PRETREATMENT
OF
POULTRY PROCESSING WASTES
FOR
DISCHARGE TO A MUNICIPAL SYSTEM

PREPARED
FOR
ENVIRONMENTAL PROTECTION AGENCY
TECHNOLOGY TRANSFER PROGRAM

DESIGN SEMINAR
FOR
UPGRADING
POULTRY PROCESSING FACILITIES
TO REDUCE POLLUTION

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A. J. Steffen

PREFACE

This brochure is intended to serve as an information medium for one section of the Environmental Protection Agency Technology Transfer Design Seminar for Upgrading Poultry Processing Facilities to Reduce Pollution.

This section relates to "Pretreatment for Discharge to Municipal Systems" and represents a half-day's session of the seminar. The other two sections cover in-house waste conservation and re-use, and complete treatment for discharge to a watercourse. Separate brochures to cover these two subjects are provided at this seminar. The material is oriented toward plant owners, managers, superintendents and their engineering and operating staffs.

Wherever possible, copies of visual aids used during the presentations are reproduced herein. The selection of speakers was based upon their familiarity with the technology being presented. Selection of a speaker affiliated with a manufacturer of a specific product, as well as the proprietary material presented herein, does not directly or indirectly imply an endorsement of such product.

Most poultry plants are now using flowaway systems, thus the subject matter relates largely to this type of waste handling system. The customary screens used in flowaway systems to remove offal and feathers are intended to improve the wastewater for re-use in the processing plant and for recovery of by-products and are thus not considered (herein) as part of pretreatment for discharge to a municipal system. However, it is recognized that effluent may often be improved by improvements in flowaway screening.

Pretreatment does not include treatment of sanitary wastes (normally discharged directly to the city sewer), storm water, cooling water, or condenser water.

Disposal of the recovered screenings, floatables and settled solids is beyond the scope of this brochure, but concentration of the floatables and settled solids by screening to reduce liquid content is included.

I. INTRODUCTION: A. J. Steffen

A. Why Pre-treatment?

In this portion of the seminar, we are concerned with the treatment of poultry wastes after the customary screening in flowaway systems and prior to discharge to a municipal sewer. We will use the term "pretreatment" to cover all physical, chemical or biological treatment provided for this purpose.

The majority of poultry plants discharge to municipal sewers. In a 1971 USDA survey (see Bibliography, Item 11) of 386 poultry plants, almost two-thirds were connected to some type of public sewer system. The survey did not show how many had pretreatment. Whether or not pretreatment is required at a poultry plant depends most frequently upon municipal regulations regarding some of the ingredients in the poultry wastes. Ingredients such as feathers may be prohibited because they cannot be efficiently removed and disposed of in conventional municipal sewage treatment plants, while other ingredients, such as solids may be subject to special charges to defray the expense of their removal and disposal in the municipal system.

Federal regulations covering grants-in-aid to municipalities touch on pretreatment of industrial wastes. The EPA has set up rules relating to industrial wastes discharged to such municipal systems, as noted in the following excerpt from the Federal Register of July 2, 1970: "Where project (for which a Federal grant is requested) is to treat industrial wastes, it must be included in a waste treatment system treating the wastes of an entire community. A waste treatment system means one or more treatment plants which provides integrated, but not necessarily interconnected waste disposal for a community, metropolitan area or region. In such a system, industry must provide pretreatment if waste would otherwise be detrimental to the system. Where industrial wastes are to be treated in the proposed project, the Commissioner must be assured that the applicant (municipality requesting a Federal grant) will have an equitable system of cost recovery".

Thus, if the municipality receives a Federal grant, the poultry plant may be required to provide pretreatment if the waste would be detrimental to the system of municipal treatment. Note also that the cost of treating the poultry wastes must be recovered in "an equitable system of cost recovery". In some cases, municipal treatment requirements can be reduced by pretreatment at the poultry plant. This may produce overall savings to the poultry plant operator, if a cost recovery charge is to be levied.

There are many other instances where pretreatment may become an economic advantage. Suppose, for example, that the municipal plant is overloaded and a plant expansion is contemplated. A study shows that pretreatment at the poultry plant will eliminate the overload. The decision whether to pretreat or go along with the municipal plant expansion program depends upon the relative annual cost (of the two alternatives) to the poultry plant operator.

As another example, suppose that excessive discharges of grease, feathers or suspended matter are causing special problems in operating primary clarifiers and anaerobic sludge digestion at the municipal plant. The first step for correction of such problems is waste conservation at the poultry plant and attention to the flowaway system (check for escape of solids in the flowaway screen and offal area). If these elements are all in order and good waste conservation is being practiced in the plant, pretreatment may be the next step.

As a further example, suppose the poultry plant management is considering an increase in poultry production or some additional processing. The added sewage treatment load resulting from such changes can be calculated, to compare the sewage service charges for municipal plant expansion (made necessary by the added load), with the cost of pretreatment to produce the same results.

B. When Pretreatment?

1. Prohibitary and restrictive limits may make pretreatment necessary.

   The discharge of some ingredients such as feathers, entrails, and the like into the municipal system may be completely prohibited. If the best in-plant conservation practices and careful operation of efficient flowaway equipment does not eliminate these materials to the municipality's satisfaction, some form of pretreatment will be necessary.

   On the other hand, restrictive limits (that is, limits of concentration of, say, BOD, solids and grease in milligrams per liter) may vary with the type of municipal treatment. For example, emulsified fats from poultry cooking operations are amenable to activated sludge treatment, whereas they may be troublesome in a trickling filter type plant. A municipality with activated sludge treatment could then recognize that emulsified fats would be paid for under BOD charges, with grease restrictions applying only to floatable grease.

2. Pretreatment may reduce a poultry processor's overall waste treatment cost when a municipal surcharge system is contemplated.

   Surcharge systems vary, and no one can predict whether pretreatment can be economically justified until costs are evaluated. A surcharge system should be based upon an evaluation, by the city's consulting engineer, of the cost of the elements of the municipal treatment plant necessary to accommodate the flow, remove the suspended matter and treat the other ingredients of the industrial wastewater to the required levels, all on a unit basis (cost per pound of ingredient).

Many surcharge systems start with a flow base rate, and apply multipliers for concentrations of such ingredients as BOD, suspended solids, and grease (any or all of these). As an example, the flow base rate, charged to all sewer users, may be, say, 50% of the water bill (flow from private water supplies would be included). Then, taking BOD as an example, assume that 250 mg/l has been established as a bottom base for surcharges. Then a multiplier might be applied for BOD between, say, 250 and 500 mg/l, and a higher one between, say, 500 and 1000 mg/l. Another set of multipliers might be applied for suspended solids, another for grease, etc. These multipliers are then added together to establish a single multiplier which is then applied to the flow base charge to arrive at the total bill.

In other surcharge systems, charges for the pounds per month, above a base quantity, of BOD, suspended solids and other ingredients are added to the flow charges based on gallons.

3. Summary.

Except for compulsory action to remove materials prohibited from entering the city sewers, the degree of pretreatment is generally an economic decision. However, since plants differ and surcharges differ, no simple set of parameters can be established. Each case must be evaluated individually not only to establish present practices but also to prepare for the future.

C. <u>How Pretreat?</u>

Pretreatment can cover a broad range of wastewater processing elements, including screening, gravity separation of solids and floatables, pressurized air flotation, chemical treatment as an adjunct to gravity separation or flotation, and biological treatment such as aerated or unaerated lagoons or some other form of aerobic treatment.

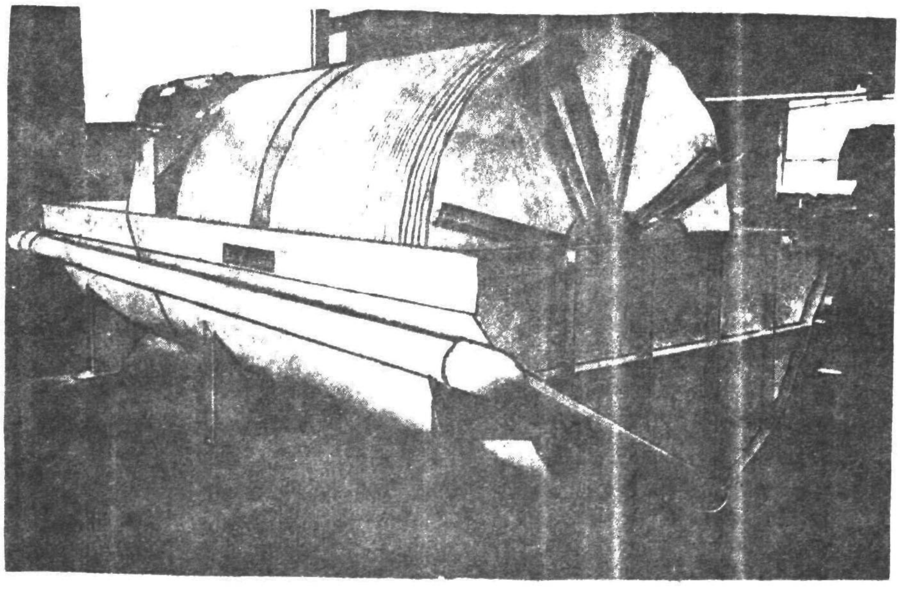
Before any pretreatment is considered, an adequate survey should be made, including flow measurement, composite sampling and chemical analysis to determine the extent of the problem and the possibilities for pretreatment. Analyses may include BOD, suspended solids, suspended volatile solids, settleable solids, pH, temperature, and oils and grease. A permanent flow measuring and composite sampling arrangement is warranted if sampling is done regularly to determine municipal surcharges.

Most commonly, pretreatment will consist of separation of floatables and settleable matter. In some instances lime and alum, or ferric chloride, or a polymer may be added to enhance separation. Paddle flocculation may follow alum and lime or ferric chloride additions to assist in coagulation of the suspended solids. Separation may be by gravity or by air flotation. Screening may precede the separation process, and also may be used to concentrate the separated floatables and settled solids. These various systems will be discussed under separate headings.

Removal of floatables and suspended matter will also accomplish some reduction in BOD. Frequently this degree of treatment will satisfy municipal requirements. If additional BOD removal is required, a study of biological processes for pretreatment may be instituted, possibly in pilot scale. Several biological treatment systems have been successfully adapted to the treatment of poultry wastes. Lagoon treatment is discussed in Session 3:

Direct Discharge to a Watercourse. Other BOD removal systems may be suitable. The so-called "Dutch Ditch", which utilizes an aeration device in an oval shaped shallow "race-track" ditch to recycle the flow, has been applied to meat waste treatment and may be suited to poultry wastes as well. High-rate aeration, with clarification and sludge return (activated sludge) is available in many configurations.

A rotating biological contactor is treating the effluent from an air flotation tank in a pretreatment system at a poultry plant in Illinois. In the contactor, wastewater flows through a tank in which a series of half-submerged discs, about 12 ft. in diameter, rotate slowly on a horizontal shaft. As the shaft turns, a film of biological growth forms on the rotating surfaces. Rotation of the discs alternately passes the bio-mass through the wastewater where the bio-mass absorbs organic matter, then through the air where it obtains oxygen for biological metabolism. Excess bio-mass sloughs off and is separated in a clarification step. The plant in Illinois treats 130,000 gallons per day and is reported to remove 90% of the BOD in the wastewater leaving the flotation tank (influent at 2000 mg/l, effluent at 200 mg/l).



Rotating Disc Contactor

D. <u>Costs</u>.

Costs of pretreatment depend on many factors, such as size of poultry plant, type of processing, space available for pretreatment, quality of in-house waste conservation, pumping requirements, municipal requirements regarding quality of effluent, local labor costs, construction costs and federal and state tax incentives for industrial waste treatment.

However, approximate costs of equipment are given wherever possible, as well as approximate costs of any chemicals required. Installation costs of prefabricated systems may be generally estimated at about 30 to 40% of equipment cost. Processors often prefer prefabricated units for convenience in installation.

Variations in loading due to changes in processing should not be overlooked in making rough approximations for sizing pretreatment. For example, cut-up and packaging can produce 15% greater BOD than processing to eviscerating only, and fowl can increase grease content from the usual 1.0 to 1.5 lbs. per 1000 birds to 1.5 to 2.0 lbs.

In spite of the wide divergence of costs, some examples of costs of plants, as built, may be useful. In one recent instance in Arkansas, in a plant processing 5000 broilers an hour, with partial cut-up and packaging and some deep fat frying, a 20 x 20 mesh vibrating secondary screen (4' x 10') cost $20,000 installed, including a 200 gpm pump. Dual pumps are, however, advisable and would be expected to add about $1000 to $2000 to this figure. Another plant in Arkansas, killing, eviscerating, and preparing frozen dinners, installed pretreatment in 1969, treating 1,250,000 gallons of wastewater daily. Secondary screening cost $19,500, a vacuator for grease removal (see III C) cost $45,000 and buildings, flumes, piping and controls cost $259,000 (total $323,500).

A pretreatment plant under design for a Georgia processor will cost $80,000 to $100,000. This will include pumping, and pretreatment to produce an effluent of 300 mg/l BOD and suspended solids and 100 mg/l fats and grease. The plant processes 6000 birds per hour and includes eviscerating, cut-up and packaging.

A screen plus a gravity grease separator, in Canada, treating 330,000 gallons per day from a killing and eviscerating plant, cost $85,500, installed, without the building.

A pretreatment facility in South Carolina which handles offal and blood in addition to 2,800,000 gallons of daily flow for a plant killing, eviscerating and preparing frozen dinners cost $278,000 for screening and a vacuator (1965 costs). The building cost an additional $125,000.

The plant in Illinois, described in an earlier paragraph, with air flotation and revolving disc contactor system cost $80,000. The contactor alone cost $22,000.

To assist in arriving at rough approximations, Table 1 is included, showing raw waste loads.

E. Summary.

The following outline suggests procedures in developing a decision matrix for pretreatment:

1. Select a project manager. He may be a company engineer or a consulting engineer, depending upon the extent to which the study is to progress and the capability of company personnel to produce the necessary information.
2. Measure flow and collect and analyze composite samples over a period of days sufficient to develop maximum as well as average data.
3. Make an in-plant waste conservation survey. The annual cost for

each possible change should include:

a. Amortized cost of improvements, installed.

b. Power costs (heating, cooling, pumping).

c. Chemical costs (if any).

d. Labor cost (maintenance and operation).

4. Make a study of possible pretreatment systems, with annual costs developed as in item 3 above.

5. Determine the annual cost of municipal surcharges and compare with costs of 3 and 4.

6. Select the elements of 3 and 4 that are economically justified.

7. Design necessary improvements considering:

a. Portability of system.

b. Flexibility, for alteration and expansion.

c. Operating skills required.

d. Cost of disposal of residual solids and grease.

TABLE 1 — TYPICAL POULTRY PLANT EFFLUENT (Untreated)

(Based on Standard Raw Waste Levels (SRWL) from EPA Guide Lines for Poultry Processing Plants, assuming good in-plant waste conservation, flowaway systems with customary flowaway screening, but no pretreatment).

BROILER PROCESSING

SRWL/1000 Birds		Daily Discharge from Typical Plant Killing 125,000 Birds/day	Pop. Equiv.*
Flow	8000 gal.	1,000,000 gals.	7,700
BOD**	30 lbs. (450 mg/l)	3,750 lbs.	18,800
Sus. Solids	23 lbs. (345 mg/l)	2,870 lbs.	14,400

FOWL & DUCK PROCESSING

SRWL/1000 Birds		Daily Discharge from Typical Plant Killing 125,000 Birds/day	Pop. Equiv.*
Flow	—	—	—
BOD**	40 lbs.	5,000 lbs.	25,000
Sus. Solids	25 lbs.	3,130 lbs.	15,700

TURKEY PROCESSING

SRWL/1000 lbs. Live Wt. Kill		Daily Discharge from Typical Plant Killing 1 million lbs/day	Pop. Equiv.*
Flow	1,700 gal.	1,700,000 gals.	13,000
BOD**	8 lbs. (565 mg/l)	8,000 lbs.	40,000
Sus. Solids	5 lbs. (410 mg/l)	5,000 lbs.	25,000

** BOD = 5-Day BOD

* Pop. Equivalents Based on:
Flow: 130 gal/cap/day
BOD: 0.2 lbs/cap/day
Sus. Solids: 0.2 lbs/cap/day

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II. SCREENING

A. Introduction: A. J. Steffen

In pretreatment, after flowaway, secondary screens may serve for final polishing with no further pretreatment, or may precede air flotation systems and gravity separation basins to reduce the bulk of solids that would otherwise have to be removed in the subsequent units.

Screens vary widely both in mechanical action and in mesh size, which ranges from 0.5 inch openings in stationary screens to 200 mesh in high speed circular vibratory polishing screens. In some cases the efficiency of screening in the flowaway systems may be sufficiently successful to circumvent secondary screening; in others secondary or polishing screening may be warranted. Floor drains not connected to the flowaway systems are usually then discharged to this polishing screen. With no secondary screening, the floor drains in the offal room and those adjacent to the flowaway screens and offal conveyors should be pumped back to the flowaway screen influent. These floor drains are frequently the source of serious problems when difficulties arise in the flowaway screen systems or conveyors.

In some plants "follow up" stationary screens, consisting of two, three or four units placed vertically in the effluent sewer before discharge to the municipal sewer, have successfully prevented escape of feathers and solids from the drains in the flowaway screen room and other drains on the premises. However, there is always the temptation to pull these screens in an emergency. These stationary "channel" screens are framed, and are generally constructed of stainless steel (mesh or perforated), with $\frac{1}{4}$ inch to $\frac{1}{8}$ inch openings. The series arrangement permits removal of a single screen for cleanup and improves efficiency. However, these screens may be inadequate to satisfy municipal requirements and then secondary (polishing) screening becomes necessary.

II B. Vibrating Screens: Dan Lindenmeyer

The vibrating screen is a structure with means for producing a rapid motion with one or more perforated or meshed surfaces for separating material according to size. The effectiveness of a vibrating screen depends on a rapid motion. Vibrating screens normally operate at speeds of 1000 to 2000-RPM in a motion of 1/32" to 1/8".

A successfully operating screen of any type must accomplish a combination of the following functions:

1. Conveying of material retained on the screen surface. This must be done to uncover the opening so that the cloth can pass the undersize material or liquid.

2. Agitation of the bed of material on the screen surface. Agitation and stratification are required to open the bed so that the fine particles or liquids can work their way down through the large particles and pass the opening.

3. Dislodgment of particles which stick or wedge in the opening. Particles which possess dimensions having nearly the same size as the opening will clog. Motion of the screen must dislodge the particles.

4. Distribution of the material in order to take full advantage of the area of the screen. The material must be distributed over the surface to insure efficient screening. The motion of the deck should distribute the material over the deck evenly.

5. Retention before discharge. For high efficiency, sizing or removing water from the solids, it is desirable to retain the oversize as long as possible. The material must be moved faster at the feed end to obtain quick distribution and a shallow bed where the volume is the greatest. At the discharge end where the volume is least, the rate of travel should be slowed to allow the remaining fines or liquids to be removed.

Following are some of the advantages of the vibrating screen over the rotary in handling poultry plant waste:

1. The vibrating screen requires less floor space.

2. The vibrating screen requires less horsepower for operation.

3. Spray water is not normally needed to wash particles from the screen cloth.

4. The screen cloth required to resurface a vibrating screen is less than one-third the amount needed for a revolving screen and much easier to install.

5. The initial cost of a vibrating screen is lower in most cases.

6. The vibrating screen produces drier tailings due to its motion.

The vibrating screen is driven by a shaft turning in a pair of bearings. The shaft carries unbalanced weights, either machined into or keyed to the shaft. This assembly is normally driven by a V-belt drive.

When the unbalanced weights are rotated the screen follows the weights through a path. When a vibrator is placed on the top of the box, a slight rocking action will take place, resulting in elliptical motion with the ellipse leaning toward the vibrator. This motion tends to move the material away from the feed end and retard it at the discharge end. The screen box is mounted on springs to keep vibration from being transmitted to the supports.

On most vibrating screens the cloth is pulled tightly across longitudinal steel members equipped with rubber caps. The cloth may be easily changed by loosening the tension bolts and sliding the screen cloth out at either end.

Of prime importance in the selection of a proper vibrating screen is the application of the proper cloth. The capacities on liquid vibrating screens are based on the percent open area of the cloth. With this in mind, cloth should be selected with the proper combination of strength of wire and percent of open area. If the waste solids to be handled are heavy and abrasive, wire of a greater thickness and diameter should be used to assure long life. However, if the material is light or sticky in nature the durability of the screening surface may be the smallest consideration. In such a case, a light wire may be necessary to provide an increased percent of open area and more free screen cloth conditions.

Screen cloth is woven in a variety of materials, such as black steel, spring steel, all types of stainless steel, monel and brass wire. Normally, on liquid waste applications, a type #304 stainless steel wire is used. However, when conditions require other types of metal, special wire cloths can be supplied.

In our discussion of various installations a term will be used frequently to designate the opening, this term is "mesh." Where mesh is referred to as a number it refers to the number of openings to the linear inch. The mesh is counted by starting from the center of one wire and counting the number of openings to a 1" distance. If the count does not work out to an even number the fractional part of the opening should be specified.

The actual opening between the wires is known as "space." Thus, ¼" space, .135 wire implies that the wires are ¼" apart and the diameter of the wire is .135". We have standardized on a 20 mesh screen for offal and a 36 x 40 mesh screen cloth for feathers and a 36 x 40 mesh for pretreatment. On most applications a double crimped square weaved cloth is used. Double crimped wire is woven in a manner so as to arch the shoot wire over the warp and then the warp wire over the shoot. By doing this, each wire forms a support for the other, keeping both wires tight and rigid, thus eliminating shifting or slipping of the wire.

We will now see how a liquid dewatering vibrating screen can be used effectively in the pre-treatment of poultry plant waste for discharge to a municipal system.

There are many vibrating screens in service in poultry plants throughout the United States—too many to list. They are installed as feather screens, as offal screens and as pre-treatment screens for discharge to municipal systems.

The following cost datanecessarily is limited to screens we manufacture.

The liquid vibrating screen is manufactured in sizes that vary from 2'0" wide x 4'0" long to 4'0" wide x 10'0" long. The most common unit we supply is an NRM-148 liquid dewatering screen. This screen is 4'0" wide x 8'0" long and as a pretreatment screen, it is equipped with a 36-mesh x 40-mesh 304 stainless steel screen cloth. The unit will handle approximately 600 gallons per minute of wastewater. An NRM open screen complete with stainless steel screen cloth and drive will cost slightly less than $2,000.00. An NRM-148 liquid dewatering screen complete with screen cloth, drive and with feed flume and tank will cost slightly more than $3,000.00.

The NRM-148 screen, as a feather screen, will handle feathers from about 8,000 birds per hour.

The NRM-148 screen, as an offal screen, will handle the viscera from about 10,000 birds per hour.

We will now discuss the proper feeding to the screen and the maintenance required on the screen.

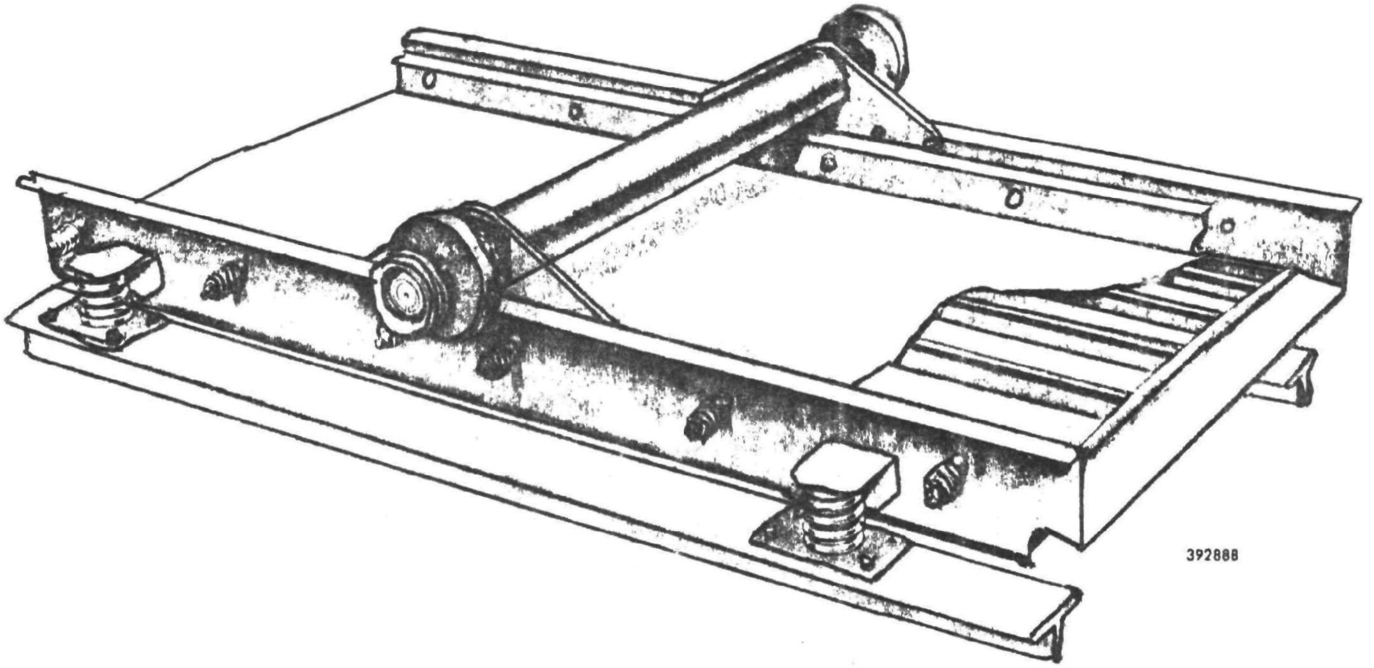
The influent to the pretreatment screen has had most of the feathers and viscera removed and the screen's primary function is to remove most of the remaining solids from the plant wastewater before it goes to the sewage treatment plant. The ideal way to feed a vibrating screen is directly by gravity from the flowaway system. The velocity of the water must be fed over the screen so as to reduce screen blinding. The screen is installed at a 10 degree down slope and as the pretreatment screen is subjected to wastewater with a high fat content, the less pumping that is done, the longer the screen cloth operates without blinding. Pumping breaks down fat in the water and the smaller particles cause blinding. Emulsified fats from cooking can also have the same effect. In some plants where a high percentage of the fats are emulsified, the screen cloths must be sprayed intermittently with hot water or steam to remove the fat or an automatic spray system should be installed.

Good efficiency in feather removal is reported. In fact, a plant engineer at a poultry plant in Athens, Georgia states that a 4 x 8 vibrating screen operating as a pretreatment screen, showed only one feather in the effluent in a 24-hour test.

The normal maintenance on a liquid dewatering screen consists of greasing the bearings at regular intervals, and maintaining the proper spring tension on the screen cloth. If you experience screen cloth breakage and the break is parallel to the longitudinal members of the screen deck, you can be assured the screen broke because it was too loose.

The operating cost of an NRM-148 liquid dewatering screen is the current required to operate a 2-HP motor.

NRM *liquid vibrating screens*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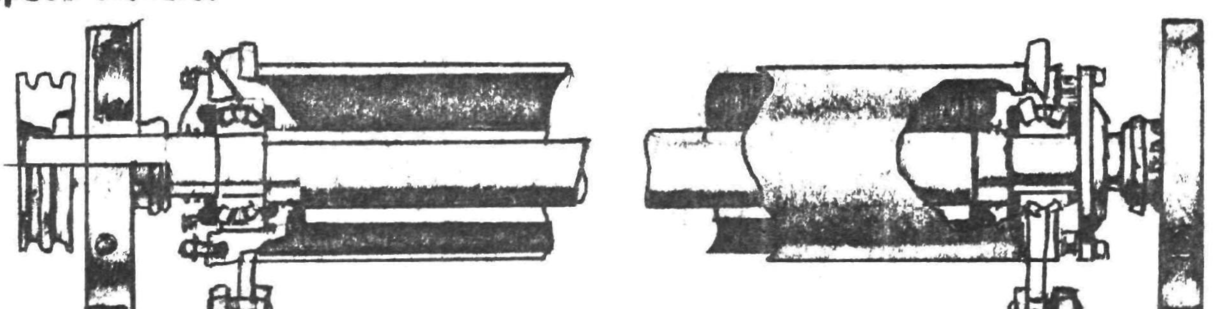
High-speed Vibrator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FMC/Link Belt

II C. Static Stationary Screens: M. E. Ginaven

During the past two or three years, a substantial number of so-called static screens have been installed in many process industries to recover suspended matter from plant effluents or liquid flows within a plant. Highly successful screening operations have been achieved in the meat packing, tanning, canning, textile, and paper and board products industries, as well as in domestic sewage treatment operations. Interesting new developments are underway, such as the treatment of wastes from animal producing farms and poultry processing plants.

In most instances, the installed equipment represents new functions or concepts in recovery and generally involves recycling or some other use of the recovered solids. In other cases, stationary screens are installed as replacements for screens that require moving parts to make a suitable separation of solids from a process stream.

Basic Design concepts:

The primary function of a static screen is to remove "free" or surface fluids. This can be accomplished by several ways, and in older concepts, only gravity drainage is involved. A curved screen design using high velocity feeding was developed and patented in Europe in the 1950's for mineral classification has been adapted to other uses in the process industries. This design employs an interference to the flow which knifes off thin layers of the flow over the curved surface.

In 1969, U.S.A. and foreign patents were allowed on a 3-slope static screen made of specially coined curved wires. This concept uses the Coanda, or wall attachment phenomena to withdraw the fluid from the under layer of a slurry which is stratified by controlled velocity over the screen. This method of operation has been found to be highly effective in handling slurries containing fatty or sticky fiberous suspended matter.

Since the field tests to be reported were conducted on the later design of stationary screen, details of this unit are herein presented. The device is known commercially as a Hydrasieve.

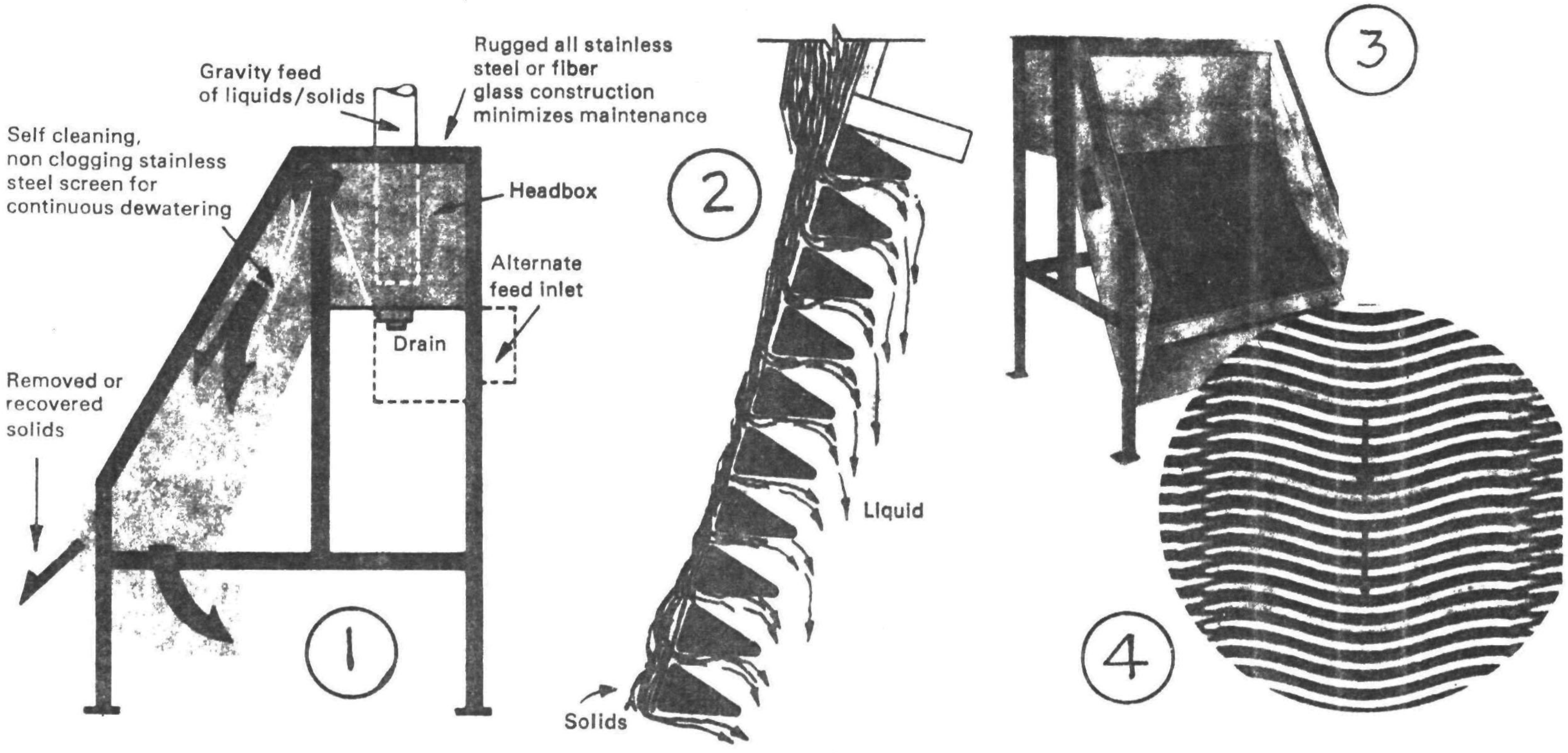
Method of Operation:

The slurry to be screened or thickened, is pumped or may flow by gravity into the head box of the machine. As shown in Figure 1, the incoming fluid overflows the weir above the screen area and is accelerated in velocity and thinned in depth as it approaches the screen. A lightweight hinged baffle is incorporated into the assembly in such a position that it reduces any turbulence in the flow. This is accomplished by the shape of the foil which causes the fluid to respond to Bernoulli's theorem through the wedge-shaped entrance. The increasing velocity of fluid draws the baffle toward the surface of the screen.

Suspended solids tend to stratify in the thin stream, and fibrous materials align themselves with the direction of flow. Figure 2 shows a segmental section of the screen wires and the slurry as it contacts the upper end of the Hydrasieve screen. Note that the wall attachment bends an under portion of the flow, a portion of the underflow also moves along the arc surfaces of the wires and is primarily concentrated at the apex of the arc. Here it falls from the screen back or flows in streams attached to the underside of the wire assembly in a direct path between the supports. The screen pattern permits a maximum of fluid extraction based on the limit of time and screen area.

On the first (top) slope of the screen most of the fluid is extracted from the bottom of the stream travelling at 25° from the vertical. When the angle of the screen changes to 35° some additional fluid is withdrawn, and usually the massing solids begin to roll on the surface, due to the residual kinetic energy. This action compacts the solids very slightly. On the final slope of the screen, the solids tend to hesitate for simple drainage action, but are always moved off the flat surface by displacement with oncoming material.

HOW IT WORKS



"Cleaned" effluent improves plant pollution control efficiency, lowers B.O.D., reduces sewage rates

*Note how "Coanda" effect strips liquid from bottom of the stream flowing down the screen. This "wall attachment" effect **accelerates fluid removal action**.*

Downward curve of [redacted] screen bars divides the flow of slurry into separate streams between the vertical supports thus preventing clogging or blinding.

Figure 3 shows a typical completed assembly of the screen installed in an Ohio poultry processing plant, and Figure 4 illustrates the design of the special screen employed in the test work.

Unique features:

The arrangement of transverse wires with unique singular curves in the sense of flow provides a relatively non-clogging surface for dewatering or screening. The screens are precisely made in No. 316 stainless steel and are extremely rugged. Harder, wear-resisting stainless alloys may also be used for special purposes.

Openings of 0.010 to 0.060 inches meet normal screening needs. The essential features of the Hydrasieve are covered in U.S. Letters Patents No. 3,452,876 and No. 3,751,555. Other U.S. patents are pending. Patents are also issued and pending in foreign countries.

Advantages. The wedge bar screen has a number of advantages over vibrating and rotary screens, including:

1. Low initial cost.
2. Compact and inexpensive to install.
3. No motor, no wires, no moving parts, no noise.
4. Requires little, if any, attention.
5. Stainless steel construction. Fiberglass frame optional.
6. Screens will not puncture or warp.
7. Wide variation in flow rate or loading does not seriously affect performance.
8. Uniform terminal solids moisture can be maintained.
9. Units can be readily combined with secondary and tertiary biological treatment systems.
10. Assemblies of units are readily constructed to meet high capacity flow needs.

Summary:

While the screening device described is now widely accepted for solids removal from effluents in many process plants, it is not yet commercially established in the poultry industry, primarily due to the manufacturer's unfamiliarity with its operations and problems. However, the exploratory work due within the next sixty days indicates that improvements in effluent quality can be made along with some economic advantages.

TYPICAL DESIGN INFORMATION FOR CHICKEN PROCESSING PLANT EFFLUENT
BASED ON USE OF .020 INCH SLOT OPENING

HYDRASIEVE	OVERALL DIMENSIONS - FEET WIDTH	DEPTH	HEIGHT	WEIGHT POUNDS	CAPACITY G.P.M.	PRICE FOR ESTIMATING
No. 552-18"	2	2.5	5	350	25	$ 2,600
No. 552-36"	3.5	4	5	550	50	$ 3,200
No. 552-48"	4.5	5	7	650	125	$ 4,000
No. 552-60"	5.5	5	7	800	175	$ 5,000
No. 552-72"	6.5	5	7	1000	225	$ 6,300
No. 552-72-2	7	9.5	7.3	1800	450	$10,000
No. 552-72-4	14	9.5	7.3	3600	100	$20,000
No. 552-72-6	21	9.5	7.3	5400	1350	$30,000
No. 552-72-8	28	9.5	7.3	7200	1800	$40,000
No. 552-72-10	35	9.5	7.3	9000	2250	$50,000

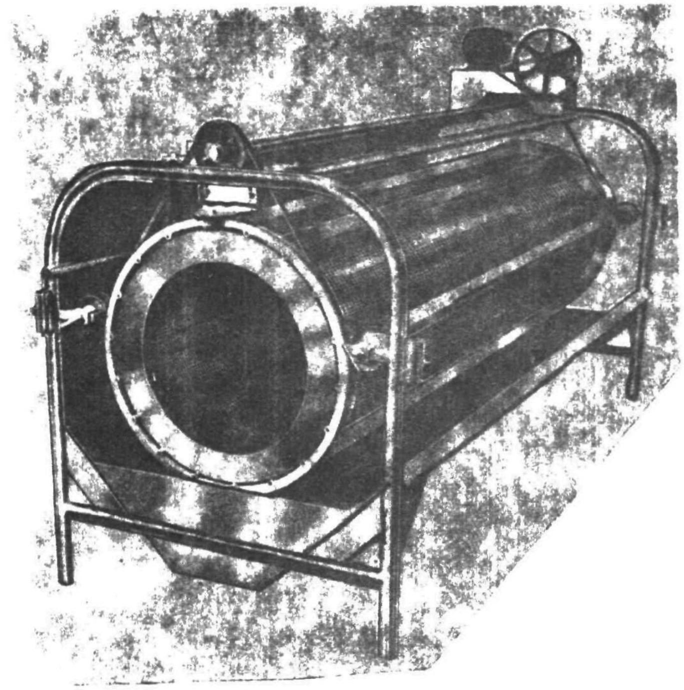
D. <u>Other Screening Devices</u>: A. J. Steffen

1. Rotary screen (Revolving, Trommel, Scrubber or Barrel Screens).

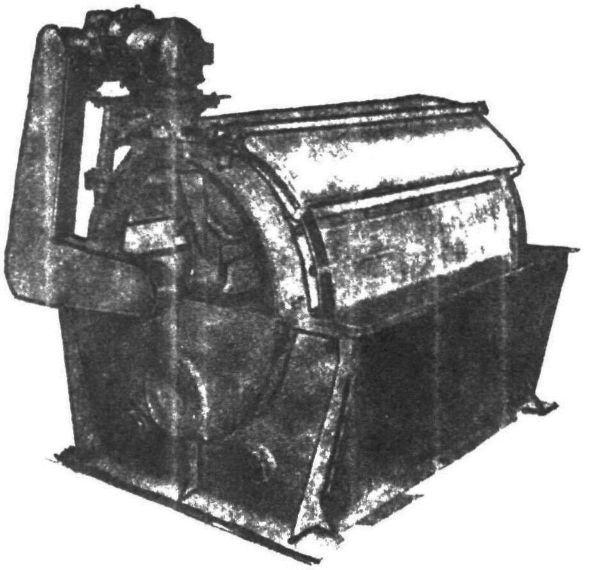
Rotary and vibrating screens are the most popular types in poultry wastewater processing.

One type of barrel or rotary screen (see Figure "A"), driven by external rollers, receives the wastewater at one open end and discharges the solids at the other open end. The liquid passes outward through the screen (usually stainless steel screen cloth or perforated metal), to a receiving box and effluent sewer mounted below the screen. The screen is usually sprayed continuously by means of a line of external spray nozzles. The screen is usually inclined towards the solids exit end. This type is popular as an offal screen but has not been used to any great extent in secondary screening.

The other most common type and one used to some extent in secondary screening is driven by an external pinion gear. The influent is discharged into the interior of the screen below center, and solids are removed in a trough and screen conveyor mounted lengthwise at the center line of the barrel (see Figure "B" and section view "C"). The liquid exits outward through the screen into a box in which the screen is partially submerged. Perforated lift paddles mounted lengthwise on the inside surface of the screen assist in lifting the solids to the conveyor trough. This type is also generally sprayed externally to reduce blinding. Four of these screens (5' dia. x 12' long with 10 x 10 mesh-cloth) were installed at the municipal sewage treatment plant in Gainesville, Georgia, in 1964 to polish the raw wastewater. They operate at 4 r.p.m. and each treats 2 million gallons per day. At that time

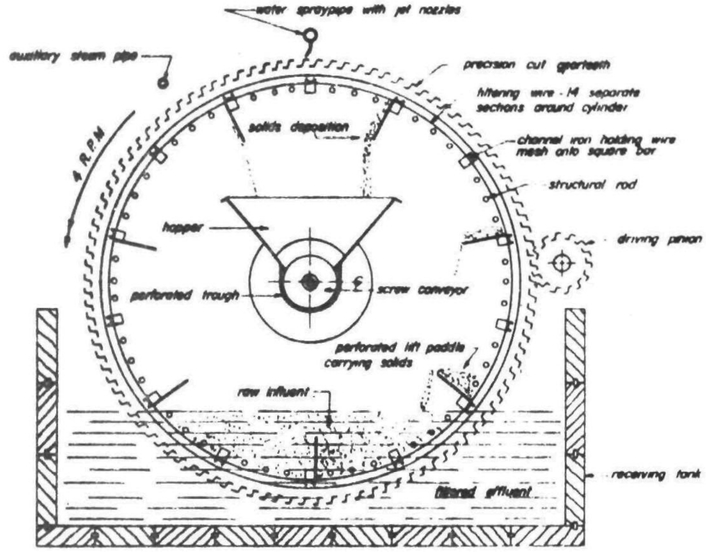


A

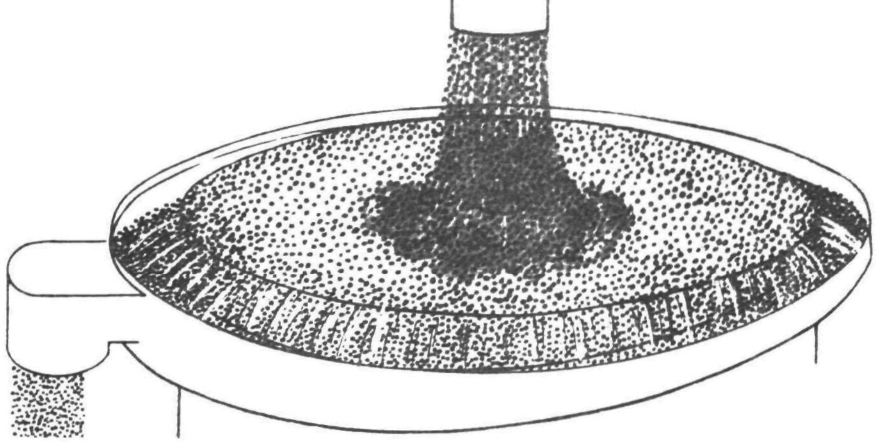


B

C →



CROSS - SECTION OF SEWAGE SCREEN SHOWING CONSTRUCTION & OPERATION



← D

there were 7 poultry processing plants in Gainesville and the central system solved maintenance and operating problems at the municipal plant, resulting from residual feathers and offal which were not captured by offal and feather screens at the processing plants.

2. Other Mechanical Screens.

Several other types of mechanical screens have had limited application in this field.

One is a rotating disc which is partially submerged in the wastewater flow. As it rotates, particles partially adhere and are scalped off above the flow. The screen disc is placed vertically or at a slight angle.

Another type is a circular spring-mounted horizontal screen, driven by a motor located under the screen and equipped with variable eccentric weights. As the motor rotates, the eccentric weights impart multiplaned vibrations to the spring mounted screen. These units are normally centrally fed at the top, with liquid discharging through the screen to a pan above the motor and sludge discharging from a port at the periphery (see sketch "D"). Small units (18" dia.) are available on loan for testing.

There are many other ingenious mechanical screens but they have not been tested on poultry wastewaters. Some, such as a vertical spinning drum, have successfully screened red meat waste solids. With the impetus of need to improve effluents, testing such devices on poultry waste may be accelerated.

III B – TREATMENT OF POULTRY PROCESSING WASTE BY DISSOLVED AIR FLOTATION

Charles B. Grimes
Sales Engineer - Industrial Waste Treatment Products
Process Equipment Division
Environmental Control Group
REX CHAINBELT INC.

Dissolved air flotation is a waste treatment process in which oil, grease and other suspended matter is removed from a waste stream. This treatment process has been in use for over fifteen years and has been most successful in removing oil from waste streams. Its early principal use was, and still is, the removal of oil from petroleum refinery waste waters. Another natural area for application of this treatment system has been the removal of contaminents from the food processing plants waste streams. One of the very first applications of this treatment system was for this purpose.

Basically, dissolved air flotation is a process for removing suspended matter from waste water using minute air bubbles which upon attachment to a discrete particle reduces the effective specific gravity of the aggregate particle to less than that of water. Reduction of the specific gravity for the aggregate particle causes separation from the carrying liquid in an upward direction. As Figure No. 1 suggests, the particle to be removed may have either a natural tendency to rise or settle. Attachment of the air bubble to the particle induces a vertical rate of rise noted as V_T.

Figure No. 2 illustrates the basic design considerations of the flotation unit. The parameter, V_T was discussed above and the measurement of this parameter will be discussed later. Since the waste flow must pass through a treatment unit, the particle to be removed will have a horizontal velocity. Certain criteria have been established for limits of the parameter V_H which sets the width and depth of the treatment unit. Therefore, as Figure No. 2 suggests, the effective length of the treatment unit is directly proportional to the horizontal velocity and depth and inversely proportional to the vertical rate of rise of the particle to be removed.

The mechanics of operation for a dissolved air flotation unit are illustrated in Figure No. 3. It can be noted that a portion of the clarified effluent is pressurized by a recycle pump. This recycled flow is pumped to a pressure tank into which air is injected. In the pressure tank at approximately 40 psig, the recycle flow is almost completely saturated with air. The pressurized recycle flow, containing the dissolved air, leaves the air saturation tank and flows through a pressure reduction valve.

A 40-psig pressure drop occurs at the pressure reduction valve and causes the pressurized flow stream to relinquish it dissolved air in the form of tiny air bubbles. This air-charged recycle flow is then blended with the raw process flow to effect attachment of the air bubbles to the oil and other suspended solids to be removed. The combined flow stream (raw flow plus recycle flow containing the air bubbles) is mixed and uniformly distributed over the cross-section of the basin.

As the incoming flow travels to the effluent end of the basin, separation of the oil and solids from the associated liquid occurs. Solids accumulate at the water surface and form an oily sludge blanket. Clarified liquid flows over the effluent weir and into a wet well. From the effluent wet well, a portion of the effluent is recirculated. The remainder of the effluent is removed from the basin for subsequent treatment or discharge. The floated scum blanket of separated solids can be removed from the basin by skimmer flights traveling between two endless strands of chain. Since the influent stream may also contain small amounts of heavy solids, such as grit, which are not amenable to flotation, provision must also be made for solids removal from the bottom of the unit.

The preceding discussion illustrates the recycle method of injecting the air bubbles into the waste stream. Figure No. 4 shows all three methods of dissolved air injection currently used. Total pressurization, as the name implies, is where the total waste flow is pressurized prior to entering the treatment unit. Partial pressurization is a method whereby a portion of the waste flow is pressurized and mixed with the remaining raw flow prior to entering the treatment unit.

To obtain optimum treatment with some wastes, it has been necessary to use chemical pretreatment prior to dissolved air flotation. The necessity for use of chemical conditioning is normally associated with a high degree of emulsification of the oil or grease matter in waste stream flow. It is, therefore, a requirement to break the emulsion and form a floc to absorb the oil or grease. It has been shown (Figure No. 5) that by increasing the particle size, the rate of separation is increased. Flocculation as a means of promoting particle growth preceding flotation contributes to the effectiveness of the flotation process where chemical conditioning is used. The points of chemical injection and the possible use of flocculation associated with the three methods of air injection are shown in Figure No. 6.

The use of steel package dissolved air flotation units lends itself to application in the poultry processing industry. This arrangement provides an economical, flexible design which requires minimal construction cost and area investment (Figure No. 7). Most manufacturers of dissolved air flotation units have complete line of steel tank units to meet a wide variety of flow conditions. Figure No. 8 shows a partial listing of steel package units manufactured by Rex Chainbelt. The Model No. 9550A shown would handle a raw waste flow of approximately 800 GPM, the Model No. 8032 handles a raw flow of about 300 GPM, and the Model No. 6020 would handle a raw flow of about 200 GPM. These raw flow figures indicated above were based on a vertical particle rise rate of 0.5 FPM and recycle rate of 33 percent.

The use of steel package units lends itself equally well to those applications requiring flash mixing and flocculation as a part of chemical pretreatment. Figure No. 9 illustrates this arrangement. This particular unit includes two stages of flash mixing preceding flocculation and flotation and is shown just prior to shipment. The access ladders, handrails and drive units will be removed before shipment. From this illustration, it can be seen that a minimum of field installation work is required since the unit has been shop assembled.

In the following discussion, a steel package Model No. 6020 with flash mix and flocculation compartments has been used to illustrate the costs associated with this type of unit. The capital cost of this unit would be approximately $37,500.00, which would include the following equipment:

1. Flash mixer and drive
2. Flocculator and drive
3. Two-shaft surface skimmer and drive
4. Screw conveyor, sludge collector and drive
5. Complete steel tank
6. Pressure tank and associated air central system
7. Recycle pump
8. Compressor
9. Recycle piping

Chart I lists the operating horsepower included in the above described unit. Based upon a 10 hour per day, 5 day per week operation, costs of running the Model No. 6020 for 52 weeks is shown for electrical costs at $0.01 per KWH and $0.015/KWH.

Chart II illustrates typical results from the treatment of poultry processing wastes by dissolved air flotation with and without chemical treatment. The raw waste characteristics and treatment results shown in Chart II are for grab samples from a unit in

Alabama. The characteristics of this waste are somewhat stronger than the waste normally encountered in this application, and, therefore, the necessity of chemical treatment is evident for this particular application. The raw flow to this unit is 150 GPM and based upon a lime dosage of 100 mg/l, the total lime usage in a single 10 hour working day would be 76 pounds. Extending this usage to a continuous operation of 5 days per week, 52 weeks per year, the yearly lime usage would be approximately 20,000 pounds per year. The cost of this amount of lime would be about $1,000.00 per year and capital cost of simple lime feed system would be between $6,000.00 and $8,000.00.

As is the case with most industrial waste, treatability studies should be conducted to determine not only the design parameters for a flotation unit, but also to determine if chemical treatment is a necessity to meet treatment objectives.

Pilot dissolved air flotation units (Figure No.10) are available from most manufacturers for treatability studies. The rental cost varies, but the normal rate is approximately $500.00 per month.

A laboratory bench scale test procedure has been developed to simulate the dissolved air flotation process and has been used most successfully in the determination of design parameters for an air flotation unit.

This flotation test (Figure Nos. 11 and 12) is used to determine the suspended particle rise rate (V_T) which is the most critical design parameter in the design of the flotation unit. This is done by filling the pressure cell with liquid and to closely simulate the recirculation of the unit effluent of pressurization in a full size unit; this recycle water should be developed by several previous flotation runs. This liquid is then injected with air until a pressure of over 40 psi is obtained and then the cell is shaken vigorously to assure that the air is put into the solution. The pressurized liquid is then introduced into the waste. The exact amount of pressurized liquid is determined by trial and error for best results. As the minute bubbles are released from solution, they attach to the suspended particle and oil and rise to the surface. After flotation is complete, a sample of the effluent is then taken and analyzed. During the test, observation of the rise rate of the major portion of the solid material with respect to time is recorded. From a graphical plot of this data a rise rate can be calculated. This rise rate along with factors for turbulence and short-circuiting are used in the selection of the basin size necessary to accomplish treatment required.

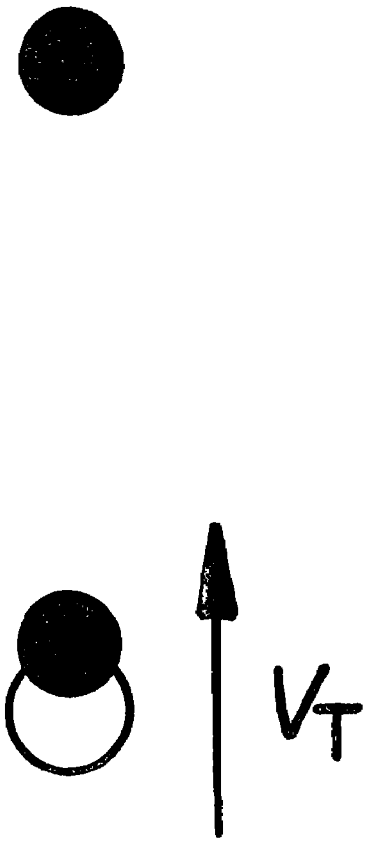


FIGURE 1

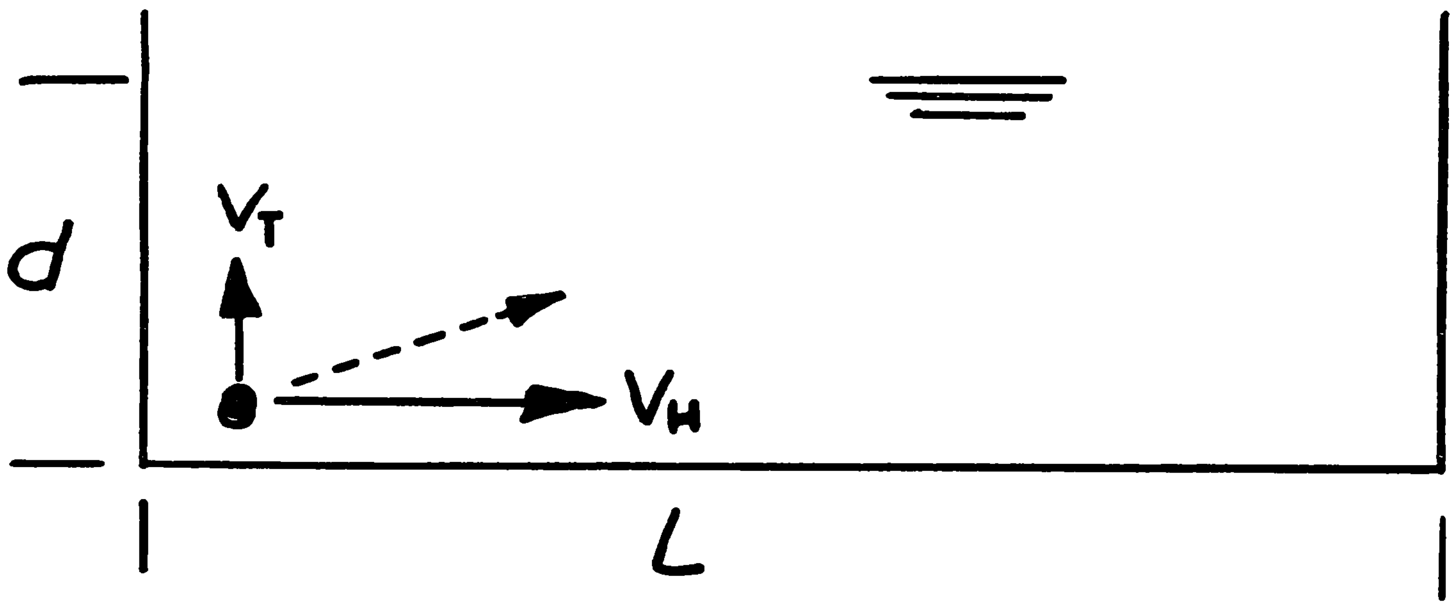
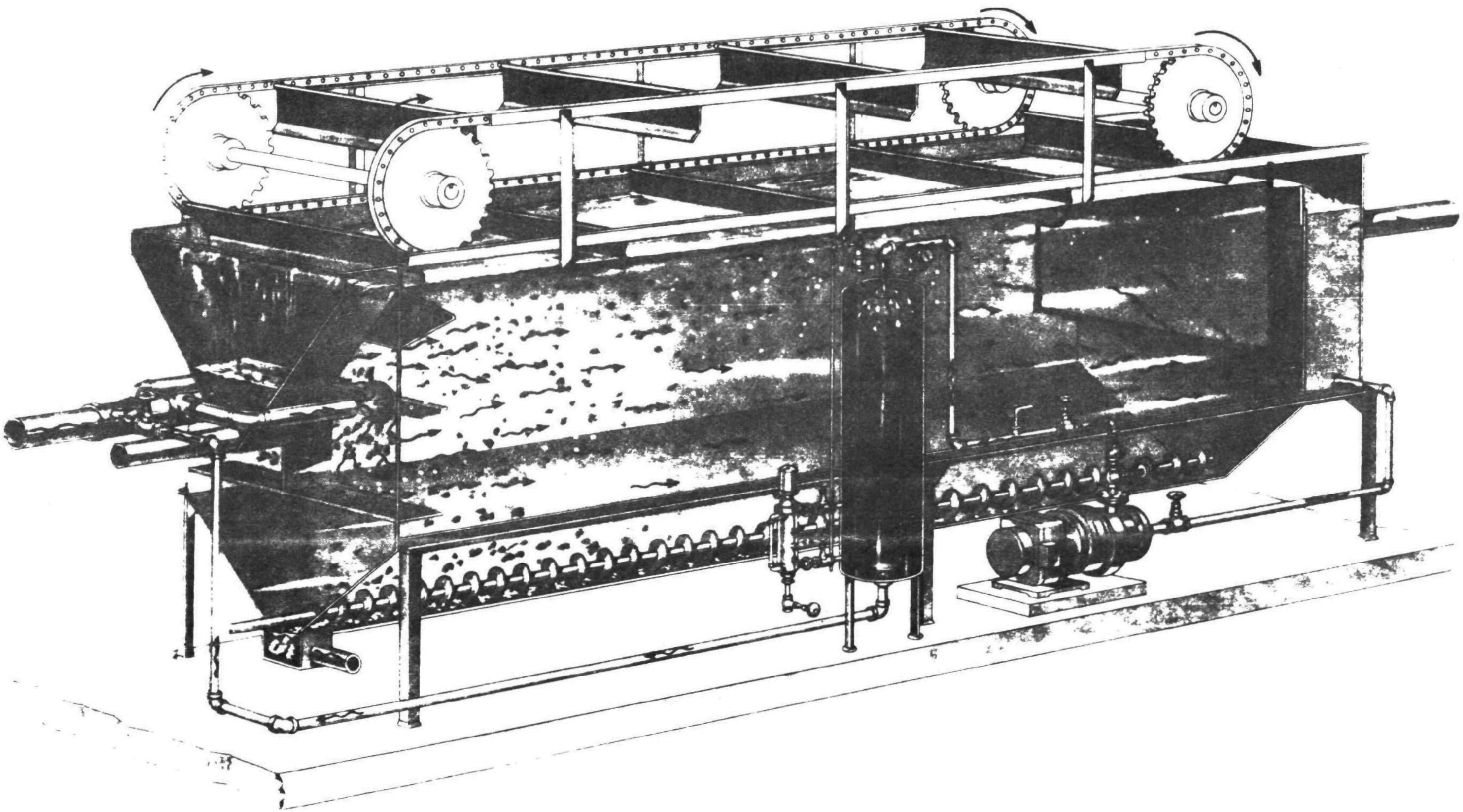


FIGURE 2

FIGURE 3



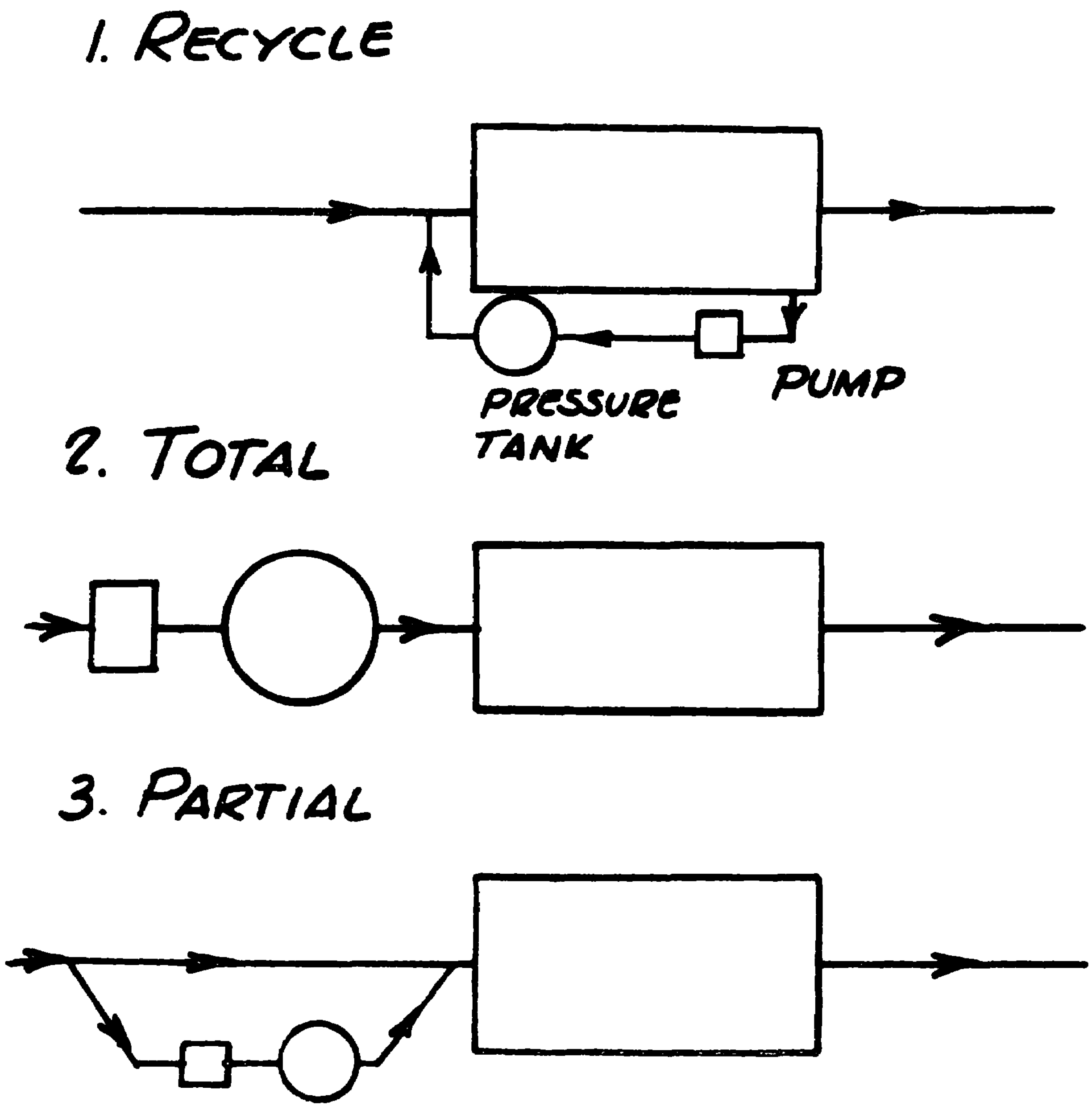
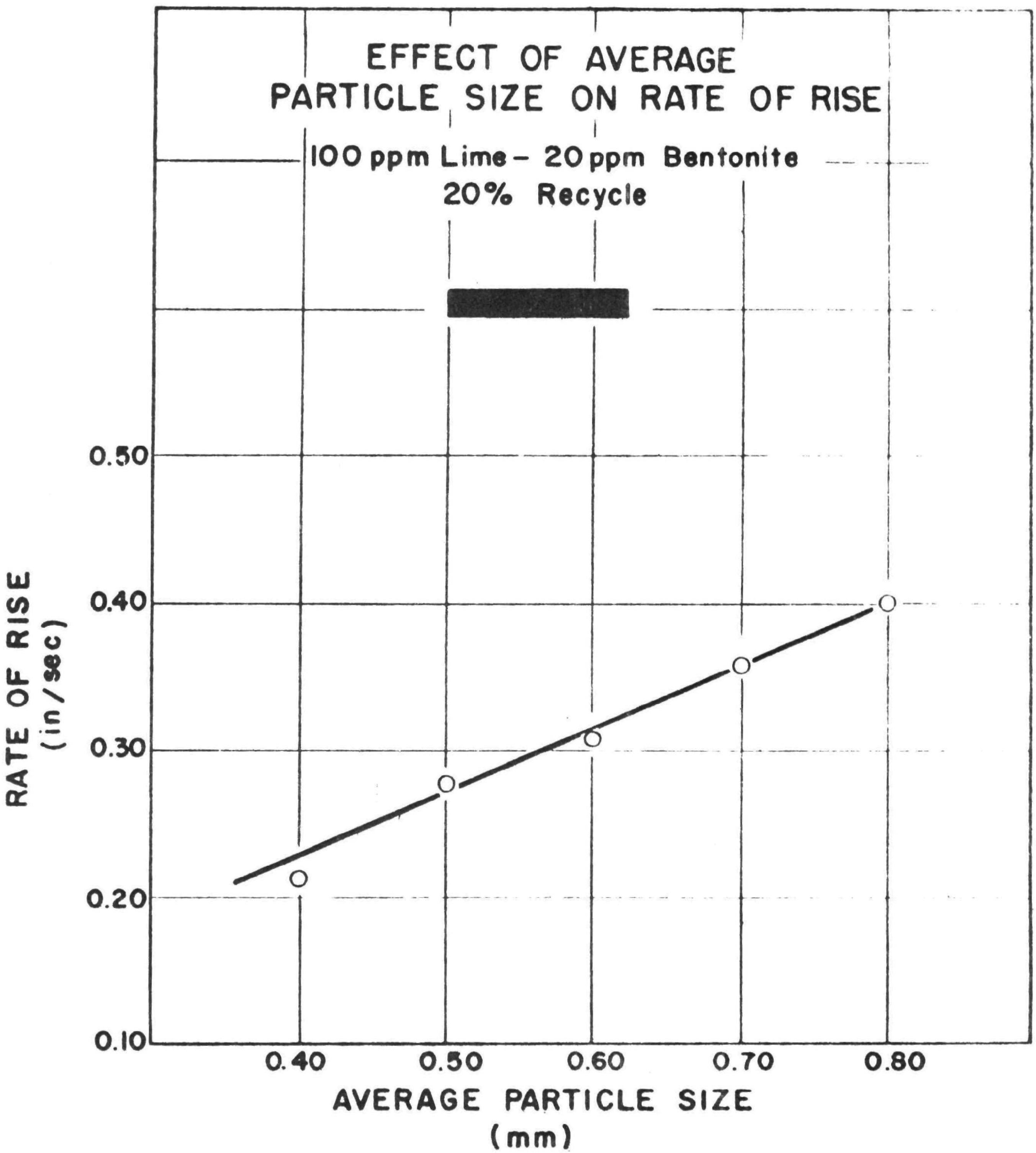
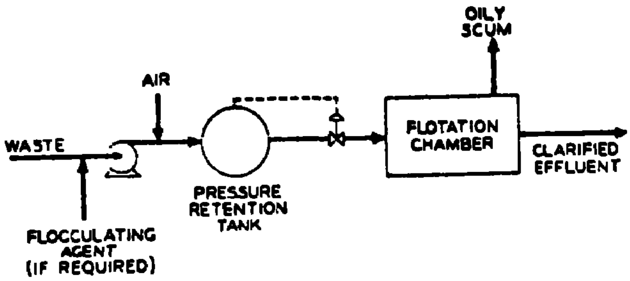


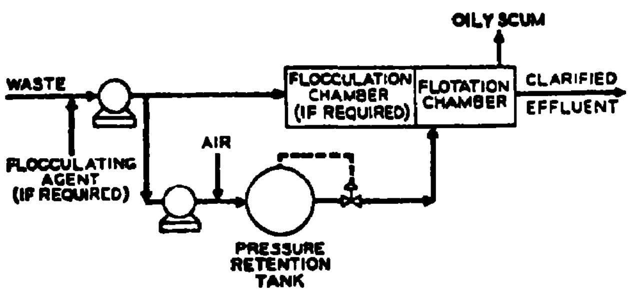
FIGURE 4

FIGURE 5

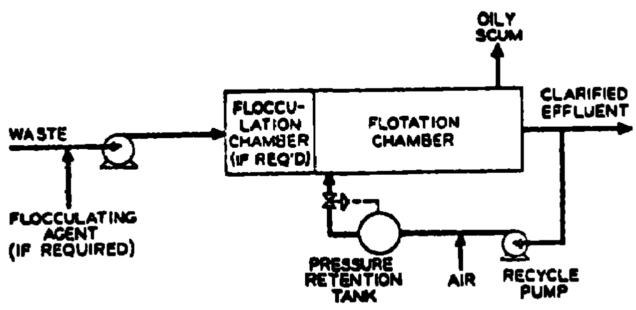

EFFECT OF AVERAGE
PARTICLE SIZE ON RATE OF RISE
100 ppm Lime - 20 ppm Bentonite
20% Recycle
[redacted]
0.50
0.40
0.30
0.20
0.10
RATE OF RISE
(in/sec)
0.40
0.50
0.60
0.70
0.80
AVERAGE PARTICLE SIZE
(mm)



TOTAL

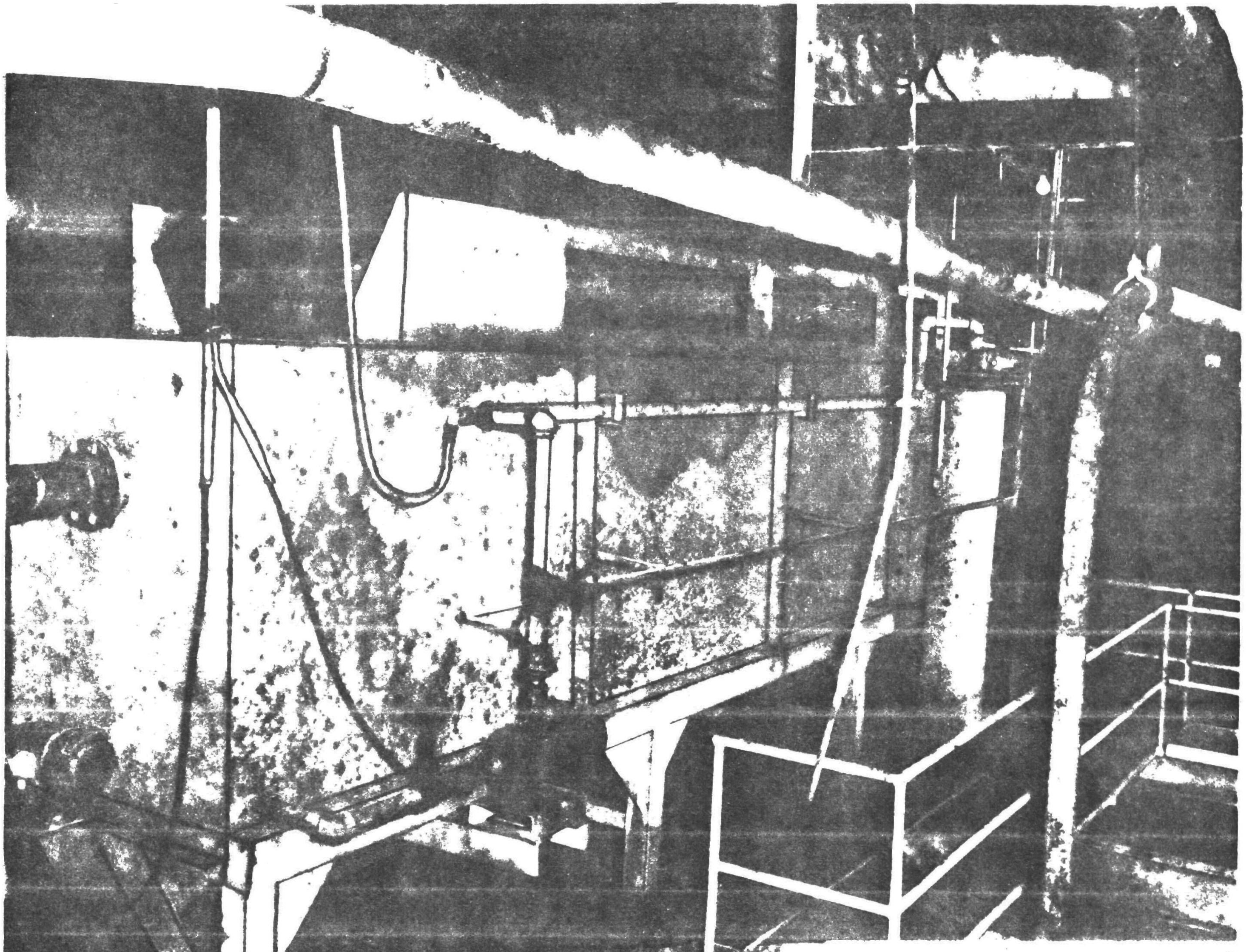


PARTIAL



RECYCLE

FIGURE 6



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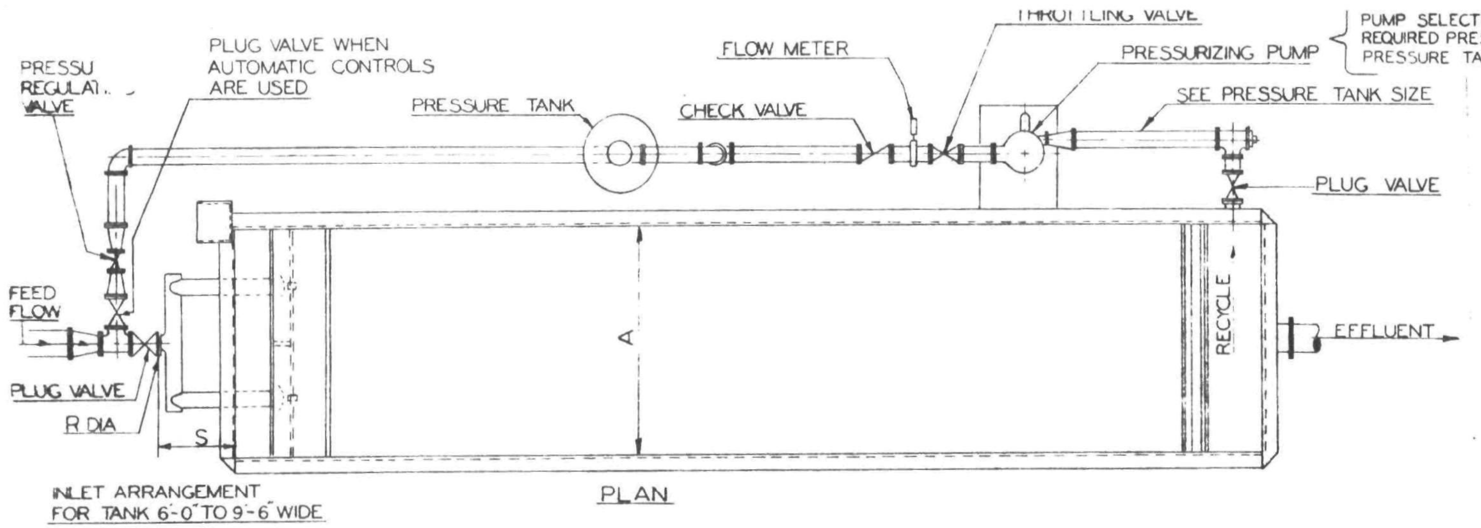
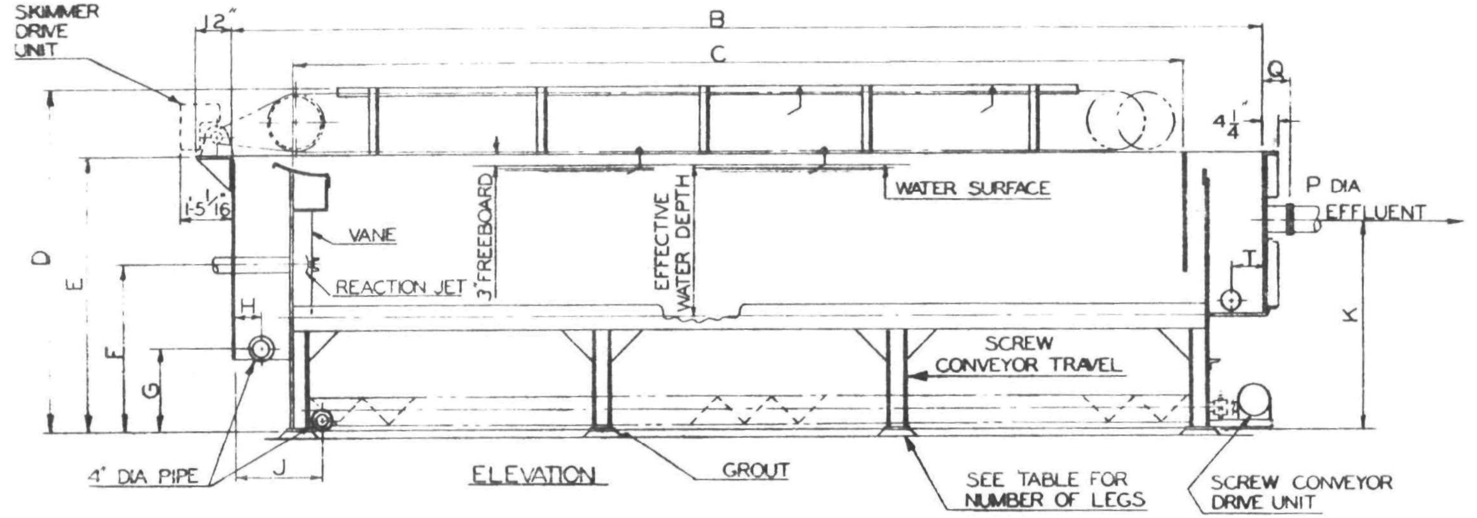
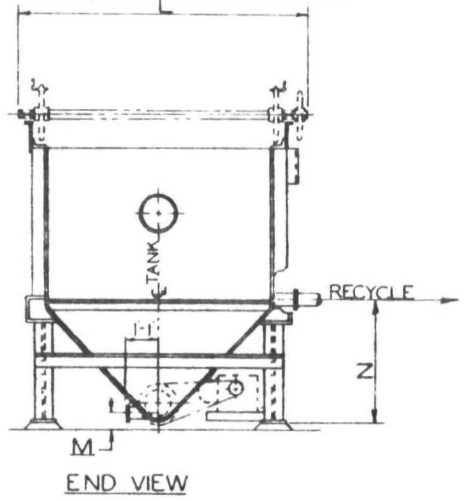


PRESSURE TANK MAS-PAC TYPE ONLY				
RECYCLE FLOW GPM	Y TANK OD	INLET & OUTLET DIA	Z OVERALL HEIGHT	W
0-50	12	2		
50-75	16	2 1/2	8'-8 5/8"	8"
75-115	20	3	9'-0 7/8"	1'-2"
50-70	24	4	5'-2"	
70-100	24	4	6'-2"	
105-135	24	4	7'-0 3/4"	
136-160	30	4	7'-5 3/4"	
161-185	30	4	7'-11 3/4"	
186-210	30	4	8'-5 3/4"	
211-250	30	4	9'-3 3/4"	1'-2"
251-275	36	6	6'-11 7/8"	1'-6"
276-310	36	6	7'-8"	
311-360	42	6	8'-7 3/4"	
361-410	42	6	9'-1 3/4"	
411-455	42	6	9'-7 3/4"	
456-505	42	6	10'-1 3/4"	
506-550	42	6	10'-7 3/4"	1'-6"





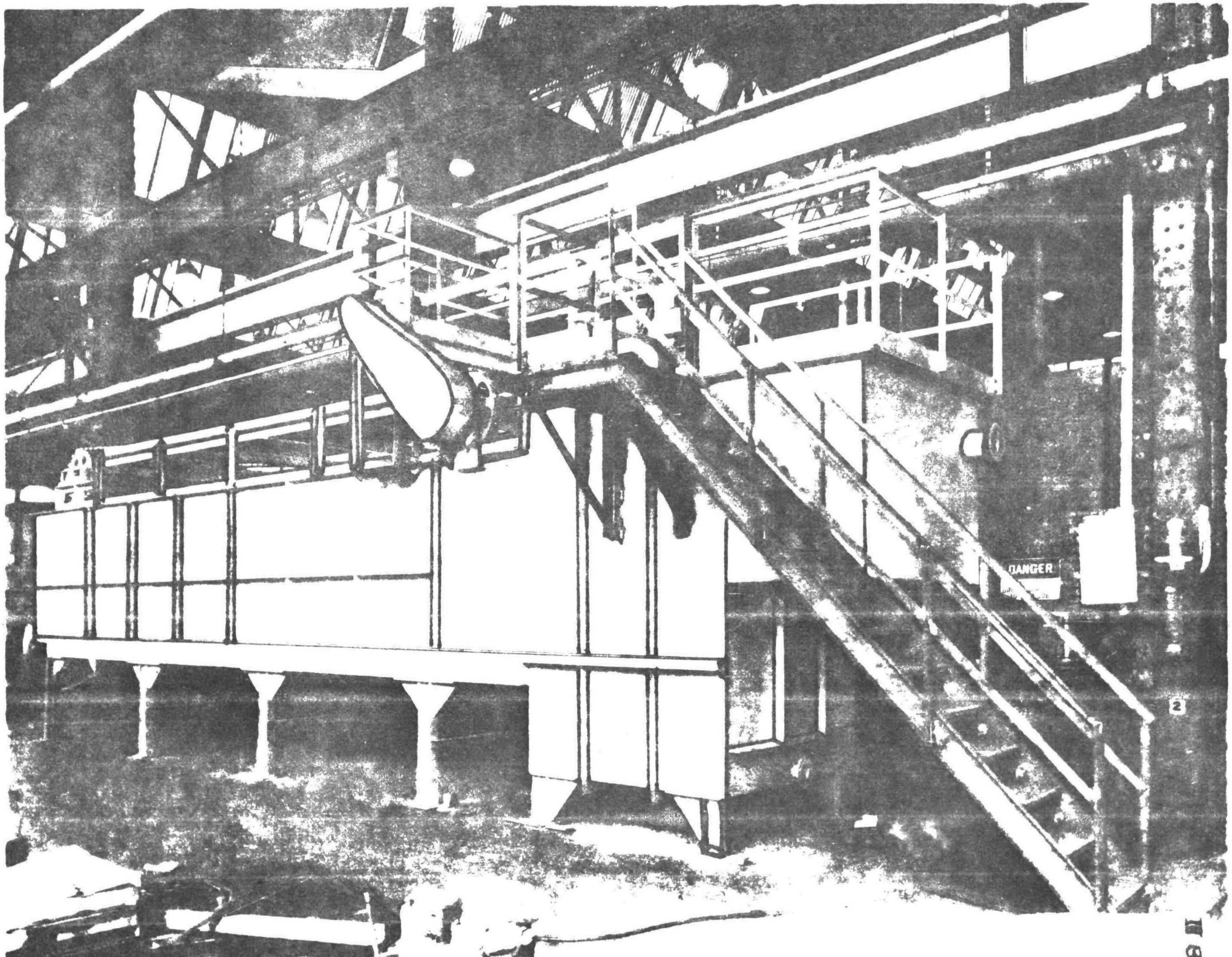
MODEL NUMBER	EFFECTIVE WATER DEPTH	A INSIDE WIDTH	B INSIDE LENGTH	C EFFECTIVE LENGTH	D TOTAL HEIGTH	E TANK HEIGHT	F	G	H	J	K	L	M	N	P DIA.	Q	T	U	SKIMMER DRIVE MOTOR	SCREW CONVEYOR DRIVE MOTOR	TOTAL NUMBER OF LEGS	TANK WEIGHT WITH WATER	TANK WEIGHT EMPTY 3/16 ℞
2511	3'-0	2'-6"	13'-6 3/4"	11'-0"	6'-9 7/8"	5'-1"	2'-11 1/2	2'-7	6"	1'-4	4'-0	4'-1 1/4"	8 1/2"	2'-0 1/2	4"	3"	6"	2-7	1/4 HP	1/2 HP	6	11950	5050
3511		3'-6"	13'-6 3/4"	11'-0"	7'-0 7/8"	5'-4"	3'-2 1/2	2'-9			4'-3	5'-1 1/4		2'-3 1/2	4"	3"	6"	2-9				15450	5450
3516		3'-6"	18'-6 3/4"	16'-0"	7'-0 7/8"	5'-4	3'-2 1/2	2'-9			4'-3	5'-1 1/4		2'-3 1/2	5"	3 1/2	6"	2-9				20850	6750
5015		5'-0"	17'-6 3/4"	15'-0"	7'-9 7/8"	6'-1"	3'-11 1/2	3'-2			5'-1	6'-7 1/4		3'-0 1/2	6"	3 1/2	6	3-2				28150	7400
5020	3'-0	5'-0"	23'-0 3/4"	20'-0"	7'-9 7/8"	6'-1"	3'-11 1/2	3'-2	6"	1'-4	5'-1	6'-7 1/4	8 1/2	3'-0 1/2	6"	3 1/2	9	3-2				36200	8950
6020	4'-0	6'-0"	23'-0 3/4"	20'-0"	9'-3 7/8"	7'-7"	4'-11 1/2	2'-6	9"	1'-7	5'-10	7'-9 1/4"	7"	3'-6 1/2	8"	4"	9'	2-4				53650	10600
6024		6'-0"	27'-6 3/4"	24'-0"	9'-3 7/8"	7'-7	4'-11 1/2	2'-6			5'-10	7'-9 1/4		3'-6 1/2	10"	4"	9'		1/4 HP			63350	12150
8024		8'-0"	28'-0 3/4"	24'-0"	9'-9 7/8"	8'-1"	5'-5 1/2	2'-4			6'-4	9'-9 1/4		4'-0 1/2	10"	4"	1'-0		1/2 HP	1/2 HP	6	85250	13900
8032		8'-0"	36'-6 3/4"	32'-0"	9'-9 7/8"	8'-1"	5'-5 1/2	2'-4			6'-4	9'-9 1/4		4'-0 1/2	12"	4 1/2	1'-3			1 HP	8	110950	16800
9530		9'-6"	34'-6 3/4"	30'-0	10'-3 7/8	8'-7"	5'-11 1/2	2'-4			6'-10	11'-3 1/4		4'-7 1/2	14"	5"					8	127250	17700
9538			42'-6 3/4	38'-0	10'-3 7/8	8'-7	5'-11 1/2	2'-4			6'-10				12"	4 1/2					8	158400	20600
9550	4'-0		54'-6 3/4"	50'-0	10'-3 7/8	8'-7	5'-11 1/2	2'-4			6'-0				14"	5"		2-4			10	205750	25550
9530 A	5'-0		34'-6 3/4"	30'-0"	11'-3 7/8	9'-7	6'-5 1/2	2'-7			7'-4				14"	5"		2-5			8	146850	18750
9538 A	5'-0		42'-6 3/4	38'-0	11'-3 7/8	9'-7	6'-5 1/2	2'-7			7'-4"				16"	5"		2-5			8	182900	2[illegible]800
9550 A	5'-0	9'-6"	54'-6 3/4	50'-0"	11'-3 7/8	9'-7	6'-5 1/2	2'-7	9"	1'-7	7'-4"	11'-3 1/4	7"	4'-7 1/2	16"	5"	1'-3	2-5	1/2 HP	1 HP	10	237600	27000

150# INLET FLANGE CONNECTION		
R DIA	S	FLOW RANGE GPM INCLUDES RECYCLE
3	3"	40-60
4	6"	61-100
5	1'-0"	101-160
6	1'-0"	161-250
8	-8"	200-319
10	2'-4"	320-499
12	3'-2	500-799
14	4'-2	800-1060

REX CHAINBELT INC

FIGURE 8

CB-29585



III B 5

CHART I

OPERATING HORSEPOWER
MODEL 6020

1. FLASH MIXER ---- 1/2
2. FLOCCULATOR --- 1/2
3. SKIMMER ----- 1/2
4. BOTTOM SCREW -- 1/2
5. RECYCLE PUMP -- 7 1/2
6. COMPRESSOR 1 1/2

11.0

BASED ON 10HR/DAY, 5 DAY/WEEK OPERATION, YEARLY OPERATING COST EQUAL

a. $214 @ $0.01/KWH

b. $321 @ $0.015/KWH

CHART II

OPERATIONAL RESULTS

1. RAW WASTE CHARACTERISTICS

a. BOD_5 = 2460 mg/l
b. S.S. = 946 mg/l
c. OIL & GREASE = 200 mg/l

2. RESULTS

RUN No.	% RECYCLE	CHEMICALS	% REMOVAL BOD_5	% REMOVAL S.S.
1	33	none	38	54
2	50	none	39	62
3	33	100 mg/l - lime	57	81
4	33	300 mg/l - alum	33	94

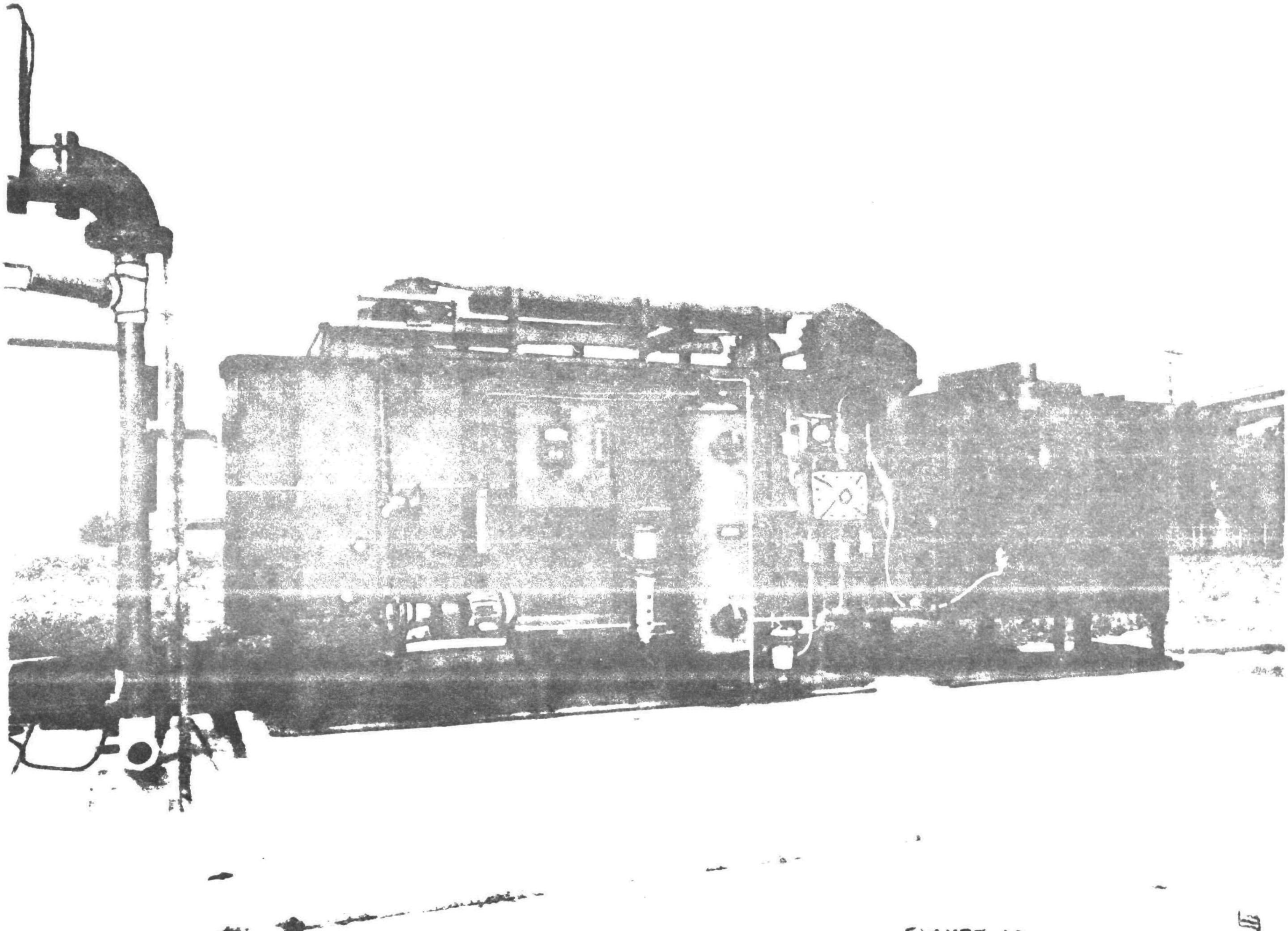


FIGURE 10

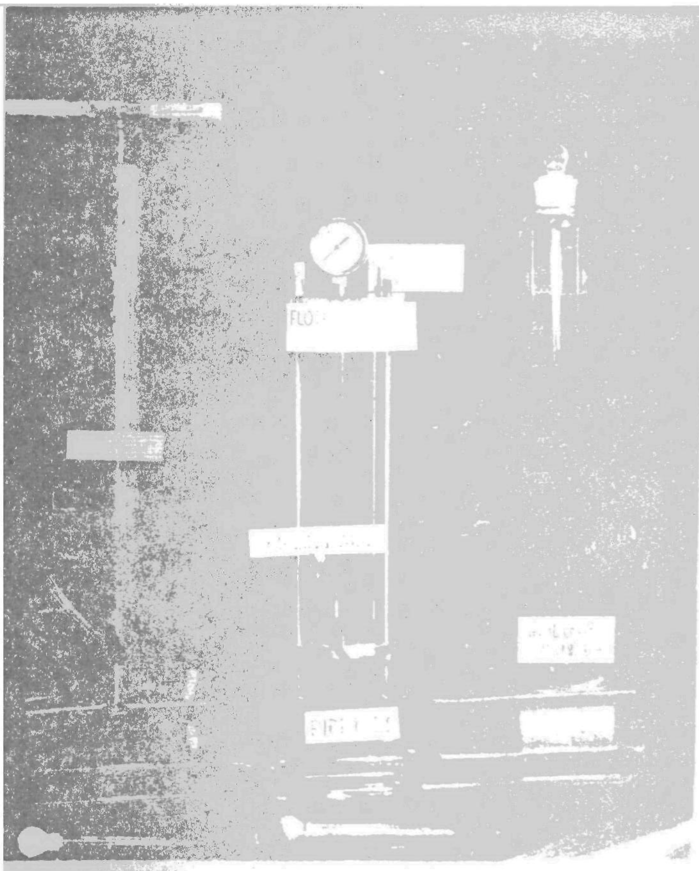


FIGURE 2
COMPONENT PARTS - REX FLOT-AIRE KIT

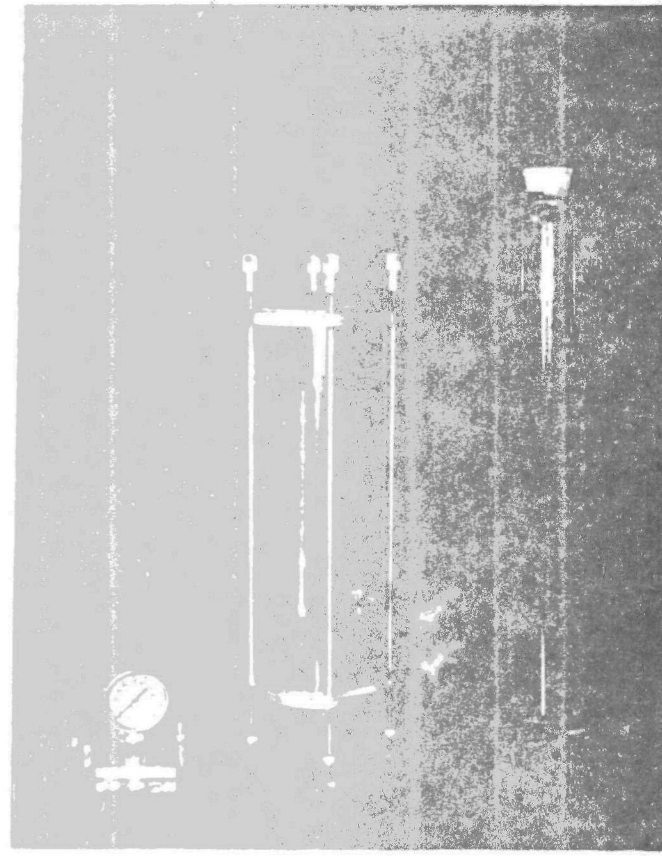


FIGURE 3
FLOT-AIRE PRESSURE CELL WITH CLARIFIED [illegible]
GLASS CYLINDER WITH RAW WASTE

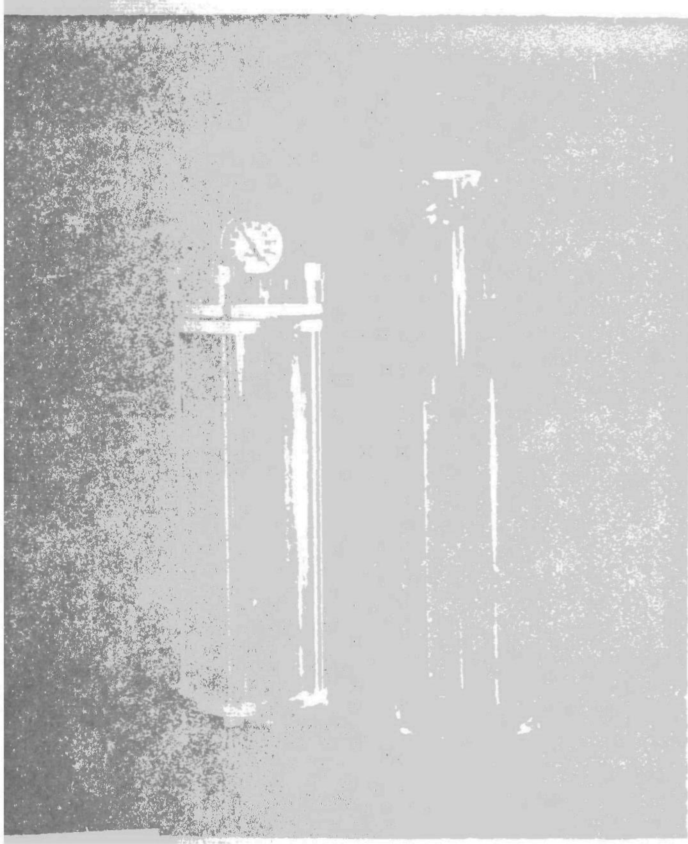


FIGURE 4
CLARIFIED EFFLUENT IN FLOT-AIRE PRESS
CELL PRESSURIZED TO 40 psi.

FIGURE 11

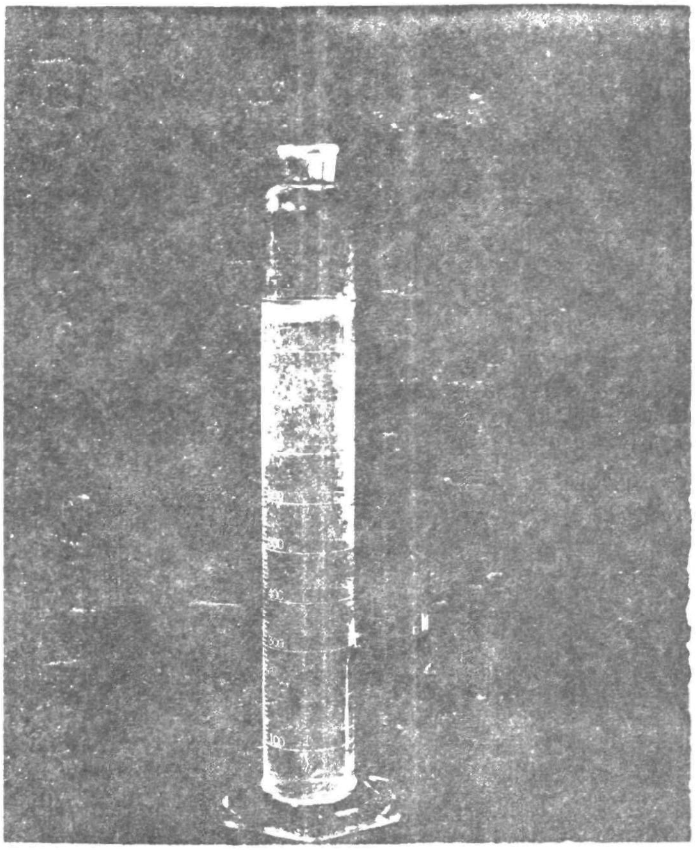


FIGURE 6
MINUTE AIR BUBBLES FLOATING WASTE MATERIAL TO SURFACE OF CYLINDER

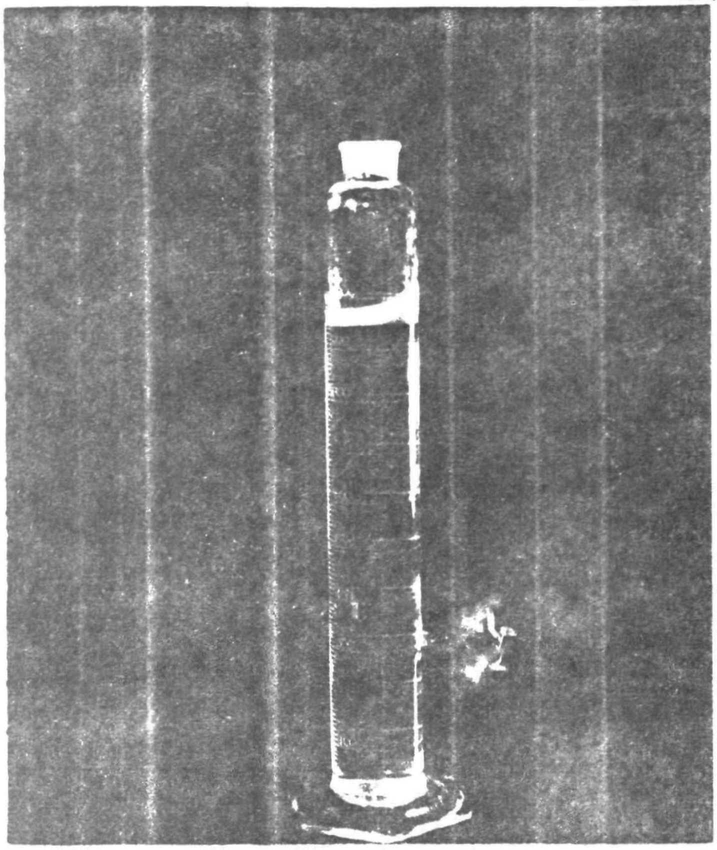


FIGURE 7
FLOTATION COMPLETE IN CYLINDER

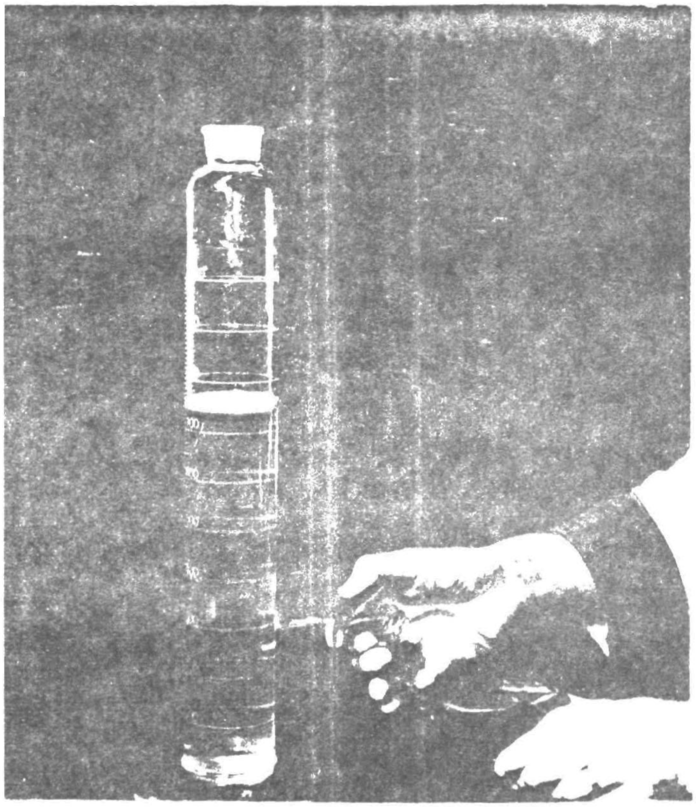


FIGURE 8
CLARIFIED WASTE SAMPLE BEING WITHDRAWN FROM CYLINDER

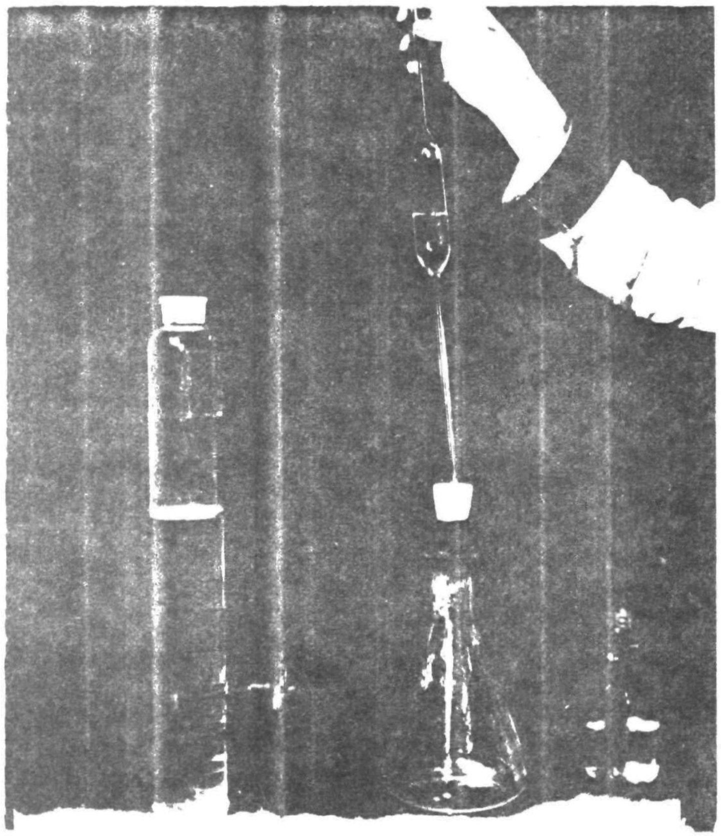


FIGURE 12

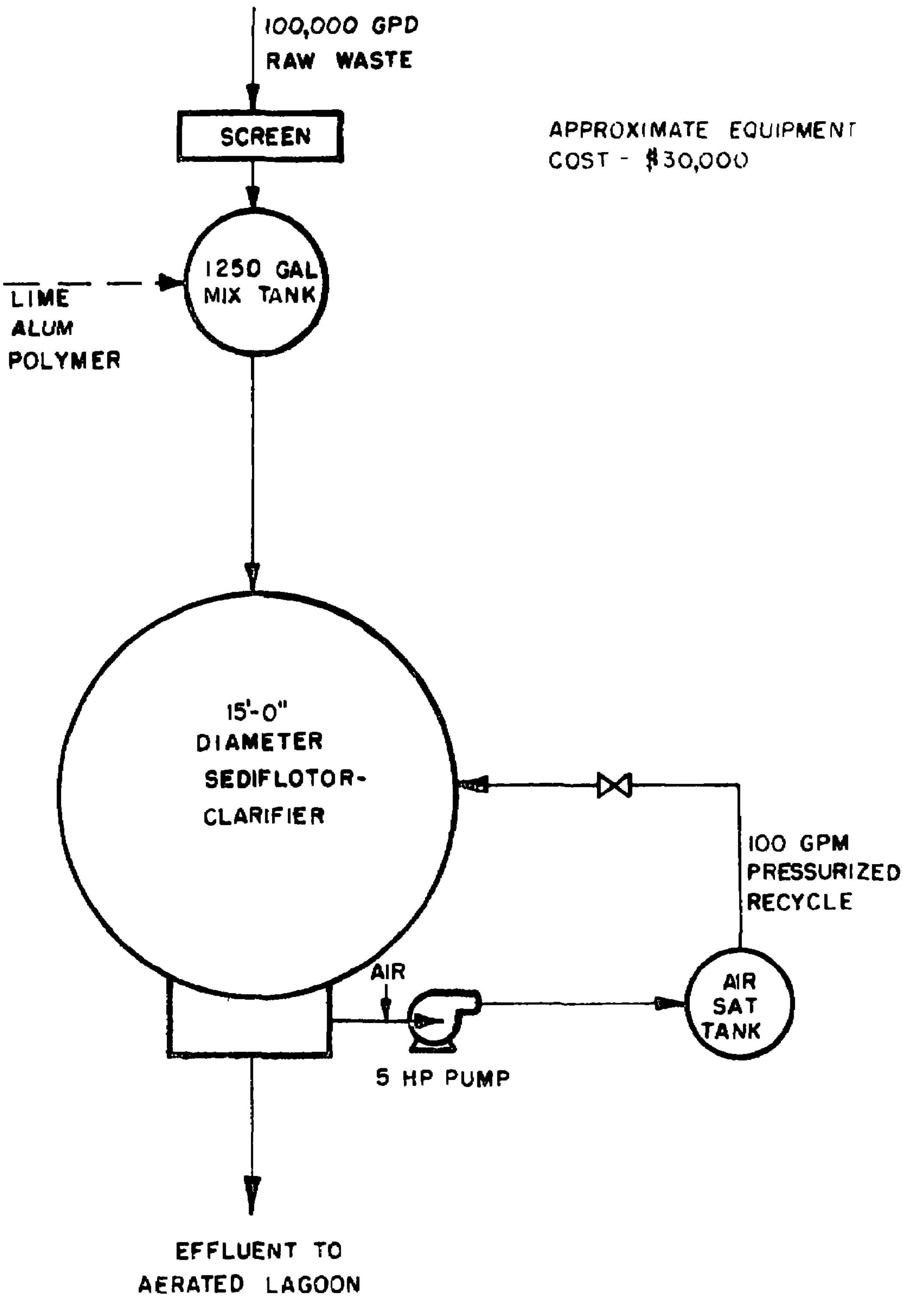
III C. <u>Other Systems</u>: A. J. Steffen

Whereas the preceding section (B) was limited to a discussion of rectangular dissolved air flotation systems, it should be noted that the same principle is applied to circular-shaped tanks by a number of equipment manufacturers. These tanks are similar to conventional clarifiers with center baffled inlet, peripheral weir, bottom sludge removal scrapers, and surface skimmer arms discharging to a surface scum trough. The pressurized air recycle arrangements are the same as those used in rectangular tank systems. The accompanying flow diagrams show typical poultry plant pretreatment systems incorporating circular flotation tanks. One is a small plant in Allentown, Pa., and the other, using two flotation tanks in parallel, is at a large poultry plant in New Holland, Pa. The data shown for the New Holland operation was developed in preliminary tests and is reported to be typical of current operating results, using chemical treatment (a polymer) to enhance clumping or agglomerating of the fine suspended and colloidal matter, thereby improving flotation. The costs shown include the flotation tanks complete with pumps, air saturation tanks, and mixing tanks and mixers but do not include the screens nor the cost of erection.

In some cases, vacuators have been used to separate floatables in pretreating poultry plant wastewaters. Vacuators are basically completely enclosed concrete tanks where a vacuum is applied as the wastewater passes through the tank. The vacuum enhances flotation in a 3-product separation similar to air-pressurized flotation. The need for complete enclosure limits observation of operating characteristics. Designs range from 300 gpm to 2000 gpm per unit. As stated in II D, a vacuator installed in Arkansas to treat 1,250,000 gallons daily cost $45,000 in 1969.

JAINDL'S TURKEY FARM
ALLENTOWN, PA.

APPROXIMATE EQUIPMENT COST - $30,000



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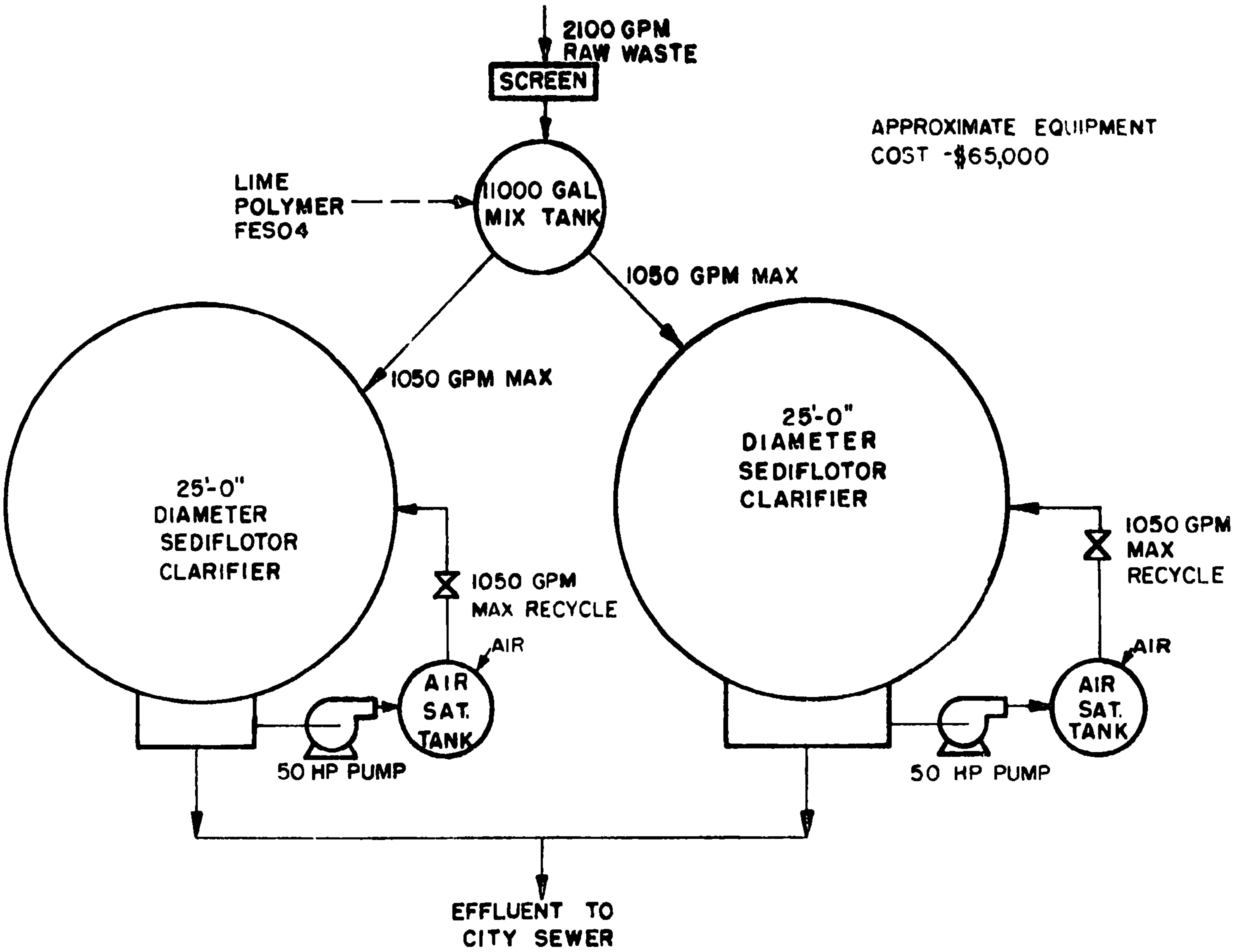
VICTOR F. WEAVER
NEW HOLLAND, PA.



APPROXIMATE EQUIPMENT
COST -$65,000

PRELIMINARY TEST DATA;

	COD MG/L	BOD_5 MG/L	TSS MG/L	PO_4 MG/L	GREASE MG/L	CHEMICAL
RAW WASTE	2815	1350	1034	54.5	623	10 MG/L
EFFLUENT	334	213	43	2 4	8	C-31
%REMOVAL	88	84	96	96	99	

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IV. SUMMARY: A. J. Steffen

Pretreatment of poultry processing wastewater, prior to discharge to a municipal system, is a consideration:

1. When constituents prohibited by municipal regulations are present in the wastewater. Feathers, whole blood and entrails are typical of such prohibited materials.
2. When maximum concentrations have been established for certain constituents and the wastewater contains such constituents in excess of those limits. BOD, grease and oils, and suspended solids are examples of such constituents.
3. When the poultry processor is paying or anticipates paying for municipal treatment through a surcharge system and can effect economies by pretreatment. Examples of constituents for which surcharge rates may be established are: BOD, suspended solids, and possibly grease and oils.

Decisions regarding the last item are the most difficult. To save "surcharge" dollars by pretreatment, the poultry plant operator must determine the degree of pretreatment that represents the economic break-point. He must also weigh other factors such as the probability that the surcharge rates may change, that the municipal treatment plant may need expansion in the near future and may seek a Federal grant which will introduce requirements previously discussed, and that the state may establish regulations relating to pretreatment both as to degree of treatment and operation of the facilities (such a law was recently passed in New Jersey). The processor must also consider his own future business plans, such as changes in processing, additional processing, overall expansion, or possibly reduction in operations.

Within these often elusive variables, the poultry processor must select the type of pretreatment, such as:

1. No pretreatment at all.
2. Secondary screening only.
3. Secondary screening and separation of floatable and settleable solids by gravity, pressurized air flotation or other means.
4. Separation of floatable and settleable solids, as in 3 above, but without secondary screening.
5. Treatment as in 3 above plus biological or chemical treatment for further BOD removal.

The pretreatment processes and the capacities selected depend upon the size of the processing plant, efficiency of the selected process, facilities for handling the materials removed from the wastewater, and related engineering and cost factors, as well as the three regulatory considerations set forth above.