



Design and Fabrication of Seed Sowing Machine by using Electro-Pneumatic System

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Abstract: India is an agricultural country cultivating more number of ground nuts, corns, etc., in the village sides of the country. The available sowing machines are imported from foreign countries. The imported machines are not only bulk in size but cost also very high. In this proposal an attempt has been made for the design and fabrication of maintenance free seed sowing machine exclusively for farmers at low cost. The different components of above multipurpose seed sowing machine are modelled using one of the end parametric modelling software Solid Works and it was simulated by the software Automation Studio. The modelled components are fabricated and assembled together to form a complete machine. The electro-pneumatic action is a control system for pipe organs, whereby air pressure, controlled by an electric current and operated by the keys of an organ console, opens and closes valves within wind chests. This method is used for seed sowing technique. According to the cylinder controlled action seed will show in the land. Here we are using cascade method for cylinder control. This method is very useful for short term and long term crops. In cascade method, we are use only four sequence for seed sowing those are A+, B+, B-, A-. Due to hopper open and close condition seed will easily have sowed in land.

Keywords: Pneumatic, Solid works, Automation studio, electro-pneumatic, sowing machine.

I. INTRODUCTION

Even through many apparatuses are used for seed sowing purpose, pneumatic seed sowing machine is a one of the good sewing machine in industries. It is mainly use for long level area seed sowing. Many advantages are in pneumatic seed sewing machine, we discuss briefly. The production and productivity of ground nuts, corns, etc., were quite low, when India became independent in 1947. The production was not sufficient to feed the Indian population. The country used to import them in large quantities for fulfilling the need of our people from many countries. The reason of low production and productivity were unavailability of machine in the cultivation field. In India most of the farming work is done manually when compared with foreign countries. There was no machine for sowing the seed like groundnuts, corns then and it is done by man power only.

The cost spent for manpower was more and the speed of the operation was very less. When small farmers with minimal physical resources or financial assets attempt to improve their productivity, they have a limited choice. The only resource they can maximize is knowledge in which they are not poor. To prove they can statement, Mr. Shivraj was invented the first bullock driven sewing machine in the year 1987 at Madhya Pradesh to improve his productivity. It was light weight and can perform up to six agricultural operations. India is a world leader in groundnut farming with 8 million hectare of cultivated area in the year 2003. Groundnut cultivation has increased from 6.8 million hectares in 1980 to 8 million hectare in the year 2003. Groundnut is grown mostly in five states namely Andhra Pradesh, Gujarat, Tamilnadu, Karnataka, and Maharashtra and together they account for about 90 percent of the crop total. The sowing time is the most important non-monetary input influencing productivity. Delay in sowing by one-week result in considerable yield losses

Result obtained from all India coordinated research's revealed that in most parts of the country, sowing should be done between the first week of June and the last week of July, Advancement of sowing by a fortnight with pre-sowing irrigation was found to increase the yield substantially. The government of India appointed a commission to assess the feasibility of increasing the crop productivity under prevailing India ecological conditions. In order to develop the standard of living of small farmers we should make the machine with low cost. Then only small farmers can implement the recent modern machines for farming purposed multipurpose sewing machine is used to sowing different types of seed like groundnuts, corns, etc. so in this work an attempt has been made to provide the multipurpose sewing machine at low cost.



1.1 Electro-Pneumatic Seed Sowing Machine

The pneumatic action is a control system for pipe organs, where by air pressure, controlled by an electric current and operated by the keys of an organ console, opens and closes valves with in wind chests. This method is used for seed sowing technique. According to the cylinder controlled action seed will show in the lands. Here we are using cascade method for cylinder control. This method is very useful for short term and long term crops. In cascade method, we are only four sequence for seed sowing those are A+, B+, B-, A-, Due to hopper open and close condition seed will easily have sowed in land. There are four hoppers are used, first 3hoppers are short term crops and a final hopper for long term crops. Cylinder will actuate according to cascade method then seed will show with in the respective places. Short term and long term seed will show with some gap. It will give good growth to crops, pneumatic seed sewing machine good accuracy method, fast signal delivery during actuating the cylinders. It is a high reliability method so less maintenance.

The performance of seed sowing devices by using image processing algorithm. They also studied the effect of speed depth seed spacing, miss seeding ratio and performance seed sowing devices on germination of speed depth seed spacing miss seeding ratio and performance seed sowing devices on germination of seed and efficiency of yields crop. The test seed sewing machine concluded the multipurpose seed sewing machine maintain row spacing control the seed and fertilizer depth the two sewing machine pneumatic vacuum. Sowing machines are pneumatic pressure sowing for interval sowing differing in the made of operating for cultivation.

Agriculture sector is changing the socio-economic environment of the population due to liberalization and globalization. About 73% people are living in the rural area and are still dependent on agriculture. About 43% of geographical area in used for agriculture activity. Agriculture has been the backbone of the Indian economy.

As Indian population is growing continuously, the demand for producing crop per hector is also increasing; this requires efficient and high capacity machines. So mechanization in agriculture industry plays an important role in Indian economy. The basic function of seed sowing operation is to sow the seed and fertilizer in rows at required depth and to maintain the distance.

II. LITERATURE REVIEW

Automation studio is circuit design, simulation and research projects documentation software for fluid power systems and electrical projects conceived by M/s. Famic technologies Inc.in 1996. It is used for CAD, maintenance, and training purpose.

Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. The main purpose seed sewing machine conventional method are new proposed machine which can perform number of simultaneous operation [2]. The required row to row spacing seed rate seed to seed spacing and fertilizers placements varies from crop to crop can be achieved by the proposed machine. The machine reduces the sowing time human effort and labour cost the growth of India economy mechanization is necessary the main purpose of mechanization in agriculture is to improve the overall productivity [5].

Agriculture sector is changing the socio-economic environment of the population due to liberalization and globalization. About 73% people are living in the rural area and are still dependent on agriculture. About 43% of geographical area in used for agriculture activity. Detail about agriculture has been the backbone of the Indian economy. As Indian population is growing continuously, the demand for producing crop per hector is also increasing, this requires efficient and high capacity machines [1]. So mechanization in agriculture industry plays an important role in Indian economy [3,4].

In industrial seed sewing machine have some drawbacks, many automatic seed sewing machine are only adapted to horticulture field. Long level seed sowing is not possible. Currently using machines need a human for operating the system. The automation is very much essential for improving the productivity as well as reducing the man power [6]. Total time is comparatively very high. Accuracy is very less in pneumatic seed sewing machine. These systems are not reliable. Regular maintenance is needed. These are some drawback to reduce the productivity.

III. FABRICATION OF EXPERIMENTAL SETUP

The experimental apparatus of our proposal consist of major part like hopper, GI tray, mild steel plate, double acting cylinder, electro pneumatic setup, compressor, 5/2 directional valve, 3/2 directional valve, slide valve. First of all, the materials were brought to fabricate the experimental setup, and the major parts of the system that is hopper and tray. The whole experimental setup made in to rectangular steel frame with supported bars.

Hopper is mounted on the tray; hoppers another side is placed on the rectangular plate. Another one slider plate is placed on the supporting plate; supporting plate is reciprocated on the supporting plate. If slider plate moves on the supporting plate and its having hole, if the hole is match in condition means seed will show on the land.



For our convenience we are using double acting cylinder for reciprocating action, reciprocating part is connected to a sliding part. Sliding part moves along the plate with particular time interval so seed are sowed between the correct intervals of time. Welding and gas welding is used for joining purpose. The whole setup fabricated properly with appropriate dimension. It a prototype model, it will be mounted on tractor; According to the tractor movement seed will show in the land. Tractor must be moved on same speed then only seed will show in the land with respective distance

3.1 Electro Pneumatic System

The most used pneumatic actuation system electrically controlled systems. These systems are called electro-pneumatic actuation systems.

Electro-pneumatic control system is a combination of electrical unit and pneumatic unit both in one unit. A number of electro-pneumatic elements are used in electro-pneumatic controls. In electro-pneumatic circuits solenoid operated directional control valves, limit switches and pressure switches are used. On an automation system one can find their families of components, which are sensors, valves and actuators. A solenoid is used in pneumatic valves to act as the actuating elements. An adequate technique is needed to the logic circuit to integrate all the necessary components and execute the sequence of movements properly. For a simple direct sequence of movement an intuitive method can be used, but for indirect or more complex sequence the intuition can generate a very complicated circuit and signal mistakes. It is necessary than to use another method that can save time of the proposal, make a clean circuits and can eliminate occasional signal overlapping redundant circuits. The present method is called step-by step or algorithmic, it is valid for pneumatic and electro-pneumatic, the method consist of designing the system based on standard circuit made for each change on the state of the actuators, and these change are called step, the next task is the link the standard circuits and the last part is to connect the control element that receive signal from sensors, switches and the previous movements, and give the air or electricity to the supply line of each step.

3.1.1 Cascade Method

Cascade method is used as a mechanism in the proposal, four sequence is used those at A+, B+, B-, A-
Sequence A+

During the A+ condition cylinder A will move forward direction so in first 3 hoppers are in open condition, so seed will easily fall down shown in Fig.1

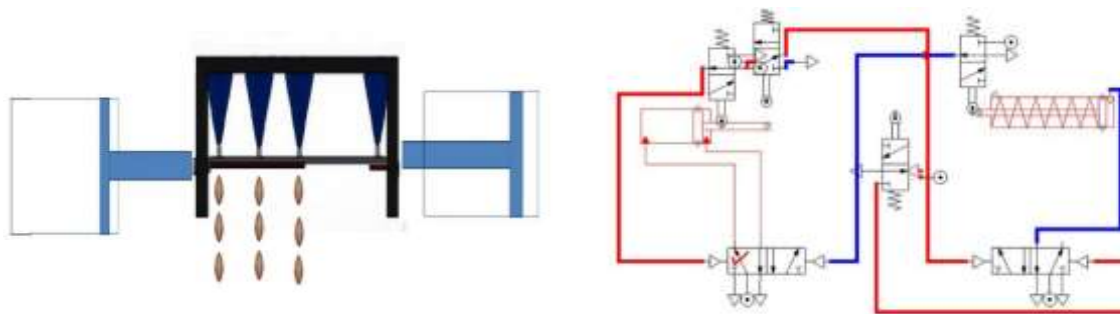


Fig. 1 Seed Sewing Machine A+

The performance of seed sowing devices by using image processing algorithm. They also studied the effect of speed depth seed spacing, miss seeding ratio and performance seed sowing devices on germination of speed depth seed spacing miss seeding ratio and performance seed sowing devices on germination of seed and efficiency of yields crop. The test seed sowing machine concluded the multipurpose seed sowing machine maintain row spacing control the seed and fertilizer depth the two sewing machine pneumatic vacuum. Sewing machine and pneumatic pressure sowing for interval sowing differing in the made of operating for cultivation.

During the A+ condition cylinder a will move forward direction so in first 3 hoppers are in open condition, so seed will easily fall down. The presented method is called sequence circuit by using automation studio step –by-step or algorithmic, it is valid for pneumatic and electro-pneumatic the method consists of designing the system based on standard circuit made for each change of the state of the actuator. And these changes are called step.



Sequence B+

During the B+ condition cylinder B will move forward direction so in first 3 hoppers are in open condition and final hopper also open in condition so seed are sowed via all hopper. The performance of seed sowing devices by using image processing algorithm. They also studied the effect of speed depth seed spacing, miss seeding ratio and performance seed sowing devices on germination of speed depth seed spacing miss seeding ratio and performance seed sowing devices on germination of yields crop. The test seed sewing machine concluded the multipurpose seed sewing machine maintain row spacing control the seed and fertilizer depth the two sewing machine pneumatic vacuum. Sewing machine and pneumatic pressure sowing for interval sowing differing in the made of operating for cultivation

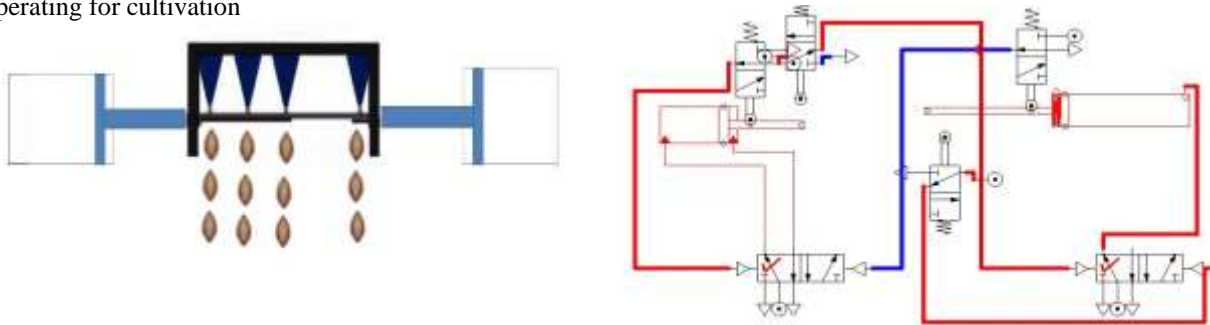


Fig. 2 B+ Sequence Circuit using Automation Studio

During the B+ condition cylinder a will move forward direction so in first 3 hoppers are in open condition, so seed will easily fall down. The presented method is called sequence circuit by using automation studio step –by-step or algorithmic, it is valid for pneumatic and electro-pneumatic the method consists of designing the system based on standard circuit made for each change of the state of the actuator. And these changes are called step.

Sequence B-

During the B- condition cylinder B will more reverse direction so in first 3 hoppers are in open condition and final hopper is on close condition. So seed are sowing only in first 3 hoppers.

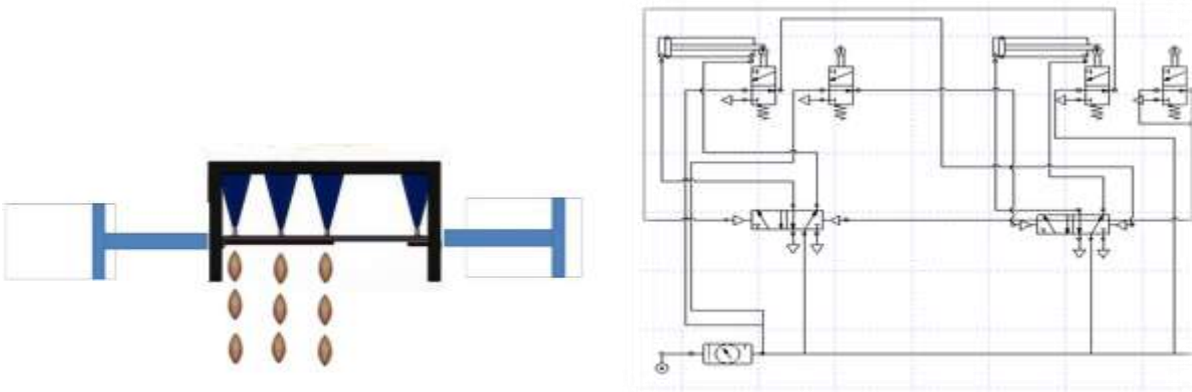


Fig. 3 B+ Sequence Circuit using Automation Studio

During the B- condition cylinder a will move forward direction so in first 3 hoppers are in open condition, so seed will easily fall down. The presented method is called sequence circuit by using automation studio step –by-step or algorithmic, it is valid for pneumatic and electro-pneumatic the method consists of designing the system based on standard circuit made for each change of the state of the actuator.

Sequence, A-

During the A- condition cylinder A will move reverse direction so in first 3 hoppers are in close condition and final hopper also close in condition. So seed not sowed.

During the A- condition cylinder a will move forward direction so in first 3 hoppers are in open condition, so seed will easily fall down. The presented method is called sequence circuit by using automation studio step –by-step or algorithmic, it is valid for pneumatic and electro-pneumatic the method consists of designing the system based on standard circuit made for each change of the state of the actuator. And these changes are called step.

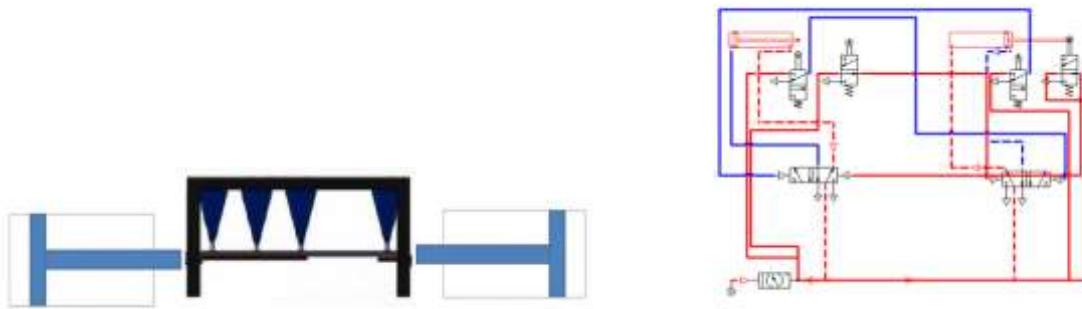


Fig. 4 A- Sequence Circuit using Automation Studio

3.2 Automation studio

Automation studio is circuit design, simulation and research projects documentation software for fluid power systems and electrical projects conceived by M/s. Famic technologies Inc.in 1996. It is used for CAD, maintenance, and training purpose. Mainly used by engineers, trainers, service and maintenance personnel. Automation studio can be applied in the design, training and troubleshooting of hydraulics, synoptic and pneumatic control system.

Result obtained from all India coordinated research revealed that in most parts of the country, sowing should be done between the first week of June and the last week of July, Advancement of sowing by a fortnight with pre-sowing irrigation was found to increase the yield substantially. The government of India appointed a commission to assess the feasibility of increasing the crop productivity under prevailing India ecological conditions. In order to develop the standard of living of small farmers we should make the machine with low cost. Then only small farmers can implement the recent modern machines for farming purposed multipurpose sewing machine is used to sowing different types of seed like groundnuts, corns, etc. so in this work an attempt has been made to provide the multipurpose sewing machine at low cost



Fig. 5 Control Valve of Automatic Studio

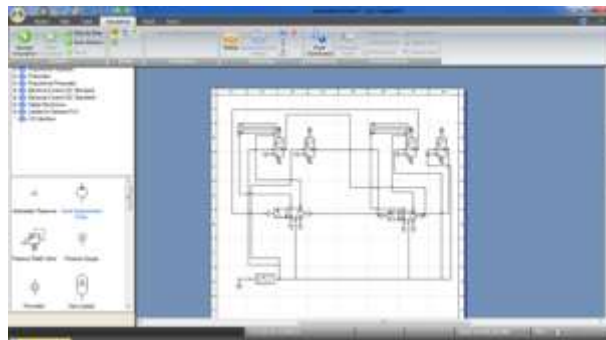


Fig. 6 Control Valve of Automatic Studio

Electro-pneumatic control system is a combination of electrical unit and pneumatic unit both in one unit. A number of electro-pneumatic element are used in electro-pneumatic controls. In electro-pneumatic circuits solenoid operated

3.3 Formula Description

The measurements of the effective time of sowing by the individual sowing machine, the time needed for turning the sowing machine and the tractor and settings of the coulter ensured the calculation of the efficiency factor. Then, the working efficiency of the compared sowing machines was calculated according to the formula. The force exerted by a single acting pneumatic cylinder can be expressed as

$$F = p A = p \pi d^2 / 4 \dots\dots (1)$$

Where

F = Force exerted (N)

p = gauge pressure (N/m², Pa)

A = full bore area (m²)



d = full bore piston diameter (m)

The force exerted by double acting pneumatic cylinder on outstroke can be expressed as (1). The force exerted on in stroke can be expressed as

$$F = p \pi (d_1^2 - d_2^2) / 4 \dots \dots \dots (2)$$

Where

d_1 = full bore piston diameter (m)

d_2 = piston rod diameter (m)

$$F = 10 \cdot \pi \cdot 52 / 4$$

$$F = 196 \text{ N}$$

3.4 3D Design Model



Fig. 7 3D model of a hopper

IV. CONCLUSION

This Electro-pneumatic seed sowing machine is designed for farmer to improve their productivity and also it is used to sowing a multi variety of seed in a same time. The draw back in the existing sowing machine is rectified successfully in our machine. It will be more useful for farmer and the agricultural society.

Comparing the different traditional sowing method with the proposed machine and considering its limitations, it is concluded that,

- ✓ Seed and fertilizer flow rate can be controlled.
- ✓ Row spacing and seed spacing process can be achieved.
- ✓ Seed and fertilizer utilization can be done in proper manner with minimum loss.

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