Enabling the next generation
of feed plant

Lark
Engineering Co. (India) Pvt. Ltd.

4-6 MT/hr Mash Feed Plant
(Poultry & Cattle)

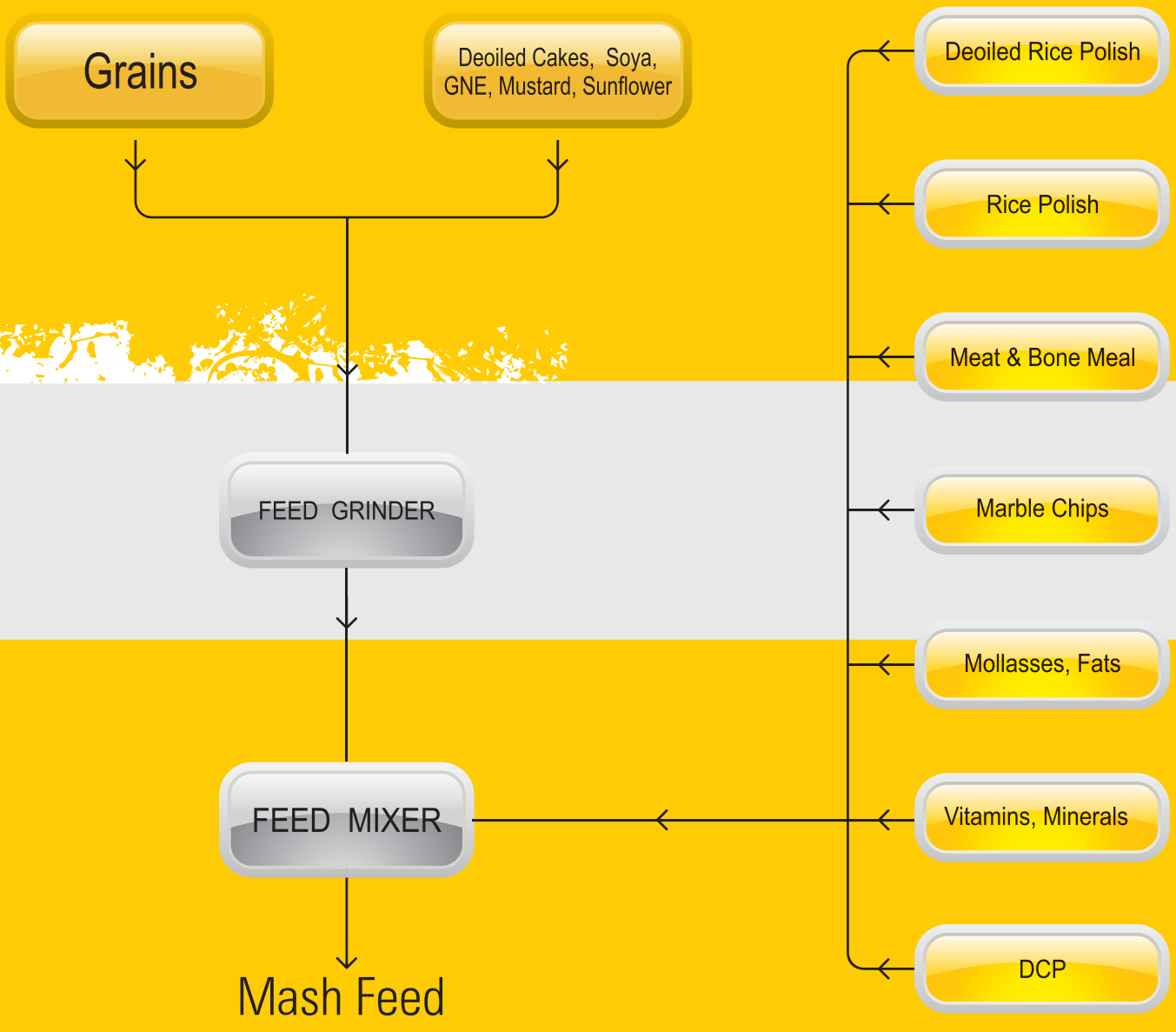
Machinery is a product which is designed to serve for an extended time period. Hence before purchasing a machine it is advisable to contemplate thoroughly over all the available options in its category to make the perfect choice.

The present brochure facilitates you to delve in the intricate details of each machine, thereby assisting you to zero in for a product that offers the maximum value for your investment.

Index

1	Basic Process	2
2	Desired Features in Ideal Mash Feed Plant	4
3	Different Machines of the plant	5
4	Detailed Design Features	7
(a)	Dumping Hopper	7
(b)	Bucket Elevator	8
(c)	Cascading Magnet	9
(d)	Intermediate Bin over Hammer Mill	10
(e)	Hammer Mill : *(Significance of Proper Grinding)*	11
(f)	Batch Bin	14
(g)	Mixer : *(Significance of Mixing)*	15
(h)	Optional Equipments	17
(i)	Why only Lark	21

Basic Mash Feed Milling Process



Basic Mash Feed Milling Process

Animal feed consists of different ingredients to make a balanced diet in terms of proteins, carbohydrates, fats, vitamins, minerals and medicines etc. In manufacturing of feed in mash form, there are few ingredients like DRB, Rice Polish etc which are already available in powder form, while some of these like Grains, Fish, GNE, Soya etc. are available in solid form and has to be converted to granular form of particle size suitable for the animal. For this purpose grinding of these ingredients is carried out with the help of Grinder or Hammer Mill.

After converting all the ingredients in the powder form, these have to be mixed in right proportions to get the homogeneous feed. Mixers are employed for this purpose. So there are two basic operations of grinding and mixing in manufacturing of feed in mash form.

The intake hopper of the grinder and top of mixer are usually at some height between 5 to 8 ft. (Depending upon the size of machine) from floor level and material have to be lifted at this level manually. For auto lifting of feed from floor level to the top of machine, Screw Conveyors are employed.

For vertical lifting of material more than 8-9 ft. from floor level Bucket elevators are best suited.

Desired Features in an Ideal Mash Feed Plant

In a poultry farm, whether it is broiler or egg production, feed comprises the 70 to 80% of the total cost of production.

The quality of feed we are feeding to our birds has a direct impact on egg or broiler production, and of course, our profitability.

The quality of feed is governed by two major factors :-

One is formulation i.e. the balance of nutrients.

Second is the processing- means how best it is being processed.

Here we are concerned about processing technology for making quality feed.

First of all we will discuss briefly, the features that are desired in an ideal mash feed plant.

In grinding it should be capable of giving **all sort of** grinding from coarse to fine suitable for day old chicks, Grower, Finisher, Layer or Breeder flock. It will be a bonus if **grinding is uniform**.

In mixing it should be capable of **mixing properly** in an efficient way even the smallest quantity of micro-ingredients.

Magnetic system should be capable of **removing all size of iron impurities**.

It should give **consistent production** for which it is designed.

It should be highly reliable and **maintenance free**.

It should be **energy efficient**.

It should be **easy to operate** and maintain.

It should be equipped with all **safety measures**.

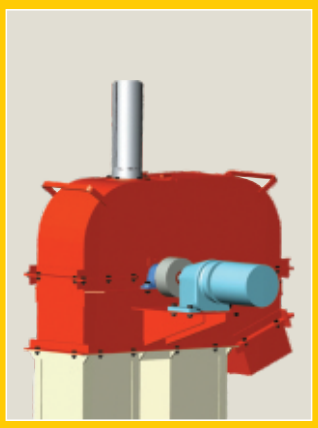
Dust emissions should be minimum.

The plant comprises

Working on these desired features and getting feed back from working plants, our innovative team of Engineers at Lark with years of experience have come up with a most modern plant of 4-6 Metric Ton per hour capacity now with more and unique features and it is a solution to all your problems in feed processing.

Different Machines of this plant

Dumping Hopper a



Bucket Elevator b

Cascading Magnet c

Intermediate Bin over Hammer Mill d

Hammer Mill e

Batch Bin f

Mixer g

1. Hammer mill feeder
2. Extra dumping Hopper
3. Medicine hopper
4. Oil/Molasses addition
5. Side stairs platform

Optional Equipments h

Working of Plant

The materials after weighing manually are poured into dumping hopper and is lifted up by bucket elevator. Then it passes through cascading magnets where any iron impurities are separated. Material is stored into intermediate bin over hammer mill and it ensures uniform feeding to hammer mill.

Hammer mill perform the grinding of material as per requirement and ground materials are again lifted up by second elevator and stored into batch bin over mixer. The function of batch bin is to keep on storing the material coming out of grinder while mixing and bagging is carried out.

As soon as the bagging is completed from mixer, the next batch is released from batch bin into mixer. Here pre-mixes are added from medicine hopper and mixing is started. Oils and liquids are added from a tank provided over mixer. When mixing is complete, the mixer is emptied by direct manual bagging.

It was brief working of plant. Next you will see the **detailed design features** of individual machine and their working. But before that we discuss briefly the various designs available with our company and which design is suitable for you.

Selection of Machines

After analyzing your individual requirement in terms of throughout and quality of final product, we will make a suitable combination of machines.

In grinding, now we have three designs to offer you i.e. Half Screen, Full Screen, Our patented QGA series, and three designs in Horizontal Mixer - Paddle Mixer, Double Ribbon Screw Mixer and Double Shaft Paddle Mixer. The Magnetic separation is now much modified with powerful magnets and self cleaning design. Similarly Bucket elevators are also of maintenance free design.

Detail Designed Features

Dumping Hopper

First of all, all the ingredients are weighed manually as per the formulation to make a batch of one Metric Ton. After weighing, materials of one batch are poured into the intake hopper of first elevator.

movement control mechanism

Design & Working

After dumping of material into intake hopper, the slide gate is opened to feed the material to bucket elevator.

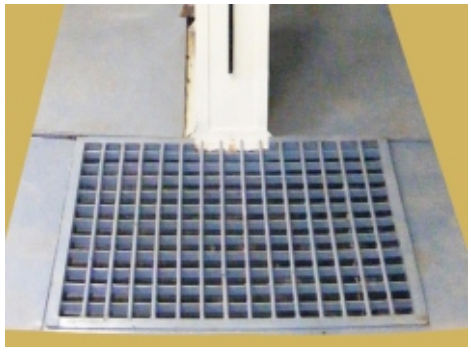
The Slide gate is manually operated through handle and rack pinion mechanism and is equipped with a movement control mechanism, which is adjustable to retain its position.

The movement control mechanism is provided so that slide gate retains the position it is set, at the same time can be shut down quickly if desired.

The feeding from intake hopper of first elevator is controlled by monitoring the level of intermediate bin over grinder. As soon as the level reaches the higher level in bin, feeding from intake hopper is stopped and when it reaches lower level, gate is again opened.

Salient Features :

The hopper has the capacity to hold 200 kgs of feed and is designed to help free flowing and complete clean out of ingredients. It is equipped with big size grill over it. The size of grill is designed large to facilitate easy dumping of bags of ingredients. The size of openings in grill is such that any oversize materials or lumps in feed ingredients are prevented from going to bucket elevator. If oversize materials are allowed to go into elevator, it can cause the moving buckets of elevator to bend or pluck from belt or can got stuck into cascading magnets causing pipe blockage or can interrupt the flow of material in slide gate over hammer mill.



The grill is detachable for easy maintenance or cleaning of hopper

Bucket Elevator-I

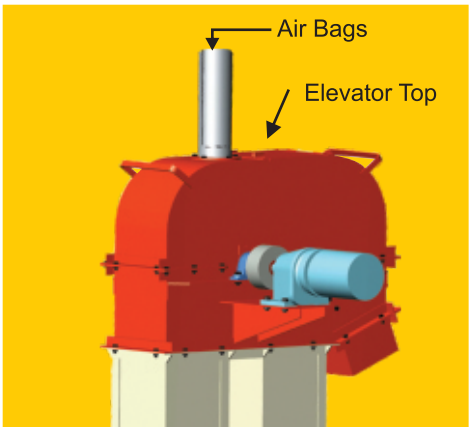
The material fed by intake hopper is lifted up for further processing with the help of bucket elevator.

Design

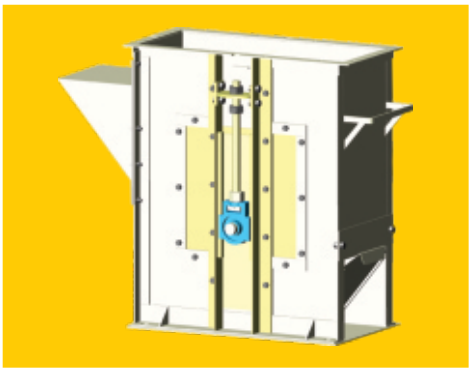
Bucket elevator consists of Head section at top, boot at bottom and trunking in between.

There are two pulleys- one in head and second in boot section and over these pulleys run a belt on which buckets are mounted by bolts. Top pulley in head is a driving pulley and bottom pulley is a driven pulley in boot section. The top pulley is driven at suitable rpm by either a geared motor or simple motor with belt chain sprocket. Belt with buckets run on these pulleys and buckets are filled at boot section and are emptied at top in head section.

Our bucket elevators are designed for maintenance free operation To achieve this : -



Elevator Top



Elevator Boot

Large Service Window

1. The elevator top or head is fabricated with heavy gauge sheet and has an inspection window for checking position of belt on pulley.
2. The head is having an adjustable plate to avoid material falling back downward
3. The head is having air bags for controlling dust and air pressure.
4. Bucket Elevator with more that 25 ft. height are equipped with back stops to prevent reverse movement of belt on power failure causing jamming of elevator.
5. Our elevators are equipped with large service window for easy installation of buckets on belts and replacements in future.
6. Our elevators are equipped with window with sight glass at front side to monitor the running of elevator.
7. The boot is fabricated with heavy gauge sheet and is all bolted design for easy maintenance. Pulley is movable down wards for tensioning of belt.

   The boot is having inspection window as well as cleaning gates for cleaning the elevator and in case of changing feed formulation.
8. Both pulleys of elevator are crowned for self centering of belt so that belt does not touch the sides of elevators. It ensures smooth, maintenance free working of elevator.
9. Nylon rubberized belt of MRF, Dunlop of reputed Indian brand with heavy thickness is used for long life and maintenance free operation. We do not use cotton belt which keep on elongating and frequent maintenance is required.

Cascading Magnets

Unclamping toggle clamps

Pulling the handle

Iron thrash drop in collection tray

Collection tray removel for cleaning

Magnet

After the material has been lifted up by bucket elevator, the next step of feed processing is separation of iron trash from the material going to hammer mill, which otherwise can cause serious damage to hammer mill rotor, feeder rotor, can break the screens and hammers.

Cascading magnets are designed to catch iron impurities from small particle of iron dust to big pieces with equal ease with almost 100% efficiency at maximum designed flow rate of plant.

This is achieved by using high power rare earth magnets enclosed in stainless steel housing.

To reduce the time wasted in cleaning the magnets and for complete clean out, we have specially developed self cleaning design, in which we don't have to pluck the iron trash stuck on magnets by hand.

It is now simplified with just unclamping the magnetic plate without using any tools and with just a pull of handle, all the entrapped metal falls in collection tray. The tray is removed for cleaning and fitted back. It takes just 10 seconds for cleaning.

Double magnets are provided to ensure further safety.
Although all the iron impurities are filtered in first magnet, a second magnet is there for further safety.

Intermediate Bin over Hammer Mill

After separation of ferrous impurities in cascading magnets the material then flow to hammer mill through an intermediate bin provided in between.

Features:

1. The bin can store 500-700 kgs of material and purpose of providing this bin is to neutralize uneven feeding at intake hopper and ensure uniform and full width feeding to hammer mill.
2. Bin is provided with sight glasses to facilitate the operator monitor the high level and low level of bin and accordingly control feeding at intake hopper of elevator - I
3. Bin is provided with a manhole at top for cleaning or maintenance of Bin.
4. Bin is supported on an iron structure and has flexible joint between bin and hammer mill.

Flexible Rubber Joint

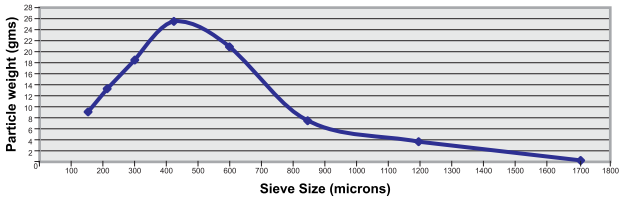
5. Flexible rubber joint is provided between hammer mill and intermediate bin to isolate any small vibration of hammer mill transferred to bin.
6. Flexible joint assembly has slide gate to control the feeding rate to hammer mill

Hammer Mill

After magnetic system and intermediate bin the material then flow towards the hammer mill for carrying out one of the most important function in feed preparation. i.e. known as grinding or crushing for size reduction.

An ideal hammer mill is expected to perform the following :

- It should perform all sort of grinding from very fine to very coarse suitable for all age, breed of birds.
- The grinding should be uniform allowing better working of enzymes in digestion.



Weight of Sample taken = 100gms
Geometric Mean Diameter = 459 micron
Geometric Standard Deviation = 1.749

The uniformity of particle size is described by Geometric Standard Deviation(GSD), a small GSD repersenting higher uniformity

Test result of a ground sample

Significance of proper grinding

Both the average size of particles as well as uniformity of size in the feed product affect animal feed efficiency, gut health, and feed manufacturing cost.

Average particle size :

Research suggests that how feed particle size affects digestion- Finer particles improve nutrient absorption but can encourage keratinisation or erosion of digestive tract tissues, possibly leading to ulceration and pathogenic bacteria.

While a coarsely ground ration changes the physio chemical and microbial properties of stomach contents, which decreases the survival of pathogenic micro organisms such as salmonella.

Uniformity of grinding :

Uniform grinding or particle size distribution is of utmost importance as it allows better absorption of enzymes for better digestion. Production of feeds with better uniformity is the outcome of design parameters of the equipment.

Besides feed efficiency and gut health, particle size characteristics play a role in nutrient excretion. "Proper processing of feeds represents a very practical means to positively impact nutrient excretion through improvements in feed digestibility. Particle size is an area where producers can significantly improve feed efficiency."

Technology to achieve proper Grinding

Our Patented QGA – Technology

Patent Application No. 1993/DEL/2007

Inventing this technology is one more feather to our cap and a total grinding solution for all types of grinding. “Quick-Gap-Adjustment” QGA, as its name implies this technology is a boon for grinding different sizes of products as fine/ Medium/ coarse by quick change of gap between hammer tip and screen, thus creating ideal parameters for optimum grinding of product.

Grinding different sizes of product (fine/ Medium/ coarse)

In poultry feed, we need different particle size of feed referred to as fine or coarse to feed a day old chicks to full age broiler/ chicken. For optimum grinding we need different parameters for fine grinding or coarse grinding.

In simple hammer mills, the required particle size is obtained merely by changing the hole size of screens while the other parameter of hammer mill such as tip speed of hammer mill, gap between hammer tip to screen, remain same.

In modern hammer mills, to obtain coarse/fine grinding following steps are taken.

- Screen of smaller hole for fine and bigger hole for coarse feed is used.
- Speed of motor can be changed by fitting a VFD (Variable frequency drive) or dual speed motor or D.C. motor.
- Gap adjustment between hammer tip to screen is varied by changing the position of hammers on different PCD on circular plates of rotor.

Our Modifications

Our modifications relates to point III Gap Adjustment between hammer tip to screen

In prevailing method of gap adjustment, as the no. of hammers on rotor goes on increasing with increase in size of hammer mill. Particularly on bigger hammer mills it wastes so much time to remove all the hammers from one position and fitting in other position. Sometimes, requirements are there to shift from one setting to other many times a day. So practically it is not usually possible to always change the gap by altering the position of hammer for varying quality of feed because it causes huge production loss as well as trained person are required for it. So usually only changing of screen is done to achieve the target. It result compromises on quality of feed and production loss.

If a hammer mill is set for smaller gap say 10 mm for fine grinding with 3 mm hole screen. It will not give required coarseness of feed, if 6 mm hole screen is employed until gap is increased to suit 6 mm hole. Only changing of screen will result uneven grinding.

Similarly if a hammer mill is set for coarse feed with say 25 mm gap with 6 mm hole screen for coarse feed, it will get jammed if operated on 3 mm hole screen or otherwise will give poor output.

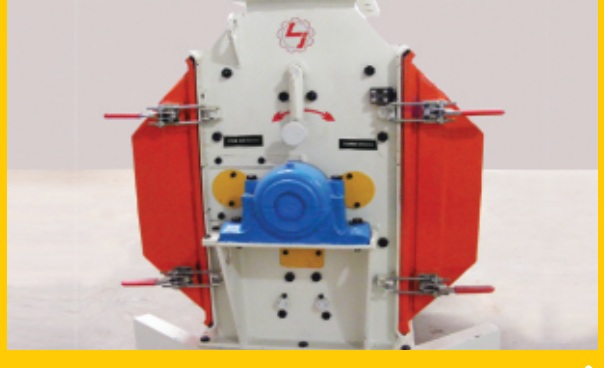
So an ideal gap is of utmost importance to achieve high quality grinding combined with efficiency. So our QGA series has solved all grinding problems that feed industry was facing from decades.

The common salient features of our full screen hammer mills of both the series are :

Dynamically Balanced Rotor

Interlock Sieve-pressing device

Direct coupled motor



Provision for Coarse - Fine Adjustment

a Hammer mill rotor is dynamically balanced to minimize vibrations.

b In grinding chamber gap between tip and screen is very important for efficiency as well as quality of grinding. Our hammer mills are having the gap adjustment facility to be fit for fine or coarse grinding.

c Has optimum screening area per unit power for efficient grinding.

d Screen changing is very quick and easy without use of any tools.

e Rotor is designed with rotation in both sides so that when hammer in one side is worn out, only by changing direction of rotation, second edge of hammer is used. This reduces time of changing hammers.

f For changing of bearings etc. rotor can be disassembled from hammer mill body easily and quickly without removing any of machines over hammer mill.

g For efficient power supply motor is installed on common base frame and is directly connected to hammer mill through flexible tyre coupling.

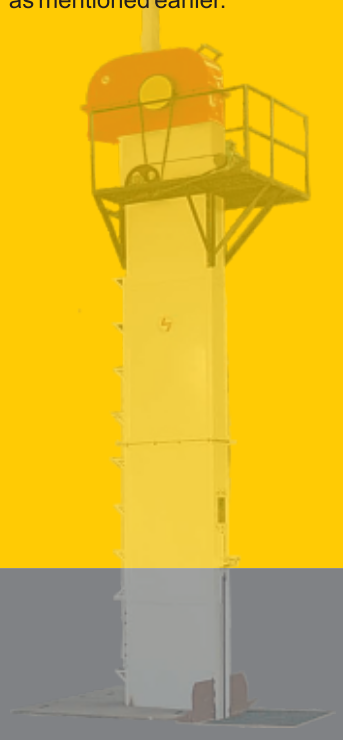
h Hammer Mill is mounted on anti static vibration pads and flexible connection is there at intake and discharge points so that there is no vibration transferred to other parts of plant.

i Hammers and hammer rods of hammer mill are heat treated for resistance to wear and are highly balanced for vibration free performance.

j Hammer mill screens are having maximum holes per unit area to have more output and life of screen.

Bucket Elevator-II

Material after grinding is again lifted up by second elevator for feeding to batch bin and further processing. This elevator has the same features as mentioned earlier.



Batch Bin

The bin is designed to hold one metric ton of material.

The purpose of installation of batch bin over mixer is to increase the output and continuous running of plant.

Because it takes 10-15 minutes for hammer mill to grind one complete batch of matreials and similarly 10-15 minutes are requires for proper mixing and discharging the mixer by bagging .

During grinding operation feed is continuously being stored into this bin. So by the time, grinding of one batch is completed, the previous batch from mixer is mixed and discharged.

The batch bin designed by our company has the following features

a. The capacity of bin is large to hold one ton of even the low density materials.

b. The discharge gate is wide and easy to operate. For effortless operation of gate, bearings are used in place of bushes, which also ensures smooth sliding of gate without jamming for years.

c. Proper slopes at sides is provided. This ensures smooth and complete discharging of bin without jamming, further more, discharging gate is sealed for any leakage of material while discharging.

d. Batch bin has sight glass at both sides of bin close to discharge point for viewing complete discharge of bin.

e. Big size man hole is provided at top of bin for cleaning of batch bin.

f. Batch bin is equipped with air exchange pipe for smooth discharge of materials without emitting any dust.

g. Batch bin has rounded off /chamfered corners to avoid any material entrapped in corners causing fungus etc.

Mixer

Significance of Mixing

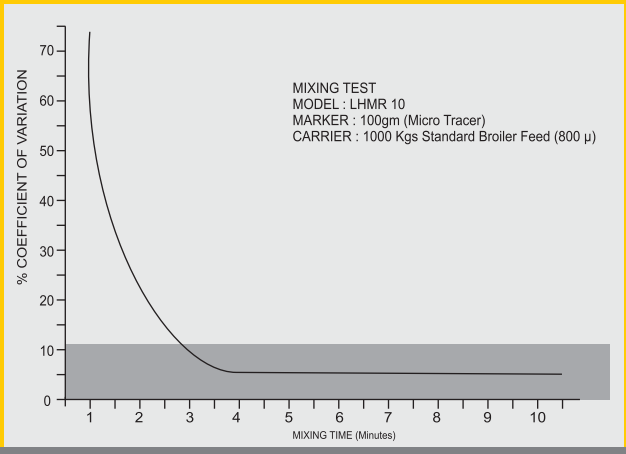
Mixing is one of the most important operations in manufacturing of animal feeds and mixer is considered to be the heart of feed milling operation.

The need for uniformity in a complete feed is a must in order to satisfy nutritional requirements of the animal to achieve growth, production and good health. Those associated with animal feed production realize that if feed ingredients particularly micro- ingredients such as vitamins, amino acids, trace elements and drugs are not properly blended, overall animal performance will be reduced and wide variation within the group of animals will exist. It is also possible to create a toxic situation if some ingredients are not properly mixed. Most feed additives, such as fat soluble vitamins, trace minerals, antibiotics and growth promoters will not perform their intended function if they are not properly blended in the feed.

The objective of mixing is to create a completely homogeneous blend. In other words, any sample taken should be identical in nutrient to any other sample. The value of homogeneous blend is very critical for small animals which consume very little feed as compare to large ones. For example a shrimp of 1 gm wt. will require 0.12 gm of feed per day and a day old chick will consume 6-8 gm feed at early stage. Accordingly, if a feed formulation has been properly mixed a 0.12 gm sample of shrimp feed and 6 gm sample of broiler pre starter feed should contain all the nutrients formulated for that diet. Conversely, the value of a homogeneous blend for large animals is not as critical as they consume greater quality of feed say 5 kg to 20 kg per day.

During the manufacture of feeds there are several factors which create or contribute to incomplete mixing. Some of these are related to the machine i.e. type of mixer, design of mixing elements and mixing parameters etc and some are related to the physical properties of the ingredients like particle size, particle shape, density, hygroscopicity, static charge and adhesiveness.

For accurate mixing of all these ingredients, the plant is supplied with our latest designed double ribbon screw mixer, which has the highest mixing efficiency in its class.



Mixing tests have shown that it can mix even the minute quantity say 100 gms of micro ingredients in one ton batch within 6 minutes resulting a coefficient of variation less 7% easily.

With pre-mixing, it will give CV< 5% within 3-4 minutes.

Testing Facility at Lark Engineering Company assists our Product Development Engineers in their effort to create new products or to modify existing ones.

This is made possible with significant changes made in mixing ribbons and continuous testing of mixer for mixing accuracy.

We have developed a totally new technology to achieve highest mixing efficiency and to overcome the problems. The abstracts of our new

Patented Technology (No. 1544 / DEL / 2007)

* The mixing ribbons are of variable cross-section and with end relief as compare to previous simple ribbons.

* Very little clearance is there between ribbon and drum and at the sides which ensure that there are no dead corners within mixing drum.

* Sharp corners in ribbon-arm joints are removed to prevent entrapped feed causing fungus etc. thus maintaining feed hygiene inside the mixer.

It has solved all the problems that the other mixers are having like.

a) Long mixing time

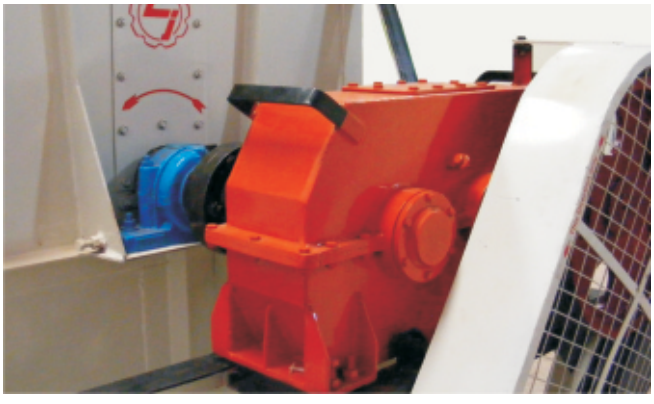
b) Heating of product while mixing.

c) Improper mixing of oils, molasses etc.

d) Breakage of shafts etc.

e) Bending / or breakage of ribbons.

Further more, for speed reductions, mixer is equipped with a well designed, highly reliable gear box which will guarantee trouble free service for years to come.



Gear Box ↑

It has following features:

Service factor of Gear Box is very high as it is designed for 30 HP while working power is 15HP.

Gears are hardened and ground and of best grade steel.

All shafts are hardened and ground for long life.

Spherical roller bearings are used for maintenance free operation.

Your Gains with this mixer:

1) The Mixing quality is very good.
2) Power consumption per ton of feed is very low.
3) The mechanical system is very reliable and maintenance free.

After the mixing is completed in ribbon mixer, emptying of mixer is carried out by direct bagging.

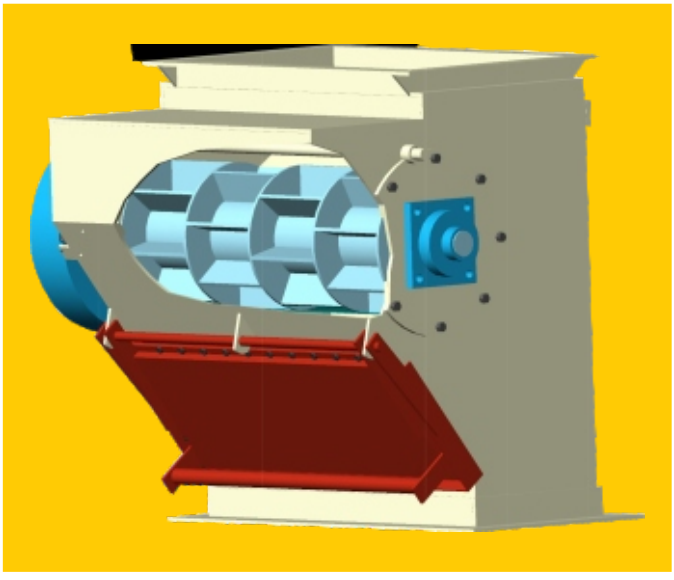
Optional Equipments

To further improve the working of plant, following equipments can be incorporated in the plant.

Hammer Mill Feeder

Hammer mill feeder is required to control the feeding to hammer mill automatically.

Our modified feeder has long vanes converted into multiple cups that provide instead of 6 discharge points to 24 or more depending on size, which results more even feed rate and distribution of material across full width of mill intake.



1

Hammer Mill Feeder Drive Panel

In this panel, variable frequency drive (VFD) is used to control the speed of feeder. It has following features:

In auto mode VFD controls the feeding rate automatically with respect to the load of main motor. This drive communicates the "Load" or "Amperage" of hammer mill main drive motor to the feeder motor to adjust the feeder speed. This ensures that the feeder does not supply more material than Hammer Mill main drive motor can tolerate.

In manual mode, we can control feeding manually through a potentiometer.

Incase of any major problem in electronic Feeder Drive Panel , we have provided a direct mechanical bye pass mechanism which allows gravity feeding through slide gate control to keep the plant running.

2

Extra dumping Hopper at 2nd Elevator

Some times we need to add some materials in feed directly into mixer without passing through hammer mill e.g. soya or fish.

For this an extra dumping hopper can be provided between hammer mill and intake of second elevator

The dumping hopper has a slide door at bottom which can be opened or closed from ground floor level and it has dust proof cover to prevent dust.

Medicine Hopper

3

Medicine or premixes can be added directly into mixer by opening the lid of window provided at the top of mixer.

However to prevent the wastage of micro ingredients by back pressure of air of elevator etc. a medicine hopper can be installed. Its material of construction is stainless steel of 304 grade and is specially designed for smooth discharging into mixer without any residue in medicine hopper when bottom slide gate is opened. Sealed top cover is provided to prevent the dust leakage equipped with medicine hopper for addition of micro-ingredients directly into mixer.

4

Direct oil/Liquid addition system

For direct addition of oil etc into mixer, a small service tank is provided with hopper which allows pouring of liquids in small droplets in full width of mixer.

5

Oil / Molasses addition system on level measuring basis.

Oil/ Mollasses/Liquid addition on Level Measuring basis For measurement of liquids on level basis a day tank, a measuring tank with valves and fittings is provided.

After measurement, liquids from measuring tank flow into a small service tank provided over mixing drum through hopper which allows pouring of liquids in small droplets in full width of mixer.

6

Side Stair & Platform:

As the medicines oil molasses are added directly to mixer from top and slide gate of batch bin is also at some height, for easy access to operate these side stairs and platform can be installed.

The stairs are wide for comfortable walking and has railing all around and chequered plate is used for flooring and stairs to avoid any slippage.

Electrical Section

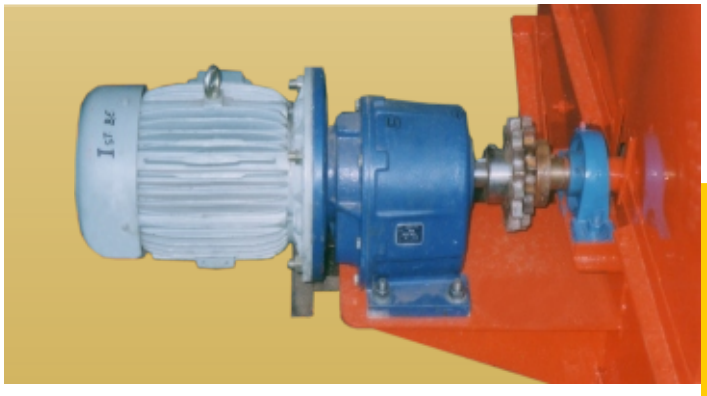
Simple motor with chain sprocket

Geared Motors

For Bucket Elevators, geared motors are used, which has no v-belts or chains sprockets and are directly coupled to elevator shaft. These motors are highly energy efficient and maintenance free.

Simple motors

Simple motors can also be used in place of geared motors with first stage reduction through V-Belts & pulleys and second stage reduction by chain & Sprockets.



Direct coupled geared motor

Motors

Electrical Panel

Plant can be supplied with a well designed electrical control panel :

The MCC is consist of followings:

a) An Incoming main switch.
b) Indication lamp to indicate interchange of phases in Main supply.
c) Main line Ampere meter and Voltmeter with selector switch and indication
d) Switches for all motors.
e) D.O.L. starters for motors of 10 HP or less.
f) Star-Delta Starter for motors above 10 HP.
g) Change over to change direction of rotation of grinder.
h) All internal wiring of MCC.

MCC is cubical type, self supporting and all starters and switches mentioned will be of L & T/ Schneider/ GE/telemaquinic make.

Why a plant from Lark only

Grinding Quality :

All size of grinding from coarse to fine is possible with more uniform texture that results better Feed Efficiency.

Mixing Quality

Highest accuracy of mixing is achieved which is a key to better animal health, better growth etc.

Power Consumption

Power consumption per ton of feed production is minimum.

Maintenance Cost

Maintenance cost is negligible.

Reliability

Plant is highly reliable. The design and quality of each component is such that it will give very good service.

Dust free operation

Plant is almost dust free and with very good working conditions. To achieve this:

a) Packings are provided on all the joints.
b) Air exchange pipe is provided between mixer and batch bin for smooth discharging of materials from batch bin mixer.
c) Air Bags are provided over all bins and bucket elevators for release of air pressure without dust.
d) Dust proof flexible joints are provided at inlet and outlet of hammer mill.

Up gradation to 8-10 MT/Hr.

The plant can be upgraded to higher capacity using most the machines

Lark
Engineering Co. (India) Pvt. Ltd.

Similar Plants with different capacities

1. 6 - 8 MT/hr
2. 8 - 10 MT/hr
3. 14 - 16 MT/hr (with auto batching and bagging)

are also available

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