DESIGN AND FABRICATION OF PNEUMATIC EXPANDABLE BUS

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ABSTRACT

An expandable screw-less vehicle attachment device is provided for fastening articles to a vehicle. The device is shown as an expandable bus that is particularly suited for enlarging the vehicle. The bracket includes a stationary portion and an expandable/retractable sliding portion, and an activating portion. The sliding portion may be moved to a retracted position toward the stationary portion so that the bracket may be positioned within an opening in the panel with retainers (e.g. hooks) on the stationary portion engaging one side of the opening. The pneumatic system in the vehicle to expand the bus by extending the sliding portion toward an opposite side of the opening so that retainers (e.g. hooks) on the sliding portion engage the opposite side of the opening. The actuating portion includes an angled member that expands the bus as the angled member is inserted through the opening.

Keywords: pneumatic cylinder, compressed air

CHAPTER 1
INTRODUCTION

1. INTRODUCTION

Pneumatic systems are used in various fields of technology, for different purposes, to achieve different tasks. Used as power transmission systems to run different mechanisms, then as a management and control systems in the field of embedded systems and others. Pneumatic static systems exhibit their primary effect of pressure energy of the working fluid. Using kinetic energy to get -to do their work but also used less frequently, but the effects of the power is used in automation. Carrier of energy and information (command, control and other signals) in pneumatic systems, is the gaseous fluid and usually compressed air. Compressed air has long been used to drive a variety of tools: air hammers, riveting hammers steel structures, tools for downloading oxidation edges, slag after welding, polishing, drilling, transportation of loose materials, etc.. Today, in addition to the application field of application is very spread so for example: use of pneumatic brake systems and door opening to the road and rail vehicles, the use of performing various operations in construction, forestry, mining and other machinery and facilities, on vessels and aircraft for mechanization and automation of processes and machines, and the like.

A pneumatic system consists of a group of pneumatic components connected together so that a signal (compressed air) is passed through the system to make something happen at the output. These groups of components can be divided into five categories according to their function in the pneumatic circuit as follows:

1. Supply elements: these elements are the sources of power that drives the system which are the compressors.

2. Input elements: these elements are used to send signals to the final control elements and come in two forms; either as components that is actuated by the operator like push buttons or sensors that determine the status of the power elements such as limit switches and proximity sensors.

3. Processing elements: these elements may perform operations on the input signals before sending the signal to the final control elements such
as non-return valves, directional control valves and presser control valves.

4. Final control elements: to control the motion of actuators such as directional control valves.

5. Power elements (actuators): these are the outputs of the pneumatic system which use the stored potential energy to perform a certain task such as pneumatic cylinders and motors.

2. PNEUMATICS

Pneumatics is a branch of engineering that makes the use of gas or pressurized air.

Pneumatic systems used extensively in industry are commonly powered by compressed air or compressed inert gases. A centrally located and electrically-powered compressor powers cylinders, air motors, and other pneumatic devices. A pneumatic system controlled through manual or automatic solenoid valves is selected when it provides a lower cost, more flexible, or safer alternative to electric motors and actuators.

Gases used in Pneumatic systems

Pneumatic systems in fixed installations, such as factories, use compressed air because a sustainable supply can be made by compressing atmospheric air. The air usually has moisture removed, and a small quantity of oil is added at the compressor to prevent corrosion and lubricate mechanical components.

Factory-plumbed pneumatic-power users need not worry about poisonous leakage, as the gas is usually just air. Smaller or stand-alone systems can use other compressed gases that present an asphyxiation hazard, such as nitrogen—often referred to as OFN (oxygen-free nitrogen) when supplied in cylinders.

Any compressed gas other than air is an asphyxiation hazard—including nitrogen, which makes up 78% of air. Compressed oxygen (approx. 21% of air) would not asphyxiate, but is not used in pneumatically-powered devices because it is a fire hazard, more expensive, and offers no performance advantage over air.

Portable pneumatic tools and small vehicles, such as Robot Wars machines and other hobbyist applications are often powered by compressed carbon dioxide, because containers designed to hold it such as soda stream canisters and fire extinguishers are readily available, and the phase change between liquid and gas makes it possible to obtain a larger volume of compressed gas from a lighter container than compressed air requires. Carbon dioxide is an asphyxiant and can be a freezing hazard if vented improperly.

3. PNEUMATIC CYLINDER

Pneumatic cylinder(s) (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.

Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage.

Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tiki Room, pneumatics are used to prevent fluid from dripping onto people below the puppets.

4. AIR COMPRESSOR

An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its engineered upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank. An air compressor must be differentiated from an air pump which merely pumps air from one context (often the surrounding environment) into another (such as an inflatable mattress, an aquarium, etc.). Air pumps do not contain an air tank for storing pressurized air and are generally
much slower, quieter, and less expensive to own and operate than an air compressor.

Fig 2: portable air compressor

Compressors can be classified according to the pressure delivered:

- Low-pressure air compressors (LPACs), which have a discharge pressure of 150 psi or less.
- Medium-pressure compressors, which have a discharge pressure of 151 psi to 1,000 psi.
- High-pressure air compressors (HPACs), which have a discharge pressure above 1,000 psi.

They can also be classified according to the design and principle of operation:

- Single-Stage Reciprocating Compressor
- Two-Stage Reciprocating Compressor
- Compound Compressor
- Rotary-screw compressor
- Rotary Vane Compressor
- Scroll Compressor
- Turbo compressor
- Axial Compressor

CHAPTER 2
LITERATURE SURVEY

1. LITERATURE SURVEY

- In 1830

A steam bus is a bus powered by a steam engine. Early steam-powered vehicles designed for carrying passengers were more usually known as steam carriages, although this term was sometimes used to describe other early experimental vehicles too.

- In 1882

A trolleybus (also known as trolley bus, trolley coach, trackless trolley, trackless tram [in early years] or trolley) is an electric bus that draws power from overhead wires (generally suspended from roadside posts) using spring-loaded trolley poles. Two wires and poles are required to complete the electrical circuit. This differs from a tram or streetcar, which normally uses the track as the return path, needing only one wire and one pole (or pantograph). They are also distinct from other kinds of electric buses, which usually rely on batteries. Power is most commonly supplied as 600-volt direct current, but there have been, and are, exceptions.

- In 1895

A single-decker bus or single-decker is a bus that has a single deck for passengers. Normally the use of the term single-decker refers to a standard two-axled rigid bus, in direct contrast to the use of the term double-decker bus, which is essentially a bus with two passenger’s decks and a staircase. These types of single-deckers may feature one or more doors, and varying internal combustion engine positions.

- In 1930

A double-decker bus is a bus that has two storeys or decks. Double-decker buses are used for mass transport in the United Kingdom, Europe, Asia and many former European possessions, the most iconic example being the red London bus.

- In 1975

An articulated bus (either a motor bus or trolleybus) is an articulated vehicle used in public transportation. It is usually a single-deck design, and comprises two rigid sections linked by a pivoting joint (articulation) enclosed by protective folding bellows on the in- and outside the vehicle (usually of gray or black colour) and a cover plate on the inside of the vehicle. This arrangement allows a longer legal overall length than single-decker rigid-bodied buses, and hence a higher passenger capacity, while still allowing the bus to maneuver adequately on the roads of its service route.
CHAPTER 3

METHODOLOGY

1. SELECTION OF PNEUMATICS

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and the control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power). The main advantage of an all pneumatic system are usually economic and simplicity the later reducing maintenance to a low level. It can also have outstanding advantages in terms of safety.

2. PRODUCTION OF COMPRESSED AIR

Pneumatic systems operate on a supply of compressed air, which must be made available, in sufficient quantity and at a pressure to suit the capacity of the system. However it will indeed the necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

Four Ways to Boost Pneumatic Efficiency

Once Upon a Time, every plant had an air system, fed by central compressors that hissed cheerfully whether working or idling. Hey, air was free, right? Maybe then, but not today. Energy consumption is one of the key factors determining how a machine or system is received these days. Different regions of the world have experienced differing energy costs over time. But today, users in every region want to squeeze the most bang from the fewest pneumatic bucks. Fortunately, most major vendors of pneumatics are prepared to help you work toward this goal. Trade organizations like the USA’s National Fluid Power Assoc. (NFPA) have useful guidelines to assist in designing efficient pneumatics. International standards help ensure that compliant components, wherever built, will deliver good performance and value. And Total Cost of Ownership (TCO) guidelines, to be covered in a future Design World article, will help you choose the right type of system for your job.

Nonetheless, recent advances by several international firms have reinforced specific steps you can take to cut energy consumption in pneumatic applications. Here, from Bosch Rexroth and Festo, are steps you can take to reduce energy costs from pneumatic systems.

A. Beware of oversizing components

For decades, old-timers like this editor recall oversizing actuators. If we really needed, say, a 2-in. cylinder, then we’d specify the next size larger. At the same pressure, the larger actuator would bring more force to the task, and could better cope with heavier or misaligned loads, we surmised.

But oversizing equals waste. And the first way to increase energy efficiency is optimal dimensioning of the components used, thereby avoiding unnecessary air consumption due to oversizing. Over the life cycle of a machine, this adds up to a significant amount of money. Pneumatic components are available in a wide array of sizes, which provide the optimal conditions for precise application dimensioning. A cylinder with an application-optimized diameter can reduce air consumption by at least 15%, when compared to one with a commonly oversized diameter.

B. Reduce volume by cutting distance between valves and actuators

You can substantially increase machine efficiency by reducing lengths of tubing runs between components. Thus dead volumes are reduced and pressure losses are avoided through shorter tube lengths. Look closely at the advantages of decentralized air supply. Centralized valve manifolds are typically cumbersome, require long air lines, and consume a lot of energy. Vendors now offer small, decentralized valves and manifolds that concentrate pneumatic functions at the point of use. Valves can mount directly to cylinders without hose connections. This direct connection eliminates pressure losses through long lines from the control cabinet to the pneumatic drive. Valve/actuator units can reduce tubing connections by 50% and cut energy use by 35%. Decentralized systems can also yield faster response times and higher cycle frequencies.

If harsh operating conditions or sanitary washdowns for, say, food processing equipment are issues, look into decentralized valve units made of engineered polymers that are small, light, chemically resistant, and able to withstand harsh operating conditions. Some valves and manifolds have sanitary designs and materials suitable for food processing, eliminating need to house pneumatic valves in remote stainless-steel enclosures with long tubes running to the actuators. Rexroth makes a valve system that fulfills IP69K
requirements. This system enables a significant reduction in tube lengths by allowing it to be placed directly around the actuators in the food and beverage industry, something that is not normally possible due to high-pressure cleaning requirements.

Innovative pneumatics modules with high energy density offer the cycle time advantages of decentralized automation structures and also lower air consumption up to 35%. These very compact components are so small and lightweight that they can be integrated directly on the actuators.

C. Avoid using excess pressure

Pneumatic systems frequently waste energy by supplying higher pressure than an actuator needs. For instance, in many applications cylinders either push or pull a load, but not both. Yet most often machines use the same pressure for both extend and retract strokes, which is extremely inefficient.

Using pressure regulators to supply the right pressure for each task can lower energy consumption by more than 25%. For instance, “smart” regulators combine digital control electronics with proportional valves. They constantly compare preset pressure limits with actual values to ensure exact metering.

Rexroth’s term for this is energy on demand, based on decentralized intelligence to adapt the pressure individually to needs and thus raising energy efficiency. The pressure profile of an actuator’s movement is divided into different phases: Start, movement, end and return stroke. Start and end phases usually require high energy, while movement and return stroke phases can be performed with a significantly lower pressure.

Even if the reduced pressure usage distance appears short, it is sufficient enough to optimize the motion and to minimize hard end position stops. When many thousand repetitions of the movement are performed, the incremental savings accumulate to a noticeable efficiency increase of the entire process.

One concern to guard against: operators commonly increase supply pressure on regulators in hopes of improving performance, but this wastes significant amounts of money in air and operating costs for no actual benefit – if components are sized correctly. It is important to monitor and ensure machine pressure remains within designated limits to avoid wasting energy.

D. Minimize leakage

Every pneumatic system can save energy by avoiding leaks. Statistics from the Dept. of Energy suggest the problem is widespread: the average facility, estimates show, has 30 to 35% leakage if it hasn’t taken recent action. Valves and deteriorated seals are two common sources. Some valve designs, such as lapped-spool valves with metal seals, have inherent internal leakage that is constant as long as air is supplied to the valve. Switching to comparable valves with soft seals can significantly reduce leakage.

Another source of leaks is deterioration of seals. If standard seals are observed to degrade, consider extreme-service seals like Viton, Teflon, or polyurethane.

Modern air-preparation units are available with an integrated air-volume sensor. The sensor emits an electrical pulse each time a specific volume of compressed air has passed through the air-preparation package. The electrical pulse signals can be totaled by the controller and therefore actual air consumption (and energy costs) can be calculated for the machine over a period of time.

This also lets users detect increases in machine air consumption that indicate developing leaks or nonscheduled changes to the operating pressures for the motions of the machine. The real life cost of leakage and over pressurization can be counted as well as the cost savings from correcting these problems.

According to National Resources Canada, small leakages in compressed air systems can add up to significant costs. For example, a single leak as small as 1/16 in. on a compressed air system running 24/7 at 125 PSI can cost over $1000/yr. That’s for a single leak.

Multiply those numbers by several leaks and you’re talking serious money, notes a Festo quality engineer. “When you go into a plant and hear the leaks,” he says. “That’s just money being burned up.”

Festo offers customer services including leak detection, air quality and similar air auditing services. The company also offers a new system for monitoring and diagnosing sources of air consumption in pneumatic systems. It includes pressure and flow sensors, a diagnostic controller and visualization tools so that users can to detect and fix air problems early. The company estimates optimizing application of pneumatic components coupled with proper system maintenance can lower air consumption up to 60%. At that rate, return on investment averages around six months.

CHAPTER 4

COMPONENTS DESCRIPTION

1. PNEUMATIC CYLINDER

Pneumatic cylinder(s) (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.
A. Types of Pneumatic Cylinder

Although pneumatic cylinders will vary in appearance, size and function, they generally fall into one of the specific categories shown below. However, there are also numerous other types of pneumatic cylinder available, many of which are designed to fulfill specific and specialized functions.

Single-acting cylinders

Single-acting cylinders (SAC) use the pressure imparted by compressed air to create a driving force in one direction (usually out), and a spring to return to the “home” position. More often than not, this type of cylinder has limited extension due to the space the compressed spring takes up. Another downside to SACs is that part of the force produced by the cylinder is lost as it tries to push against the spring.

Fig 3: single acting cylinder with spring return

Double-acting cylinders

Double-acting cylinders (DAC) use the force of air to move in both extend and retract strokes. They have two ports to allow air in, one for outstroke and one for instroke. Stroke length for this design is not limited, however, the piston rod is more vulnerable to buckling and bending. Additional calculations should be performed as well.

Fig 4: double acting cylinder

Multi-stage, telescoping cylinder

Telescoping cylinders, also known as telescopic cylinders can be either single or double-acting. The telescoping cylinder incorporates a piston rod nested within a series of hollow stages of increasing diameter. Upon actuation, the piston rod and each succeeding stage “telescopes” out as a segmented piston. The main benefit of this design is the allowance for a notably longer stroke than would be achieved with a single-stage cylinder of the same collapsed (retracted) length. One cited drawback to telescoping cylinders is the increased potential for piston flexion due to the segmented piston design. Consequently, telescoping cylinders are primarily utilized in applications where the piston bears minimal side loading.

Fig 5: multi stage and telescopic cylinder

B. Piston

A piston is a component of reciprocating engines, reciprocating pumps, gas compressors and pneumatic cylinders, among other similar mechanisms. It is the moving component that is contained by a cylinder and is made gas-tight by piston rings. In an engine, its purpose is to transfer force from expanding gas in the cylinder to the crankshaft via a piston rod and/or connecting rod. In a pump, the function is reversed and force is transferred from the crankshaft to the piston for the purpose of compressing or ejecting the fluid in the cylinder. In some engines, the piston also acts as a valve by covering and uncovering ports in the cylinder.

Fig 6: piston
C. Piston Cylinder

The piston-cylinder apparatus is a solid media device, used in Geosciences and Material Sciences, for generating simultaneously high pressure (up to 6 GPa) and temperature (up to 1700 °C). Modifications of the normal set-up can push these limits to even higher pressures and temperatures. A particular type of piston-cylinder, called Griggs apparatus, is also able to add a deviatoric stress on the sample. The principle of the instrument is to generate pressure by compressing a sample assembly, which includes a resistance furnace, inside a pressure vessel. Controlled high temperature is generated by applying a regulated voltage to the furnace and monitoring the temperature with a thermocouple. The pressure vessel is a cylinder that is closed at one end by a rigid plate with a small hole for the thermocouple to pass through. A piston is advanced into the cylinder at the other hand.

D. Pneumatic Actuator

A Pneumatic actuator mainly consists of a piston or a diaphragm which develops the motive power. It keeps the air in the upper portion of the cylinder, allowing air pressure to force the diaphragm or piston to move the valve stem or rotate the valve control element.

E. Directional Control Valves

Directional control valves are one of the most fundamental parts in hydraulic machinery as well as pneumatic machinery. They allow fluid flow into different paths from one or more sources. They usually consist of a spool inside a cylinder which is mechanically or electrically controlled. The movement of the spool restricts or permits the flow, thus it controls the fluid flow.

F. Servo Valves

Servo valves (or servo valves) provide closed loop flow or pressure response to an electrical or electronic control signal. They can be infinitely positioned to control the amount, pressure and direction of fluid flow. The distinction between servo valves and proportional valves is inconsistently defined, but in general, servo valves provide a higher degree of closed-loop control. Both types of valve are used for control in pneumatics, hydraulics, gas, steam, water transport, and other specialized applications. In a conventional open-loop force control system, servo valves output pressure, which is applied to the hydraulic piston that drives the load. The controlled pressure may be the differential between the two sides of the load actuator or it may be the pressure in a single line connected to one side of the load actuator.

E. Pneumatic Tubes

Pneumatic tubes (or capsule pipelines; also known as pneumatic tube transport or PTT) are systems that propel cylindrical containers through networks of tubes by compressed air or by partial vacuum. They are used for transporting solid objects, as opposed to conventional pipelines, which transport fluids. Pneumatic tube networks gained acceptance in the late 19th and early 20th centuries for offices that needed to transport small, urgent packages (such as mail, paperwork, or money) over relatively short distances (within a building, or at most, within a city). Some installations grew to great complexity, but were mostly superseded. In some settings, such as hospitals, they remain widespread and have been further extended and developed in the 21st century.
F. Air Compressor

An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its engineered upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank. An air compressor must be differentiated from an air pump which merely pumps air from one context (often the surrounding environment) into another (such as an inflatable mattress, an aquarium, etc.). Air pumps do not contain an air tank for storing pressurized air and are generally much slower, quieter, and less expensive to own and operate than an air compressor.

Displacement Type

There are numerous methods of air compression, divided into either positive-displacement or roto-dynamic type.

Positive displacement

Positive-displacement compressors work by forcing air into a chamber whose volume is decreased to compress the air. Once the maximum pressure is reached, a port or valve opens and air is discharged into the outlet system from the compression chamber. Common types of positive displacement compressors are

- Piston-type: air compressors use this principle by pumping air into an air chamber through the use of the constant motion of pistons. They use one-way valves to guide air into and out of a chamber whose base consists of a moving piston. When the piston is on its down stroke, it draws air into the chamber. When it is on Technical Illustration of a two-stage air compressor its up stroke, the charge of air is forced out and into a storage tank. Piston compressors generally fall into two basic categories, single-stage and two-stage. Single stage compressors usually fall into the fractional through 5 horsepower range. Two-stage compressors normally fall Technical Illustration of a portable single-stage air compressor into the 5 through 30 horsepower range. Two-stage compressors provide greater efficiency than their single-stage counterparts. For this reason, these compressors are the most common units within the small business community. The capacities for both single-stage and two-stage compressors is generally provided in horsepower (HP), Standard Cubic feet per Minute (SCFM)* and Pounds per Square Inch (PSI). *To a lesser extent, some compressors are rated in Actual Cubic Feet per Minute (ACFM). Still others are rated in Cubic Feet per Minute (CFM). Using CFM to rate a compressor is incorrect because it represents a flow rate that is independent of a pressure reference. i.e. 20 CFM at 60 PSI.

- Rotary screw compressors: use positive-displacement compression by matching two helical screws that, when turned, guide air into a chamber, whose volume is decreased as the screws turn.
- Vane compressors: use a slotted rotor with varied blade placement to guide air into a chamber and compress the volume. This type of compressor delivers a fixed volume of air at high pressures.

Dynamic displacement

Dynamic displacement air compressors include centrifugal compressors and axial compressors. In these types, a rotating component imparts its kinetic energy to the air which is eventually converted into pressure energy. These use centrifugal force generated by a spinning impeller to accelerate and then decelerate captured air, which pressurizes it.

CHAPTER 5

WORKING PRINCIPLE

WORKING

In this process of expanding the bus we use compressed air to pass through the solenoid valve. And then the compressed air is allowed to pass through the cylinder. With the maximum of 3bar (Pressure) is allowed into the cylinder for the expansion. The amount of pressure inside the cylinder will be 1.75bar is applied to expand the bus. By using hooks the compression the bus after the expansion to get back to the normal position. And then finally the process is to apply the enlargement in the back portion of the bus for the load handling. So the working is tends to have an alternate way to develop this project to have an innovative method in the future. At this point, skilled artisans should appreciate that the number
and arrangement of bus trunks and peripheral devices shown is merely representative. As will be seen in other embodiments, these will vary. They may be as few as one or as great as three or more with adaptability for many more. It is preferred the main hub controller embodies a commercially available busses are interfaced with functional components that accommodate the physical and electrical environments in which straddle vehicles are regularly operated.

CHAPTER 6

CONCLUSION

The goal of this project is to produce an interactive and flexible design for the vehicular marketplace. This main goal of this project is to increase the seating capacity of the bus by expanding a certain portion of back panel of bus. The above proposed model is easy to implement considering the available technology infrastructure. Moreover, with the advancement in the technology every now and then, this system can be made more and more robust by adding expandable features. Thus, the system functioning is efficient and is recommended for commercial implementation.

REFERENCES


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