ALL seed processors would like to have one compact machine that would do
all of the cleaning and separating jobs in a seed house. As yet, no one has found
the answers to build such a machine, so screens, air cleaners, and a lot of
special purpose machines are used. One of these so called special machines is a
Specific Gravity Separator. The gravity machine has in the past had a reputation
of being a difficult machine to operate and to keep in adjustment. In reality, it is a
very simple machine to operate if the principle behind its operation is understood.
The two main parts of the gravity separation process are air and table motion. If
we understand how these two things work together then we have the basis for good
operation.

The basic principle of operation of the gravity separator is that it takes ad-
vantage of the difference in size, shape and specific gravity of particles.

The actual separation takes place in two steps. The first is in the vertical
direction by stratification of the seeds and the second is in the horizontal direction
by the table motion and gravity. Both of these actions take place at the same time
all across the deck of the separator to give a continuous grading of material till it
leaves the table. The first step, the vertical separation of the material, is the key
that allows the separation to be made. If the material is not first stratified the
second step cannot take place.

The stratification of material is accomplished by air being blown thru the
porous deck and in effect floating the light material away from the heavies.

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enengineers and manufacturers of specific gravity separators, aspirators, air-float
stoners, dry concentrating tables and electrostatic separators.
(See Figure 1). A good example of this would be like taking a hand full of ground cork and rock and putting them in a glass of water. The cork would float on top of the water and the rocks would sink to the bottom. This is exactly what happens on the deck of a gravity separator. With the deck load stratified the second step is ready to take place.

The second step, the separation in the horizontal direction, is accomplished by gravity and by the deck motion. The deck of the machine is slanted in two directions; from the feed zone up to the heavy end discharge and from the feed zone down to the discharge edge. This slanting of the deck allows the light material floating in air to flow down hill by gravity, while the table motion conveys the heavy materials, in contact with the deck, uphill.

It can be readily seen that the stratification of the material by fluidization with air is the key to an effective separation. Also, that to get the most efficient separation the material must be stratified as soon as it is fed on the deck. The reason for this is to utilize the maximum amount of the deck surface to make the separation after the material has been stratified (Figure 2).

All points on the separator deck do not need the same amount of air, as the depth of bed and weight of material varies across the deck. The greatest amount of air is needed in the feed zone because the deck load is the deepest there. The least amount of air is needed at the light end discharge because only the lightest material is in this zone and the material bed is not too deep. Another point that requires a lot of air, but not as much as the feed zone, is along the heavy end discharge. Generally, the air distribution across the deck of the separator should be the highest in the feed zone, slightly less along the heavy banking rail and tapering off from these two zones, to practically no air flow at all at the light end discharge (See Figure 3).

There are four simple adjustments on the gravity separator that control the factors affecting the separation; amount of air, table speed, end raise and side
Figure 1. This picture shows how the deck load should appear when properly stratified.
Figure 2. Stratification is set up in the entrance zone with a rough separation made in zone B. In zone C the separation is completed.
Figure 3. The above is the air distribution chart on a production separator. Note the high air flow in the feed zone and low flow at the light end discharge.
raise. No one of these adjustments can be called more important than the other because they all effect the separation.

One thing that may confuse an operator is that the effect of the various adjustments is quite similar. To illustrate this, listed below is the different adjustments that can be used to accomplish the same thing:

Move deck load to heavy end.
1. Increase Speed
2. Decrease Air
3. Decrease End Raise
4. Decrease Side Raise

Move deck load to light end.
1. Decrease Speed
2. Increase Air
3. Increase End Raise
4. Increase Side Raise

The air adjustment, amount of air, is the key to an effective separation. If there is too much air it will cause bubbling of the deck load, which causes mixing and upsets the stratification. Also, too much air will blow the heavy seeds out of contact with the deck and cause them to report toward the light end of the deck. Too little air will cause only the lightest seeds to be fluidized and most of the seed will be conveyed up the deck to the heavy end.

The speed adjustment controls the rate at which seeds are conveyed up the deck toward the heavy banking rail, in a direction parallel to the discharge edge. Too much speed will cause the deck load to shift toward the heavy end discharge and too slow a speed will cause a shift to the light end discharge.

By adjusting the deck end slope the rate at which the light material, which is suspended in air, flows down hill is controlled. This adjustment also effects
the rate at which the heavy material is conveyed uphill. It is good practice to have this slope as steep as possible and still maintain an even flow of seed over the discharge edge.

The side slope adjustment controls the rate at which seeds travel across the deck from the feed zone to the discharge edge. By raising the side the discharge of seed from the deck is shifted toward the light end and by lowering it the discharge is shifted toward the heavy end.

In normal operation the end raise and side raise are set and the speed and air controls are used to adjust the separation. If it is found that the air and speed does not give the desired results then the end or side raise is changed. When adjusting a separator the following items should be kept in mind.

1. The deck load must be fluidized to make a separation. The feed zone should have some turbulence or boiling, but no where else.
2. In nearly all separations the end raise exceeds the side raise.
3. When making adjustments make them one at a time and wait 5 minutes before making another. This allows the deck load to react to the change and stabilize.
4. Feed the machine to its capacity. The reason behind this is that with light deck loads the distribution of air is upset.
5. The separator should have a constant feed. A varying feed rate will make it necessary to continually adjust the controls to maintain the separation.

In an installation of a separator there are two items that should be given consideration. The first is a firm foundation. In the great majority of complaints about a separator not operating properly or making a poor separation, the cause of the trouble has been found to be poor foundations. The manufacturer of the separator designs and builds it as rigid as possible, but if the foundation on which the machine sits is weak and not rigid all of this work is for nothing. A weak
foundation will cause the whole machine to vibrate and this vibration is greatly magnified by the time it gets to the deck. Any false vibration that reaches the deck tends to cause mixing of the deck load which upsets the stratification of the material. The best foundation is one at ground level made of concrete. If the machine is mounted on a wood floor it should be mounted as close to a supporting wall as possible, with some under floor reinforcing to eliminate all motion of the base of the machine.

The second item to consider is the air supply. The air supplied to the machine should be as clean as possible as any dirt in the air will tend to stick to the underside of the deck cover and cause blinding. The filters supplied with the machines should always be used and if the machine is in a dusty location the air inlet and filter should be in another room. The air filters should be cleaned once a day and more often if the location is dusty.

In summary, the key to the separation made on a Specific Gravity Separator is the stratification of the deck load. This stratification should take place as soon as the material is feed onto the deck and maintained as long as it is on the deck. To maintain this stratification the deck should be fed at a constant rate and as closely as possible to the capacity of the machine, at any given setting. If the separator does not have a firm foundation and clean air the stratification will be upset and a poor, if any, separation will be made.

The Specific Gravity Separator is no better than its operator. If the operator does not know how and why it operates he cannot get the most efficient separation. The principle of operation is simple and the time taken to understand it pays off in cleaner seed processed at a higher rate.