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PIGEONS, STARLINGS AND ENGLISH SPARROWS

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This paper deals with the control of excessive numbers of pigeons, starlings and English sparrows in urban situations in the Midwestern region of the United States. Control procedures should always be based on a survey of the factors involved in the problem so that the most feasible methods can be determined. There is no one tool of bird control that fits all situations, and in most cases more than one tool is indicated.

Since the feral pigeon is the most common pest species, emphasis will be placed on pigeon control methods.

Urban bird control, like urban rat control, may involve only individual properties or it may involve a community wide problem. Due to the great mobility of all birds, the community wide approach is usually the most productive and also the most economical.

Pigeons

General

When pigeons become so numerous as to constitute a health hazard, or even a recognized nuisance (See Figures 1 and 2), the public demand is usually to "Kill them!" Under Midwestern conditions, where food, water and nesting sites are nearly always

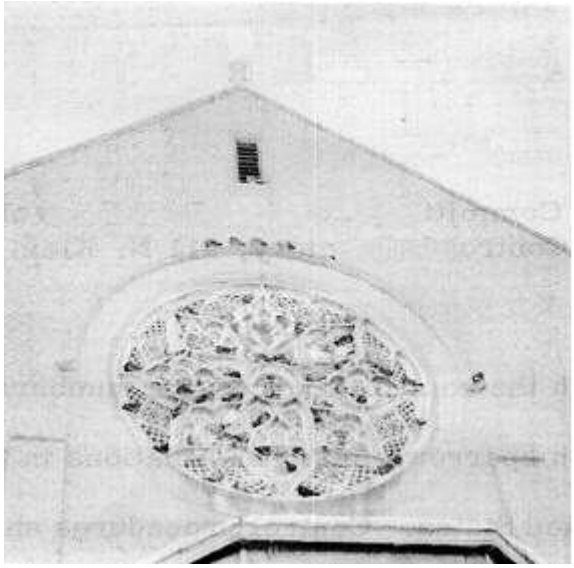

Figure 1 - Here Are More Than 50 Pigeons on a Church Window. Are They Symbols of Tender Sentiment or Are They Filthy Desecrators?

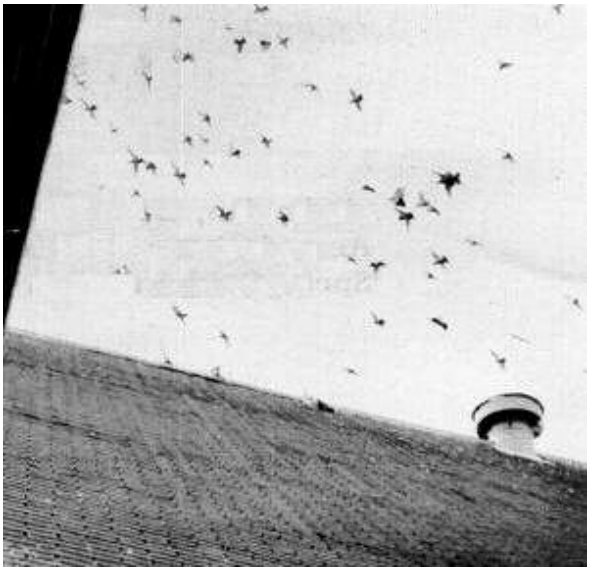

Figure 2 - This Is the Church and This Is the Steeple. These Are the Birds That "Mess" up the People.

abundant, it is relatively futile to kill them unless the ecological factors are altered. If these factors cannot be altered, then a continuing program of population reduction must be resorted to. The following discussion deals with those specific phases of control from which a program can be chosen to meet existing situations.

Nesting Control

Pigeons prefer nesting sites that are protected from the weather. Since they are relatively unafraid of man and are also highly social, they may nest, as shown in Figure 3, in great numbers in church towers, attics, abandoned buildings and in rusted or rotted gutter boxings. In our older cities there are many situations

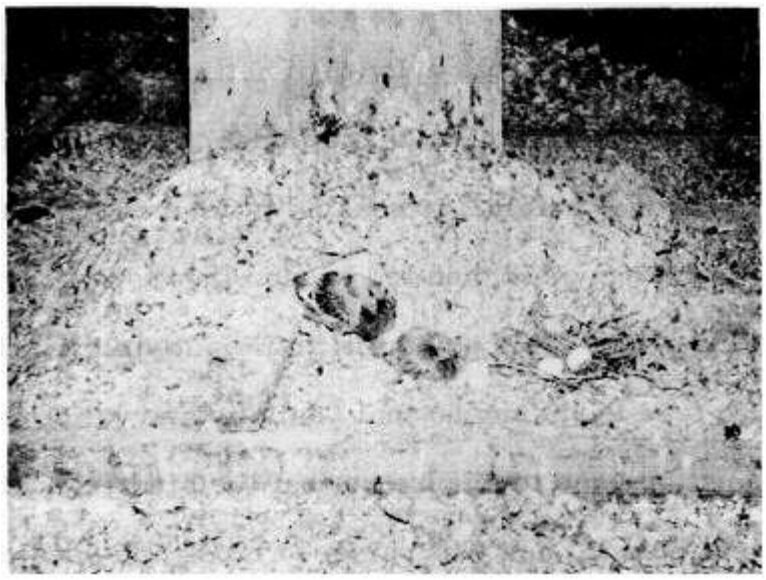

Figure 3 - A Pigeon Production Line. Squabs Moved Over to Make Room for More Eggs. People Lived in a Room Just Under This.

where buildings have been torn down and the land converted into a parking lot. Where this happens, it is not unusual to find holes in the walls of the adjacent buildings where floor and ceiling joists had been removed. These holes often provide ideal nesting sites for pigeons or other pest birds.

In one Midwestern city located on the Mississippi River, hundreds of pigeons nest in abandoned limestone quarries of the horizontal or cave type. In another city on the Illinois River, the principal nesting location is inside the hollow chords of a large steel highway bridge.

The obvious answer to most nesting situations is to close off entrances. Preferably this should be done by proper building repair, but more often must be done by screening with chicken fencing or the

cheaper but less durable nylon fish netting. Screening is best done at night while the adult birds are inside. They can then be gassed, if this can be done safely. If gassing is impractical, they can be allowed to become hungry and then fed bread dipped in water poisoned with Compound 1080. This poison is sufficiently slow-acting to allow the adults to feed the young so that death by starvation is eliminated. Care must be used to ensure so that the birds cannot escape after eating the poison, and that poisoned birds and uneaten poison are removed.

Where screening is not practical, one can remove existing nests and apply sticky repellent to prevent rebuilding. Where only a few nests are involved and they are accessible, one can place two tablespoons of Cyanogas A dust in each nest. This kills young birds and eggs, and in most cases will result in killing at least one of the adult pair at the nest. Obviously, one must consider hazards that might result from the cyanide gas evolved from the nests. It has been shown that placing a Conibear steel trap flat on the nest will almost invariably catch and kill one of the adult birds.

The control of nesting has proven eminently practical in down-town areas and has greatly reduced pigeon build-up after population reduction has been achieved. Residential areas, however, pose a more difficult problem. Here the breeding is widely scattered and so frequently tolerated, or even encouraged, that control can usually be applied only to individual properties.

Food Control

In the Midwestern grain growing states, the wastage of grain around elevators and mills is the chief source of food for pigeons and sparrows. Control of this food supply is seldom practical, but the determination of these sources in the initial survey is very important in planning control programs.

Water Control

Pigeons require an abundance of water in hot weather. Under Midwestern conditions, there are usually numerous and adequate sources of supply. In areas where water is not so readily available, the possibility of controlling water sources may be well worth considering. Water cooling towers associated with air-conditioning systems are one of the most common and most easily controlled sources of drinking water for birds. Covering the towers with nylon netting has been shown to be a cheap and effective means of eliminating the bird nuisance, and also of reducing maintenance problems due to feathers and filth.

Poisoning

Pigeon populations can be quickly and cheaply reduced by the use of any of several poisons. However, many of the most effective poisons present hazards of secondary poisoning, and any poisoning program may run into adverse public opinion. Highly toxic chemicals applied as contact sprays and as roost applications have been

shown to be very effective, but until the potential hazards have been more completely evaluated, they are not to be recommended.

It seems probable that in the near future there will be a new generation of contact toxicants, as well as internal poisons and soporifics, which will be much safer and more humane than those now known.

Where poisoning is indicated as the method of choice, the use of 1 percent strychnine-treated baits, as detailed in publications of the U. S. Fish and Wildlife Service, is to be recommended.

Trapping

In the direct reduction of pigeon population, trapping may often be the most practical method. It is humane and safe, but is time-consuming. To be worthwhile, it must be used as a persistent and continuing program.

Considerable numbers of pigeons can sometimes be captured by closing the entrance at night to an attic or other nesting site. In one case more than four hundred birds were taken from one attic in one day. A fish landing net on a telescoping aluminum pole will serve to catch birds roosting on ledges, if the work is done late at night and in a dark area.

Most trapping is done with wire cage traps (See Figure 4) approximately a foot high, two feet wide and four feet long. Various forms of funnels, metal bobs, and even simple swinging doors (See Figure 5), serve to trap the birds after they have entered.

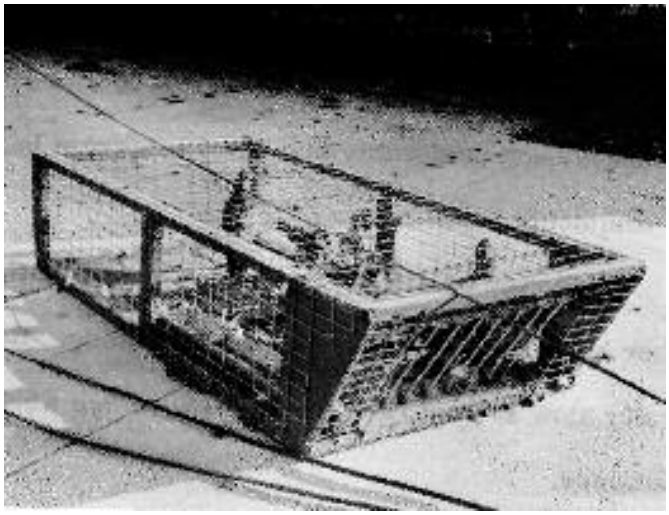

Figure 4 - A Common Form of Pigeon Trap Using the Aluminum Bob Entrance.

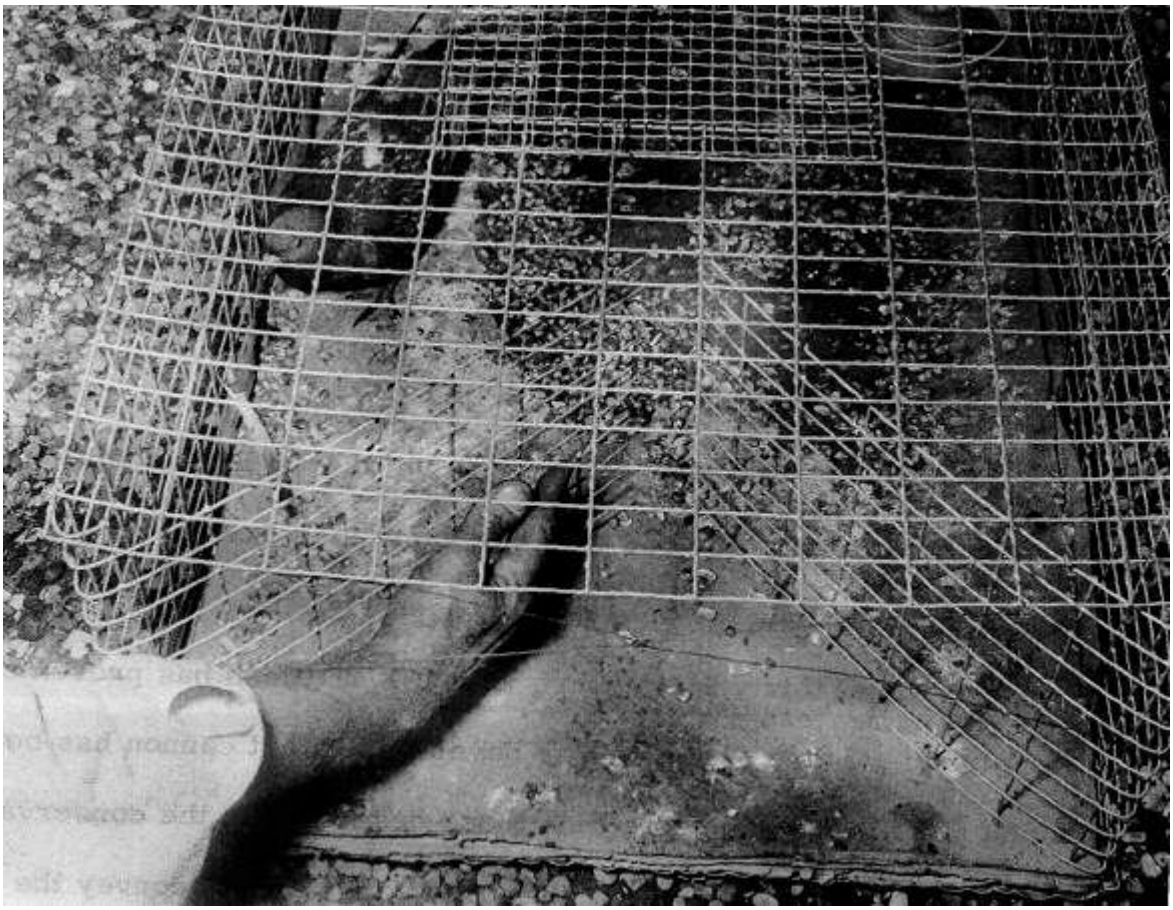

Figure 5 - Showing the Pigeons Where to Walk In. The One Inside Is Asking How to Get Out. Courtesy of U. S. Fish and Wildlife Service.

Traps are usually located on flat roof areas which are of easy access, and preferably at a level somewhat below where the birds commonly rest.

Bait may be whole grain corn, wheat, kaffir, or whatever grain or other food the birds are used to eating. Results are generally slow at first, and it may require two weeks before results are obtained.

In regions where snow is a common occurrence, it is during periods of snow cover that best catches are likely to be obtained. Traps must be cleaned after each snowfall, but placing a roof on the trap to keep snow out has not been helpful.

In warm weather, water, as in a chick watering trough, may be more effective as an attraction than any kind of food.

Traps should be run at least twice a week, and preferably every other day. Birds can be carried in a burlap bag, provided not more than twenty birds are in each bag.

One dramatically effective form of trap is an adaption of the cannon thrown net, as used by some game management agencies to capture game birds for banding purposes.

A net thirty feet square with 1-1/2" mesh has proven suitable for pigeon capture. A specially developed invert cannon has been found to be more adaptable than those described in the conservation literature. The illustrations with this paper should convey the

essentials of this method. The cannon shown (See Figures 6 and 7) requires a charge of 9 grams of powder for shooting a rather heavy linen thread net, and would probably project a lighter nylon net with half as much charge. These nets have been extensively used in freight yards and around mills (See Figure 8) with individual catches seldom amounting to less than a hundred birds and with some shots netting more than five hundred birds. This method is useful only in regular feeding areas, where the birds can be depended on to come at a definite time each day. If a conspicuous pile of feed is placed in the path of the net and the birds are slowly herded to this pile of feed, the results are nearly always good (See Figure 9).

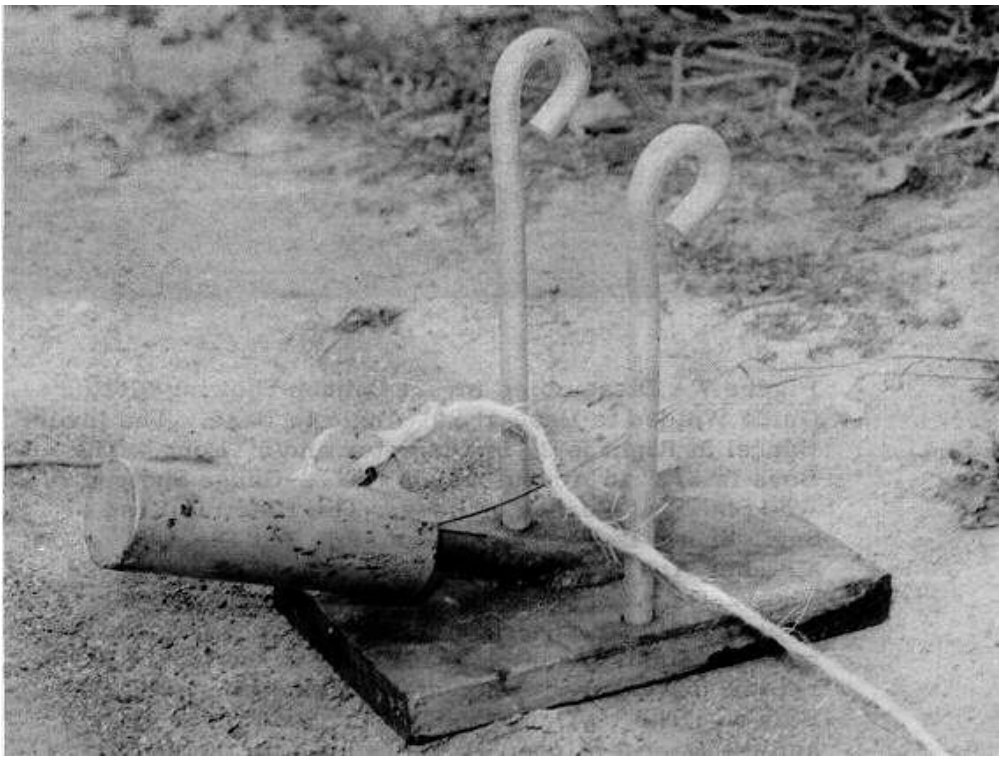

Figure 6 - Invert Cannon Ready to Shoot. Pins Hold It in Place. Rope Pulls Net and Wires Lead to Battery. Courtesy of U. S. Fish and Wildlife Service.

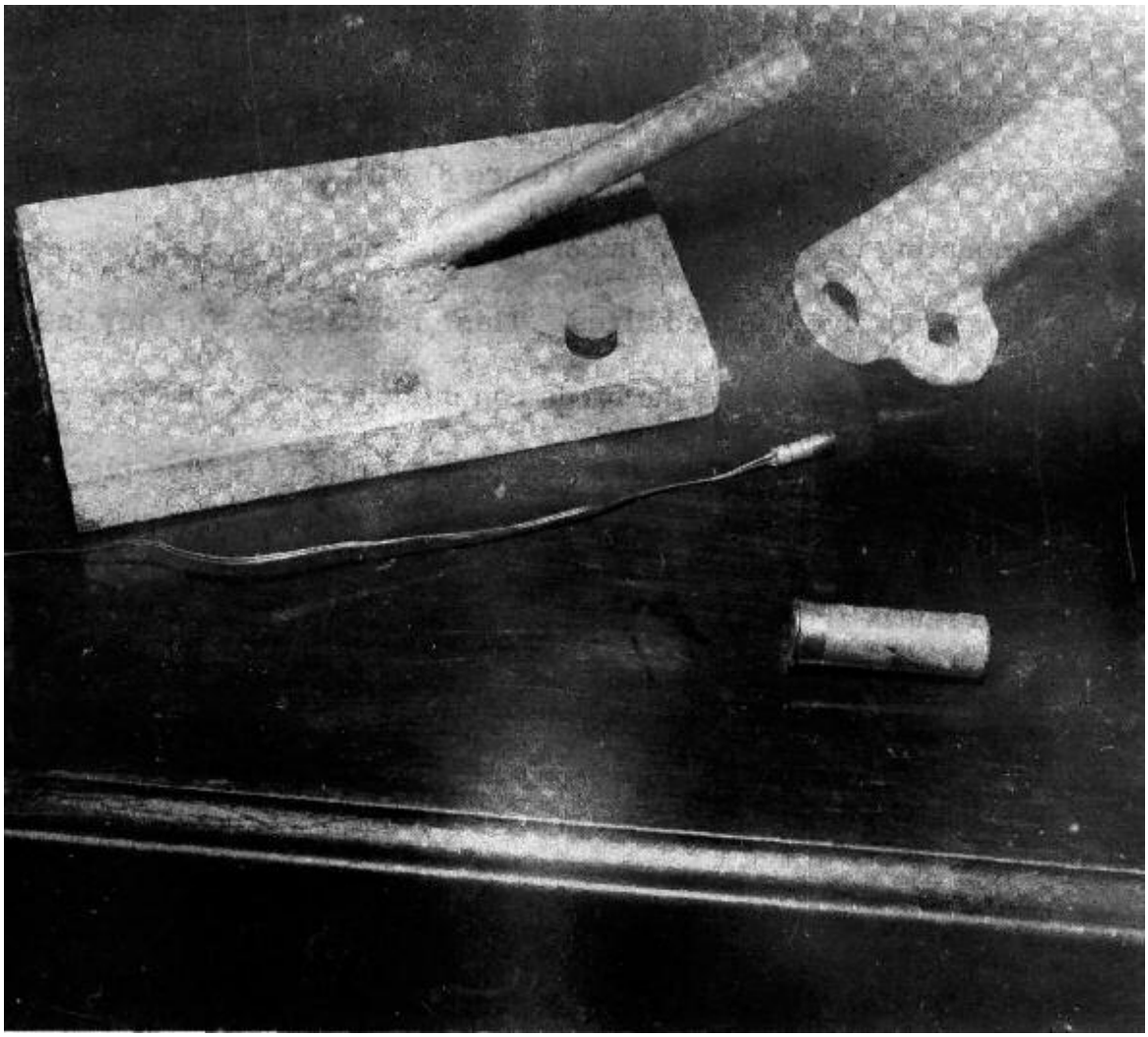

Figure 7 - Dissembled Invert Cannon Showing Slotted Guide Welded to Base at 20° Angle to Base. The Invert Barrel at Right is 2" in Diameter and 5" Long. The Bore Is 5/8" to Accommodate the 12-Gauge Shotgun Wad Shown at Corner of Base. The Electric Fuse or Squib Shown Is No Longer Available But Electric Matches Are Obtainable and Serve the Same Purpose. The 12-Gauge Shotgun Shell Is Included in the Picture to Show Comparative Size of Parts. To Load the Cannon, the Squib or Match Is Inserted in the Invert Barrel and a Measured Amount of Powder Poured in the Barrel. The 12-Gauge Wad Is Pressed in the Barrel and the Barrel Slipped on the Guide with the Squib or Match Wires in the Slot. Courtesy of U. S. Fish and Wildlife Service.

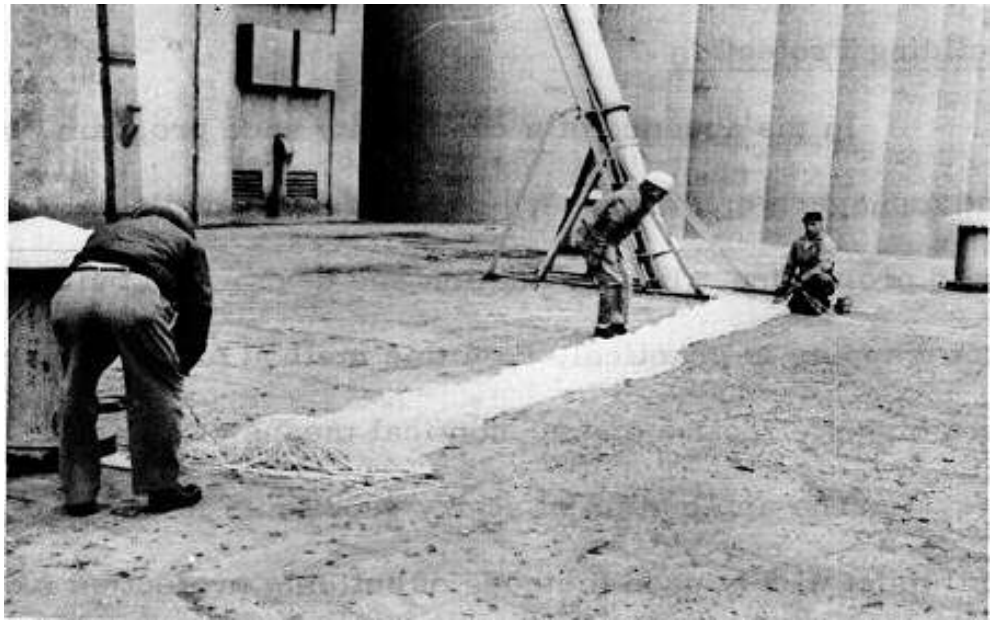

Figure 8 - Laying Out and Folding a Cannon Net Preparatory to Shooting When Pigeons Come to Bait Placed in Front of Net.

Figure 9 - Net Result of a Cannon Shot Net. 174 Pigeons in This Shot.

Building Protection

In the absence of a community wide program, building owners and managers must use such means as are available to protect their properties. If the situation and design of a building are such that trapping is practical, then this method properly carried out may be a highly effective and economical means of control.

The application of sticky repellents is one of the oldest and still most widely used methods of building protection from all species of birds (See Figures 10 and 11). Sticky compositions are rather fully discussed in Technical Release 8-58, which may be obtained from the National Pest Control Association. Properly used, the better sticky repellents give positive control. They have however, the disadvantages of being messy, unsightly, and having relatively short useful life. It is for this reason that other means of protection are being sought. It is almost certain that sticky repellents will remain as important supplementary materials, even though less objectionable methods of protection are developed. Recent improvements in their composition as well as in methods of application have made their continued use very valuable.

Wire screens, hardware cloth and chicken fencing have long been used to keep birds from those parts of buildings attractive to them. Unfortunately, such screening is often unattractive if extensively used. Recently, the use of fish netting made of fine black

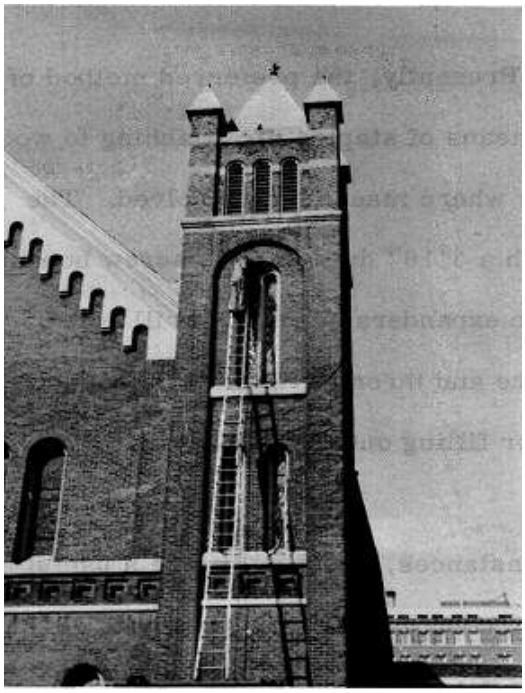

Figure 10 - One Way to Get There and Apply Sticky Repellent. Not Everyone Enjoys Bird Control.

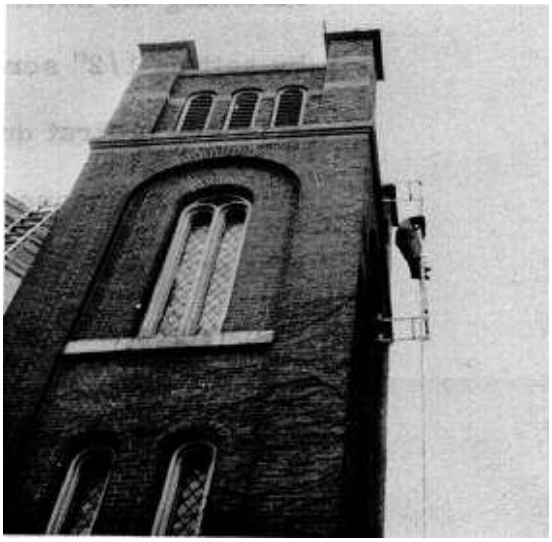

Figure 11 - Getting Down to Work from the Top. A Hook Ladder Used in Applying Sticky Repellent. Rope Is Used to Pull Up Materials.

nylon thread has been brought into use for this purpose. Although it is not as durable as wire screen, it is substantially invisible above the first floor on most buildings. It does not result in rust staining, as may happen where wire is used. It is also very cheap and in most cases easily applied.

This netting method is in an early stage of development, but results indicate eventual wide-spread use. The netting is provided with a heavier thread border to make it easier to handle

and increase its strength. Presently, the preferred method of fastening the netting is by means of staples for attaching to wood, or by setting 1/2" screw hooks where masonry is involved. The masonry is first drilled with a 3/16" drill and the screw hooks fastened by means of plastic expanders set in the drill holes. The nets are available in any size and thread with suitable border. Odd shapes are also available for filling out corners.

Shooting

Under many circumstances, shooting can be a useful supplementary method of pigeon control. The possible hazards and the possibility of adverse public reaction come immediately to mind. However, if done carefully and late at night, it can be a very valuable means of cleaning up a few birds following the use of other methods.

To avoid public offense, shooting should be done from two o'clock in the morning to, perhaps, five o'clock. Certainly, police should be notified when shooting is to start and when it has been completed. Judgement must be used in determining whether an area is suitable for use of this control weapon.

One would probably be more than criticized if this shooting method were used in some parts of the Embassy section in Washington, D. C., but in Springfield, Illinois, it has been done extensively for control of starlings and pigeons for three years without one complaint. Fortunately, the good people who might complain are in bed.

The best gun for this purpose is the smooth bore 22 caliber rifle. One can obtain long rifle shot shells for use with this gun; and most birds can be killed at up to 25 feet range. The #11 shots are so small that hazards to windows and to people are almost negligible. For a range of 25' to 35', a 410 shotgun with a skeet load of powder and #11 shot is indicated. The maximum charge should be skeet loaded 410 shells with #9 shot. The above requirements can be supplied by most sporting goods stores.

Fireworks, Spraying and Sprinkling

These methods were developed primarily for starling control. Pigeons are too persistent for these dispersal techniques to be of value under most circumstances. They may be useful, however, in moving pigeons to some nearby building where they can be readily trapped. These methods will be described under starling control.

Starlings

General

Starling control in urban communities is at the present time largely a matter of driving them from roosts in trees and on buildings. In late summer, trees in foliage provide roosts for the first brood juveniles; and in winter, dormant trees and buildings provide roosts for birds of all ages.

The U. S. Fish and Wildlife Service has described and is continuing work on methods of poisoning and trapping starlings in rural situations. In urban communities, however, we are still limited to community "starling-chasing" and to building protection. The methods of building protection described under "Pigeon Control" are all applicable to starling control. In starling "chasing" programs, sprays, fireworks and shooting have been the most positive control in this writer's experience.

Sprays

Where heavy infestations are involved and most of the birds are at a relatively low level on the buildings, a program of irritating sprays is quickly and economically effective. The large mist blowers used for spraying trees are the only practical sprayer to date. The object is not to apply a fine mist, but rather to use the air blast to carry a coarse spray as high as possible. To accomplish this, the spray nozzles should be removed and a 1/4" to 1/2" solid stream of liquid pumped into the air blast with all the pressure available.

The first choice of sprays to safely drive the birds from their roosts is 10% of concentrated aqueous ammonia (26 Deg. Baume) in water with about 4 oz. of a good wetting agent per 100 gallons to insure wetting the birds' feathers. An alternative spray is a 1/4% emulsion of synthetic mustard oil (allyl isothiocyanate) in water plus a wetting agent. The chief advantage of the ammonia is that its use does not alarm the public.

When used on buildings or dormant trees, the spray is simply directed on the roosting birds; and a strong spotlight is directed on them at the same time. If the work is done late at night when traffic is light, one can make good time on streets and alleys. One slow pass of the sprayer will move the birds; and after two or three passes, the light and the sound of the mist blower will suffice to move them.

Spraying trees in foliage involves the possibility of damage to the leaves. Tests of 5%, 10% and 20% ammonia on some twenty species of trees showed no damage at any of the three concentrations save on one species only. The common sweet gum (Liquidambar styraciflua) showed leaf damage at all three concentrations. Red pine, white pine and blue spruce were not affected, even at the highest strength of ammonia used. This is encouraging since these species frequently are used as winter roosts. For the present, it is advisable to test the spray on a small scale, prior to extensive spraying. Since starlings are easy to move from summer roosts, one need not go beyond 5% ammonia to achieve good results. It has been found that Spray applications during the roosting period for four consecutive evenings will free a summer roosting site, but in winter and especially during severe weather as many as five nights of work may be required. The basic principle is simply that, if they cannot sleep for a few consecutive nights, they will find another hotel.

Spraying can be done from streets and alleys during the evening dinner hour when traffic is light, but the best time is made in the early morning hours when traffic is at a minimum. If the birds can be kept stirred up from two in the morning until dawn, they will (in common parlance) "get the message quickly."

Sprinkling

Recently experimental work has been done on the use of the cheap flexible water pipe as a means of spraying-or rather sprinkling diluted ammonia or synthetic mustard oil directly on birds at their roosting sites on buildings. Black polyethylene hose in the 1/2" size costs approximately 5c[1] per running foot and is readily fastened to a wall just above a ledge by means of metal conduit hangers; one fastener at each ten feet will suffice in most cases. One end of the pipe is firmly plugged and the other brought to where it is easily available for attachment of a sprayer hose or a gas line. After the hose is in place, it is easy to make the outlets where needed. A pin vise is used to hold a sewing needle of approximately .045" diameter. The needle is easily pushed through the hose so that either spray or gas can be directed at any angle to the hose. This includes very low angles so that spray can be directed down the line of the hose.

In most cases, one pin hole per running foot of pipe has been adequate to apply either liquid spray or ammonia gas. When pumping spray, each 1 GPM of capacity of the pump will serve 44 of the pin holes. Thus, a 5 GPM sprayer will take care of 220 delivery

holes. A pressure of 50 lbs. will cause the pin streams to reach out approximately five feet in a horizontal direction. Allowance for the pressure to get the spray up to the hose line from the ground must be made. Since a few gallons of spray may be held in the hose line, between the sprayer and the point of discharge, one needs a feed back valve at the spray tank to drain the hose back into the spray tank.

Where open roof areas are involved, the rotating sprinklers used in irrigation of fields provide an economical means of applying sprays, but cannot be used for gases. The radius covered depends on the size of the sprinkler and the GPM capacity of the pump rather than on pressure. Most of the sprinklers operate at a top pressure of only about 80 lbs. but a sprinkler to cover a 75 ft. radius will need a pump delivering 16 GPM. One pass of the sprinkler has always been adequate to move birds. In fact the results of applying either ammonia or synthetic mustard oil have always been immediate and even dramatic.

Although such sprays are highly effective on starlings and sparrows, it has been found that pigeons are very persistent at established roosts and resting sites. Thus with this species the initial program will require some time longer. Furthermore, if changes are not made to reduce the attractiveness of the building to pigeons, it will have to be treated repeatedly at intervals. There would seem to be a need for a completely developed and permanent

installation that could be put into operation by the flick of a switch or the opening of a valve.

The use of sprays and gases applied through sprinkling systems is still in an early stage of development, but experience indicates that in most cases such systems can be installed for little, or any, greater cost than one application of sticky repellent, and they should be functional for several years. The plastic hose is known to resist weather quite well, and, unlike copper or brass, is not affected by ammonia. The synthetic mustard oil emulsion will work equally well and is quite cheap, but ammonia is so well known to the public that its use will not create any apprehension in the public mind.

Some years ago a department store in Cincinnati, Ohio installed a rubber air hose on its window ledges with small cuts in the hose every 3 ft. An air compressor and tank system was installed to provide strong air pulses at intervals. This has served to keep starlings from the building for quite some years and is reported to be still working.

Trapping

This writer is not aware of any successful trapping of starlings in urban situations. Even efforts to drop nets over them on their roosts have been unsuccessful in our experience.

The U. S. Fish and Wildlife Service has developed a large light trap that has in some trials been dramatically effective. Where

this can be used in winter roosts near urban centers, it can reduce the pressure of starlings on cities.

Essentially, the method consists of setting up a large funnel-shaped net with the open end facing a winter roost. A tent is set at the small end and a set of powerful lights are directed through the funnel onto the roost. On a dark night, the birds are slowly driven from the roost and in their confusion fly into the net opening and down into the tent. When the maximum number of birds are in the net, a flap is dropped and the birds are gassed. Spectacular catches have been made when conditions were right. At a roost on the edge of Springfield, Illinois some 75, 000 starlings were taken in March of 1960. This was estimated to be one-half the birds in the roost. The method requires considerable man-power to operate and the equipment is rather costly. Although this method is dramatic, it does little to reduce the total number of birds in an area.

Fireworks

Starlings have been successfully driven from roosts in cities and on bridges as well as in trees by the use of fireworks alone. It is this writer's feeling, however, that where sprays are applicable they are more economical, safer, and less disturbing to the public. Fireworks are certainly an almost invaluable tool, to be used as an adjunct to other methods, and have been the only feasible tool in some situations.

At the present time, dependable fireworks pieces specifically suited to urban bird control work are not commercially available. It is hoped that this unfortunate situation will be corrected as bird control work becomes a larger outlet for these materials. For the present, however, we are forced to adapt those pieces that are available to our work by home-made devices. These adaptations are at a fairly satisfactory stage of development.

Nearly all states have some form, of fireworks legislation. These laws must of course be investigated and observed before fireworks are purchased, made, stored, or used.

> (NOTE: The National Pest Control Association recognizes the hazards associated with amateur experimentation with fireworks. NPCA advises strongly that people inexperienced in handling fireworks, use only those devices which become commercially available after their safety has been proved, and safe techniques for their use have been reported.)

The two most used elements of fireworks in bird control are, first, the Roman candle star or comet, hereinafter referred to as stars, and, second, the many forms of salutes and firecrackers, which will be referred to as crackers. The problem is to ignite these stars and crackers and get them to where the birds are roosting. Occasionally it may be desirable to project them into flocks of birds on the wing.

The fireworks applications to be described here will be limited to two methods of igniting crackers in place and one method of projecting stars or crackers. Projection is of course usually from the ground up, but where tall buildings are involved, at times it may be downward from roofs.

The use of slow-burning fuse rope with fuse attached crackers is well described in literature available from the major fireworks producers, as well as in publications of the U. S. Fish and Wildlife Service. Essentially, these units are made up of a slow-smouldering twisted rope to which crackers are fixed at intervals by inserting the fuse of the cracker between the braids of the rope (See Figure 12). One of our men found that a convenient means of inserting the fuse in the rope was to fasten one end of the rope to a bench vise and then insert the fuses by using a short piece of thin-walled 1/8" pipe with an inside diameter large enough to take the fuse. The small pipe is cut at an angle to a point so that it resembles an oversized hypodermic needle or a veterinarian's trocar. The "needle" is thrust through the rope and the fuse of the cracker inserted into the pointed end of the needle and the cracker fuse drawn back through the rope.

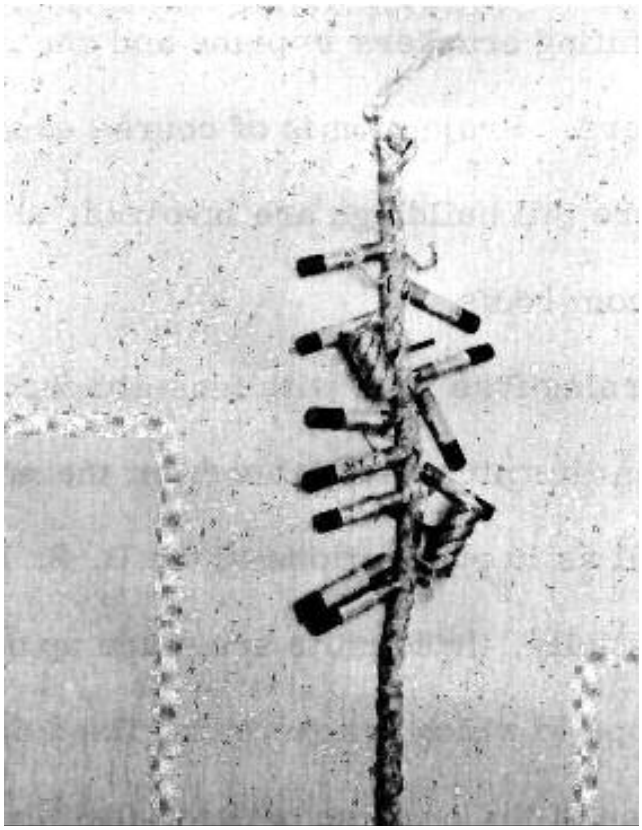

Figure 12 - Slow-Smouldering Fuse Rope Strung with Chinese Flash Crackers and Two M-80 Crackers.

The fuse rope and cracker units were developed for control of bird depredations in the agricultural and, particularly, the orchard field. They may be used to combat starlings in tree roosts and have been used on bridges, and in some cases on roofs. On roofs, they may be hung from some form of scaffold at a height of several feet. The distance the crackers drop before exploding will depend on how much cracker fuse is left between the cracker and the fuse rope. In no case should the large crackers, commonly sold for bird control, be allowed to drop on a roof or even on a cement floor. Several of them exploding in the same spot will drill a hole of a few inches in

concrete. A bucket of sand has been found to be a safe place for them to drop. If properly placed on the fuse, the crackers should explode in the air and give the full benefit of their bird-frightening power.

Since the rate at which the fuse rope burns is fairly uniform, the units can be hung in place and lighted any time during the afternoon hours and be depended on to start shooting as the birds come to roost. Where the large crackers would be too disturbing, the smaller Chinese flash crackers can be used. The timing of the shots will of course depend on the spacing of the crackers on the fuse. The fuse burns or smoulders at from 6" to 8" per hour, depending on air conditions.

The second method of igniting crackers in place is by means of the ingenious "pull wire ignitors," made by the Ensign-Bickford Company of Simsbury, Connecticut. These are cut down in size and a cracker fastened to the end and the unit then held together and waterproofed by means of tape or by dipping in rubber Latex. Properly spaced and with the units attached to a pull rope, they have proven most useful. The units are placed where the birds are a problem and the units can be exploded from the ground by pulling on a light rope which reaches up to the unit. We have found it desirable to keep the rope several feet beyond the reach of the hand so that it cannot be easily tampered with. A small ring of #9 or #12 aluminum wire on

the end of the rope can be reached with a light weight pole with a hook on the end. The details can be readily understood from Figure 13.

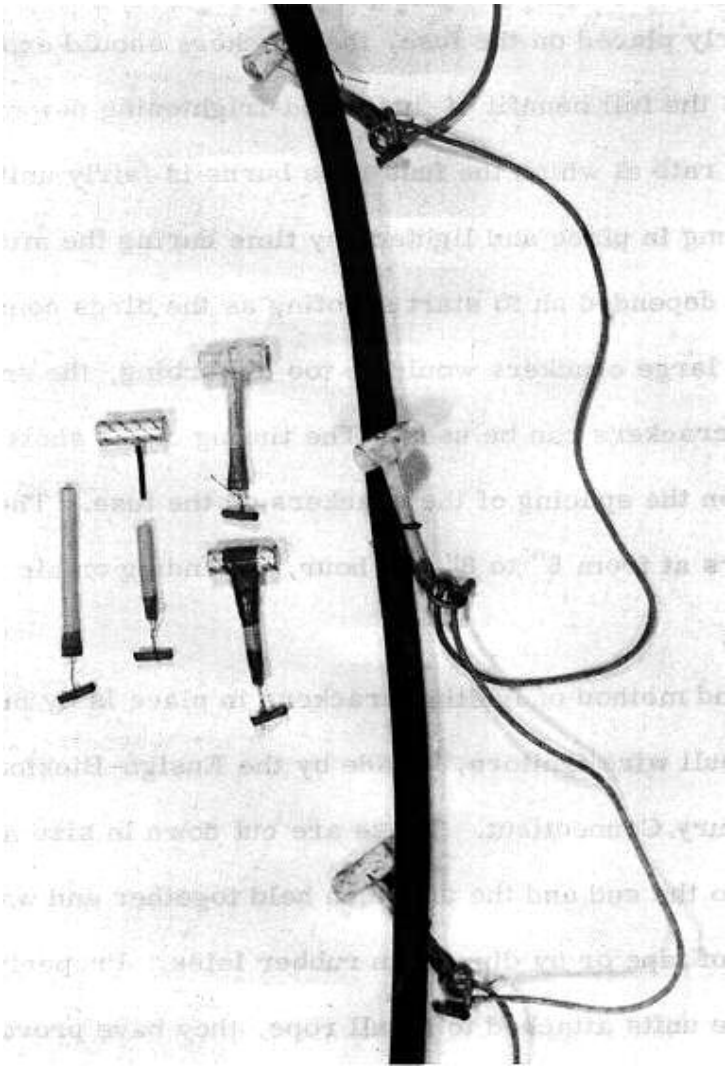

Figure 13 - Mounted, Multiple Shot Pull Rope Cracker Assembly Shown on Right. Parts on Left Are from Left, a Pull Wire Ignitor Full Size, Next Is a Cut Down Ignitor and a Typical Salute Type Cracker. Next on Right Are Two Ignitor-Cracker Units United by Water Resistant Tape as Below and by Dipping in Rubber Latex as Above. The Completed Assembly on Right Shows Rubber Hose with Light Nylon Cord Tied to Pull Wire Ignitors. The Cracker Units Must Be at Least Ten Inches and Better Twelve Inches Apart.

Where birds must be moved from roosts several stories up on a building, it is often easiest to lower crackers from the roof by means of a fishing pole and line. If the birds cannot be seen from the roof the operator may need assistance from the ground level. This can be by means of directions called through a megaphone.

Both stars and crackers can be readily projected from the ground up to a height of several stories on a building. With well made

pieces, the stars and crackers can be well placed and timed. Perhaps the best piece made to date was a "pulled string" sky flare and sky cracker which unfortunately is no longer available. One manufacturer has made special star and cracker shells to use in hand mortars but so many have been defective and even dangerous that until dependable pieces are forthcoming, they cannot be recommended.

The making and reloading of home-made pieces is relatively simple and not too time-consuming. Two sizes of cartridges and mortars to project the cartridges are suggested. These are 3/8" and 5/8" diameter to take stars and crackers of that size, or slightly less in size (See Figure 14).

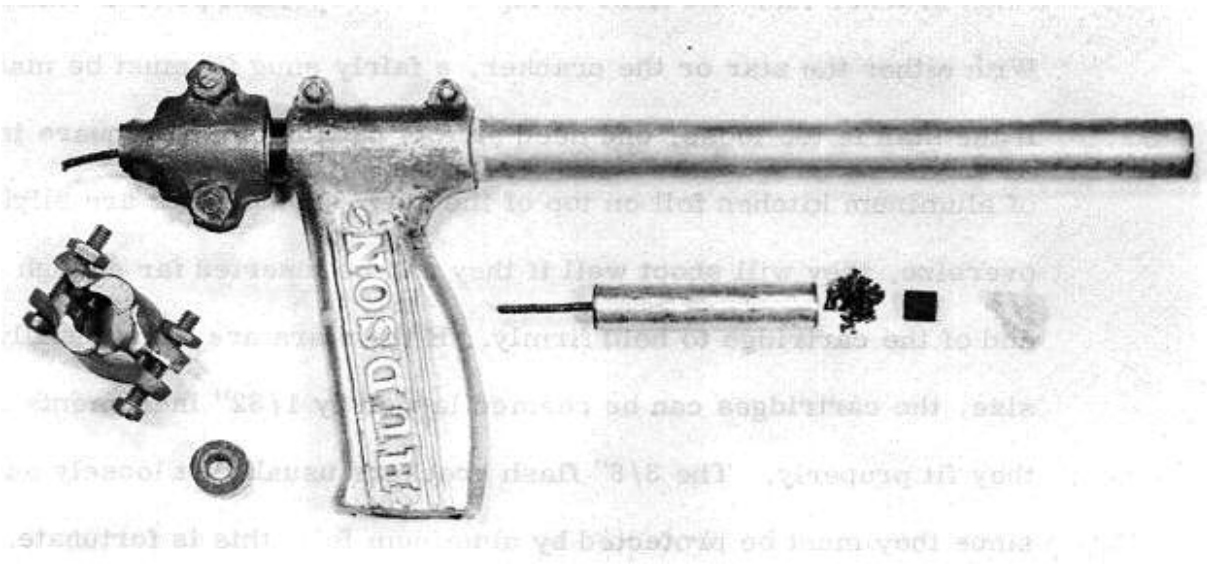

Figure 14 - Hand Mortar for 3/8" Stars and Crackers. The Barrel Is 12" Long with 3/4" O. D. and 5/8" I. D. The Handle Is a Standard Hudson Sprayer Part and the End Plug Is a Spray Hose Clamp. The Clamp Can Be Removed Easily to Clean the Barrel. The Cartridge Is a 2" Piece of Water Pipe 1/2" O. D. and 3/8" I. D. One End of the Cartridge Is Plugged with Solder and Drilled to Take the Fuse. The Powder Charge Which May Be from 1 /2 to 1 gm Is Placed in the Cartridge Followed by the Star and a Bit of Rock Wool or Aluminum Foil Wadding. The Cartridge Is then Dropped in the Mortar and the Fuse Lighted.

The 3/8" cartridges are easily made from ordinary metal pipe with an I. D. of 3/8" and not over 1/2" O. D. The pipe should be cut into 2-1/2" to 3" lengths and one end filled with solder to a depth of about 1/8" to 3/16". Since most fireworks fuses fit snugly into a 7/64" hole, the solder in the end of the cartridge should be center-drilled to a 7/64" size. To load the cartridge, simply twist a 1" length of fuse into the hole in the solder, dip in from 1/2 gm to 1 gm of IF black powder and press a 3/8" star into the cartridge. This completes a star cartridge.

To make a 3/8" cracker cartridge, insert a 3/8" Chinese flash cracker fuse end first on top of the propellant powder charge. With either the star or the cracker, a fairly snug fit must be made. If the star is too loose, one need simply pack about two square inches of aluminum kitchen foil on top of the star. If the stars are slightly oversize, they will shoot well if they can be inserted far enough in the end of the cartridge to hold firmly. If the stars are substantially oversize, the cartridges can be reamed larger by 1/32" increments until they fit properly. The 3/8" flash crackers usually fit loosely and, since they must be protected by aluminum foil, this is fortunate. To protect the fuse end, a piece of foil 1" wide and several inches long is smoothly wound around the fuse end of the cracker so that 1/2" protrudes over the end of the cracker and around the fuse. This is then rolled in and around the fuse, using care not to twist the fuse loose.

The fuse is then cut off about 1/8" beyond the fuse wrapping. A little practice will determine how much foil is needed to insure a snug fit with any given lot of crackers.

To make 5/8" cartridges, one needs only 12-gauge solid brass shot gun shells. These are no longer readily available, but can be obtained from the Alcan Company, of Alton, Illinois. The opening in the end of the shell where primer caps are inserted is filled with solder and drilled exactly as described for the 3/8" cartridge. The shells are loaded in the same way except that 5/8" stars and crackers are used. If the high powered end-fused crackers that are made for two-shot fireworks pieces are being used, one must be sure the packing around the fuse is strong and well made. If it is not, the cracker may explode in the mortar, which is unpleasant if not dangerous. To be safe in this respect, it is well to make a paste of the commercial water putty that is on the market and pour a little around the fuse on each cracker. Crackers so reinforced have never blown in the mortar.

The mortars (See Figure 15) to fire these cartridges are easily made. Required is a piece of metal tube one foot long and of such inside diameter as to allow the cartridge to slide in readily. For the 3/8" cartridge, a 5/8" I. D. tube is suitable; and for the 5/8" cartridge an I. D. of 1" is excellent. The mortar is closed at one end by some convenient means. On the smaller tube a ridged hose clamp is very satisfactory; and the larger tube can be closed by a

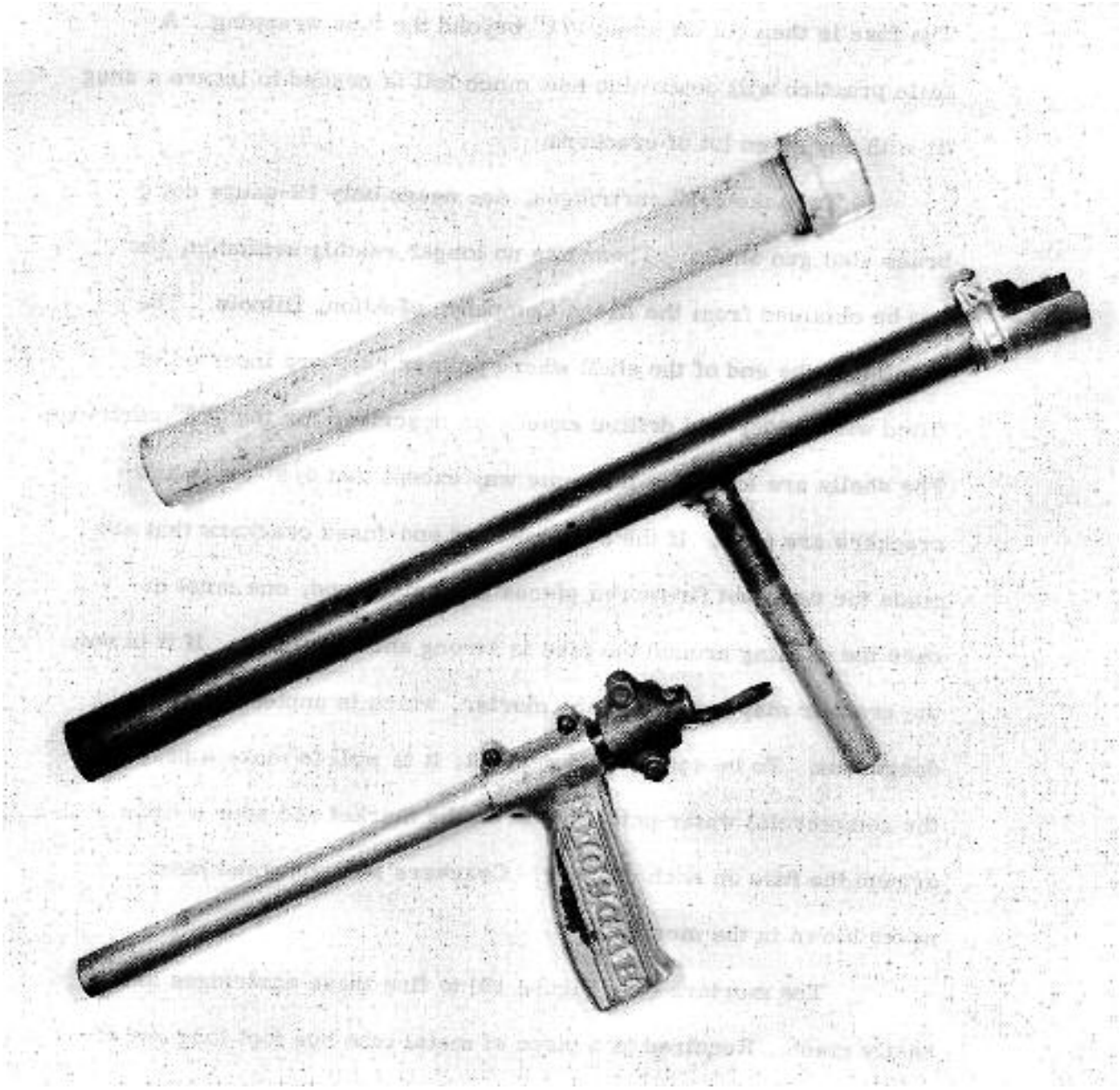

Figure 15 - Three Shell Firing Mortars. The Upper Is Fitzwater's Simple Pipe and Cap. A Hole Drilled in the Cap Permits the Fuse to Stick Out at the Lower End. The Other Two Mortars Are the Same as Shown in Another Illustration Except that a Sheet Metal Shield Has Been Added to Permit Easier Lighting of the Fuse. The Shields Are Sandpaper Lined for Convenience in Striking Matches.

brazed-in metal plug. In either case, a hole slightly smaller than the cartridge must be in the middle of the plug so the fuse will drop readily through the hole when the cartridge is dropped into the tube. A handle is usually attached for convenience.

In use, a cartridge is simply dropped into the mortar, fuse end first, and the projecting fuse is lighted. The mortar is directed by holding it to one side of the body and never directly in line with the eye, as some burning powder may spit back through the fuse hole.

After some considerable use it will be necessary to clean the burnt powder deposit from both the mortars and the cartridges. The cartridges should not fit the tube too tightly where powerful crackers are used, as the danger of splitting the mortar tube is reduced by a loose fit. By the same token, they should not fit too loosely or one gets poor directional control. The distance the star or cracker travels will depend on the amount of powder used and on the tightness of the fit in the cartridge. From 1/2 gm to 1 gm is the usual range for the small cartridge and about twice that amount for the large cartridge.

One of the major problems has been to light the fuse. When the fuse is cold and a strong wind is blowing, this has been a time-consuming annoyance. The problem has been eased, if not completely solved by two minor changes. The first trick was suggested by Dr. Herbert Ellern, staff scientist for the Universal Match Company. It is to make a slurry by stirring a fine-grained black powder in a

10% solution of nitrocellulose in acetone. After the cartridges are fused, the fuse end is slightly slit and then dipped in the slurry. The slurry dries quickly, and although the dipped fuse is completely safe to handle, so far as shock is concerned, it will ignite on the slightest touch of flame. The second added convenience was to clamp a semi-circular shield around the end of the mortar to protect the fuse from the wind. This is lined by sandpaper, so that a common kitchen match can be struck inside the wind shield and the flaming match head is immediately in contact with the tip of the fuse.

Most bird-chasing fireworks are of course used against roosting birds; and the pieces described have been for this purpose. Occasionally, one would like to shoot directly into a flock of birds on the wing. A form of pull wire ignitor and also an electric ignitor have been developed and proven satisfactory. These, however, are of such infrequent use as to be hardly worth more than mention. Several forms of sling guns and sling pistols have proven useful, but are difficult of description, and it is believed the few items detailed here will serve for most purposes.

It has been the writer's very real pleasure to work for some time with William Fitzwater of the U. S. Fish and Wildlife Service on the development of the special equipment and pieces described here. In fact, in many cases it would be hard to say which one of us is the real parent of the concepts involved. Perhaps the honors could be

divided by suggesting that - if it works, I would appreciate hearing about it, and, if it blows up in your hand, be sure to write to "Bill. "

Shooting

The use of shooting as a control measure has been described at some length under pigeon control. Suffice it to say that where a few starlings persist, after a program of spraying and fireworks, there is nothing quite so terminal as a pinch of #11 shot. The dying squawk of a bird is one of the best repellents known.

Sparrows

Nesting Control

Sparrow nests are generally so widely dispersed that control is seldom possible by nest destruction. Occasionally, however, an old building has become a major sparrow hatchery and considerable control can be achieved by either screening or persistent nest destruction. It has been found that spraying nests with 10% coal tar disinfectant in water emulsion form, or, better, 5% of crude cresylic acid emulsion, will stop eggs from hatching and will kill young birds. The nests may be rebuilt in a matter of ten days, so a program of repeated spraying from about May to July is needed in the Midwest.

Nests are frequently abundant (as are also winter roosts) in heavy vine growth on the sides of buildings. Nests can be broken up in such situations by high pressure streams of water; and the vines can be protected in summer or winter by covering them with the cheap nylon netting referred to earlier in this paper.

Roosting Control

The methods described under pigeon control and starling control are applicable to sparrow problems. They are midway between these species in their persistence in roosting sites.

In one experiment, sparrows were sprayed late at night with the temperature at two degrees below zero. Water and anti-freeze alcohol (Methanol) was used. A high pressure hydraulic sprayer with a fire gun tip delivered the spray. All sparrows well hit by the water were killed by the shock. Since they had been experimented with before, they did not sit well for this study. This method is recommended only for cold climates and hardy operators.

Gassing

Under the right conditions, sparrows can be satisfactorily gassed with Cyanogas "A" dust. The temperature should be above 45° F. ; and there must be some sort of backstop to keep the "A" dust from moving past them too fast. Best results have been obtained in summer with trees in foliage, or, in winter, where they are roosting on vines on the face of a building. A back pack power duster is the only method used for applying the "A" dust.

In a few cities, one pest control firm has successfully gassed both sparrows and starlings by pouring "A" dust down on the roosts from above, in downtown areas in as near complete darkness as could be achieved. Apparently, this requires a dark night with all streets lights and signs turned off.

A form of gassing inside buildings is suggested by one experience. A barn with 40 M cu. ft. capacity and no animals were gassed late at night with #50 of fertilizer grade anhydrous ammonia. All of the many sparrows and also mice were killed. Considering that ammonia is its own warning agent and that the anhydrous costs around 6-1 /2¢ per pound, it might well be further investigated as a means of controlling birds in some types of buildings.

Poisoning

Sparrows, like pigeons, are rather easy to control by means of poisons. All of the precautions mentioned under pigeon control apply as well to sparrow poisoning. The use of strychnine baits is well described in a U. S. Fish and Wildlife Service publication and in an admirable paper by Johnson Neff of that agency, published as a Technical Release by the National Pest Control Association.

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National Pest Control Association, 250 W. Jersey St., Elizabeth, N. J.

Technical Release No. 8-58 - Bird Repellent Compositions ($2. 00)

Technical Release No. 8-59 - Handling Localized Pigeon Problems

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Modern Pyrotechnics, Dr. Herbert Ellern (1961) Chemical Publishing Co. ($11. 00)

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Blasters' Handbook, E. I. DuPont Co. (1958) 14th Edition ($2. 50)

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Nets and Netting - Carl Miller Co. , 2311 Park Avenue, Memphis 14, Tenn

Electric Matches - Atlas Powder Co. , Wilmington, Delaware

Pull Wire Ignitors - Ensign-Bickford Co. , Simsbury, Connecticut

Special Star and Cracker Shells - John Miller Fireworks Co. , Holland, Ohio

Crackers and Slow Burning Fuse Rope - Toledo Fireworks Co. , Toledo, Ohio

Crackers and Slow Burning Fuse Rope - New Jersey Fireworks Co. , Elkton, Maryland

Pigeon Trap Bobs - Charles Siegel and Son, 4939 N. Elston Avenue, Chicago 30, Illinois

Invert Cannon for Net Shooting - Napier Machine Shop, 306 N. 5th Street, Springfield, Illinois

Hand Mortars, Sling Guns, etc. - Napier Machine Shop, 306 N. 5th Street, Springfield, Illinois

Twelve-Gauge Brass Shot Gun Shells - Alcan Company, Alton, Illinois