREW DISC

Diameter must be held so that washer assembles into screw. There should be no burrs that might cut cloth washer when assembled..

All cloth and paper discs must be held to limits of diameter and not be cut or torn in any way, since they seal the fuze against moisture.

ASSEMBLY OF BODY ASSEMBLY M-54.

The body is inspected visually for burrs in the interrupter cavity, flash hole and for dirt in any of the cavities. The interrupter is inserted into the body and the interrupter spring assembled and the retainer screwed in place and staked. The body is then tested for arming and non-arming at the specified speeds. The body then goes to the loading plant where it is tested for arming and non-arming 100%. The arming test is always given before the non-arming test to insure the fuzes being in the unarmed position when they go out of the loading plant. This procedure should always be followed in the arming test.

All arming tests should be conducted after the interrupter is staked in so that it will arm, even after the distortion of the metal by the staking operation. In some shops the arming test is conducted both before and after arming to eliminate the added expense and destruction of material from tearing the body down after it has been staked. The final acceptance test must always be conducted after staking.

M-54 TIME RINGS

Upper ring:
1st operation: Ream inside diameter and face small diameter of ring.

Inspection: Ring must clean up inside and be a clean round hole. Face must have good finish, straight and be square with axis of the ring. Inside should be concentric with outside of ring.

2nd operation: Face large diameter and form angle.

Inspection: Ring should be parallel, straight and good finish. Outside angle must have good finish with specified angle and be concentric with inside.

3rd operation: Broach set-screw slot in ring.

Inspection: Slot must be straight with axis of ring. Width of slot very important for powder groove operation; locates from this slot. Depth must be held for wall thickness between slot and powder groove.

4th operation: Routing of powder groove.

Inspection: Powder groove must be concentric with inside of ring. Thickness of metal from bottom of groove to face of ring must be held. Diameter of powder groove and the width of the groove are very important and must be held in order that they conform with fixture used in loading department. The distance between the ends of the groove must be held.

A careful inspection of all operations is necessary as the loading of the rings depends greatly on their correctness. Also, the Metal Components operations tie up with the loading operations and if not correct, the final test, such as burning time, will be such that it will not meet the required limits.

Graduated rings
1st operation: Turning up of outside diameter.

Inspection: Care that not too much metal be removed as this straight surface must clean up on angle-forming operation.

2nd operation: Reaming and straightening of expansion cavity and inside diameter, small angle adjacent to expansion cavity.

Inspection: Diameters must be within tolerances. Expansion cavity with radius not too deep.

CAUTION: If expansion cavity is too deep on this operation when upper ring seat, on small diameter side of ring, is made, web of ring will be thin. This web should be parallel. Angle adjacent to inside cavity must clean up on facing operation.

3rd operation: Facing of ring, upper seat counter-bored, outside angle formed.

Inspection: Ring should be parallel, web of even thickness, inside diameters and upper ring seat concentric with outside diameter. Angle and good finish on outside must be held. Diameters and thickness of ring must be held.

CAUTION: Even thickness of web for refacing operation. Inside diameters must meet loading fixtures properly. Even depth of upper ring seat for the proper seating of upper ring and to make a gas-tight seal between upper and lower rings. Angle important for graduating operation. Good finish necessary for graduations or letters to be legible.

4th operation: Drilling of locating holes.

Inspection: The correct location, depth and diameter.

CAUTION: Much depends upon the accuracy of the location of these holes, as graduating, drilling of pellet and vent holes, and the routing of powder groove operations are located from these holes.

5th operation: Stamping of graduations and numerals.

Inspection: Letters and figures must be legible and in correct location. There should be little or no distortion of the inside diameter by the graduating operation. The inside diameter is reamed before finishing in loading to insure proper diameter.

6th operation: Routing of powder groove.

Inspection: Concentricity of groove and outside diameter, thickness of metal between bottom of groove and face of ring. Diameter and width of powder groove, distance between ends of powder groove, dimension from locating hole to end of powder groove, no radius of groove on face of ring.

CAUTION: To properly fit the loading fixtures and meet the requirements these points must be given a thorough and complete inspection. At the starting point in the routing of the groove it is necessary that the tool be relieved, thereby cleaning the tool. If this is not watched the tool may pick up turnings and cut the groove deeper at this point than over the rest of the groove or make the groove wider at this point or cut a deeper radius on the face of the ring that will not clean up in facing operation. This will cause a soft spot or spots in the groove when the powder is pressed in or make ragged edges of powder on inside and outside of groove. These soft spots cause wide variation in the burning time of the ring.

7th operation: Cut fuze-setter slot.

Inspection: Correct location, depth and width. Slot must have sharp corners with one side of slot having specified angle.

CAUTION: The correct location of this slot in relation to graduations very important.

8th operation: Milling of flat surface adjacent to fuze-setter slot.

Inspection: Specified dimension from bottom of groove to surface, see that milling of flat has not produced burr in groove.

During all operations a careful inspection should be made for cracks in the metal. Cracks in the metal result in damaged rings when they are subjected to the loading pressure and make them unfit for further use.

THE INSPECTION OF THE M48 & M51
POINT DETONATING DELAY AND SUPERQUICK FUZE

Before the manufacture of the component parts can be started, the inspector must carefully read the specifications pertaining to the material used. All chemical and physical tests must be applied and approved as required. All cadmium plated parts (samples) must be subjected to the salt spray test as called for in the specifications of metal parts for this fuze.

As the process of manufacture progresses the inspector should carefully watch for latent defects that could not be detected before machining. These hidden defects such as pipes, cracks, etc., might not be discovered until the machining of the piece was well under way. In case this occurs, care should be used to sort out and discard all pieces made from the defective stock.

LIST OF PARTS IN M-48 FUZE

Head
Closing Disc
Closing Disc Washer
Striker
Firing Pin
Firing Pin Support
Detonator
Detonator Disc
Detonator Retainer
Detonator Cushion (Cork)
Retainer Washer
Detonator Retaining Screw
Tube
Ogive
Body
Interrupter
Interrupter Spring
Spring Cup
Setting Sleeve
Tension Ring
Setting Sleeve Retainer
Plunger Body
Plunger Support
Plunger Support Spring
Relay Washer (Cork)
Relay Cup
Delay Element
Delay Element Washer
Primer Housing
Primer Cover
Primer Disc
Baffle
Plug
Centrifugal Pin
Centrifugal Pin Spring
Centrifugal Pin Spring Retainer
Plunger Head
Delay Firing Pin
Housing
Closing Screw
Closing Screw Disc
Plunger Housing Lock Pin

SPRINGS

The wire used in the manufacture of springs is music wire WD 1085. This wire must meet all chemical and physical tests specified in contract drawings and specifications. The diameter of the wire must be gaged before winding. The number of coils, and the number of active coils, overall length, free height, and compressed length with required load applied must be correct after seasoning and plating. Outside diameter and direction of winding are very important in order that there be no binding or distortion after assembly.

The springs should have closed ends at right angles to axis where specified on the drawing. This is necessary to make springs bear properly on both ends.

While the safety and the correct functioning of the fuze depends greatly on the correct action of the springs, it is vitally important that they meet all specified requirements, and are inspected 100% before assembly. After assembly the interrupter spring and the centrifugal pin springs are again inspected 100% on the arming-non-arming machine.

FIRING PINS

After physical and chemical tests have been completed and found to meet all requirements according to the drawings and specifications the material is then satisfactory for manufacture.

The diameter of the pin must be gaged to guard against taper. If the diameter tapered toward the striker it would cause a weakness in the pin.

The overall length of the pin is gaged 100%. A long pin will extend too close to the detonator in assembly which is extremely dangerous. Should the pin be short, there is a possibility that it will not fire primer or detonator as the case may be.

The point of the pin is extremely important and must be gaged to insure the diameter across the flat of the point and that there are no burrs on either the point or the angle. The point must be concentric with the diameter of the pin. This flat must be maintained in order to create friction when the firing pin comes in contact with the detonator charge.

HEAD

1 Closing Disc
2 Closing Disc Washer
3 Firing Pin
4 Firing Pin Striker
5 Firing Pin Support
6 Detonator Cushion
7 Detonator Cup
8 Detonator Disc
9 Detonator Retainer
10 Detonator Retaining Screw
11 Retainer Washer

HEAD

The overall length must be held in order that the proper distance be maintained between the point of firing pin and detonator. In the event of the head being short the firing pin would extend too close to the detonator which would be a dangerous condition during assembly. If long, a condition would result in which the firing pin might not reach the detonator, also it would contribute to the overall length of the completed fuze which is gaged 100% for maximum length after the fuze is completed. The crimping wall and shoulders must be concentric with the outside diameter. A thin wall or an eccentric wall will crack on the crimping operation. A heavy wall when rolled will make a shoulder on the outside surface which will be detrimental to the flight of the projectile. For proper alignment of firing pin with detonator it is necessary that striker cavity and firing pin support counterbore be concentric with the firing pin hole. In order to maintain the proper distance between firing pin and detonator it is essential that the specified depths be maintained. For proper functioning of the firing pin it is necessary that the detonator cavity be concentric with the firing pin hole and of the proper depth. Care must be taken with the chamfering of the detonator retaining cavity threads. To hold the proper alignment and length of the completed fuze, it is necessary that the depth and concentricity of the tube cavity thread be maintained. The large diameter of the head must overhang the ogive. It is suggested that this diameter be held within plus or minus .002" of the mean dimension. This will aid in maintaining the proper dimension across nose end of head. The ogive seat diameter must be held for proper alignment of head with ogive. The location of the wrench and staking hole must be held in order that they fit the staking fixture in the loading department.

1.) CLOSING DISC
To make a proper crimp the disc must be of proper diameter and thickness.

2.) CLOSING DISC WASHER
Sharp burrs on the outside diameter of the washer may cut the disc and allow moisture and foreign particles to enter the cavities of the head. This washer must be held to the correct dimension in order that an effective crimp may be made.

3.) FIRING PIN
The firing pin information has been covered on page 3.

4.) FIRING PIN STRIKER

If the striker is being manufactured separately of the firing pin, it is suggested that the diameters be held toward the minimum since when riveting, the outside diameter becomes too large due to the distortion caused by the spreading of the striker. Care must be taken that in riveting the face of the striker it is not cupped which will increase the overall length of the assembled piece.

5.) FIRING PIN SUPPORT

Care must be taken that there are no draw cuts in this component since they weaken the support, thereby causing it to fail in the crush test which determines its strength to withstand setback force. In the trimming operation it is necessary that no chamfer is put on the cup since the chamfered section offers less resistance than if the bottom were flat. The overall length is checked 100% since a short support would bring the firing pin closer to the detonator. Side walls of cup must be of even thickness.

6.) DETONATOR CUSHION

This is a cork washer the diameter of which must fit the detonator cavity.

7.) DETONATOR CUP

The inside diameter if small will cause the punch to stick in cup or otherwise to distort it, thereby setting up an extremely dangerous condition in the loading operation. The outside diameter, if large, prevents the cup from fitting the loading fixture which makes it useless. This component must be absolutely without draw marks, scratches, and cuts inside or out and maintain as much flat as possible in the trimming operation. The small hole must be concentric with the inside and free of burrs as the burrs may cut the detonator disc allowing the powder to seep out.

8.) DETONATOR DISC

Thickness of thin disc is important since firing pin must pierce it.

9.) DETONATOR RETAINER

All dimensions must be held on this component in order that proper assembly in detonator cup can be made.

10.) DETONATOR RETAINING SCREW

The chamfer on the slotted end of this piece must not be too great since the piece is staked in place. The face of the opposite end must be straight and with good finish. A small chamfer is permitted to aid in assembly.

11.) RETAINER WASHER

This is a fuze cloth washer of which diameters and thickness must be held for proper assembly.

Tentative Instructions for Inspection

M 48 FUZE
Points to check while inspecting

Body
Interrupter
Spring Cup
Setting Sleeve
Spring
Sleeve Retainer
Tension Spring

Body

The diameter across the top where the max. only is shown on the drawing should be held to insure a clearance between body and Ogive. The tube cavity must be concentric and straight with the axis of the body for the proper alignment of the complete fuze. The Ogive seat is very important as to angle, diameter and concentricity. The alignment of the completed fuze greatly depends on the accuracy of these points. The outside diameters of the body flange must be held within the drawing tolerances to insure the proper overhang in mating of body to the Ogive and the body to the projectile. The surface of flange must be smooth finish and correct angle to insure proper stamping. The surface under the large diameter of the body flange must be straight for proper seating and staking to the projectile. The dimension from this surface to the bottom of the body is gaged 100% in the loading department as this is a factor in the clearance between the bottom of booster cup and the bottom of the cavity in the projectile. The diameter of the adjacent shoulder must be of specified dimension to avoid any interference with the minor diameter of threads in the projectile. The distance from this shoulder to the bottom of the fuze should be held because the bottom of the body must seat on the rotor cover of the booster. The undercut on either side of the outside body thread should clear the minor diameter of the thread. The body thread must be concentric and straight with the axis of the body. The closing screw threads must be concentric and straight so the inside diameter of the closing screw will align with the plunger cavity. If these two diameters do not align the plunger assembly will bind. There should not be too much chamfer on this thread as it is staked. Depth of the closing screw and plunger cavity are very important. If shallow the plunger support may bind the centrifugal pins and not permit proper functioning and it will also bring firing pin closer to primer. Check for burrs or shoulders in either cavity before gaging, also see that proper radius is maintained at bottom of plunger cavity. Check wrench slots to make sure they do not distort projectile seat. The interrupter hole must have good finish (FF) and the proper radius in the bottom so the gage will give the correct depth. The setting sleeve cavity must have a good finish (FF) for the free movement of the setting sleeve. The eccentricity between the setting sleeve cavity and the interrupter cavity must be as specified to insure the proper action of the interrupter for either the delay or superquick setting of the fuze. The retainer screw threads must be concentric with the setting sleeve cavity so there will be no binding between the retainer and the sleeve. The flash hole should be straight with the axis of the body.

INTERRUPTER

The interrupter must be free from burrs on the end caused by the parting tool and the diameter should have the finish specified on the drawing. It should also have the correct radius on each end. The length of the interrupter must be maintained; if long, it might affect the action of the setting sleeve.

INTERRUPTER SPRING

See paragraph on springs.

SPRING CUP

The bottom of the spring cup must be straight and free of burrs. The spring cavity must be concentric with the side walls, and the finish such that there will be no binding in the setting sleeve as its functioning depends on centrifugal force.

SETTING SLEEVE

As the setting sleeve governs the path of motion of the spring cup, it is very important that the width, depth and concentricity of the slot be held in accordance with the drawing. It is also important that the finish of the slot shall be FF and free of burrs. The spring recess must be of proper depth and have the proper radius to insure the proper functioning of the interrupter spring. As the setting of the fuze is controlled by the screw driver slot in the end of the setting sleeve, it is very important that this slot be properly located.

TENSION SPRING

This spring must be free of burrs and in accordance with the drawing.

SETTING SLEEVE RETAINER

The threads on the retainer must be concentric with the large inside diameter. The depth of large inside counterbore must be maintained for the proper tension on the setting sleeve. The overall length must be held as the retainer must seat on shoulder and not extend outside the surface of the body and interfere with inside of Ogive. This is also important for the staking operation.

BODY ASSEMBLY

Visual inspection of interior cavity for burrs and foreign matter. Insert interrupter; spring cup; spring; setting sleeve tension ring; finger action for tension of spring-setting sleeve retainer screwed in place.

Placed in arming machine (2000 R.P.M.) in non-arming (1500 R.P.M.).

Staked with double staking tool so as not to pinch setting sleeve. Again run through arming machine to insure free movement of setting sleeve.

The arming is both of the Super-Quick and Delay positions, to determine the action of the sleeve.

Operator tries with finger action to determine if spring is free and down in place.

PLUNGER ASSEMBLY

Plunger Body
Plunger Support
Plunger Support Spring
Plunger Head
Plunger Housing
Delay Firing Pin
Relay Cup
Relay Cup Disc
Relay Washer
Relay Cushion
Delay Holder
Baffle
Delay Washer
Primer Housing
Primer Disc
Primer Cover
Plug
Centrifugal Pins
Centrifugal Pin Springs
Centrifugal Pin Spring Retainers
Lock Pin

PLUNGER BODY

As the plunger assembly and its free movement in the fuze make the outside diameters important, they must come within the specified tolerances. To align the firing pin with the primer it is important that the head cavity and the slots (different widths) in the body, be concentric and in correct location. The plunger support cavity must be concentric and free of burrs to avoid binding in assembly. The specified depth of counterbore and plunger support cavity must be maintained, as these depths govern the working of the firing pin with the primer; (deep counterbore will allow firing pin to travel closer to primer when gaging compressed height of plunger assembly). Bottom corners of guide slots must be sharp and free of burrs. The centrifugal pin cavities must be of specified depth, have fine finish (FF) and be free of burrs as the safety and arming of fuze depend greatly on these points. The concentricity between delay and relay cavities must be held for assembly of the delay element. Sharp corners in bottom of delay cavity (as noted on drawing) must be held for sealing. The depths are important for the assembly of the complete delay train. Care must be taken in drilling flash hole that the drill does not ruin the shoulder in delay cavity.

PLUNGER SUPPORT

The plunger support being one of the safety factors of the fuze must be held to close dimensions. The overall length must be maintained to hold the firing pin away from the primer when assembled, and under no condition can this length be less than the min. length shown on the drawing. The ends must be square with the axis. The flash hole free of burrs.

PLUNGER HEAD

The concentricity of the plunger support cavity with the outside diameter and the location of the ears are important. This combined with the location of the firing pin hole make it difficult to manufacture these as a close inspection is required to insure its correctness. Care must be taken when tapping firing pin hole that the tap does not ruin flat bottom or shoulder thereby allowing firing pin to extend beyond the max. dimension of assembled piece. A close check should be made after assembly and staking of firing pin to see that it has no bulge in plunger support cavity. Note: The ears are of different widths and the firing pin hole must be drilled on the side having the narrow ear. Surfaces must be straight and parallel.

FIRING PIN

See paragraph on firing pins.

PLUNGER HOUSING

A close check must be made of sharp corner inside of housing and that there are no burrs, and the evenness of metal maintained in drawing.

PLUNGER SUPPORT SPRING

See paragraph on springs.

CENTRIFUGAL PINS

It is of importance that finish is in accordance with drawing (FF) and that there are no shoulders or teets on bottom of pin.

CENTRIFUGAL PIN SPRINGS
See paragraph on springs.

CENTRIFUGAL PIN SPRING RETAINER
Inside diameter must be held and free of burrs so centrifugal pin will not foul on the arming of the fuze. Outside diameter must be held for proper fit in plunger body.

RELAY CUP
Overall length must be maintained and free of burrs. The inside and outside diameter important to meet loading requirements.

DELAY HOLDER
The correct depth and finish of the delay is important, as the depth must be held to meet loading requirements, and the finish of this cavity must also be free of tool marks and shoulders in order to eliminate danger in loading. The concentricity of these holes is important so that the shoulder does not cut off the baffle groove. The depth and width of the slot on the bottom of delay must be held as specified on the drawing as this slot governs the amount of flash from delay. The overall length is important because it is a factor in determining the distance between primer and firing pin. Sharp corners must be held for sealing.

BAFFLE
The diameters of baffle are very important, it must assemble in delay holder (press fit). The groove must be correct and free of burrs as through this groove the flash is delivered from primer to delay.

DELAY WASHER
Maintain diameters and overall thickness to insure its assembly in the delay train cavity. Surfaces must be flat, parallel and free of burrs.

PRIMER HOUSING
Surfaces must be parallel and straight, and with good finish. The powder cavity must have sharp corners. It is suggested the overall thickness be held near the maximum dimension and depth of cavity near the minimum dimension; this will insure proper dimensions after burring. The two flash holes must be on a cl to fit loading fixture.

PRIMER COVER AND DISC
Thickness and diameter important for proper assembly and functioning of firing pin and must be free of burrs.

PLUG
T he plug must have good finish (FF) across bottom surface to insure no distortion of primer cover in assembly. The firing pin hole must be concentric with outside threads and proper angle held to insure the functioning of firing pin with the primer.

CLOSING SCREW
As the functioning of the plunger assembly largely depends upon the correctness of the closing screw, it is important that the concentricity and all dimensions be held. It must be free of burrs. Wrench holes must not distort minor diameter of outside threads, there must not be any burrs on the outside thread and the chamfer must not be too great as this thread is staked. There must not be any burrs on the inside of the crimping wall as this will cut the closing screw disc.

OGIVE

The bottom edge of the Ogive must be square with the axis and have proper bevel for seating on the body. The upper edge must also be square with the axis. Care must be taken when facing bottom of Ogive that the dimension from the bottom of Ogive that the dimension from the bottom of Ogive and bottom of locating lugs are maintained.

The setting screw hole and the lugs on inside must be in proper relation to each other, and the hole must be the correct distance from the bottom of the Ogive. Check the stamping at the setting sleeve hole to make sure that it is legible and has not distorted the Ogive. Check the inside diameter of the small end of Ogive to insure its proper assembly to the head.

TUBE

Threads on both ends must be concentric with each other for proper alignment. The flash hole should be concentric with the threads, free of burrs. T he flash hole of tube must be closely inspected for plating.

M-51 FUZE

PLUNGER BODY

As the M-51 and M-48 fuze are the same with but a few exceptions, the differences will only be discussed in this paper. However, the depth of plunger head being different, it again becomes important that this dimension be held in order that the lock check washer may be assembled in plunger body in order to maintain the proper relation of firing pin with primer. The locking device slot in plunger body must be in center of body. The depth of this slot must be held; if this slot is too deep it is possible for the centrifugal pins to be forced out of their normal position into the slot. The pivot lock pin hole must be parallel with the centrifugal pin cavities for the free movement of the centrifugal plunger pin lock

LOCK-CHECK WASHER

Hole the alignment of the two holes with the ear on the firing pin side and lock-check on opposite side as this determines the alignment of the firing pin with the primer. The length of the lock-check-stop determines the position of the lock when the fuze is in an armed position.

PLUG

The only difference in this plug and the plug in the M-48 is the thickness.

CENTRIFUGAL PLUNGER PIN LOCK

As the lock must swing freely in the plunger body it is necessary that all dimensions be held and the lock be free of all burrs.

PLATED PARTS

Whenever plating is called for, special attention should be given small holes and inside diameters that may be difficult to plate. The inspector should carefully read the specifications on the salt spray test and see that these requirements are met. It is suggested that where there is difficulty in determining the proper plating that a sample be cut open; in order to satisfy himself as to the quality of the plating.

ELEMENTS OF CADMIUM PLATING
(Non-Technical)

V. C. Allison

There are two general classes or types of metallic protective coatings.

The first class of metallic coating protects the plated metal by its blanket action of excluding corrosive materials from contact with the protected metal. Nickel and chromium are examples of this class; the presence of a pin-hole in these coatings will result in a spot of corrosion on the metal underneath. The specification for nickel plating in industry permits only 6 pin-holes per square foot of coating and these are so small that they must be determined by their chemical effects, using a reaction of the blue-print type.

The second class of protective metallic coatings protects the plated metal not only by their blanket effect in excluding corrosive materials, but also by going into solution, or corroding, more easily than the protected metal. Therefore, the presence of a pin-hole in a coating of this type does not result in corrosion of the metal underneath until the diameter of the pin-hole exceeds a certain limit. Zinc and cadmium are examples of this class of metallic protective coatings which are called "anodic" protectors because their protective action is largely electro-chemical in character.

Zinc is a somewhat better anodic metallic coating than cadmium, as it will tolerate a pin-hole of larger diameter than a cadmium coating without permitting corrosion on the underlying metal. Zinc, however, except in somewhat rare instances where a film of zinc oxychloride quickly forms, is not very resistant to salt water spray. Cadmium, on the other hand, resists salt water spray quite well but is easily attacked by substances containing sulphur. For these reasons cadmium is not used so much inland where the air is contaminated with sulphur gases resulting from the industrial burning of fuels, and zinc is not used so much along the seaboard where there is salt water spray in the air.

In military cadmium plating, such as is done at this Arsenal, the primary object is quality of the protective coating, while in commercial plating the aim is to produce a coating which will last only long enough to get the plated article into the hands of the customer. For this reason production efficiency, or output efficiency, will not be discussed here, but emphasis will be put on the production of a cadmium coating that will protect for many years, output efficiency being considered as a minor factor only.

When a metal is dissolved in an acid, a salt is formed consisting of the metallic atom (cadmium atom) connected to the acid atom (cyanide atom). When this cadmium salt is dissolved in water the two atoms tend to split apart and form a cadmium atom carrying a charge of positive electricity and a cyanide atom carrying a negative electric charge. These charged atoms are called ions because they are free to wander in the solution and in classical antiquity the Ionic Greeks were noted for being great wanderers, not content to settle down in one place.

In the electro-plating process the cadmium salt is dissolved in water (in actual practice the cadmium salt used is the oxide and this is dissolved in a solution of sodium cyanide to form the soluble double sodium-cadmium cyanide; this is done because of the prohibitive cost of cadmium cyanide and the fact that free sodium cyanide is required in the plating bath) to form the plating solution and this results in the formation of cadmium ions and cyanide ions. When an electric current is passed through this plating solution it greatly increases the number of both kinds of ions, cadmium and cyanide, present in the solution and the voltage drives the cadmium ions over to the cathode (the piece being plated) where the positive electric charge carried by the cadmium ion is neutralized and the cadmium atom is deposited to form the plated coating. The voltage also forces the cyanide ion over to the cadmium anode where it dissolves more metallic cadmium to form more soluble cadmium salt and this tends to maintain the concentration of the cadmium salt constant in the plating bath. Theoretically, then, when the cadmium anode is used no additional cadmium salt would have to be added to the plating bath as long as the cadmium anode lasted. Actually, on account of loss of plating solution adhering to the plated piece when it is removed from the plating bath (known as "dragout") and other small losses, the concentration must be maintained by the occasional addition of small quantities of cadmium salt. When a steel anode is used in the cadmium plating bath, however, all the cadmium plated out is at the expense of the cadmium salt concentration of the plating bath.

If the piece being plated is a flat plate placed crosswise in the plating bath so that all parts of the surface of the plate are at about equal distance from the anode, then plating is a very simple operation. In actual practice, however, especially at this Arsenal, the piece being plated is of an irregular shape and this causes difficulties. For example, consider a cup-shaped piece with the edge or rim of the cup facing the anode. Here the cadmium ions driven by the voltage will reach the rim of the cup first and stop there, thus depositing very little cadmium on the bottom and sides of the cup. This difficulty is overcome by increasing the "throwing power" of the plating bath so that it will "throw" more of the cadmium ions on back past the rim to the sides and bottom of the cup. This is done by so adjusting the plating bath that there are not enough cadmium ions to carry all the current, so the current splits some of the water into gaseous oxygen and hydrogen to supply current-carrying ions. The hydrogen ion also carries a positive electric charge so it also goes to the piece being plated and forms a gaseous blanket on the rim of the cup, thus forcing the cadmium ions to go on past the rim and deposit on the sides and bottom of the cup. The way in which the concentration of cadmium ions is reduced is by adding so much sodium cyanide to the bath that the cadmium ions are widely scattered.

It is to provide a cadmium plating bath of maximum "throwing power" that the concentration of free sodium cyanide is maintained so high at this Arsenal, for some of the pieces plated here are so deeply cup-shaped that, in addition to a plating bath of maximum "throwing power", a stick anode projecting inside the cup is used to insure a good cadmium coating at the bottom of the cup.

The protective metal coatings are all crystalline and the smaller the voids between them and therefore the more protective the coating. In general, the smaller the crystals the brighter the deposit and the operating conditions of the plating bath are so adjusted that a bright coating is deposited on the metal to be protected.

If the plating process is "forced" too much to secure a greater output efficiency, a condition not often encountered at this Arsenal, the cadmium ions arrive so rapidly on the plating piece that the cadmium metal builds up in large crystals which form a dark deposit. This is known as "burning" and, on account of the tendency of the cadmium ions to first plate out at the edges nearest the anode, appears at the projecting edges and points of the piece being plated, while the rest of the deposit remains bright. The remedy, of course, is not to "force" the plating bath so hard.

There is another condition which causes the formation of a dark deposit, but this dark deposit is uniform over the surface of the plated piece and not confined to the edges and points. In a plating bath the operating range of electric current and voltage is adjusted to the bath composition and when this adjustment is disturbed, it must be corrected. When the deposit darkens all over when cyanide is added to the plating bath, it will probably be noticed that the voltage drop across the bath also rapidly decreases at the same time. If so, the working range of the bath should be changed so that the voltage drop across the bath decreases only very slowly on addition of cyanide, for this is the operating condition which produces a uniform and good deposit, and which requires a considerable excess of cyanide.

The method of destroying or rendering harmless spent plating solutions of this poisonous type, and contaminated rinse waters from this source, is to add ferrous sulphate which, in the presence of sulphuric acid and the oxygen of the air, converts the very soluble poisonous sodium and cadmium cyanides into the very insoluble ferriferrocyanide or "Prussian Blue". Such an insoluble material, even though it contains cyanide radicles, can not be poisonous. The destroying reaction proceeds most rapidly when there is no alkalinity present and this is recognized by the addition of 1 ounce of commercial sulphuric acid to each gallon of plating solution to neutralize the alkalinity known to be present in the solution. In the past the acid has not been added to the rinse water when it was treated with the ferrous sulphate on account of its small amount of alkalinity. However, instances may occur occasionally when an unusual amount of alkaline rinse water is run into the destruction tank and the destroying reaction therefore goes very slowly. For this reason the solution to be destroyed should probably always be acid to test paper (Litmus) before the ferrous sulphate is added; an excess of acid is to be avoided because of the production of the poisonous cyanide gases. More efficient use of the ferrous sulphate could be obtained, providing it is not too much trouble, by first dissolving it in a ten or fifteen gallon tub or crock and then adding this ferrous sulphate solution to the slightly acid plating solution or rinse water to be destroyed.

In a recent duPont manual on bright zinc plating appears the following:

"Antidotes For Cyanide"

Always have on hand a liter of a 1 percent solution of sodium thiosulphate and a carton of amyl nitrite pearls.

Directions For Treatment.

1. Have the patient inhale the content of an amyl nitrite pearl.
2. Cause vomiting by giving soap water or mustard water.
3. Give 500 cc. sodium thiosulphate solution by mouth.
   Repeat the above procedure every 15 minutes. If necessary, give artificial respiration until the physician arrives.

COPPER AND BRASS PARTS. M20 BODY

1. Wyandotte Cleaner, 6 oz. to Gallon, 212 F. 2 to 4 min.
2. Cold Water Rinse.
3. 10% Sulphuric Acid Dip, 30 sec.
4. Cold Water Rinse and Hose.
5. Sodium Bicromate Dip and Hose.
6. Cold Water Rinse and Hose.
7. Hot Water Rinse and Dry Air Hose.

STEEL PARTS FOR PLATING

1. Wyandotte Cleaner, 212 F. 3 to 10 min.
2. Cold Water Rinse.
3. Hydrochloric Acid Dip, 30 Sec.
4. Cold Water Rinse.
5. Nitric Acid Dip, 30 sec.
6. Cold Water Rinse.
7. Hydrochloric Acid Dip, 30 sec.
8. Cold Water Rinse.
9. Then in 2 oz. gallon Sodium Cyanide Storage Tank before Plating. If pieces blister, use electric cleaner, 6 oz. Sodium Hydroxide to gallon, reverse current 3 to 5 min.

RIDOLENE CLEANER NO. 46 FOR ALUM

(a) 1/2 oz. Emulsifier No. 15.
(b) 6 oz. to Gallon (Cleaner).
(c) This cleaner must be heated to about 160 F. to work right.

FOR STRIPPING CAD. PLATING

1 lb. Nitrate of Ammonia to Gallon of Water, 212 Degrees.

CLEANING PARTS FOR PLATING CADMIUM

6 oz. to gal.water	Cold water	(HNO_3) 30 sec.		(HCl) 30 sec.	(H_2O)		25 Min.				
Alkaline cleaner →	Water Rinse →	Nitric No. 42 Acid Dip →	Water Rinse →	Muriatic Acid →	Water Dip →	Storage Bath 2 oz. Cyanide to Gal. →	Plating Bath →	3 Water Rinse →	Fish Soap Rinse →	Hot Water Rinse →	Dry

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CLEANING ALUMINUM PARTS

3 to 6 oz. gal. water					
Alkaline cleaner special Ridolene No. 46. 170 F. →	Water Rinse Well →	Sodium Bichromate 30 second dip →	Cold water dip →	Hot water dip →	Drying Table

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CLEANING BRASS AND COPPER PARTS

6 oz.to gal.						
Alkaline cleaner →	Water Rinse →	10% Sulphuric Acid →	Sodium Bichromate Dip →	Water Rinse →	Hot Water Rinse →	Drying Table

LOADING FIXTURES

A brief description of loading fixtures, bringing out the locating points for the various components parts while being loaded and assembled; why these points must be held; and if not held what may happen in the loading plant.

DETONATOR CUPS

The loading fixture consists of 3 parts, namely: Sleeve, Anvil, and Guide.

Sleeve: The sleeve is a cylinderical bushing where the inside diameter is the maximum diameter of the detonator cup. This sleeve supports the outside diameter of the cup, and prevents it from spreading during the pressing of the powder.

Anvil: The anvil has 4 steps of different diameters. The smallest diameter is the minimum diameter of the firing pin hole in the cup, and with a height equal to the minimum thickness of the bottom of the cup. The next larger diameter is the same as the minimum outside diameter of the cup which makes a seat for the cup and allows the sleeve to fit over this diameter. This makes it important that the small diameter in the bottom of the cup (firing pin hole) be concentric with the outside of the cup. The next diameter and surface on the anvil is the resting place for the guide of which the inside diameter is the same as the outside of the sleeve, making a snug fit when the guide is placed over the sleeve and the anvil. The fourth and largest diameter forms the base of the fixture. This diameter locates in a stationary V block on the press, and centers the assembled fixture in alignment with the punch for the pressing of the powder.

The guide is similar to a cup that houses the sleeve and anvil together, and has a counterbore in the top of the inside cavity to receive that part of the detonator cup which extends above the sleeve. The top of the guide is countersunk to receive the punch of the powder press, and to act as a funnel in pouring the powder. This makes it very important that the outside diameter of the cup be concentric with the inside diameter.

If the small inside diameter (firing pin hole) of the cup is not concentric with the outside; it will not fit in the loading fixture, and the cup would be useless. If the outside diameter is large it will not fit the sleeve, or, if scratched or cut, will make it difficult to assemble in the sleeve and would be dangerous in forcing out of sleeve after being loaded.

The thickness of the bottom is important in that the locating pin of the anvil does not extend in cup. This would cause trouble in the seating of the detonator disc if thick would leave this disc to bulge in firing pin hole in pressing the charge.

If the cup does not have uniform wall thickness, but the outside is concentric with the firing pin hole, the excess metal on the wall will be broached by the punch. The chip formed will act as a firing pin, which in turn would detonate the detonator.

The bottom must be of the correct thickness and must be flat. When the arbor press comes down to seat the detonator disc, rough or concave surface would tend to mutilate the disc. If the radius on the inside bottom of the cup is not as specified on the drawing, or if the inside is concave, holding the charge within tolerance would be difficult. The bottom, if rounded, would seat improperly on the fixture and the height of the compressed powder would be out of tolerance.

M20 - M21

The first fixture puts the staking notches on the inside wall of the fuze cavity. The second fixture, having a double tool performs two operations. First, the stretching of the rotor cover into the staking notches made by the first fixture. The second part of the tool folds the metal from the side wall of the fuze cavity (beneath the thread) over the cover, locking it in place.

This makes a condition, that, with the first fixture the staking notches would be too deep on one side weakening the side wall of the booster, and with the second fixture the folds would extend too far in the fuze cavity and the fuze would seat on the top of the folds instead of seating on the rotor cover.

M48

Delay Holder has a two part loading fixture, the anvil and the sleeve.

The anvil has a counterbored recess made to the max dimension of the small diameter of the outside of the holder with pin in the center to extend inside of the housing. This makes it necessary to have the outside of the small diameter concentric with the flash hole.

The sleeve houses the holder and seats on the anvil, and with the guide in place, it is located on the press by a V stop that controls the alignment of the holder with the punch making it necessary that the inside be concentric with the outside diameter and the flash hole in the bottom.

As this punch is so near the inside diameter of the holder there must not be any burrs or shoulders on the inside as this will create a dangerous condition.

The holders are taken from the loading fixture and placed in another fixture for pressing in the baffle. This fixture locates on the flash hole and the large outside diameter of the holder. This means that the flash hole must be concentric with both inside and outside diameters.

PRIMER HOUSING

The outside diameter of the a nvil is equal to the outside diameter of the housing, relieved on the inside, with two pins extending up into the flash holes and even with the inside bottom of the housing making it important that these holes be in the center of the housing and the specified center distances between holes, If these dimensions are not held, they will not fit the fixture, making them useless If the center distance is held but not in the center of the holder, it will fit on the pins, but will over hang the bearing surface of the fixture causing poor alignment. Thus when charges are pressed there will be soft spot on one side and will break out in the jumble and jolt test. This endangers the acceptance of the complete lot of fuzes.

106 TAIL BOMB FUZE

The wrench that tightens the body cap on the body is relieved on the inside so the detonator holder will enter the inside of the tightening fixture, and the pins will align with the holes in cup.

This makes it important that the wrench holes be on the center of the cap and the center distance of the hole be held.

M103 DELAY HOLDER

This component is located on a fixture by an anvil having a small diameter that extends to the s mallest inside diameter, and even with the bottom of the next larger diameter (delay ch arge cavity), this also is even with the diameter fitting the relay cup cavity for the reconsolidating of the delay charge. When crimping the relay cup, it is held by and located from the delay cavity. This means the three inside diameters must be concentric with each other and also with the outside of the holder.

It should be remembered that in all delay holders whether assembled to their respective primers or with two separate assembled components, that flat bottoms and square corners are essential for sealing. The concentricity of all diameters are also important for proper loading.

NOTES ON SHOP INSPECTION

By: E. Holley & R. Lynch.

THREADS

1. Check for right-hand or left-hand and correct number per inch. Use gage where possible.

   a. When using pitch micrometers, be sure of correct micrometer.

2. See that hob, die or roll has not hit adjacent shoulder (male and female threads).

3. Flat on one side, sharp on opposite side, indicate eccentric thread, caused by dirty collet, slip in collet or collet squeeze.

4. See that there is not too much taper in thread. Note by first and last threads.

5. Watch for overlap of hob milled thread. This is important in gas-tight fuzes.

6. Where component is to be staked, chamfer shall be not larger or deeper than depth of single depth of thread.

7. Finish according to drawing.

8. Stamping and crimping, care should be taken not to distort thread; outside and inside diameter.

9. The chamfer on ends of bore where threads are to be cut should be large enough so that the first thread will not protrude above the face. Male threads, the chamfer on 1 inch and under pieces should be approximately .010 inch under minor diameter.

10. Female threads from mean to max. Male threads from mean to min.

TIME RINGS

1. Inspect for cracks in rings and burrs in powder groove.

2. The finish on outside should be such as not to blur time graduations.

FIRING PINS

1. See that pins are flat where called for; not bent, and free of burrs.

2. Care should be taken in all dimensions where firing pin and detonator are concerned.

CAVITIES

1. All component parts must be free from all dirt, chips, etc.

2. Burrs must be removed on shoulders and surfaces before gaging.

3. Look for shoulders in bottom corners (caused by broken reamer, flat bottom drill or drill running).

4. Be sure shoulders are not ruined on smaller and deeper diameters during tapping of upper diameter.

5. Be sure first drill has not gone too deep and ruined flat bottom.

6. Watch for taper (use inside calipers).

7. Depth should be measured at least three places across bottom, from face.

   Not too much chamfer on detonator cavities where there are crimping operations to follow.

CUPS

1. Look for cuts and draw marks on inside and outside of cup, especially pellet cavities.

   Distorting or cutting of piece by chucking or slipping in the collets.

2. Watch for die marks on radius of outside bottom of cup.

CUPS, (cont'd)

3. Watch for hair line cracks.

MISCELLANEOUS

1. All shoulders should be square and at right angles with the body.

Important Points of Visual Inspection

1. Make sure fuze is complete.

2. Stamping must be readable, and has not distorted any dimension or thread.

3. The concentricity of parts that make up the outside diameter of the complete fuze (eccentricity will cause wind resistance and throw fuze off balance, if any overlap, it should be from nose end of fuze).

4. Watch for unevenness of flat on threads, see that last thread is complete, not damaged.

5. The location and alignment of cavities (where one part depends upon the alignment of the other the location of these cavities is of most importance to the functioning of fuze).

6. All parts that go to make up complete fuze shall be clean and free of all burrs.

E. B. Holley