

FABRICATION OF BUILT-IN RETRACTABLE HOSE MECHANISM FOR
DOMESTIC USAGE

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For my beloved mother and father

thank you for your kindness and endless support



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ABSTRACT

Industry hose is one of the common product that have been used in all places. However, the usage of the product could affect the property such as hose damage, poor hose cleanliness and limit the hose life span. Nowadays, the retractable mechanism is one of the common mechanism used in daily life. There is some improvement can be done to the design itself to fulfil the daily activity. This report presents the methods to design the conceptual of built-in hose mechanism, and then to perform necessary analysis and finally fabricate the chosen mechanism. Existing design was studied for upgrading to a new efficient design. Three concepts of mechanism were compared based on the type of mechanism used and sketched. One from the concepts is selected and designed by using Pahl and Beitz design process. The design was drawn and analysed by the help of Solidworks software. The design then successfully fabricated based on the criteria selected and tested. At the end, a set of information on related design evaluation to be analysed according to the study. Built-in retractable hose mechanism can be applied on hose usage in industrial area. From the research and methodology conducted, the new design had successfully been fabricated to be used for domestic usage.

ABSTRAK

Hos industri adalah salah satu produk biasa yang telah digunakan di semua tempat. Walau bagaimanapun, penggunaan produk boleh menjejaskan harta benda seperti kerosakan hos, kebersihan hos miskin dan had jangka hayat hos. Pada masa kini, mekanisme tarikan semula adalah salah satu mekanisme yang biasa digunakan dalam kehidupan seharian. Terdapat beberapa perbaikan yang boleh dilakukan untuk reka bentuk itu sendiri untuk memenuhi aktiviti harian. Tesis ini membentangkan kaedah untuk merangka konsep *built-in* mekanisme hos, dan kemudian melakukan analisis yang diperlukan dan akhirnya mengarang mekanisme yang dipilih. Reka bentuk yang sedia ada telah dikaji untuk menaik taraf kepada reka bentuk yang cekap dan baru. Tiga konsep mekanisme dibandingkan berdasarkan jenis mekanisme yang digunakan dan reka bentuk lakaran. Salah satu daripada konsep telah dipilih dan direka dengan menggunakan proses reka bentuk Pahl dan Beitz. Reka bentuk dilakar dan diuji oleh bantuan perisian Solidwork. Reka bentuk kemudian berjaya dibuat berdasarkan kriteria yang dipilih dan diuji. Pada akhirnya, satu set maklumat mengenai penilaian reka bentuk berkaitan akan dianalisis mengikut kajian. Mekanisme penarikan semula hos boleh diaplikasikan dari segi penggunaan hos dalam kawasan perindustrian. Daripada penyelidikan dan metodologi yang dijalankan, reka bentuk baru telah berjaya direka untuk kegunaan domestik.

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LIST OF SYMBOL AND ABBREVIATIONS

cm	-	Centimeter
mm	-	Millimeter
m	-	Meter
r	-	Radius
d	-	Diameter
s	-	Second
%	-	Percent
J	-	Joules
E	-	Energy
W_{out}	-	Work Output
F	-	Force
N	-	Newton
RM	-	Ringgit Malaysia
UTHM	-	Universiti Tun Hussein Onn Malaysia

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PTTA UTHM
PERPUSTAKAAN TUNKU TUN AMINAH

CHAPTER 1

INTRODUCTION

This chapter briefly shows the general idea of the research study, which consist of the background of the project, the problem statement to come with the idea, the objectives need to be achieved and the scopes of the study and lastly the Gantt chart that shows the planning of this study.

1.1 Background of Research Study

Retractable mechanism is a mechanism that allows retractable movement when the part either hose or cord, being pulled towards an anticlockwise direction to perform a function. Many problems arise when people want to deal with built-in hose such as hose damage, poor hose cleanliness and limitation of hose life span. In this case of research, the purpose is to propose the concept of retractable hose mechanism for domestic usage.

Nowadays, there are many arts or products that used the concept of the mechanism. Basically, the retractable mechanism was substituted on the product to perform the retractable movement in order to roll a hose back to its normal position. When the hose is pulled, Then, the hose is retracted back to original position after usage. The movement of the hose or cord back to its original position can be locked by manual or automatic operation without interrupting the function itself. The concept of the built-in mechanism should minimize the complications during handling the hose. There are variety of retractable mechanisms that can be implemented into the hose. The concepts of the mechanism are proposed and viewed as a general idea. Thus, the selected mechanism should fulfil the industry's feedback and requirement to produce the actual product.

From the selected mechanism, the design process should follow the criteria needed and the metrics required. The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product that meets certain criteria and accomplishes a certain task. Background researches were made and should meet with the specify requirements. Hence, the quality of the product can be comprehended with the suitable processes.

To finalize the design, fabrication process takes place. Fabrication is a process of building a structure and assembling. The construction of the structure usually referred to the engineering drawing and if awarded the contract will build the product. The drawing should emphasize precise measurements hence the fabrication process takes place. The processes included in the fabrication such as cutting, bending, assembling and welding. Figure 1.1 shows an example of industrial hose reel commonly used in local industries.

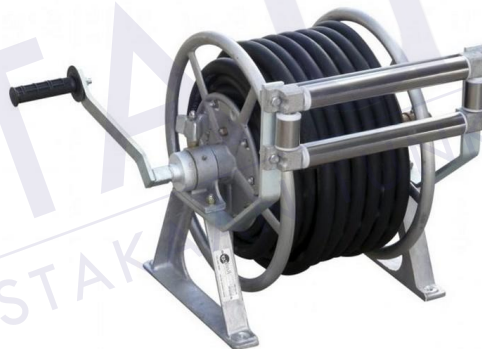


Figure 1.1: Industrial Hose Reel

1.2 Problem Statement

Nowadays, the existing design of the mechanism always comes with the product itself. For example, a retractable hose mechanism always comes with the respective hose and the mechanism can only be used for the product or that specified hose. For some cases in daily life, we may need a kind of tool or mechanism that can be used to perform the same function, but to be used in industrial area and can be the most efficient way to use it.

The daily usage of hose usually has several complications that can affect the hose and hose reel and damaged after period of usages. Usually hoses are exposed to the environment and water thus corrosion and wear can affect the life of the hose. Poor hose cleanliness and hose damage are one of the main reasons to make an alternative solution to reduce the problem occurred.

Usually, the designing process is one of the process to ensure the criteria needed and metrics required. Engineers do not always follow the engineering design process steps in order, one after another. It is very common to design something, test it, find a problem, and then go back to an earlier step to make a modification or change the design. This way of working is called iteration, and it is likely to occur in every study.

1.3 Objectives

The objectives of the research study of the retractable mechanism are listed as below:

- a) To propose the concept of the retractable mechanism for built-in hose.
- b) To appraise the built-in retractable hose mechanism according to the criteria needed and metrics required.
- c) To fabricate the retractable mechanism according to the selected concept.

1.4 Research Scope

- a) This research focused on the problem faced when handling hose in public lavatory.
- b) The three designs were compared in terms of functioning mechanism and thus scoring and screening method was conducted to choose one of them to be analysed as ideal product.
- c) The three conceptual designs were designed by using SolidWorks software and the optimum design was chosen for fabrication and become a product.
- d) The design was made to prevent the hose from damage, failure and dirt.

1.5 Significance of Study

By achieving objectives in the research study, the best mechanism could be adapted and give benefits to the desired area such as industrial area. For the main problem in handling the hose, the problem can be solved by using the selected mechanism and contributes for reducing the man power and time consumption.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter explained about the related studies to the research topic. Before preparing the design of retractable hose mechanism, it is important to understand the concept of related mechanisms that can be implemented. This study covered usage of the hose in domestic area and the hose mechanism method that commonly used by hose users. For the mechanism system, the study focussed on the traditional and modern equipment method that is often used at the present time and the way it works.

2.2 Conceptual Design of Hose Function and Mechanism

A hose is defined as a flexible hollow tube and designed to carry fluids from one location to another. Hoses are also sometimes called pipes (pipe usually described as a rigid tube, whereas a hose is commonly known as a flexible one), or more generally tubing. Usually, the hose is shaped cylindrically with a circular cross section to provide evenly distributed pressure forces around the circumference around the pipe. In term of comparison, the cylindrical pipes are more suitable compare to square pipes due to cylindrical pipes are more easily bent. For industrial hose, it comes with different pressure for industry needs. The colour of the hose will determine the type of pressure such as low, medium or high for the intended use.

The material of hoses are made of extruded synthetic rubber or soft plastic, often reinforced with an internal web of fibers. The result of these materials show that hoses are flexible and their smooth exterior facilitates pulling them past trees, posts and other obstacles. Hoses are also generally tough enough to survive scraping on rocks and being stepped on without damage or leaking. (Blue Gentian, 2014)

Usually for traditional method, the hose is commonly handled by rolling up or dispensing the hose after usage. This process of the hose dispensing from the casing to be a bit rough as it required to put a little bit of force into pulling on the hose at times. From this observation, retractable mechanism can be added to minimize the energy consumption and made the hose is easier to use. This built-in mechanism is applied by comprehending the relatable concepts of retractable mechanism to the hose. There are variety of retractable mechanisms that can be built on the hose. Thus, the selected mechanism should meet the requirement of the industry hose and the design shall follow from the customer's feedback. Figure 2.1 shows garden hose usually applied on hose reel which is shown in Figure 2.2.



Figure 2.1: Garden Hose



Figure 2.2: Hose Reel

2.2.1 Retractable Mechanism

A pullback motor is a simple clockwork motor used in toy cars. Pulling the car backward winds up an internal spiral spring. When released, the car is propelled forward by the spring. When the spring has unwound and the car is moving, the motor is disengaged by a clutch or ratchet and the car then rolls freely onward. (Robert Hooke, 1676)

Most of these cars are otherwise free-rolling. Winding them up requires them to be pushed downwards, engaging the clutch. As the motor is only engaged for winding whilst held down, the complete winding must be completed in one pass, unlike the flywheel motor. A few motors have an internal one-way clutch that allows winding with a back-and-forth motion.

This can be related to the retractable hose mechanism. Since most of the hoses are attached to the reel, the pull-back motor mechanism can be added thus the spiral spring can be acted as clockwork motor and retractable mechanism is created. Figure 2.3 shows spiral spring implemented in the toy car or pull-back motor.



Figure 2.3: Spiral spring implemented in the pull-back motor

2.2.2 Ratcheting Mechanism

A ratchet is a mechanical device that allows continuous linear or rotary motion in only one direction while preventing motion in the opposite direction. Ratchets are widely used in machinery and tools. Though something of a misnomer, "ratchet" is also often used to refer to ratcheting socket wrenches, a common tool with a ratcheting handle. A ratchet consists of a round gear or linear rack with teeth, and a pivoting, spring-loaded finger called a pawl that engages the teeth. The teeth are uniform but asymmetrical, with each tooth having a moderate slope on one edge and a much steeper slope on the other edge.

When the teeth are moving in the unrestricted direction, the pawl easily slides up and over the gently sloped edges of the teeth, with a spring forcing it into the depression between the teeth as it passes the tip of each tooth. When the teeth move in the opposite or backward direction, however, the pawl will catch against the steeply sloped edge of the first tooth it encounters, thereby locking it against the tooth and preventing any further motion in that direction. Figure 2.4 shows a ratchet gear used in ratcheting mechanism in a mechanical device.

Because the ratchet can only stop backward motion at discrete points, a ratchet does allow a limited amount of backward motion. This backward motion which is limited to a maximum distance equal to the spacing between the teeth is called backlash. In cases where backlash must be minimized, a smooth, toothless ratchet with a high friction surface such as rubber is sometimes used. The pawl bears against the surface at an angle so that any backward motion will cause the pawl to jam against the surface and thus prevent any further backward motion. Since the backward travel distance is primarily a function of the compressibility of the high friction surface, this mechanism can result in significantly reduced backlash. Figure 2.5 shows the ratcheting mechanism that involving pawl, shaft and ratchet wheel and Figure 2.6 shows an example of backlash problem in ratcheting mechanism's operation.

From this theory, ratcheting mechanism can be related to the retractable hose mechanism. It can be applied as the hose are dispensed, the ratchet wheel act as an indicator to make easier for user to use the product such that the hose dispenses in uniform and less damage.



Figure 2.4: Ratchet gear used for the mechanism

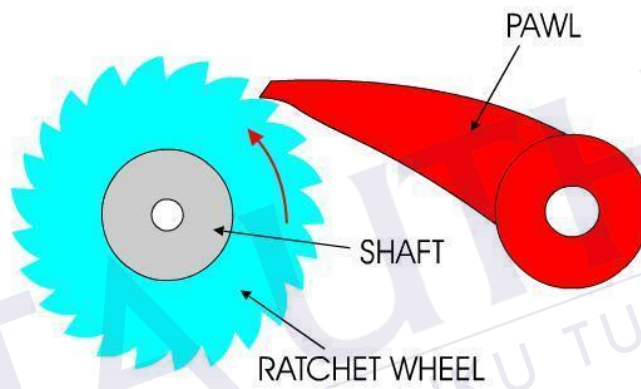


Figure 2.5: Ratcheting Mechanism

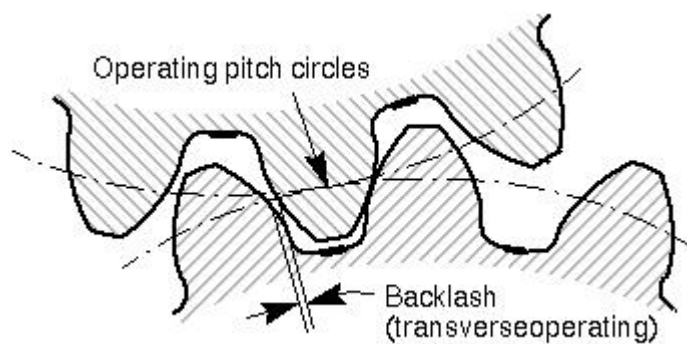


Figure 2.6: Backlash problem in ratcheting mechanism.

2.2.3 Existing Product

Define task is the initial stage to briefly define the product purpose and task involved in the product design. In this study investigation and research to improve my design of the fabricated product had been conducted. Retractable hose mechanism is used for domestic usage to solve the problems arise when it comes to handling industrial hose and proper treatment. Some researches have been done due to overcome the problem existed. By using this newly invention, customer can minimize their time to handle the industrial hose and expand the life span of the hose. Thus, this semi-automatic method is more efficient compare to manual method in a short of time.

It is designed to alleviate or minimize the problems arise when it comes to handling the industrial hose in a given short of time. Thus, the handling process should be faster and without using too much force or manpower. In addition, it should be economical which is cheap in terms of materials used and can be use anywhere. This product and the system have been designed to facilitate the users especially for any industry which is easy use product and easy to handle it.

There are few patents could be used to develop the product. Patent search is a mechanism and method that already patented in the past and nowadays. The purpose of finding patent search is to find the related mechanism that will used in producing the product.

2.2.4 Patents related to hose mechanism

Figure 2.7 shows the first patent related to the hose mechanism; which is the self-storing cord and hose reel assemblies. It used for long extendable cords, signal cables, water hoses, air hoses and like which preferably remain attached or connected at their source present a problem relative to storage during periods in which they are not in use. Telephone cords have been provided in spirals so that they may be stretched out for use with the flexibility of the spiralled cord permitting it to retract partially to a more manageable length when not in use. Cords of this type, however, readily become twisted and tangled from the figure seen (John N. Smith,1983)

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