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# Re-energizing the fence

**Designing a Desirable Electric Fence System**

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## ABSTRACT

The intent of this Master of Design study is to utilise design-aided research to develop a desirable, conceptual livestock electric fencing system in conjunction with Gallagher animal management Ltd.

Proudly known worldwide for their innovative agricultural products, Gallagher have identified an opportunity for a fence system to be marketed towards the comparatively niche industry of hobby/lifestyle farming, and provide hobby farmers with a fencing system that they can construct without requiring heavy machinery or fencing experience. This could provide a sound opportunity for Gallagher to maintain their industry status and provide a product that is really desirable to the market users.

This investigation intends to develop an electric fence design proposal, primarily for the European hobby farming market, which obtains the sought after market differentiation and innovation by proposing a new livestock fence concept that is desirable to the customer; commencing from the point of purchase, through to its installation and operation. A new product that will give the customer the traditional satisfaction of constructing their fence themselves without machinery and with a system that the user finds intuitive and physically less arduous to install, simple to operate and visually pleasing within a lifestyle farm environment.

The contemporary theory papers regarding Affective design (Warell, 2001) and 'utilitarian' and 'hedonic' design principles (Chitturi, et al. 2007) support the investigation's research methods used; determining existing product experiences through market analysis, observation, user interviews and focus

groups, followed by structured concept generation, prototypes and iterated design development.

The unresolved issues and desirable aspects identified throughout the research methods were categorised into 'performance' and 'experience' criteria attributes which the methods stated that the design required to produce a 'desirable' design proposal, and accomplish the research aim.

The final design was evaluated against the research criteria, based on the research knowledge. The testing method indicated that the fence design proposal had fulfilled most of the experience and performance design criteria, successfully achieving the research aim.

The investigation not only fulfilled the aim stated to create a desirable electric fence system, but additionally highlights the advantages of applying 'affective design' theories to this particular fencing industry which itself is so wrought by utilitarian tradition.

**Keywords:** Affective design, Desirable, Usability, Product experience, Fence systems.

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## I.O STUDY BACKGROUND

The livestock electric fencing industry has reached a level of maturity in the marketplace where noticeably little differentiation separates the Gallagher fencing products from their competition. As competitor product similarities have gradually increased, it becomes clear that additional attributes and new innovative ideas are needed to provide distinction to the fencing industry.

The hobby/lifestyle farming market is a particular niche in the industry which could provide an optimum opportunity for Gallagher to target a new, distinguishable and innovative product towards. Gallagher have identified the hobby farmer's need for an *easy to install permanent fence system*, which could be installed *without requiring heavy machinery or fencing experience*. Two factors crucial to fence construction which hobby farmers tend to lack.

Applied design principles could give the new fencing system the edge it needs to not only create market differentiation, but provide a greater product experience to the user.

## 1.1 COMPANY INVOLVEMENT

This Master of Design investigation collaborates with the following companies and design research organisations; Affect/GIPI, and Gallagher Animal Management Ltd.

### 1.2. AFFECT

Established in 2005, AFFECT the Centre for Affective Product Design, is a design research centre belonging to Massey University's College of Creative Arts, Wellington, New Zealand. To increase New Zealand industry knowledge and understanding of affective product design, the Growth and Innovation Pilot Initiative programme (GIPI) was launched. Affect's mission statement is: "To increase knowledge in affective design through practice and to transfer this knowledge to industry, the research community, and the tertiary education"

### 1.3 GALLAGHER ANIMAL MANAGEMENT LTD.

Gallagher Group is based in Hamilton, New Zealand, and has been developing and manufacturing and marketing world leading farming products since the 1930's. Bill Gallagher Snr, the founder of the company, invented the worlds first electric fence system on his own farm in 1938. Originally designed to keep his horse off his car, the electric fence concept has been further developed to control and contain livestock on farms internationally ever since.



Fig 001. Affect logo

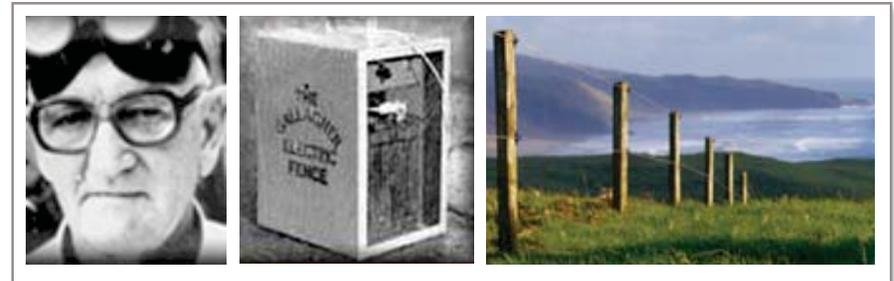


Fig 002. Bill Gallagher Snr.



Fig 003. Gallagher logo.

## 2.0 CENTRAL PROPOSITION

This Master of Design study utilises applied design research to develop a desirable, conceptual livestock electric fencing system for Gallagher Animal Management.

The research seeks to develop a new permanent livestock fence concept with a focus on the affective design features of the component system. The purpose is to improve product desirability, usability and experience within the overall constraints of existing farming practices, technology and marketing channels.

## 2.1 RESEARCH AIM

To design a *desirable* livestock electric fence system.

## 2.2 RESEARCH OBJECTIVES

**OBJECTIVE 1:** Review existing Gallagher fencing products that relate to this project and develop an appreciation of product branding values, product characterisation and attributes. Use this contextual information to inform and review applied design research development in terms of brand appropriateness and fit.

**OBJECTIVE 2:** Review and analyse current permanent electric fence products on the market in terms of desirability, usability and product experience. Develop design criteria for applied design research.

**OBJECTIVE 3:** Review affective design literature and develop an understanding of current state of knowledge. Consider how current theory could be applied to the design of a permanent electric fence. Use this theoretical base to inform design criteria and applied design research.

**OBJECTIVE 4:** Create a conceptual prototype as a result of the research and criteria conducted.

**OBJECTIVE 5:** Evaluate the prototype to inform further design changes/optimisations.

## 2.3 RESEARCH QUESTIONS

### OBJECTIVE 1



- Q.A** What company values are important to Gallagher that influence design?
- Q.B** What aesthetic, usability and experiential characteristics are typically manifest in a Gallagher product?
- Q.C** What aesthetic, usability and technical characteristics and attributes should be included in a Gallagher permanent electric fence?

### OBJECTIVE 2



- Q.D** What defines the target customer?
- Q.E** What are the current fencing related products on the market today?
- Q.F** How are livestock fences currently used?
- Q.G** What fencing related attributes are important, pleasurable or unfavourable to customers/users of fencing products?

### OBJECTIVE 3, 4



- Q.H** How can the fence system design be improved to achieve a more desirable product experience for the user?
- Q.I** What design principles should be used to create a fencing system that the customer finds intuitive to install, assemble and operate?
- Q.J** What affective design principles are best used to improve the overall design?

### 3.0 THE BACKGROUND OF THE FENCE

The means of containing domesticated livestock has evolved slowly throughout history. From shepherds keeping watch over their herd or utilising the landscape itself to help contain, through to the old stone wall and finally, the electric fence.

While livestock containment systems have improved and become more technically advanced since the stone wall, there remains room for further improvement.

Possibly the most substantial development in fencing was the electric fence, which provided a cheaper alternative compared to the rigid, high tensile farm fences, is easier to construct, and in most cases more reliable. (Gallagher, 2007)

The challenge of the investigation is to invigorate this foundation of agriculture, and propose a product that the owner can build themselves and continue to feel proud of.

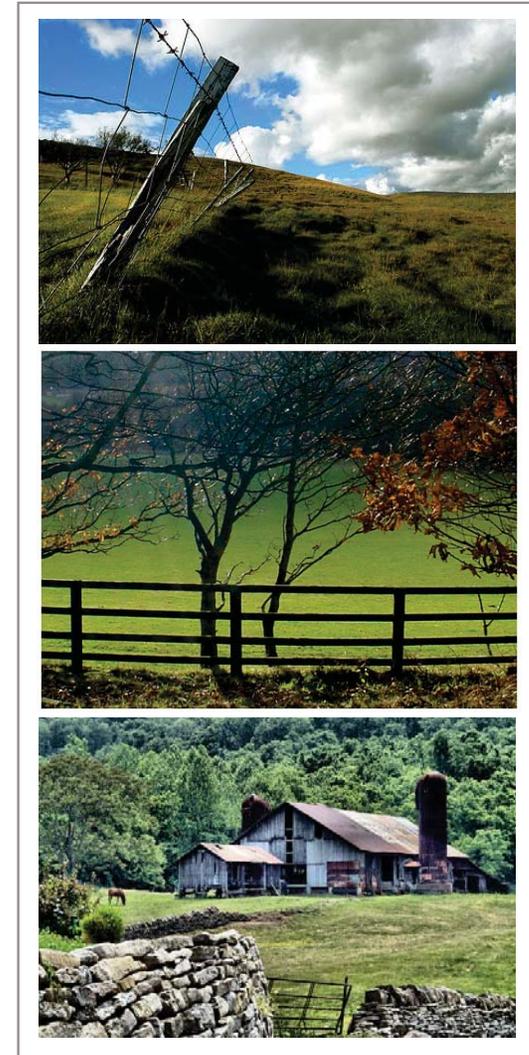


Fig 004. Fence context

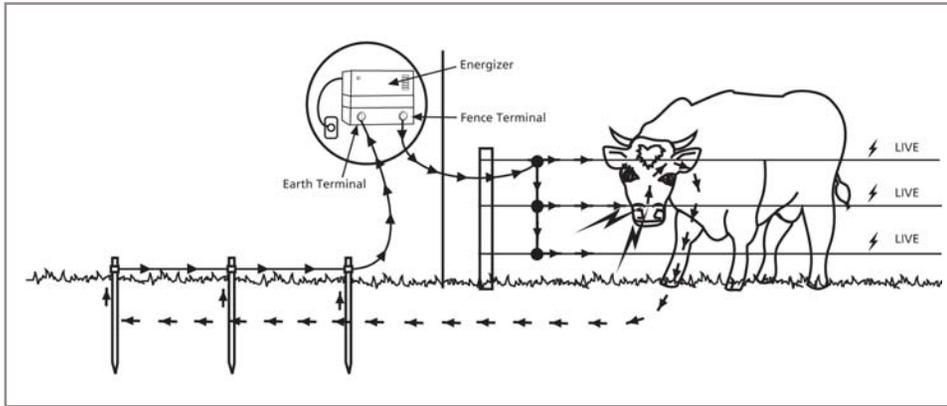


Fig 005. How an electric fence works

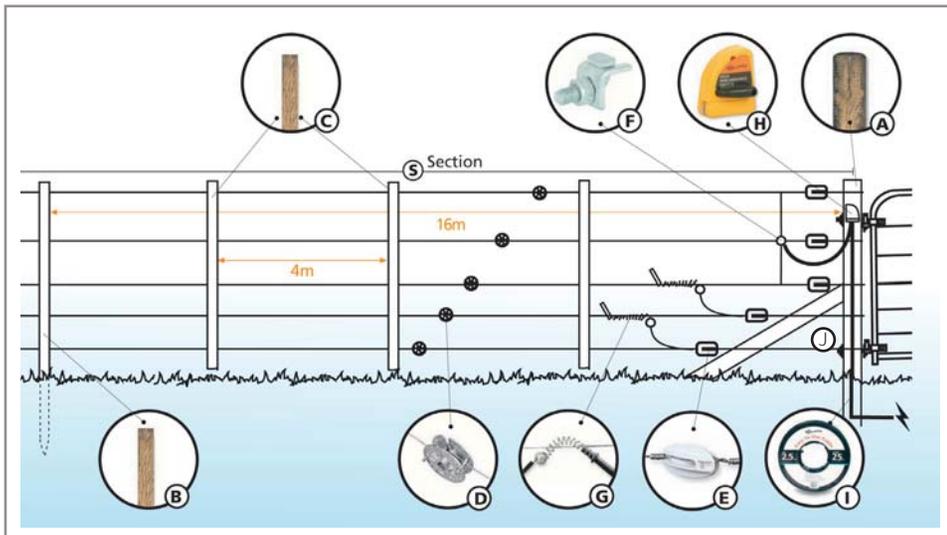


Fig 006. Permanent Cattle & sheep fence.

### 3.1 CURRENT PERMANENT ELECTRIC FENCE

A pulsed electric current is sent along the fence wire, from an energizer which is earthed. When the animal touches the fence it completes the circuit between the ground and receives a short, sharp but safe shock. The shock is sufficiently memorable that the animal never forgets that it is best to avoid the fence line.

The basic Gallagher electric fence consists of the following components:

- A** End Post/ Corner Post/ Strainer post; the strongest part of the fence which bears the tension. Installed into the ground.
- B** Line post; post inserted into the ground along the fenceline holding up the wires.
- C** Batons (optional); Batons are held up by the wire. They maintain the vertical wire spacing along the fenceline, and also aid visibility of the fence.
- D** Strainer; applies and maintains the tension on the fence wire. Can be adjusted to apply more or less tension.
- E** Insulators; Insulate the electric current and hold the wire in position.
- F** Clamp; Links multiple wires to the current.
- H** Cut-out switch; Turns the current to the fence on or off.
- I** Lead-out cable/ Under-gate cable; cable running from the energizer to the fence to provide the electric current.
- J** Stay/Brace; supports the End Post

## 3.2 MARKET ANALYSIS

This section analyses permanent fencing systems identified by Gallagher that represent the current state of design.

The products analysed were:

- Hardware
- 'Mega-Anchor', Mega Anchor Australia
- 'Speed Brace', New Farm Products Inc.
- 'Geotek Mule', Geotek Inc.
- State of the art: 'Virtual fencing' Commonwealth Scientific and Industrial Research Organisation (CSIRO)

### 3.2.0 MARKET ANALYSIS: HARDWARE

For Gallagher and the majority of livestock fencing companies it is standard to manufacture the components and hardware for the end strain post, and line posts. Because the products all cater for the same job and application, share the same function and share a very similar aesthetic, it can be very hard to identify which product belongs to which brand. For example the Fig. 007 illustrates the standard Gallagher insulators and their major competitor's insulators.

Because of the similarities and distinct lack of differentiation it would be difficult for the consumer to decide which is the better product, and to tell the brands apart, relying on the product's packaging rather than the product itself. It becomes clear that the hardware and components would benefit greatly from an established visual identity.



Fig. 007. Gallagher insulators vs. competitor brand.

## 3.2.1 MARKET ANALYSIS

### MEGA-ANCHOR

The Mega anchor has won numerous awards in the construction industry for its ability to create a solid ground anchoring system. Taking the same principle, Mega-Anchor was applied to the fencing industry. The foundation works by bashing or jack hammering in a central post, then the 'Anchor' (pictured Fig. 007) is screwed in place to the central post and three piles are driven into the ground with the anchor guiding them down, and screwed in to place.

#### ⊕ ADVANTAGES

- Structurally very strong.
- Re-usable.
- No digging required.

#### ⊖ DIS-ADVANTAGES

- Physically strenuous to install.
- Steel prices are continuing to rise, which could increase unit cost.  
(ASSOCHAM, 2008)
- Industrial aesthetic which relates well on construction sites but lacks visual harmony in the farm context.
- Does not accommodate other components such as cut-out switches.
- Highly conductive material requiring end insulators well away from the post and stay/brace.
- No indication of brace height placement.



Fig 007. Mega-anchor 'anchor.'



Fig 008. Mega-Anchor system

### 3.2.2 MARKET ANALYSIS

#### SPEED-BRACE

The Speed Brace is a galvanised steel assembly which offers rapid installation in the field. This product would appeal to user's who want an easy system without any digging being involved as the steel T posts are hand driven in to the ground.

#### ⊕ ADVANTAGES

- Quick to install.
- Recognisable.
- Physically it is relatively easy to install.
- The line posts double as the brace.

#### ⊖ DISADVANTAGES

- Does not accommodate other componentry such as cut-out switches, and gate hinges.
- Highly conductive steel requiring end insulators well away from the post and stay/brace.
- Visually unnatural aesthetic which doesn't harmonise with its surroundings. The form also appears unprofessional and structurally weak due to the slim profile and materials used.
- No indication of brace height placement.
- Steel prices are continuing to rise (ASSOCHAM, 2008), resulting in a higher cost.



Fig. 009. Speed Brace set up and assembly

### 3.2.3 MARKET ANALYSIS

#### GEO-TEK LTD. 'MULE'

The Geo-Tek 'Mule' is a fibreglass electric fence system that markets itself as being strong enough to contain any sized animal. Steel augers are wound into the ground and the end posts are then hand driven into the ground over the auger shaft. Then for each brace/stay the same process is repeated. The line posts are hand driven into the ground.

#### ⊕ ADVANTAGES

- Strong and lightweight fibreglass components.
- No digging required for installation.
- Insulated post material requires no insulators as it doesn't earth the current.

#### ⊖ DIS-ADVANTAGES

- Complex to install the angled auger stays and position correctly.
- Very long auger shafts would be heavy for transportation.
- Does not accommodate cut-out switches.
- The fibre-glass is not recyclable and the line-posts tend to splinter harming the user.
- Physically requires a lot of effort to install.

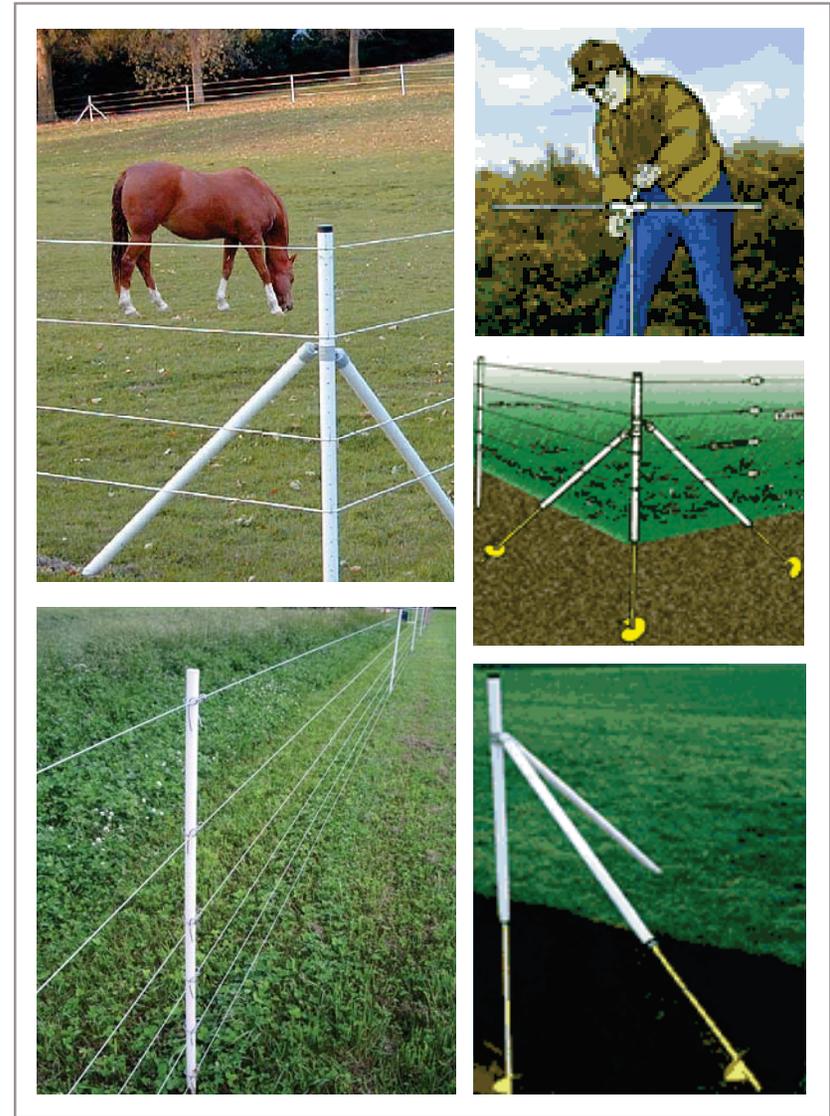


Fig. 010 Geo-Tek 'Mule' fence system



Fig. 011. CSIRO 'virtual fence' system.

### 3.2.4 MARKET ANALYSIS

#### STATE OF THE ART: CSIRO FENCELESS CONTAINMENT

Csiro are an Australian agricultural research and development company who have developed a proto-type fenceless containment system. Primarily targeted towards professional cattle farmers for the purpose of break feeding, each cow wears a collar on the neck which detects the perimeter signal, which the farmer had previously plotted via GPS. Upon reaching the set perimeter the collar emits a sound to warn the cow prior to administering a shock.

#### ⊕ ADVANTAGES

- No environmental or visual impact on the landscape whatsoever.
- Cheaper method of containment.

#### ⊖ DIS-ADVANTAGES

- A perimeter fence would still be required in case of system failure and to prevent persons or animals from intruding the containment zone.
- Psychologically the method would be more stressful for the animals comparative to the current fencing methods (particularly if a predator entered the containment zone), and training the livestock to understand the system is required.
- More testing needed to validate.

<sup>1</sup> *Break-feeding* is a method of controlling the feed intake of cattle and reducing trampling on the pasture. A single electric wire is enough to prevent livestock from pushing through onto the next break of saved pasture. R, Peden (2008).

### 3.2.5 POST COMPARISON DERIVED FROM MARKET ANALYSIS

CORNER POST/ END POST	Angle Brace	H-Brace	Mega-Anchor	Speed Brace	Geo-tek mule
					
Material	Pine and wire	Pine and wire	Galvanised steel tube	Galvanised steel	Fibreglass tube and steel
Set-up Cost	\$\$	\$\$	\$\$\$	\$\$	\$\$\$
Installation Time	🕒🕒🕒	🕒🕒🕒	🕒🕒	🕒	🕒🕒
Installation skill	<b>High</b> Digging/ramming angles, wire tying	<b>High</b> Wiretying, digging/ ramming, cutting	<b>Moderate</b> Ramming, fastening	<b>Low</b> Hand ramming, fastening	<b>Low</b> Auger screwing, fastening
Tools required	- Hydraulic rammer/ spade - Chainsaw/ saw	- Hydraulic rammer/ spade - Chainsaw/ saw	- Heavy hammer - Crescent wrench	- Hand rammer - Crescent wrench	- Screw handle - Crescent wrench
Advantages	- Strong - Environmentally friendly - Natural aesthetic	- Very Strong - Environmentally friendly - Natural aesthetic	- Strong - Long life	- Strong - Long life	- Strong - Flexible - Light weight - No insulators needed
Dis-Advantages	- Heavy - Construction required - Insulators needed at every post	- Heavy - Construction required - Insulators needed at every post	- Un-natural aesthetic - Heavy - Insulators needed at every post	- Un-natural aesthetic - Insulators needed at every post	- Un-natural aesthetic - Insulators needed at every post - Not environmentally friendly - Can cause splinters - Limited life span

Fig.012. Corner post/end post comparison chart.

Note: Csiros prototype remains in development whereby all estimations for comparison would be speculative.

### 3.2.6 POST COMPARISON DERIVED FROM MARKET ANALYSIS

LINE POST	Pine	Steel	Fibre-glass	Polypropylene	Concrete
					
Cost per post	\$\$	\$\$ increasing	\$	\$\$	\$\$
Installation Time					
Installation effort	Easy Lining up hydraulic ramming	Moderate Hand ramming	Easy-Moderate Hand Ramming	Easy-Moderate Hand ramming	Moderate Lining up hydraulic ramming
Wire attachment	\$\$ Moderate - Nailed on insulators	\$\$ Easy - Pinlock insulators	\$ Easy - Wire attachments tied by hand - screw on insulators	\$ Easy - Wire attachments tied by hand	\$\$ Moderate - Wire attachments or Pinlock insulators
Tools required	- Hydraulic rammer/ spade	- Hand Rammer	- Hand Rammer	- Hand Rammer	- Hydraulic rammer
Advantages	- Strong - Environmentally sustainable - Natural aesthetic - Long life	- Strong - Long life	- Flexible, strong - Lightweight - Transport friendly - No insulators needed	- Flexible, strong - Lightweight - Transport friendly - No insulators needed - Recycable	- Strong - Long life
Dis-Advantages	- Heavy - Transport Vehicle needed - Insulators needed at every post	- Heavy - Insulators needed at every post - Un-natural aesthetic	- Un-natural aesthetic - Not environmentally friendly - Can cause splinters - Limited life span	- Un-natural aesthetic - Limited life span	- Very Heavy - Transport Vehicle needed - Insulators needed at every post

Fig.013. Line post comparison chart.

### 3.3 LITERATURE REVIEW

The most influential papers and applicable design principles have been categorized under the following key sections in relation to product design, and this investigation:

- Desirability
- Usability
- Experience

#### DESIRABILITY

Warell's (2008) Perceptual Product Experience (PPE) framework provides a holistic understanding of how a product is experienced. The PPE framework provides a methodical analysis tool to analyse how consumers perceive products and the holistic experience between the product and the user.

Warell's PPE model describes the affective qualities of a product on an individual using two intertwined models; Representation and Presentation (see Figure 013). Each model possesses 3 modes which break-down the experience:

##### Presentation

The *Impression* mode relates to "how the product stands out" from other products and the unique characteristics which are noticeable to the users. The 'format analysis matrix' impression tool can be used to distinguish what it is in a product family or brand that creates the strongest impression.

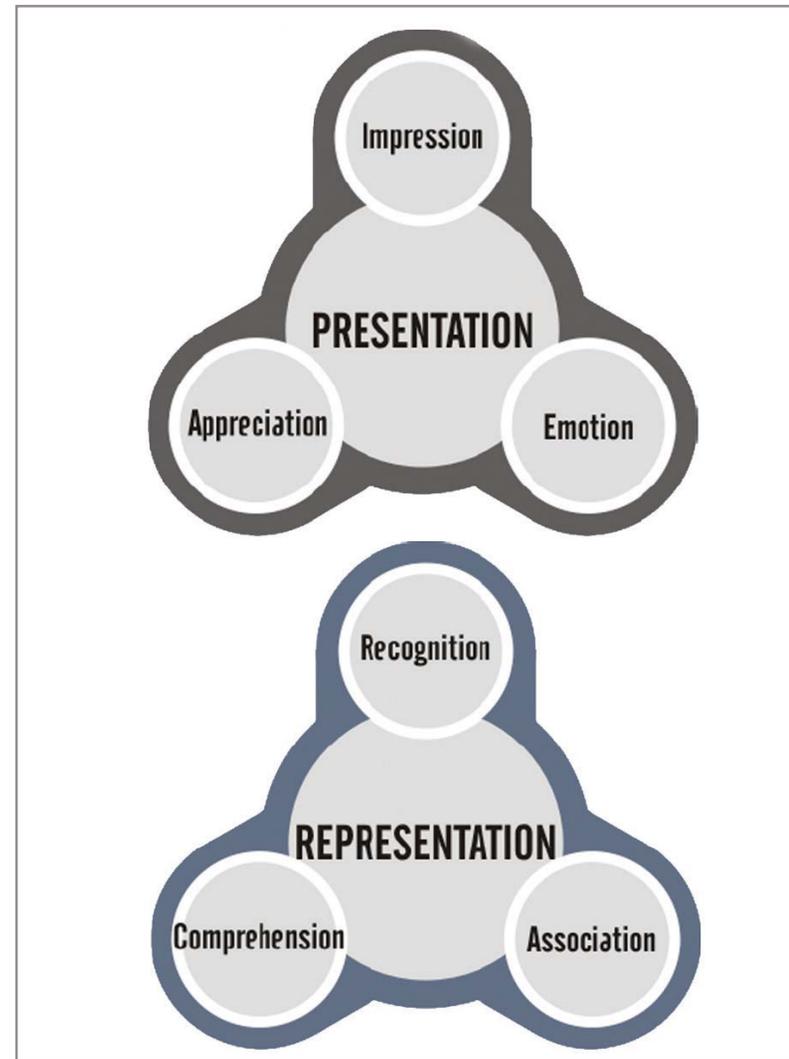


Fig.013.PPE framework

*Appreciation* identifies what people 'like' and what product traits are appealing or beautiful through the use of repetition of visual form, or 'characteristic' elements.

*Emotion* mode relates to the emotions that the product 'elicits' when looked upon or interacted with.

### **Representation**

*Recognition* mode identifies 'what people are reminded of' when interacting with the product and can provide similarity to previous experiences and familiarity or 'likeness' with the product or brand.

*Comprehension* is 'what people understand' about the product and how it functions or the significance of the products meaning. Usually relying on semantics functions to express or describe its meaning.

Association identifies what people think of when interacting with the product and what values that the product stands for. A good example of this mode was the link between the military Hummer vehicle and the shared value that is passed on to or associated with the urban Hummer.

The framework provides a very logical method to analyse how products are perceived and can accurately help to identify the a product's brand identity, which proved very useful to the objectives of this particular investigation (See section 6.4)

## USABILITY

Blackler's theories on *Intuitive use of products* (2006) investigate what it really means for a product to be 'intuitive,' and identifies a method of discovering what it is that makes a product cognitive for a user. The findings suggest that 'past experience is transferable between products' and that including familiar features or controls to a product is the most appropriate approach to creating an intuitive product experience for the user.

Spool's *what makes design seem 'intuitive'* (2005) Builds upon the theory outlined in the *intuitive use of products* research, and provides a clearer framework to understand how intuitive a product or interface may be to a user, and the two different methods to make the product more intuitive; either by training the user to increase their knowledge on the product, or reduce the knowledge necessary to operate the product.

Seeing as the investigation's design proposal is targeted towards the novice fencer, intuitive and cognitive design principles would prove useful to drastically improve the usability of the proposed fencing system.

## EXPERIENCE

Chutturi et al. (2007) discusses the way in which 'Hedonic' and 'Utilitarian' properties can influence the experience a user has with a product, and how they can be applied to the design process to benefit product design.

The term 'Utilitarian' refers to the functional and practical properties of the product, whilst 'hedonics' refers to the aesthetic and experiential

related properties.

Chutturi et al. suggest that the consumer places greater importance on the hedonic properties above those that are 'utilitarian', "but only after a necessary level of functionality is met". These hedonic properties create the more delightful experience than those that are utilitarian because consumers expect a certain level of function, whereby a hedonic benefit can be seen as a surprise, or evokes feelings of enjoyment. A product which lacks the hedonic or 'promotion' benefits will result in the user feeling disappointed with the product and purchase, however this is preferable to a product lacking the utilitarian/'prevention' properties, whereby the product will evoke anger and frustration if the functional aspects of the product fail to perform.

*Jordan's Human factors for pleasure in product use (1997)* re-affirmed similar principles to Chutturi, but provided a testing method through a structured interview process to evaluate the theories.

As the agricultural industry could be deemed a 'utilitarian' product dominated industry, the design principles of Chutturi and Jordan are very applicable to the investigation, proving the worth of attributing enjoyable experiences to such pragmatic products.

### 3.4 BACKGROUND RESEARCH CONCLUSION

The aim of this research investigation is to develop a desirable, conceptual livestock electric fencing system for Gallagher Animal Management. To facilitate this, the investigation required a thorough understanding of the fencing industry and the proposed design's context. The background research uncovered on the following areas of research:

- The Gallagher company background.
- An in-depth understanding of how an electric fence works.
- Contemporary theory on visual product communication, product experience and usability.
- Market evaluation of the current and state of the art fencing products.

Additionally, the following gaps in knowledge were identified in context to the electric fence design proposal, requiring further investigation to resolve.

- What visual attributes constitute a Gallagher product.
- Potential application of differing materials which would be more suitable for the user and more aesthetically appropriate for the environment.
- Further investigation required to identify the user's experience and usability issues with current fence systems.

The integration and significance of the background research's findings can

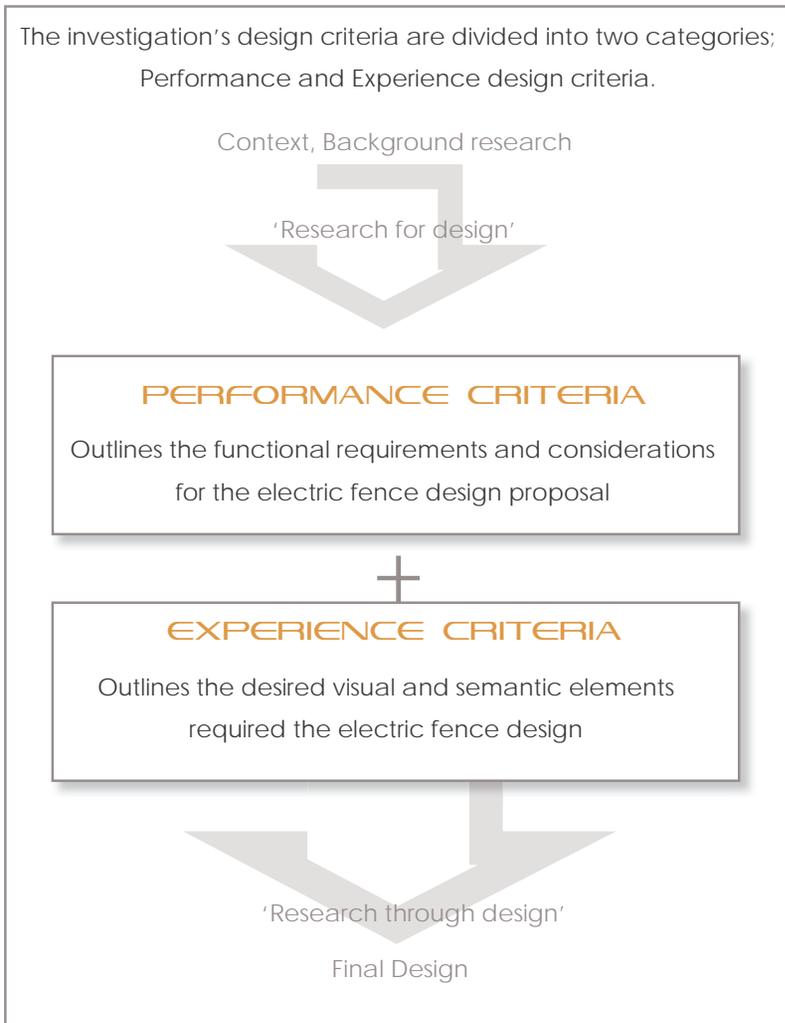


Table.001. Performance and experience criteria chart.

be seen within the design criteria in section 3. The design criteria are divided into two categories; performance and experience design criteria. Experience design criteria outlines the desired usability and visual requirements of the electric fence design proposal, while performance criteria outlines the functional requirements and considerations for the electric fence design proposal.

As well as answering some research questions and gaining valuable design criteria, the background research provided enough contextual information to form the investigation's scope (Section 4.0), identifying the research boundaries, and help to determine which research methodologies would prove to be most beneficial to fulfill the investigation's aim.

### 3.5 PERFORMANCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Posts erected and assembled without expensive tools or machinery	<input type="radio"/>			
Lightweight and easily transportable		<input type="radio"/>		
Must accommodate the existing Gallagher products (ie. Equi-wire, braid, tape, HT wire and under-gate cabling)	<input type="radio"/>			
Materials and assembly that will last 15-20 years minimum	<input type="radio"/>			
Fast installation in comparison to current systems	<input type="radio"/>			
A system that is competitively priced comparative to existing permanent fence systems		<input type="radio"/>		
A specialised Gallagher only proprietary system		<input type="radio"/>		

Table. 002. Performance criteria.

## EXPERIENCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Intuitive assembly/installation procedure, requiring minimal instruction		<input type="radio"/>		
Original aesthetic/materials which noticeably differentiates itself from other products in the market.		<input type="radio"/>		
Product identity has a strong sense of belonging within the Gallagher product range.	<input type="radio"/>			
Aesthetic styling that will last 15-20 years without out-dating.			<input type="radio"/>	

Table. 003. Experience criteria

## 4.0 RESEARCH SCOPE

This section defines the parameters surrounding the investigation, as directed by the researcher and the Gallagher project management team. The scope is illustrated as follows:

- 4.1 The Gallagher animal management brand.
- 4.2 Technology and materials forecasting.
- 4.3 Target users.
- 4.4 Target environment.
- 4.5 Livestock for containment.
- 4.6 Initial design specifications.

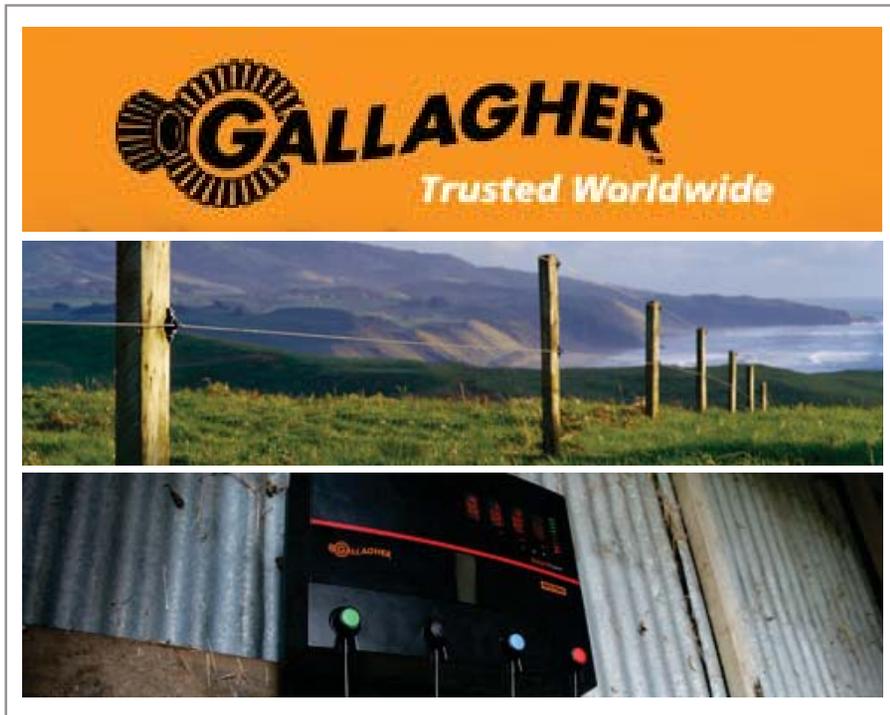


Fig.014. Gallagher Animal Management brand.

#### 4.1 THE GALLAGHER ANIMAL MANAGEMENT BRAND

The Gallagher animal management brand has been a renowned company in the global agricultural industry for over 40 years, and nationally in New Zealand since 1938.

The distinctive original logo and bright orange colour is synonymous with the company's brand, coupled with more contemporary product identity cues which help to solidify the brand identity.

The proposed design must be easily identifiable as a Gallagher product, fit within the Gallagher product range as well as the company's product motifs; Safe, Innovative and Reliable. There is an opportunity for the investigation to build upon the current visual style and propel the brand identity forward, as well as create a brand identity for product areas that have been identified as significantly lacking.

#### 4.2 TECHNOLOGY AND MATERIAL FORECASTING

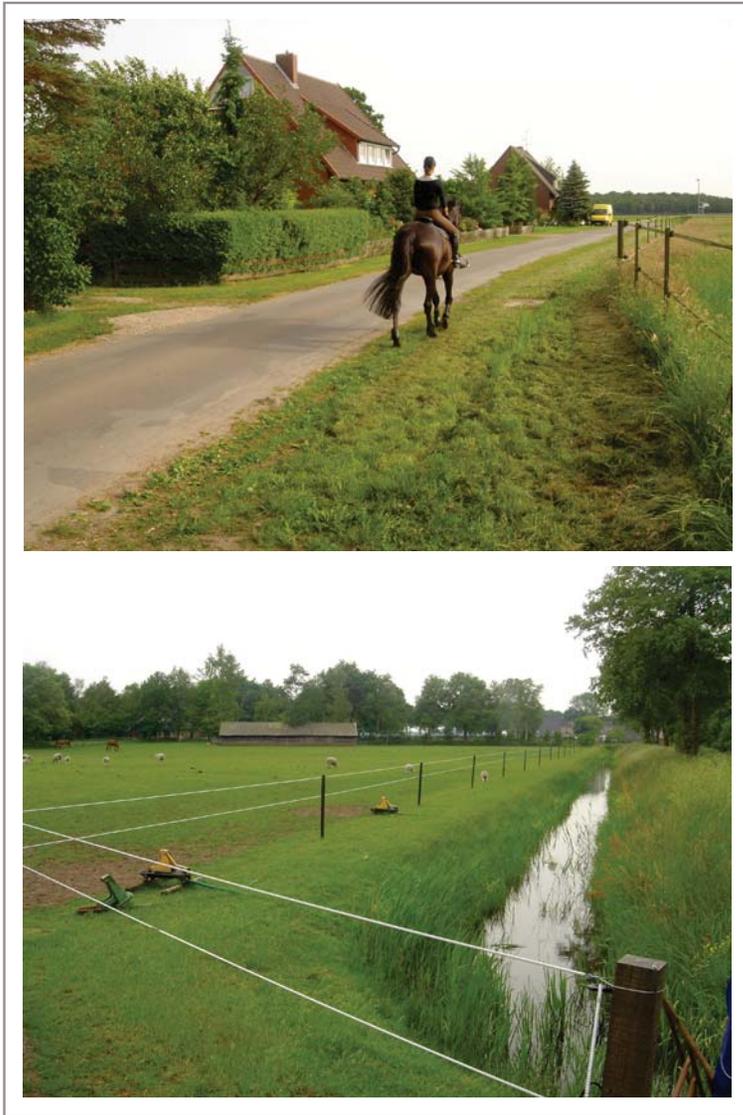
The technologies and materials incorporated into the fence systems design must be existing, or immediately foreseeable. The design, materials and technologies used must be considered technically feasible and cost effective to produce.

## 4.3 TARGET USERS

This investigation's design proposal is targeted primarily towards the European lifestyle/hobby farming market. It also aims to include the U.S, N.Z and remaining global lifestyle farming markets.

The following are typical characteristics of the primary target end user.

- Male or female.
- European.
- Own their own field.
- Physically active.
- Stable moderate to high income.
- Persons who have had some or little experience with farming.
- Non-professional farmers.
- Farm for the lifestyle and experience rather than for economic gain.
- Place high value on their animals/livestock.



*Fig.015. European lifestyle farm environment.*

#### 4.4 TARGET ENVIRONMENT

The proposed design is targeted towards the European countries and their diverse landscapes, weather conditions, drastic temperature range and the countries access laws concerning farmland, where the design must not restrict the public's right of passage over certain lands.

The fence design will need to function in all environments typical to the European countryside:

- Grasses.
- Damp clays.
- Sandy soils.
- Rocks, shingle beneath the field surface.
- Undulating landscape with various dips and rises within the property.
- Diverse temperatures including snow and frost and high heat.
- Ocean salt spray in coastal areas.

## 4.5 LIVESTOCK FOR CONTAINMENT

The projected design must contain the following two groups of livestock:

'Common livestock' species such as:

- Horses.
- Sheep.
- Cattle (Dairy and Beef).
- Goats.

'Common hobby' animals such as:

- Llamas.
- Donkeys.
- Miniature ponies.
- Alpacas.



*Fig.016. Examples of 'hobby' livestock.*

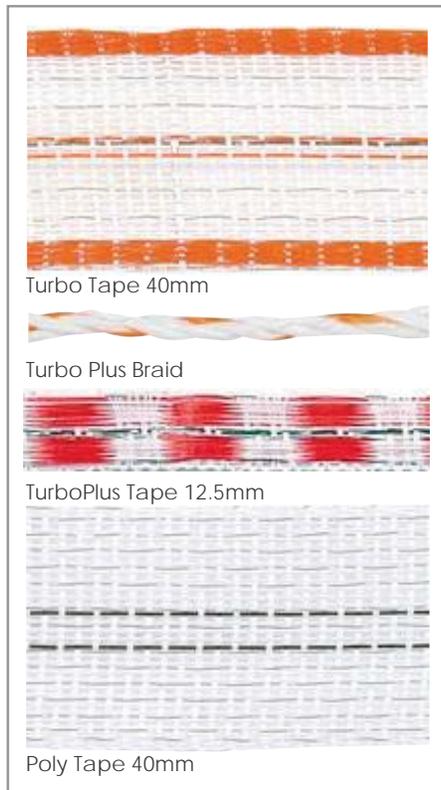


Fig.017. Examples of Gallagher electric tape.



Fig.018. Gallagher cable and wire.

## 4.6 INITIAL DESIGN SPECIFICATIONS

The proposed design's preliminary specifications are:

- Design the fence installation method, structural properties, design of the hardware/components and how they are implemented within the structure.
- Permanent for a minimum of 20 years.
- The design must be realistically affordable for mass manufacture and cost competitive comparable to other fence systems.
- Designed for use in conjunction with existing Gallagher energizer products.
- The proposed system must allow the use of all Gallagher wire/tape products: high-tensile wire, EquiFence, 12.5mm-40mm tape, Poly-wire and braid.
- It must also accommodate the use of all Gallagher lead out cabling, and under-gate cable.
- The current post heights will be used:
  - Sheep; 900mm from ground level.
  - Cattle; 100-110mm from ground level.
  - Horses; 120mm from ground level.

## 5.0 DESIGN RESEARCH

The background research has established the context, identified existing gaps in knowledge and assisted directing the investigation's focus and scope. This section outlines the research methods that were undertaken in order to gather the in-depth knowledge required to fulfill the investigation's research aims and objectives.

### 5.1 RESEARCH APPROACH

#### RESEARCH FOR DESIGN:

Research that has been undertaken to inform the investigation's design process. The Information gained from the following methods provides the backbone to the study, helping form the criteria which directs the "research through design" process.

- Observation.
- Scenario analysis.
- Semi-structured Interviews.
- PPE brand analysis.

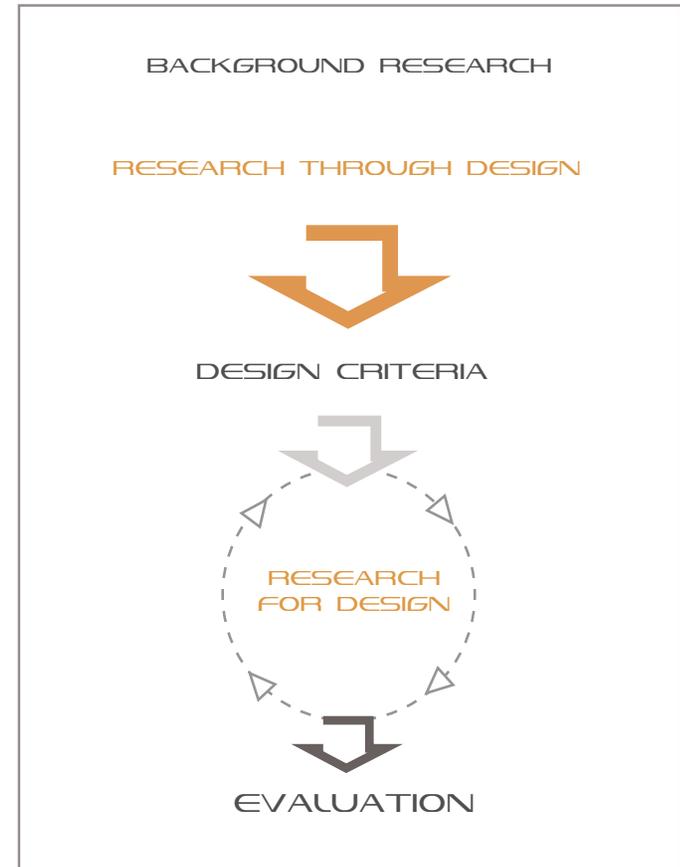


Table. 004. Research approach diagram.

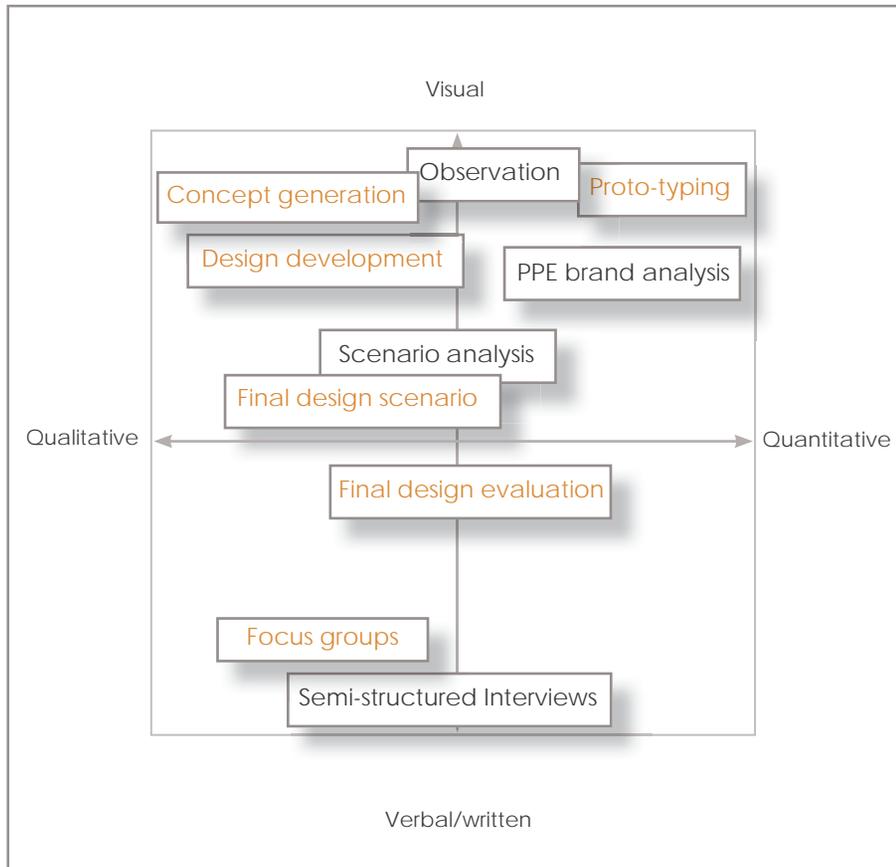


Table. 005. The investigation's Research methods.

### RESEARCH THROUGH DESIGN:

As a result of the "research for design" informing the design criteria, the following stage will use the knowledge to propose solutions to the identified unresolved fencing issues. The output from this can then be evaluated and tested against the stated design criteria, to inform whether the results of the 'research through design' has successfully met the aims of the investigation.

- Focus groups.
- Concept generation.
- Prototypes.
- Design Development.
- Final design scenario.
- Final design evaluation.

## 5.2.0 RESEARCH FOR DESIGN METHODS

### 5.2.1 OBSERVATION

Observation informed the researcher on the current methods of using existing products to construct a permanent fence system.

The process outlines the methods, tools and skills required at each stage of the installation and assembly.

It was carried out both on a private farm and at the Fieldays event. (Fieldays is the country's largest agricultural event. Held at Mystery Creek, Hamilton.)

What defines the target customer?

What are the current fencing related products on the market today?

How are livestock fences currently used?



### 5.2.2 SCENARIO ANALYSIS

Following the observation method, the interactions that the user has installing the product are focused upon and evaluated in a step by step scenario diagram.

Each step in the installation process will be analysed using the scenario analysis method to outline:

The different types of interactions with the product, and the skills required throughout each task.

The hidden 'latent' problems throughout the process that the interview and focus group participants failed to identify.

The users experience at each stage of the fence assembly.

What fencing related attributes are important, pleasurable or unfavourable to customers/users of fencing products?

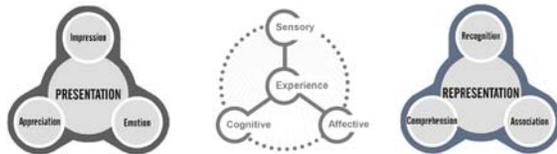
How can the fence system design be improved to achieve a more desirable product experience for the user?

FENCE INSTALLATION					
<b>Tractor operation</b>	<b>Chainsaw/saw</b>	<b>Spade- no real skill needed</b>	<b>Spinning Jenny reel</b>	<b>Wire tying</b>	
Operation can be fun and satisfying to use as no physical effort is needed. Overkill for a smaller field. Expensive to buy/hire	Satisfying operation for experienced users. Extra cost to purchase. Can be un-safe to use.	Unenjoyable due to the strenuous and slow process. Lot of effort for older users. Time consuming.	Simple, satisfying task with little effort required. Wire can bunch if unreeled too quickly.	Difficult and can be problematic and time intensive for novices to learn. A lot of knowledge needed to tie wires properly. Sore for the hands.	

What company values are important to Gallagher that influence design?

What aesthetic, usability and experiential characteristics are typically manifest in a Gallagher product?

What aesthetic, usability and technical characteristics and attributes should be included in a Gallagher permanent electric fence?



### 5.2.3 PPE ANALYSIS

#### PERCEPTUAL PRODUCT EXPERIENCE

The Perpetual Product Experience (PPE) framework (Warell,2008) will be utilised to help identify:

How Gallagher agricultural products are experienced.

Determine the Gallagher product identity; The product architecture, colours, materials and forms used which are all synonymous with the Gallagher brand.

The PPE will also help to determine what product aspects elicit a 'professional' so the same principles can be applied to the projected fence concept.

What fencing related attributes are important, pleasurable or unfavourable to customers/users of fencing products?



### 5.2.4 SEMI-STRUCTURED INTERVIEWS

The numerous Interviews with expert users were based around the research questions in order to gather the following information:

User's reactions to current products.

Personal experience with the products throughout the installation, assembly and continued use.

Issues the user has identified.

Improvements the user would like to see in the products and the system.

The interview participants were:

Fencing contractor, Dairy farm owner,

Gallagher sales representatives, at the Fielddays event.

## 5.3.0 RESEARCH THROUGH DESIGN METHODS

### 5.3.1 FOCUS GROUPS

Focus groups were used numerous times throughout the investigations concept generation stage and development stage. They were conducted primarily to:

Offer insight into the research undertaken.

Familiarise the researcher with the company and products.

Discuss and evaluate ideas.

Validate the concept and development designs brought forward by the researcher.

Provide technical specifications to structural parts of the concept design.

What fencing related attributes are important, pleasurable or unfavourable to customers/users of fencing products?

How can the fence system design be improved to achieve a more desirable product experience for the user?

### 5.3.2 CONCEPT GENERATION

Using the knowledge gained from the 'research for design' process, the researcher could then create concepts seeking to resolve the stated problems.

The focus group assisted, providing feedback and validation regarding the concepts throughout this phase.

The main goal was to generate concepts as a result of the design criteria.

What design principles should be used to create a fencing system that the customer finds intuitive to install, assemble and operate?

What affective design principles are best used to improve the overall design?

What affective design principles are best used to improve the overall design?



### 5.3.3 PROTOTYPE TESTING

Proto-typing concepts was used to determine whether any ideas, formulated as a result of the preliminary research and concept generation, could physically function.

Additionally they were used to:

Evaluate the ideas that resulted from the concept generation

Interact and visually evaluate the designs at a 1: 1 scale

What design principles should be used to create a fencing system that the customer finds intuitive to install, assemble and operate?

What affective design principles are best used to improve the overall design?

### 5.3.4 DESIGN DEVELOPMENT

The feedback gained from the concept generation, focus groups and prototypes reveal the development direction most suitable for the investigation.

Develop a concept to a stage where it fulfills most of the design criteria

Refine to a level where it is able to be developed into a "looks-like" proto-type.

### **5.3.5 FINAL DESIGN SCENARIO**

Describe electric fence design proposal in context to the end user.

Effective means for expressing user related design features.

Illustrated storyboards expressing the intended mode of use and rituals  
for the electric fence design proposal.

### **5.3.6 FINAL DESIGN EVALUATION**

Evaluate whether the interior design proposal fulfils the design criteria outlined  
in chapter 6.0.

Assess how many design criteria are fulfilled by the fence design proposal.

## 6.0 'RESEARCH FOR DESIGN' RESULTS AND DISCUSSION

The following 'research for design' method results are discussed in the following sections:

6.1 Observation.

6.2 Scenario analysis (Black, 2007).

6.3 Semi-structured interviews.

6.4 Perceptual Product Experience analysis.

## 6.1.0 OBSERVATION:

### THE CURRENT INSTALLATION PROCESS

R, Williams, a fencing contractor in the Hawkes Bay was the chosen user to observe installing a permanent electric fence. Recognised as being very knowledgeable on installing fencing systems, Williams was observed over two full days throughout all stages of the setup process: transporting the tools, plotting the fenceline, post installation, assembly and the energizer connection.

The current installation process has been divided into the 5 main sections, the information being integrated into storyboards which illustrate step by step each action required to install a typical fence. The sections are:

- Set-up.
- Fence installation.
- Energizer connection.
- Wire linking.
- Gate assembly.



Fig.019. Observation of the fencing process.

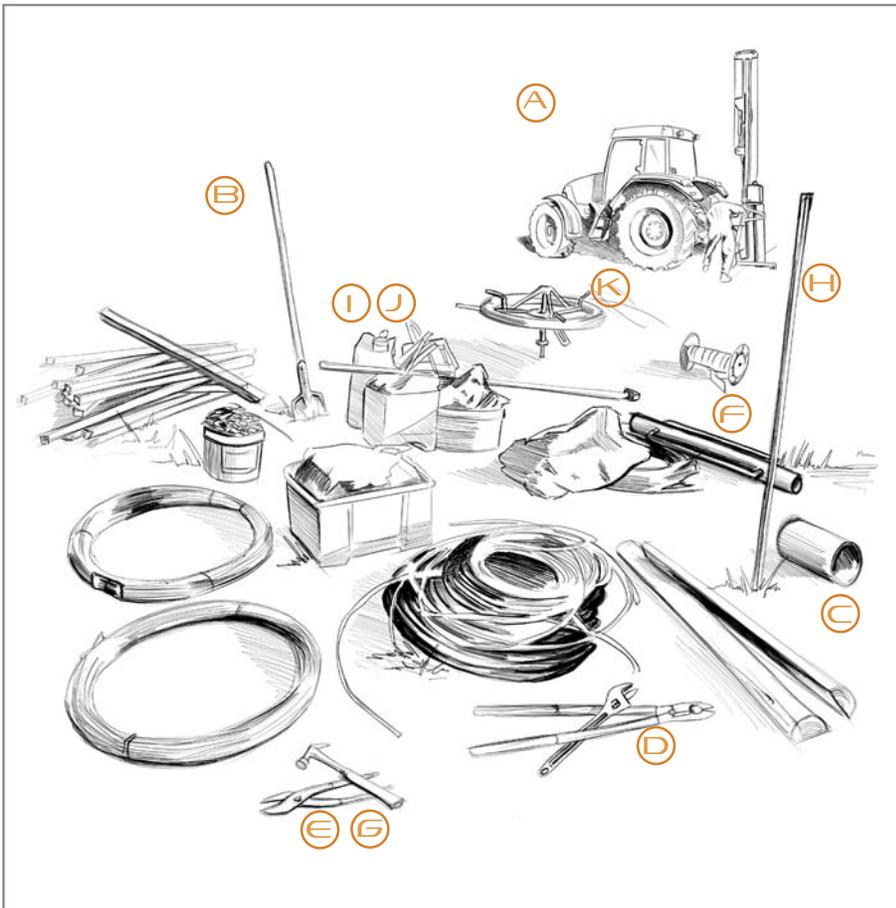


Fig.020. The tools/equipment required for fencing.

## 6.1.1 SET-UP: EQUIPMENT AND TOOLS REQUIRED

Fence construction currently requires a lot of equipment to perform the various jobs involved with the set-up.

The majority of fences use solid timber for the corner posts and strainer posts, and need a tractor or hydraulic post rammer/borer to install every post.

Line posts depending on their material, can be transported by trailer or, if light enough, with a wheelbarrow.

The following is a list of the various tools/machinery required to make a fence:

- A Tractor/post hole borer/post rammer
- B Spade
- C Driving cap (for the top of posts)
- D Wire cutters and strippers
- E Pliers
- F Line post rammer
- G Hammer
- H Hole boring bar
- I Ratchet or tensioning tool
- J Chainsaw/handsaw
- K Spinning Jenny(wire reel)

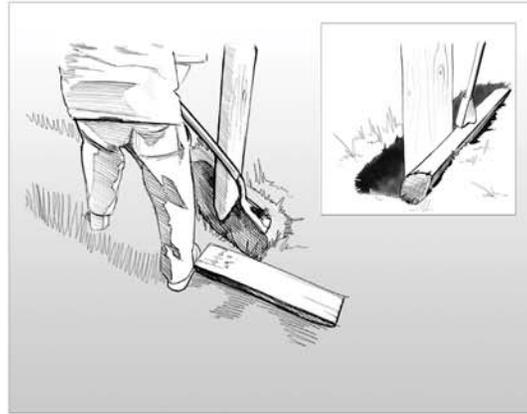
## 6.1.2 FENCE INSTALLATION



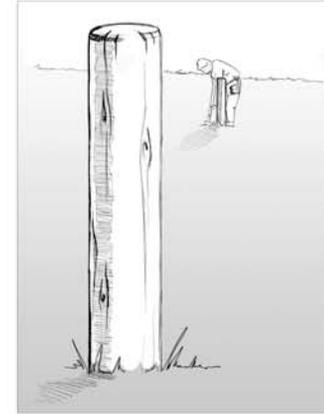
1 After moving the tractor and strainer post into position, use the hydraulic rammer to set the post into the ground.



2 With a chainsaw or handsaw, cut blocks from one of the posts to use as 'bedlogs'.



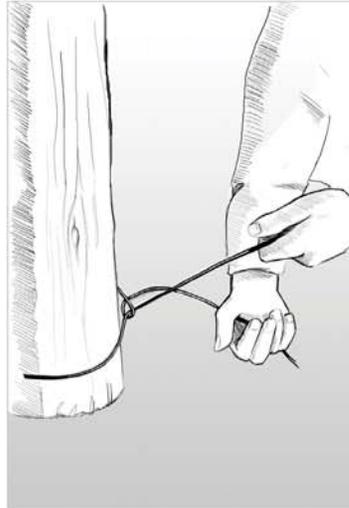
3 At a right angle to the direction of the fenceline, dig a trench to fit the bedlog into. Align, and beat the bedlog into place 200mm below the surface. This will maintain the posts upright position when tension is applied to the fence.



4 Ram the other strainer posts in at the other end of the paddock, and insert a bedlog.



5 Run the wire out to the other end post along the proposed fence-line. Preferably using a "spinning jenny" wire reel.



6 Tie the end of the wire to the fence, near the bottom of the post.



7 Connect the wire to the other end post, either tying to the post or alternatively, using the chain lightning tool.



8 Using the bottom semi-taught wire as a guide, the line-posts can be rammed (with the hydraulic rammer or with a hand ramming tool) along the line at intervals of 16-20m.



Fig.021. Fence installation storyboard, part-one.

## 6.1.3 FENCE INSTALLATION

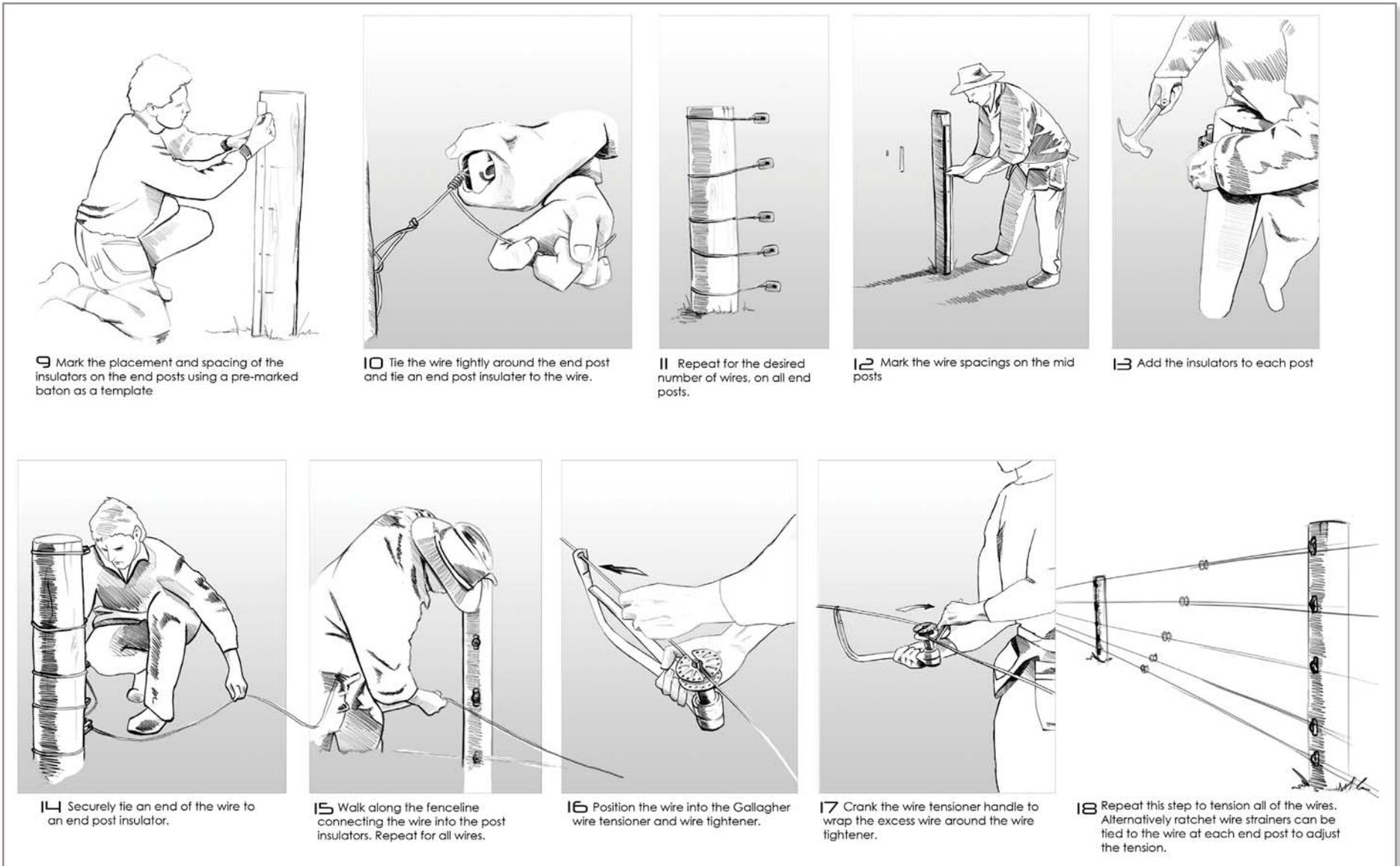


Fig.022. Fence installation storyboard, part-two.

## 6.1.4 ENERGIZER CONNECTION

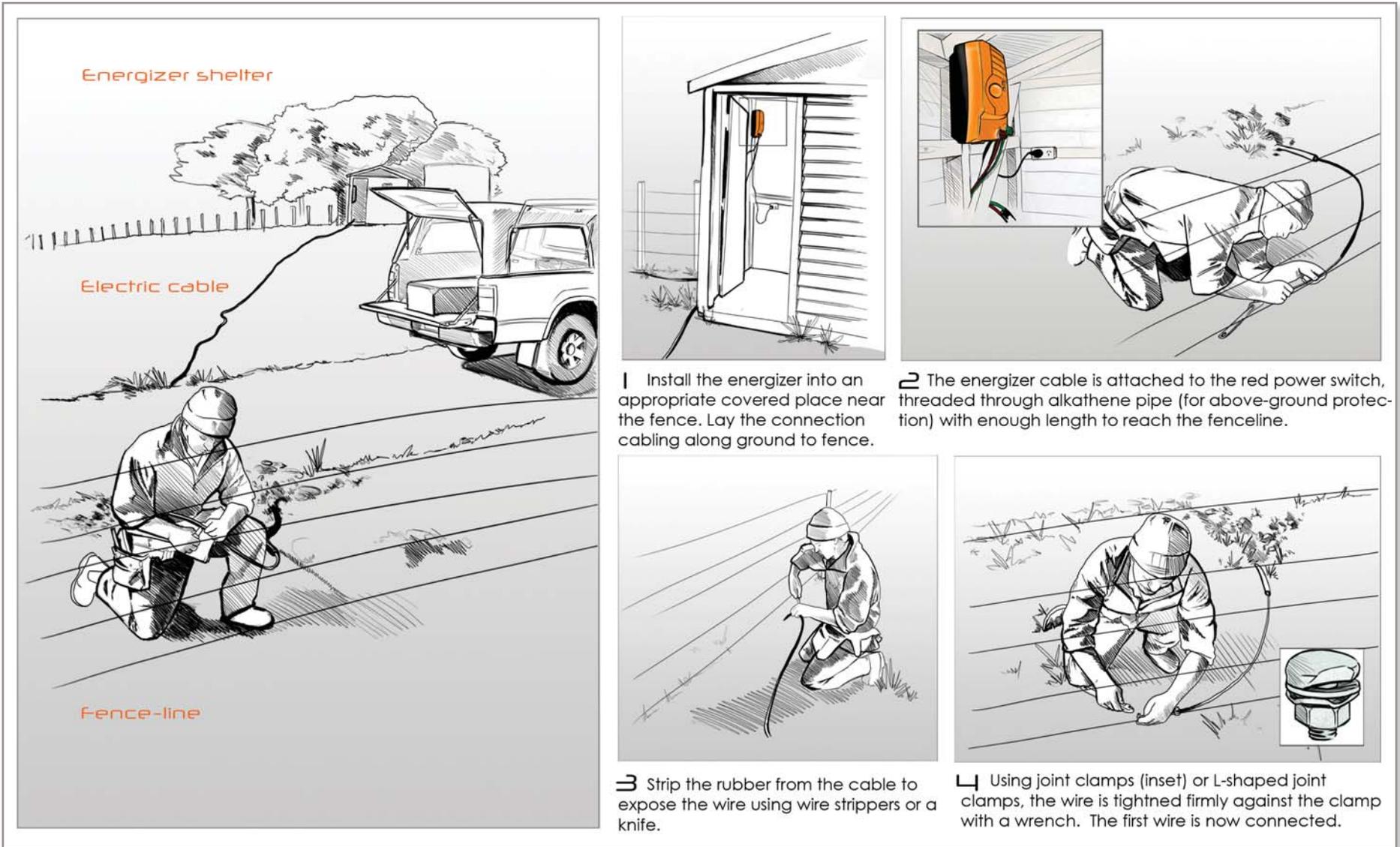


Fig.023. Energizer connection storyboard.

## 6.1.5 WIRE LINKING

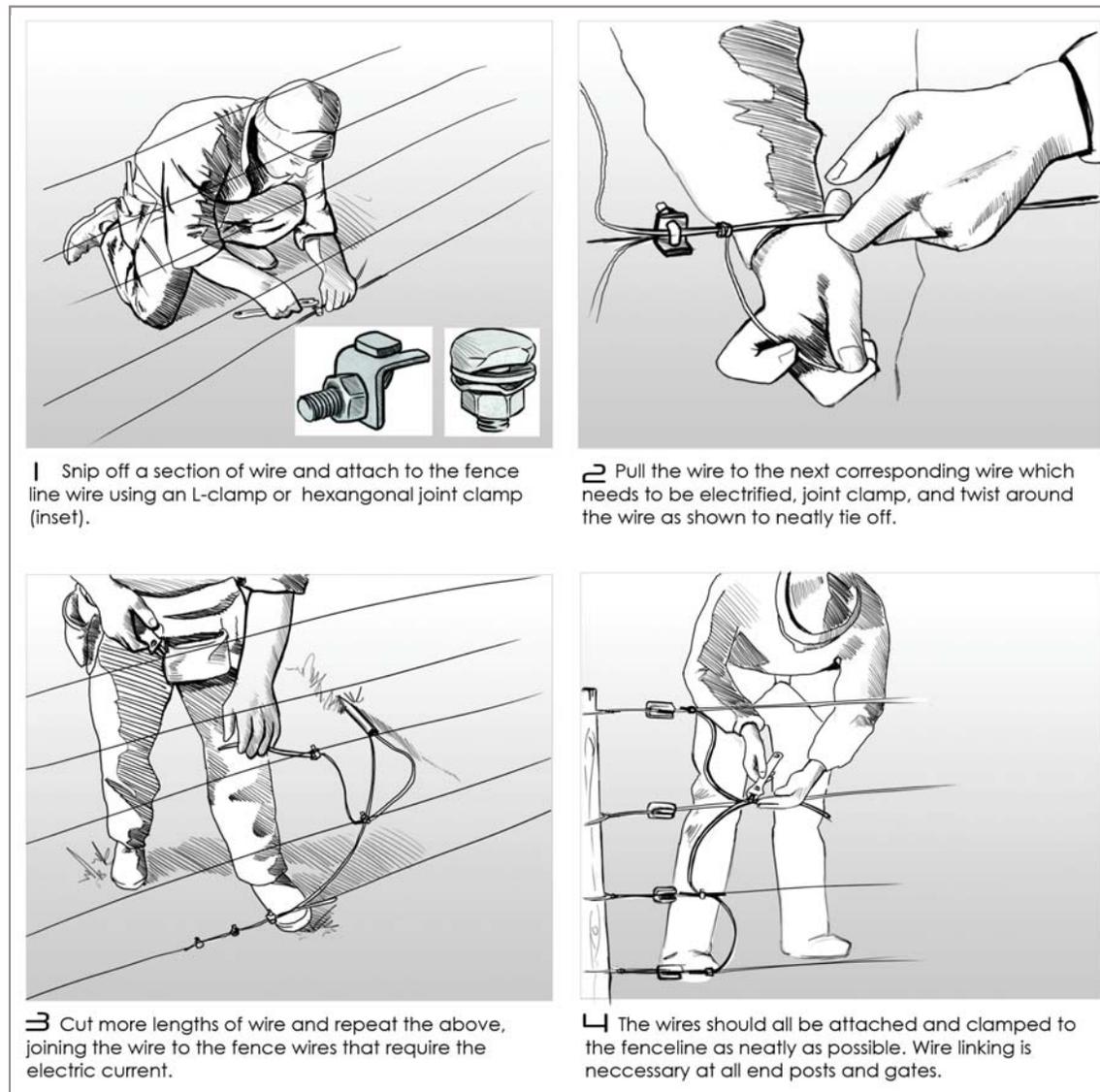
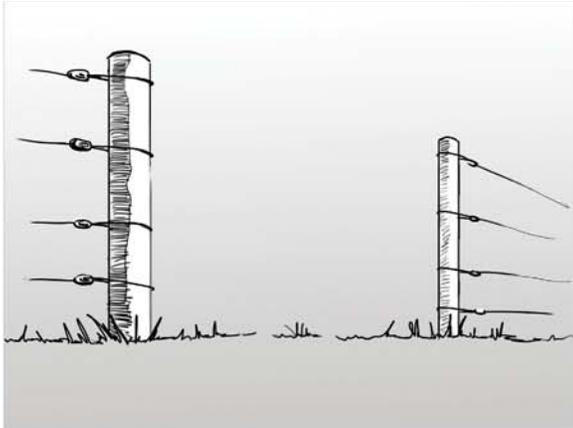


Fig.024. Wire linking storyboard.

## 6.1.6 GATE ASSEMBLY



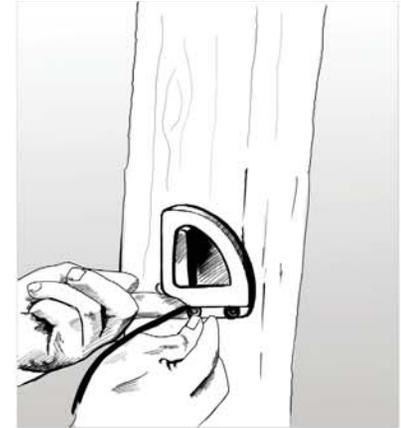
1 Plan the fence line to accommodate for the required gates in the field. Using two strainer posts at either side positioned wide enough to allow vehicle access.



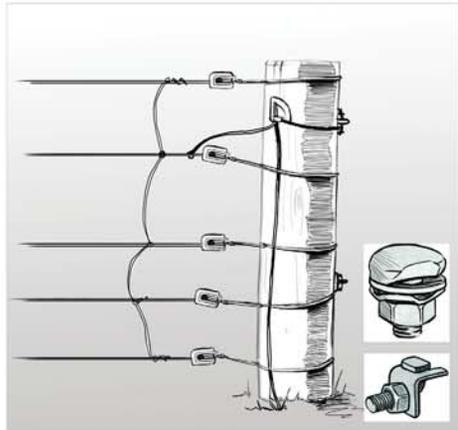
2 Between the two gate/strainer posts dig a trench 200-300mm deep, and wide enough to accommodate the underground cable (shown).



3 Attach the cut-out switch to the gate post with a screwdriver. Position in a location on the post that is easy to get to.



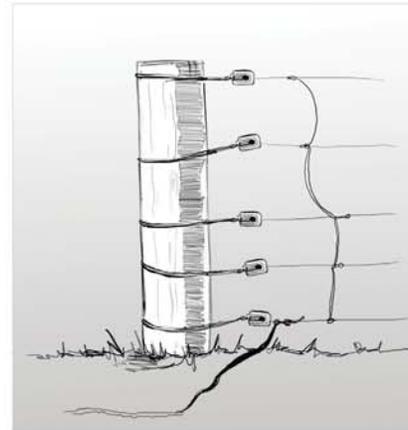
4 Attach one end of the underground cable to one of the terminals on the cut-out switch, securing in place with the nut.



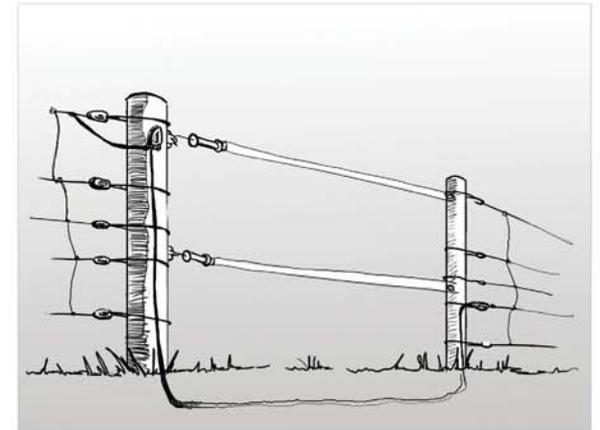
5 Snip off a section of wire and attach to the fence line wire using an L-clamp or hexagonal joint clamp (inset). Screw/ nail the gate clip holder to the post and connect to the second cut-out switch terminal.



6 Lay the underground cable across the ditch and cover up with soil.



7 Using an L-clamp or hexagonal joint clamp, attach the other end of the cable to the fence, making sure the connection bypasses the insulator.



8 Add the preferred gate to the posts and the set up is complete. The cut-out switches can also be used to strategically turn the power off at desired fence sections.

Fig.025. Fence installation storyboard.

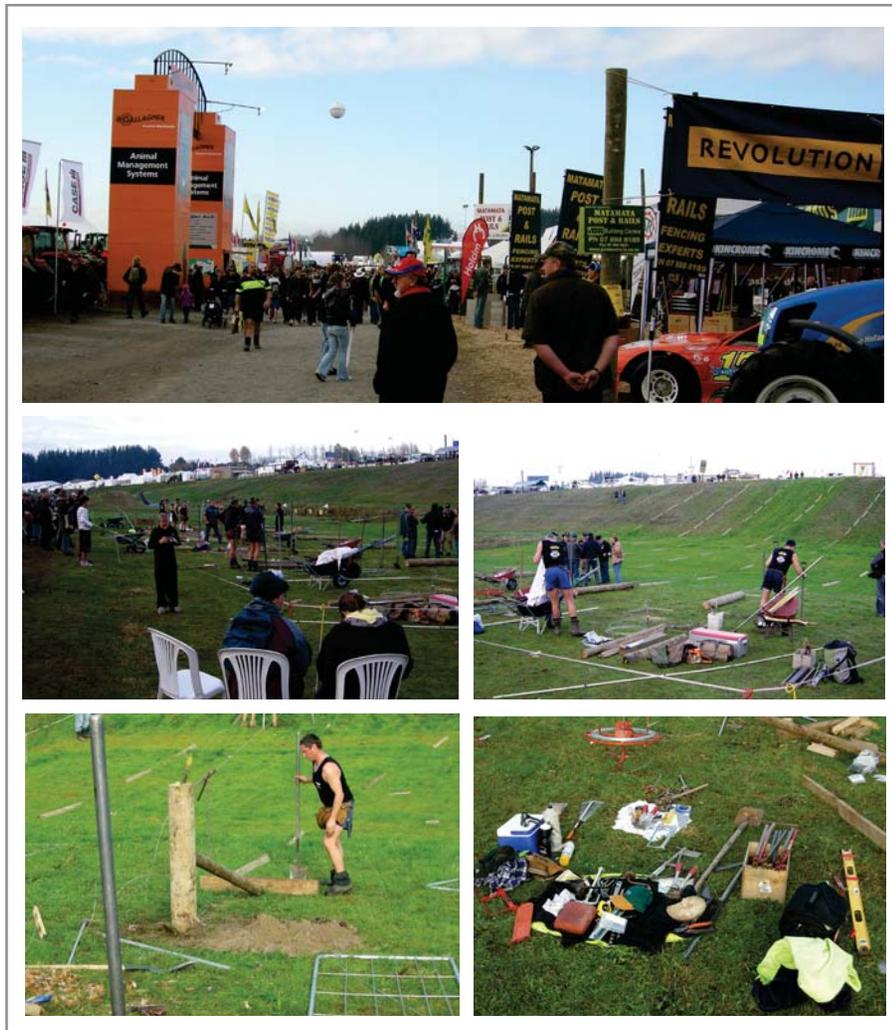


Fig .026. The Fieldays fencing competition

### 6.1.7 OBSERVATION: FIELDAYS FENCING COMPETITION

The Fieldays annual event is New Zealand's biggest agricultural event in New Zealand. Held in Mystery Creek, Hamilton the event attracts thousands of people during the four day time period.

Visiting this event was a very good opportunity to view a wide range of products, and talk to the sales representatives in the industry.

The Fencing competition is whole day event, consisting of six pairs racing to put a length of high tensile wire fence up in the fastest time and in the best condition. After observing the professional method using machinery in section 6.1.2, it was valuable to the investigation to see the professional process without using heavy machinery.

It's not often that a fence is constructed without machinery, resulting in a much more time consuming process where additional tools are required:

- Level, to ensure each post is in straight.
- Chisels.
- Sledgehammer. } For stay construction
- Handsaw.

Installing the stays (angled brace) off of the end posts was a skillful process and the most time consuming part of the set-up.

## 6.1.8 OBSERVATION: DISCUSSION / RESULTS

Observing the fence construction provided the researcher with a good indication of the time required to construct a fence. Fencing off a 100m<sup>2</sup> property was estimated to take 2-3 days, with a morning (4 hours) to mark and ram the posts. (Williams, 2008)

The fence construction was typically a one man job, made easier with an assistant to direct the post-hole placement.

- A lot of tools were required and transported around the field. The purchase of tools is necessary for the professional fencer, but adds a lot of cost to the novice installation.
- The effort, knowledge and skill was much more than anticipated. Fence construction is very labour intensive requiring physical fitness and strength. The seasoned fencer made the process look very easy and methodical due to his experience, experience and knowledge which the novice fencer doesn't possess.
- Wire tying and end-strain insulator assembly required a lot of practice and hand strength to strongly and neatly tie the wire. This is an area of installation that would discourage the un-experienced from installing the fence themselves.
- The process of installing a stay (angled brace) to support the end posts may also discourage novice fencers as sections of timber have to be sized, cut and installed into the earth and against the end post.
- Witnessing the Fieldays fencing teams exert so much energy and time

into the fence construction made it clear that a completely new approach to the fence construction is needed for an older aged hobby farmer to even consider the assembly process. Removing the brutal physical nature of process would appeal to the wider market.

## 6.2.0 SCENARIO ANALYSIS

The following process takes an inquisitive look at fence construction and determines what parts of the process are not intuitive, requires too much skill and what aspects create an unenjoyable experience.

**KEY:**

Tools/skills required

User Experience

Issues

Unnecessary process —

FENCE INSTALLATION

				
<p><b>Tractor operation</b> Operation can be fun and satisfying to use as no physical effort is needed. Overkill for a smaller field. Expensive to buy/hire</p>	<p><b>Chainsaw/saw</b> Satisfying operation for experienced users. Extra cost to purchase. Can be un-safe to use.</p>	<p><b>Spade- no real skill needed</b> Unenjoyable due to the strenuous and slow process. Lot of effort for older users. Time consuming.</p>	<p><b>Spinning Jenny reel</b> Simple, satisfying task with little effort required. Wire can bunch if unreeled too quickly.</p>	<p><b>Wire tying</b> Difficult and can be problematic and time intensive for novices to learn. A lot of knowledge needed to tie wires properly. Sore for the hands.</p>

FENCE INSTALLATION

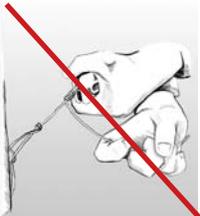
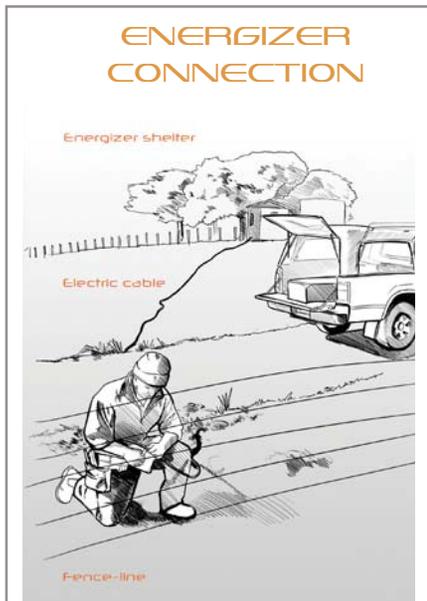
					
<p><b>Tensioning device</b> Difficult to use and confusing to set up which causes annoyance. Not obvious to use. Deemed an unnecessary purchase.</p>	<p><b>Marker</b> Frustrating due to the boring and very tedious process. Time consuming</p>	<p><b>Wire tying Insulators</b> Unpleasant as it is a confusing and dextrous task. A lot of knowledge needed to tie wires properly. Sore for the hands.</p>	<p><b>Hammer</b> Satisfying to begin with due to its ease, but soon tedious and repetitive. Time consuming</p>	<p><b>Strainer Ratchet</b> Intuitive and simple task. Little effort and time required. Repetitive.</p>	<p><b>Strainer Ratchet</b> Unenjoyable as it can be confusing and dextrous to operate. Knowledge required to judge the tension of the wires.</p>

Fig. 027. Fence installation scenario analysis.

Fig. 028. Fence installation scenario analysis.

## 6.2.1 SCENARIO ANALYSIS

Fig. 029. Energizer connection scenario analysis.



### Wire strippers

Fairly straightforward leading the cable to the fence. Threading cable through protective alkathene pipe or burying the pipe can be time consuming. Distance from mains power can be a problem. It can look untidy running over fields.

### WIRE LINKING

**Wire cutters, crescent**  
Very dextrous task holding the wires in place and twisting nuts to clamp.  
Problematic as clamps can slip.

**Wire cutters, crescent**  
Irritating to twist each wire and hold whilst clamping in place.  
Sore on the users hands.

**Wire cutters, crescent**  
Irritating clamping each wire.  
Looks very un-tidy and un-professional, even if it has been professionally done.

Fig. 030. Wire linking scenario analysis.

### GATE ASSEMBLY

**Spade**  
Unenjoyable digging, but a tidy result once finished.  
Arduous physical labour for some users.

**Screw-driver**  
Can be tricky to hold the switch whilst installing to post.  
Placement of the switch on the post isn't intuitive.

**Wire strippers, clamps**  
Confusing to novices how to assemble the switch and cables.  
Looks untidy with all the cables on the post.

**Gate accessories**  
Intuitive assembly of the gates components.  
Unclear where to move the gate to when travelling through the gate way.

Fig. 031. Gate assembly scenario analysis.

## 6.2.2 SCENARIO ANALYSIS: RESULTS

After examining the Scenario Analysis it becomes apparent which experiences are undesirable throughout the process.

- Wire tying can be quite painful for hands unaccustomed to the job, and having to learn the method of tying properly is probably something that a hobby farmer would not invest their time in to learn. Adding to this the confusing nature of the task and difficulty involved to produce a tidy set-up, it's obvious that the current process is only suitable for professional fencers rather than amateurs.
- Discarding the tedium of marking line posts would be desirable, as it would save the user from a repetitive chore, as well as save time.
- Insulator connection is tedious, requiring a lot of time as well as effort (hammering in two nails in per insulator).
- The wire linking to run the electric current through all the fence lines is an undesirable aspect of the set-up. The process is time intensive, looks visually unappealing and requires patience and dexterity to attach the wires to each small clamp. This process could be greatly improved.
- Holding the cut-out switch in the right position whilst attaching to the post can be a dextrous task, but overall installing the cut-out switch is relatively simple. It is the placement on the gate post which presents a problem as it is very vague for novice fencers.
- The cut-out switch can be confusing initially when connecting the cables and wires, and there are issues about the nuts and washers (for connection) getting lost in the grass.

### 6.3.0 SEMI-STRUCTURED INTERVIEWS

Once the detailed knowledge on the background of fencing was gained, it allowed for informed questions to be asked throughout interviews to discover what the main issues were with fencing that are yet to be resolved. Each interview followed a basic structure. The questions of which feature in Appendix. The following key personnel participated:

- R, Williams, Fencing contractor. 32 years experience
- I, Knuffe, Dairy farm owner
- Mark Harris, Marketing manager-Gallagher
- Graeme Johns, Product Manager- Gallagher
- Craig Malins, Mechanical Team Leader- Gallagher

As a result of the interviews this section outlines the various problems associated with fence products, currently in use within the agricultural industry. The fence related problems are categorised into the following sections:

- Materials
- Safety; Animal and human safety
- Utility
- Usability
- Appearance

### 6.3.1 INTERVIEW RESULTS: MATERIALS

Products used in farming applications are usually subject to all weather conditions constantly, and frequently need to withstand a lot of damage from the weather, livestock and the user.

The examples opposite illustrate the material problems of concern to the investigation:

- Fibreglass lineposts (Fig.032) have been known to break down over time, deteriorating and splintering, which not only compromises the posts strength but can also hurt the user or their livestock. The splinters can break off and lodge in the skin of the user during handling, and this undesirable incident has been known to discourage farmers from using the material completely.
- The mix of materials to form fibre-glass also creates a very un-sustainable product which cannot be recycled.
- The HDPE gate handle (Fig 032) has broken down due to the UV sunlight, weakening the product and losing the barrier which insulates the electrical current from the user.
- The UV degradation also affects the insulators and other plastic products lacking the correct UV stabilisation, which significantly weakens the product.
- Plastic coated wire (Fig. 032) for horses can crack under pressure from hard materials. This problem can also be attributed to incorrect installation.



Fig. 032. Fence material issues.

### 6.3.2 INTERVIEW RESULTS: ANIMAL SAFETY

Safety for the livestock is a primary concern to the farmer. The common problems that compromise the safety of the current fence systems are:

- Running power through barbed wire is particularly dangerous for the animal (namely sheep) because they can get caught in the barbs and repeatedly shocked, causing a lot of potentially fatal stress to the animal. Combining electric wire with barbed wire on the same fence also has this effect. The proposed fence design must not allow the user to attach barbed wire.
- Wire fences can cut and peel a horses thin skin. Equi-wire has been designed for horses with a plastic coating that is more visible than high tensile wire and prevents damage to the horses skin. This danger highlights how susceptible horses are to any small/ sharp fencing components.
- Livestock have the tendency to get themselves stuck in-between posts or under fences, usually to get at fresher pasture, requiring assistance to be removed. This problem can usually be prevented by applying the right type of fence wire to suit the animal type.



Fig.033. Examples of unsafe fencing.

### 6.3.3 INTERVIEW RESULTS: HUMAN SAFETY

“We don’t want any harm to come to the owner when using one of our products” C, Malins.

Safety for the farm owner is usually seen as being of less importance compared to the welfare of their livestock, but human safety is crucial to consider when designing a desirable product.

- Persons experienced with farming most often know to look out for tell-tale signs indicating whether a fence is electrified (such as plastic insulators holding the wire to each post), but even so the visual difference between a high tensile wire fence and an electric fence are few. The current method to warn the public that a fence is electric is by clipping signs to the fence line. Ideally the investigations fence design would be intrinsically recognised as electric, without the need for signage.
- Minimising the risks when operating the products and preventing accidental shock will help to maintain the user’s sense of safety and satisfaction with the product.
- Visibly the fence needs to be seen not only by the livestock, but the farmer as well. A major cause of injury on farms is caused by farmers travelling on farm bikes into fence lines or gates without seeing them in time to stop. This occurs usually during the night or low light conditions. (G, Johns. 2008)



Fig.034. Electric fence warning sign.



Fig.035. Utility related fence issues.

### 6.3.4 INTERVIEW RESULTS: UTILITY

- High plant growth in contact with the electric fence can significantly reduce the amount of power along the fence line. The growth earths the current and needs to be removed in order to provide a full strength electric pulse.

To remove the growth farmers have been known to spray weed-killer along the fenceline, remove the growth by hand or de-activate the bottom wire of the fence which allows the livestock to clear the growth.

The optimal preventative method is for the user to position the bottom wire at a height that the livestock can safely remove the plant growth without getting shocked, yet remain contained.

Unfortunately the latter two methods, while efficient, are hard to set up for the untrained user, presenting a design opportunity to solve this problem.

- Tree fall along the fence line can create a lot of problems and cause great damage to the fence. Typically the line posts will snap and will need replacement, and all affected wires will need to be re-set and tensioned. R, Williams (2008).
- When the electric power has weakened due to the incidents mentioned above, livestock wanting to escape, eg. to fight livestock in adjacent fields, will trample the fence resulting in further repairs being required .
- To prevent horses from chewing and damaging wooden post-and-rail fencing, black paint is applied.

### 6.3.5 INTERVIEW RESULTS: USABILITY

“With putting up your fence yourself, you get cocky’s deciding it’s easy and giving it a go, then I have to come in and fix it up” R, Williams fence contractor.

There is a significant amount of knowledge and experience required to accurately construct a fence. For the amateur fencer this lack of knowledge creates a lot of problems, but in many cases the incorrect use can be attributed to the incorrect comprehension of the product.

This section highlights the problems farmers encounter when trying to construct their own fence without professional assistance, and the various results when assembled incorrectly.

- Persons who are in-experienced at tying wire to fences is a common cause of many fence problems. If it is not tied and secured correctly it will not be able to take the correct tension strain or maintain the desired position on the fence post.
- Currently there is no way to gauge the wire strain apart from judging by eye or feel. The strainers providing the wire tension can be over tightened- weakening or snapping the wire, or under tensioned, where the wire will not be at the correct height for containment and will droop. A foolproof tension method would solve this problem.
- A good example of poor product semantics is illustrated in Fig 036, where the wires have been tied through the incorrect holes of the end post insulator, and causing the insulators plastic to crack once subjected to tension. Every incorrectly tied insulator would henceforth require replacement,

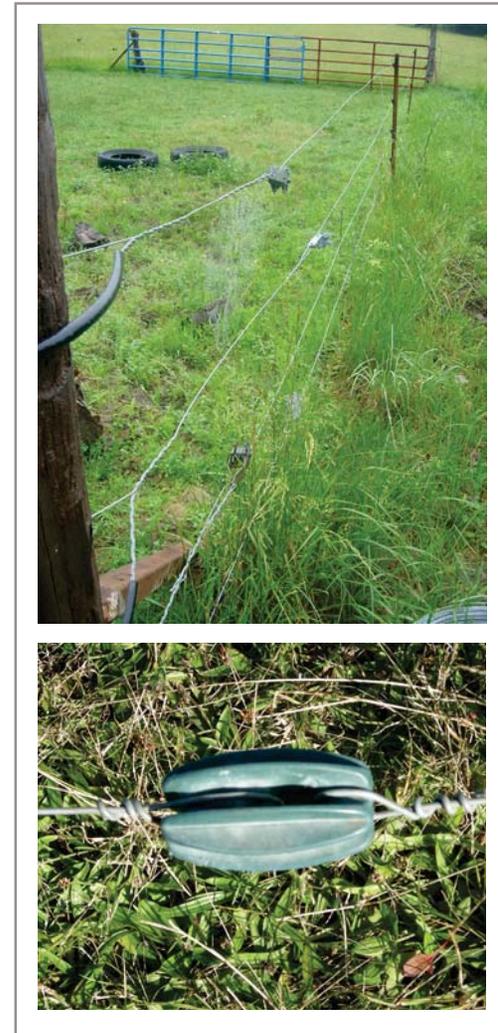


Fig. 036. Examples of amateur fencing.



Fig. 037. Examples of amateur fencing contd..

wasting a lot of time and money. This problems could be avoided if the product semantics were cognitive to the amateur fencer.

- The fencer's ability to mix and match fencing components is a big problem. As seen in Fig 037, electrical tape has been tied to an offset/pigtail, which is designed to take wire. The result is that the tape is weakened, holds moisture, and produces a greater shock visually than functionally.
- Setting up a mains power energizer as shown (Fig. 037) in the outdoors is a sure way to ruin the product as it has been designed solely for indoor use.

"It's not the technology, the technology's great, it's the people using it that don't know what they are doing" I, Knuffe, Dairy farm owner (2008)

Because there are so many varied ways of constructing current fences, it is not often that the novice fencer can figure out the correct method of assembly.

The underlying problem is the user's freedom to construct fences incorrectly. The system design and products need to be intuitive so that they guide the user through the assembly process, limiting the users options so that the fence can only be erected as intended, in the correct manner.

### 6.3.6 INTERVIEW RESULTS: APPEARANCE

The appearance of the fence can have a huge impact on the perception of the landscape such as the farm owner's property and dwelling. This section will describe the aesthetic problems with current fencing examples.

- The main reason identified why farm owners hire fencing contractors is so their fence will look "professional" (C Malins, 2006). The current fencing products are so difficult to assemble that only those with the experience can create a tidy set-up, leaving the amateur fencer to settle for a less than optimum appearance.
- Many amateur fencers lack the tidiness which helps to make the fence harmonise with the landscape. Instead, the inappropriate use of natural elements (trees for example, Fig. 038) counter this aesthetic intention and can actually look worse.
- The Gallagher catalogue photo of an end post (Fig. 038) is what a professional assembly looks like. The fact that this is the nicest possible visual outcome points out that the product design, and the whole fence system design, has room for improvement with regards to desirable looks that integrate well into landscape and match modern architecture.
- The competitor brands product choice to have components that highly contrast the fence posts can be a simple way to provide product identity and brand recognition (Fig. 038). However, the contrast appears unnatural and unappealing, thus eliciting a negative response to the product and brand.

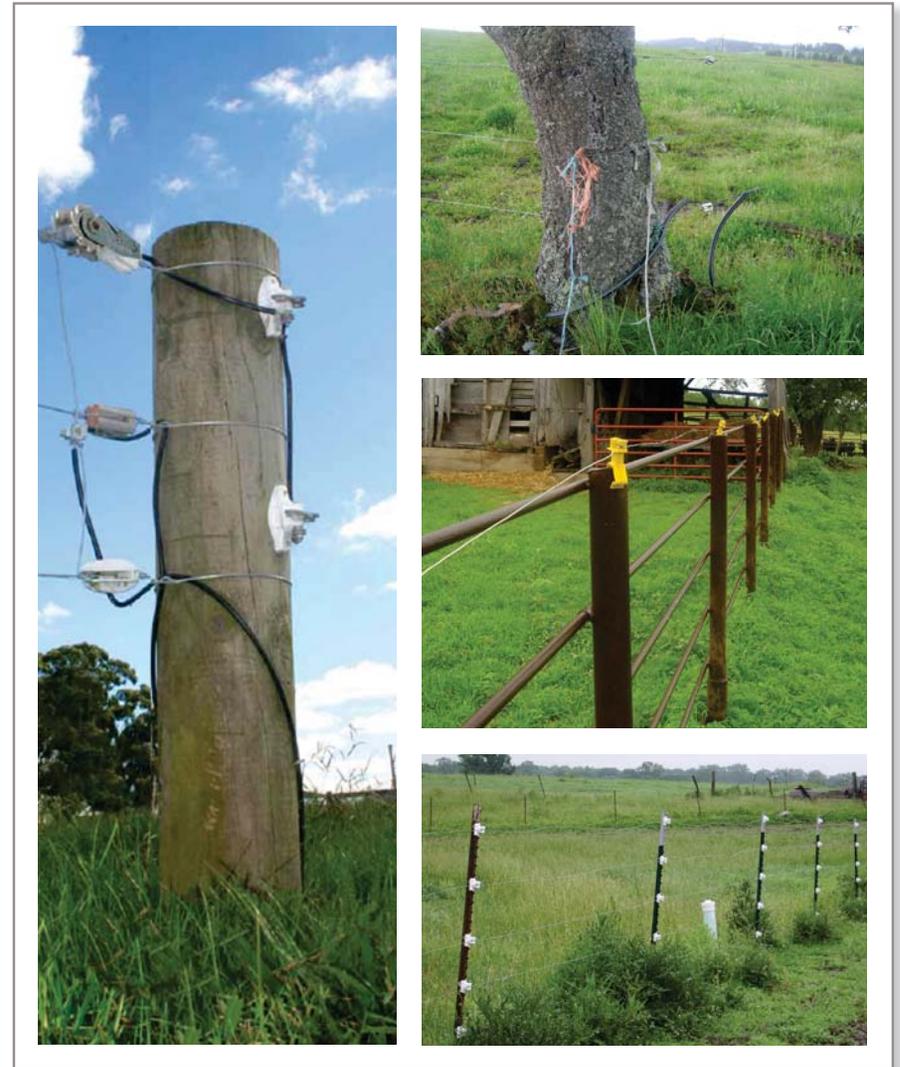


Fig. 038. Examples of visually undesirable fences.



Fig. 039. The classic post-and-rail fence and the imposters.

- The traditional post-and-rail fencing, usually associated with horse studs, is perceived as being aesthetically pleasing; The black colour is complimentary with the green pasture, and the straight, even railing and solid construction portrays the structural integrity. Is there a way to express these classic attributes in the investigations fence design without the heavy labour and cost involved with construction?
- The product (Fig.039) attempts to emulate the popular white post-and-rail aesthetic and fails in many regards; the product doesn't act as a barrier, as the rubber railing is too weak to contain an animal, and the tightening method is very poorly implemented, creating an eyesore which completely detracts from the products original intentions appearing cheap and sloppy rather than classically traditional.
- Currently, there is very little that separates the electric fence components from one another visually. Seeing as brand recognition plays such a large role in marketing a product, developing a distinct visual identity is crucial to the investigations outcomes and the design proposal.

## 6.4.0 PPE ANALYSIS

### PERCEPTUAL PRODUCT EXPERIENCE (PPE)

The researcher analysed Gallagher products using Warell's (2006) PPE framework to determine the visual and experiential cues that form Gallagher Animal management's product brand identity.

Ten current fencing products were chosen specifically to represent their product areas from the Gallagher product range and reviewed against the PPE framework:

- Turboline Horse insulator
- XDI screw-in insulator
- Power-plus B40 Battery Energizer
- Smart Power MX7500 Mains Energizer
- Power-plus B280 Battery Energizer
- Solar Power-plus S50
- Smartfix faultfinder
- Smart Reader
- Termination Kit strainer
- Geared Reel

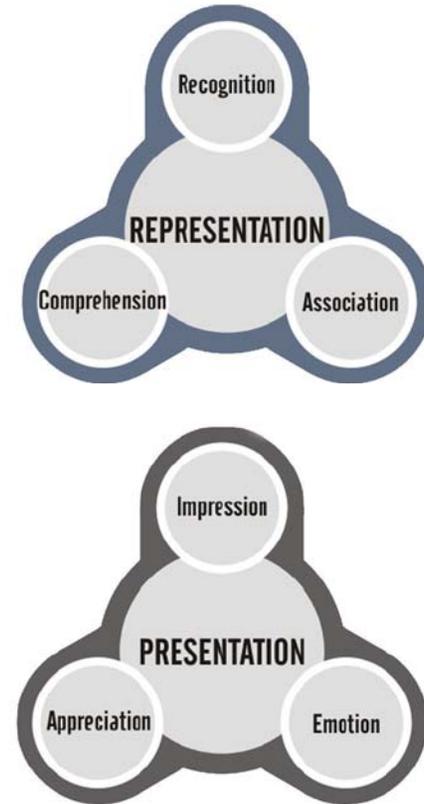


Fig. 040. PPE framework diagram (Warell, 2006)

## 6.4.1 PRODUCT VISUAL IDENTITY/EXPERIENCE

### TURBOUNE HORSE INSULATOR



#### PRESENTATION

##### Impression:

The colour detail and technical form are the most noticeable product features which separate this insulator from others on the market

##### Appreciation:

The forms subtle curve and rubber over moulded interior is pleasing to touch and its form is subtle against the posts.

##### Emotion:

The product elicits the desire to snap the jaws closed.

#### REPRESENTATION

##### Recognition:

The product is similar to clips, its jaws indicating where the tape is held. The Gallagher orange and black link the product to the Gallagher product family.

##### Comprehension:

Clip clearly depicts 'Squeeze' action  
Rubber guides the tapes placement.

##### Association:

The materials and form makes the product appear tough and durable, and the rubber over mould conveys a sense of technical quality.

Fig. 041. PPE Turboine insulator.

#### PRESENTATION

##### Impression:

The simple geometric form stands out, as does the colour detail of the insulators inside ring.

##### Appreciation:

The simple shapes are uncomplicated and make the product appear fun and easy to use.

##### Emotion:

Pleasurable to grasp and twist.

#### REPRESENTATION

##### Recognition:

Visually a new aesthetic which has no obvious features common to other industry products.

##### Comprehension:

There is an obvious screw function and handle. The surrounding form and colours indicate clearly that the wire belongs in the centre hole.

##### Association:

State of the art, approaching the product in an innovative way



### XDI SCREW-IN INSULATOR

Fig. 042. PPE XDI insulator.

## 6.4.1 PRODUCT VISUAL IDENTITY/EXPERIENCE

### PRESENTATION

#### Impression:

Bright Orange container and its large handle distinguish the energizer.

#### Appreciation:

Simple lines, subtle curves, clear dial and obvious forms convey the products of ease of use.

#### Emotion:

Assurance; Solid and functional forms.

### REPRESENTATION

#### Recognition:

A container housing that has the identifiable Gallagher curved form and colours.

#### Comprehension:

Obvious switch and side container button. Easily distinguishable carry handle promotes the portability function of the energizer.

#### Association:

Robust, heavy, protective form and materials convey a sense of durability and use in rough environments.



POWERPLUS B40

Fig. 043. PPE: Powerplus B40

SMARTPOWER  
MX7500



### PRESENTATION

#### Impression:

Clear gloss/ smooth matte texture creates an easily identifiable material contrast.

#### Appreciation:

Simple lines, clear connection terminals and information lights up when activated.

#### Emotion:

Quality.  
Pride; high-tech product.

### REPRESENTATION

#### Recognition:

Similar to the other Gallagher energizers in form and the banding aesthetic, but the colours are more subtly presented.

#### Comprehension:

Visually the terminal screws could confuse, and be interpreted as dials to change the energizer screen information.

#### Association:

State of the art, serious application.

Fig. 044. PPE: Smartpower MX7500

## 6.4.1 PRODUCT VISUAL IDENTITY/EXPERIENCE

POWERPLUS B280



**PRESENTATION**

**Impression:**  
Colour contrast, bright, large screw heads, and obvious dials.

**Appreciation:**  
Simple lines, subtle curve to the form. Differing material texture. Clear product semantics.

**Emotion:**  
Pleasure; uncomplicated.  
Pride; specialised, serious.  
Surprise; light activation.

**REPRESENTATION**

**Recognition:**  
Banding effectively acts as a flag for the Gallagher products with the distinctive colour application and form.

**Comprehension:**  
Obvious screw/switch operation. 'Traffic lights' clearly depict the energizer power output levels.

**Association:**  
Professional and well engineered; smooth material transitions remain flush with the form, and balanced positioning of objects.

Fig. 045. PPE Powerplus B280.

**PRESENTATION**

**Impression:**  
Clear glossy shield with a corrugated texture, with minor details.

**Appreciation:**  
Simple lines and subtle curve in the form. Sharp contrast in texture; corrugations/matte finish.

**Emotion:**  
Quality  
Assurance; strong  
Pride; high-tech

**REPRESENTATION**

**Recognition:**  
Corrugated iron texture prevent glare off of the screen and present the solar panels underneath. The Black band and orange dial are synonymous with Gallagher.

**Comprehension:**  
Switch dial has obvious/ clearly stated functions, the semantics of these result in uncomplicated, streamlined use.

**Association:**  
State of the art, Innovative thinking.



POWERPLUS S50

Fig. 046. PPE: Powerplus S50

## 6.4.1 PRODUCT VISUAL IDENTITY/EXPERIENCE

### PRESENTATION

#### Impression:

An odd looking object, which stands out because of its quirky form, bright colour and detail dissimilarity.

#### Appreciation:

Bright and cheerful colours, and a grip detail surrounding the product which appears inviting to grasp.

#### Emotion:

Elicits feelings of delight and playfulness.

### REPRESENTATION

#### Recognition:

Not easily recognisable as being a Gallagher product or the products intended purpose.

#### Comprehension:

The product doesn't communicate what its purpose is very clearly, or how it is operated. On/ Off power button and earthing function are too discreet.

#### Association:

The lack of harmony within the form and details fail to express the products highly professional function.



SMART FIX  
FAULT-FINDER

Fig. 047. PPE: Smart-fix fault finder.

SMART-READER  
HR3



### PRESENTATION

#### Impression:

Interesting form, which sparks curiosity.

#### Appreciation:

Smooth, flowing lines and surfaces create a form which looks appealing to use and comfortable to grasp.

#### Emotion:

A quality product which looks desirable to hold.

### REPRESENTATION

#### Recognition:

New product form which retains the Gallagher colours and the banded colour application.

#### Comprehension:

The coherent forms applied to the handle and trigger demonstrate how the scanner is used. The black indicates the functional parts.

#### Association:

An Innovative and technically advanced product which appears simple to operate.

Fig. 048. PPE: Smartreader HR3

## 6.4.1 PRODUCT VISUAL IDENTITY/EXPERIENCE

### TERMINATION KIT STRAINER



#### PRESENTATION

##### Impression:

A basic, tough strainer. The product doesn't stand out as being different comparative to other brands.

##### Appreciation:

Robust and simple looking portrays a high sense of security and utility.

##### Emotion:

Value for money.  
Fun; Appears desirable to crank.

#### REPRESENTATION

##### Recognition:

The strainer looks like other similar products on the market, but lacks the Gallagher identity.

##### Comprehension:

The semantics of the cog indicate an obvious turning direction but not how to turn the cog and attach the wires.

##### Association:

Rugged, 'no nonsense' tool, which gives the impression of robustness and durability.

Fig. 049. PPE: Termination Kit.

#### PRESENTATION

##### Impression:

Large reel product which has a distinct function

##### Appreciation:

Rubber over-moulded grips on the handles add pleasure and worth to the product. There is a desire to crank the reel.

##### Emotion:

Pleasure in the products simplicity and apparent ease of use.

#### REPRESENTATION

##### Recognition:

Similar to an oversized fishing rod reel which helps to describe its function. Only the plastic parts resemble Gallaghers product line.

##### Comprehension:

Handles clearly indicate where to hold the product and the obvious cranking action required to function.

##### Association:

Simple and reliable to operate.



### GEARED REEL

Fig. 050. PPE: Geared reel.

## 6.5.0 VISUAL IDENTITY ANALYSIS

Warell's (2006) format analysis matrix is a methodical analysis tool used to determine the strongest visual forms, materials, and colours which form the identity of a brand (ie. Gallagher).

As a result of applying the format analysis matrix to the Gallagher products (Table 006), the five most prominent Gallagher product traits were identified and categorised into the following groups discussed in this section:

- Banding
- Colour distribution
- Elliptical curved form
- Circular attribute
- Corrugated texture

## 6.5.0 FORMAT ANALYSIS MATRIX

### COMMENTS:

Generally the more expensive and higher quality products possess the most visual cues.

Curved geometrical forms, were the strongest identifiers, including the 'banding' aesthetic.

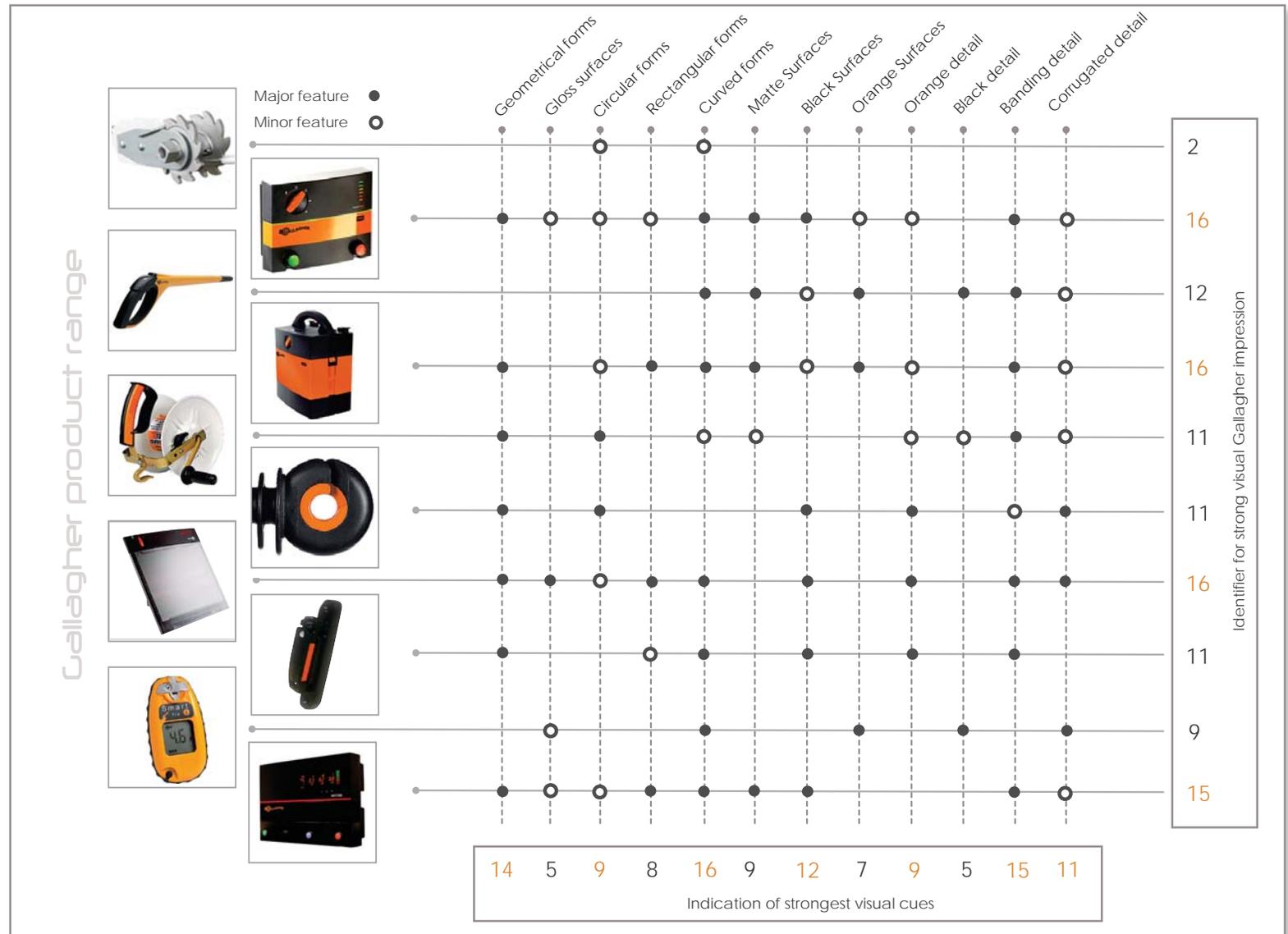


Table. 006. Format analysis matrix.

## 6.5.1 VISUAL IDENTITY ANALYSIS

### COLOUR DISTRIBUTION

Typically applied to the parts of the product that require user interaction, the orange colour creates a sharp visual contrast against the black surfaces. Predominately it is used to expose the product features and create a focal point.

Regardless of the products black/ orange colour ratio, It is valuable to note that the black is always applied to frame or contain any orange features or surfaces on the product.



Fig. 051. Gallagher colour distribution.



### ELLIPTICAL CURVED FORM

The sleek, elliptical form features in various ways to form the basis of Gallaghers product part and detail identity.

The gentle curve is a distinctive quality of the Gallagher product range which differentiates itself from the other competitors products, whilst maintaining an aesthetic of faultless functionality and robustness.

There is an obvious relationship between the overall architecture of the product and its parts, which all adopt the bold lines and smooth curves, establishing product unity.

Fig. 052. Gallagher elliptical curved forms.

## 6.5.1 VISUAL IDENTITY ANALYSIS



Fig. 053. Gallagher circular attributes.

### CORRUGATED TEXTURE

The corrugated texture serves to indicate the use or function of the product and that of its parts, allowing for easy handling or to visualise its purpose. Semantically the corrugations indicate function ie. twisting the screw heads, or indicate grip placement. (Smartfix fault-finder)

Functionally the corrugations provide grip to handles and screw heads, as well as strengthening the plastic surfaces on the product.

Aesthetically the corrugated surface on the solar energizer (S50) indicates that the products transparent surface is designed to protect the panel, as well as diffusing any glare from sunlight.



Fig. 054. Gallagher corrugated texture detail.

## 6.5.1 VISUAL IDENTITY ANALYSIS

### BANDING

The most obvious form related feature used in the Gallagher products is the banding or strip aesthetic. The band is boldly incorporated into the products to act similarly to a flag; allowing the user to differentiate the product from a far, proudly stating that it belongs to the Gallagher range without requiring obvious logo placement.

The strip has been displayed in various ways depending on the products over all form and the materials used.

With the Gallagher products that possess colour schemes which are more subtle or monotone, the texture provides the banding distinction with matte or gloss finishes. This works well to highlight and separate the band feature without the conspicuous use of high contrasted colour.

In most cases the texture difference is not required as the banding effect is often created with the orange colour application, however the texture finish does help to link the product range together.



Fig. 055. The 'Banding' visual trait in Gallagher products.

## 6.6.0 PPE DISCUSSION: GALLAGHER BRAND IDENTITY

Currently the Gallagher fence hardware products lack a distinct visual identity. The strainers, posts and the majority of insulators haven't been aesthetically styled to match the rest of the product range. They fail to resemble the Gallagher products, as well as failing to differentiate themselves from the same competitors products that are on the market. The lack of a cohesive visual identity must be rectified within the proposed fence concept.

The five main features detailed in the visual identity analysis will act as guidelines in which to base the concepts aesthetics and will ensure that the concept is recognised as a product which belongs to the Gallagher product family.

The use of black promotes the message of professionalism in the Gallagher range (ie. Smartpower MX7500, Powerplus S50), whilst orange dominated products convey a sense of playfulness and feature more commonly in the lower 'hobby' range of products. Whilst the proposed fence concept is targeted towards hobby users, it cannot be perceived as being unprofessional, nor second-rate. Applying the strong, sleek colour black would assist promoting the products advanced design and innovation.

## 6.7.0 'RESEARCH FOR DESIGN' CONCLUSION

The 'research for design' methods investigated a range of issues in context to the proposed fence system and end user. The results from these methods led to the development of additional performance and experience design criteria (Tables 7-10), which were integrated within the existing criteria outlined in Section 3.5.

The research for design also provided insight in to the following areas which require further exploration throughout the 'research through design' process (8.0) to fulfill the research aim:

- Apply the PPE identified Gallagher product traits to the fence proposal's design in a way that recognisably links the design to the Gallagher product range.
- Create an identity for the product and the components which differentiates itself from other industry products.
- Discover ways to design a foolproof fence system, so that it is impervious to user error or misuse.
- Improve the fence construction experience by substituting the 'wire linking', removing arduous physical effort and creating a product which is more intuitive to comprehend.
- Design a new method of wire attachment, substituting the wire tying skill with a more cognitive task.

The intent of the 'research through design' phase is to utilise the knowledge gained as a result of the research questions and methodologies, and apply this to the design process, whilst following each guideline stated in the performance and experience criteria.

## 7.0 PERFORMANCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Future proofed to allow for further modifications or additional hardware			○	
Foolproof system to ensure correct, safe assembly and installation		○		
Posts erected and assembled without expensive tools or machinery		○		
A system that is competitively priced comparative to existing permanent fence systems			○	
Safe for the user and the targeted livestock	○			
A specialised Gallagher only proprietary system	○			
One system suitable to contain all of the specified livestock		○		
Fast installation in comparison to current systems		○		
Environmentally friendly materials used.			○	

Table. 007. Performance criteria.

PERFORMANCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Durable against the European climate and potential livestock damage	<input type="radio"/>			
Lightweight and easily transportable		<input type="radio"/>		
Must accommodate the existing Gallagher products (ie. Equi-wire, braid, tape, HT wire and under-gate cabling)	<input type="radio"/>			
Materials and assembly that will last 15-20 years minimum	<input type="radio"/>			
Use existing technologies and materials	<input type="radio"/>			
No complicated wire tying		<input type="radio"/>		
Suitable for the majority of farm soil conditions; sandy, clay, hard packed soil and rocky soil.		<input type="radio"/>		
Wire tension indicator			<input type="radio"/>	

Table. 008. Performance criteria.

EXPERIENCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Original aesthetic/materials which noticeably differentiates itself from other products in the market.	<input type="radio"/>			
Aesthetic styling that will last 15-20 years without out-dating.			<input type="radio"/>	
Conveys a sense of professionalism, both aesthetically and functionally.		<input type="radio"/>		
Product identity has a strong sense of belonging within the Gallagher product range.	<input type="radio"/>			
Design conveys a sense of safety to the user and livestock, through the visual styling and materials.		<input type="radio"/>		
Must appear and feel structurally strong and durable.		<input type="radio"/>		
Visually appropriate aesthetic, which doesn't impede/disrupt the landscape.			<input type="radio"/>	

Table. 009. Experience criteria.

## EXPERIENCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Overall form must look tidy, and not overly complex.			○	
Intuitive assembly/installation procedure, requiring minimal instruction		○		
Design elements styled to reference traditional fences.				○
No parts are to stress/scare the livestock.	○			
Visible to the user and stock, for safety reasons.			○	

Table. 010. Experience criteria.

## 8.0 'RESEARCH THROUGH DESIGN' RESULTS

This section reports and discusses the results from a typical iterative design process. The aim of this iterative design process was to develop an electric fence design proposal which focused on fulfilling the experience and performance criteria.

The concept generation and design development phases have been categorised into the following five sections:

- Strainer post installation and stay assembly design
- Strainer design
- Line post and insulator design
- Cut out switch design
- Gate design

Focus groups, test rigs and full scale prototypes contributed to the design and development phase. They are explained in the following sections:

- Focus groups
- Prototypes/ Test-rigs
- Prototype evaluation; International conference results

## 8.1 FOCUS GROUPS

At specific points of the 'research through design' phase ( ideation, concept generation, design development and proto-types) a focus group consisting of engineers, marketing personnel, project managers, fencing experts and the researcher met for scheduled appointments. The reason for these meetings was to provide the researcher with advice and technical specifications at each stage of the products development process.

The results of the focus group's discussions are evident throughout the 'research through design' phase. Transcripts of the meetings are in the Appendices. The focus group meeting dates and objectives are as stated:

### BRIEF INTRODUCTION

March, 2008

Objectives: Comprehensively interpret the brief and identify suitable directions for the investigation.

Duration: 1 day

### IDEATION

16th-20 June

Objectives: Spend time at Gallagher Ltd. to learn more about the company. Use the 'research for design' information and criteria to generate fence concepts. Discuss and evaluate the concepts.

Duration: 5 days

### CONCEPT EVALUATION

27th August, 2008

Objectives: Researcher to present concepts of the proposed fence system and gain feedback on the designs.

Duration: 1 day

### DESIGN DEVELOPMENT

Phone conference

29th October, 2008

Objectives: Send copies of design development to the focus group members for discussion and evaluation.

Duration: 1 hour

### DESIGN/PROTOTYPE EVALUATION

19th November, 2008

Objectives: Evaluate the developed design and a full scale prototype to identify and address any unresolved product/design issues.

Duration: 1 day

## 8.2 CONCEPT GENERATION: STRAINER POST INSTALLATION

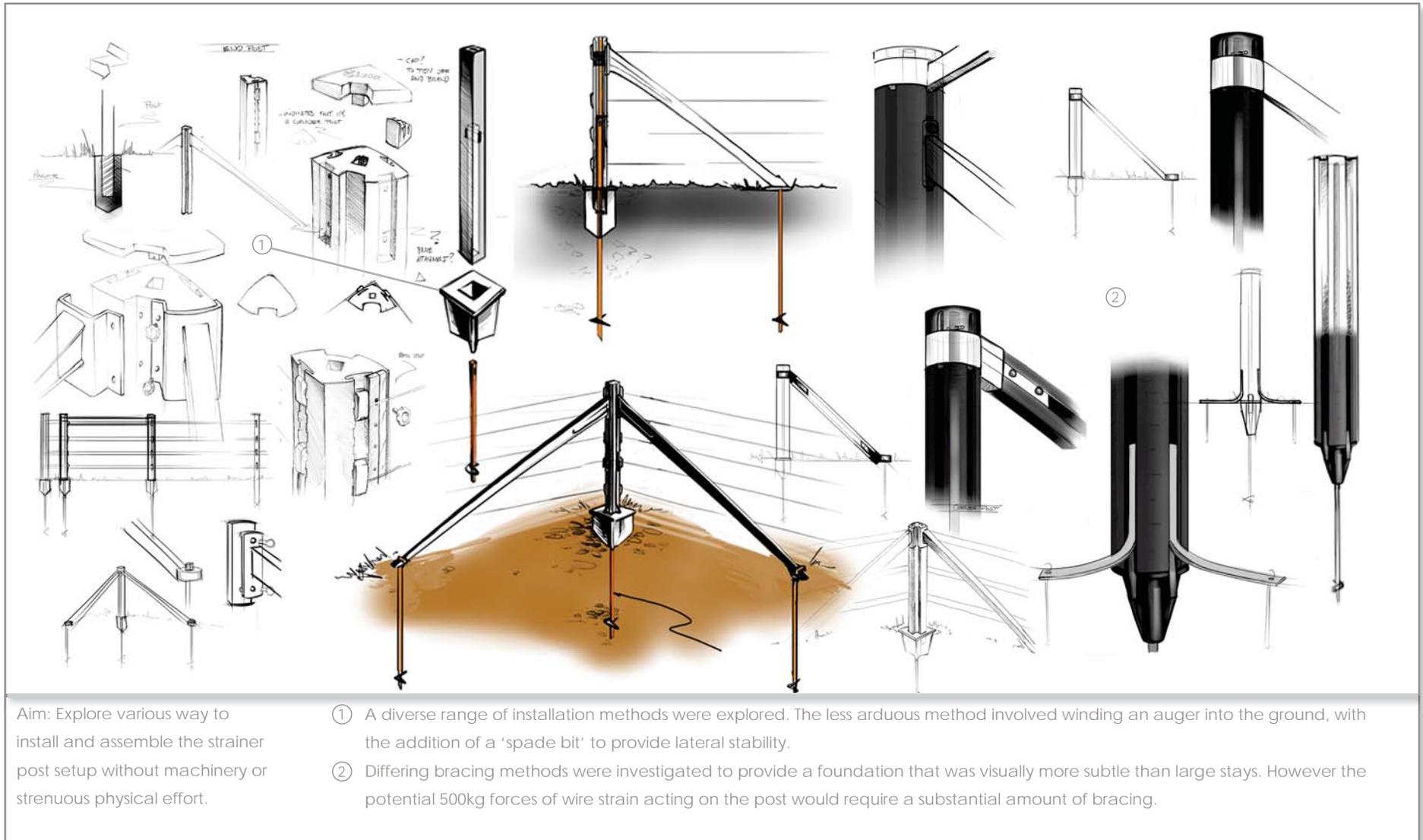
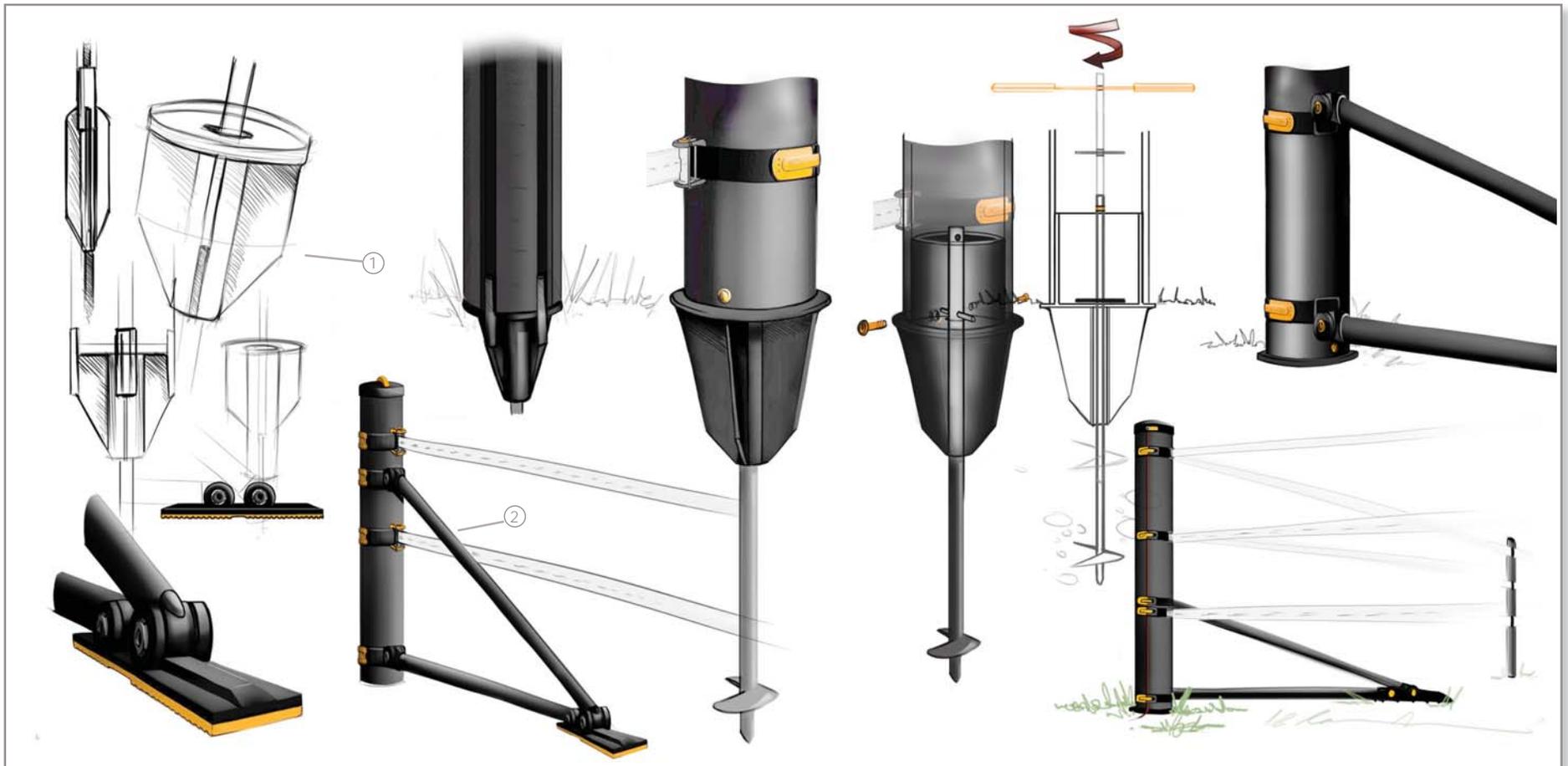


Fig. 056. Strainer post installation concepts.

## CONCEPT DEVELOPMENT: STRAINER POST INSTALLATION

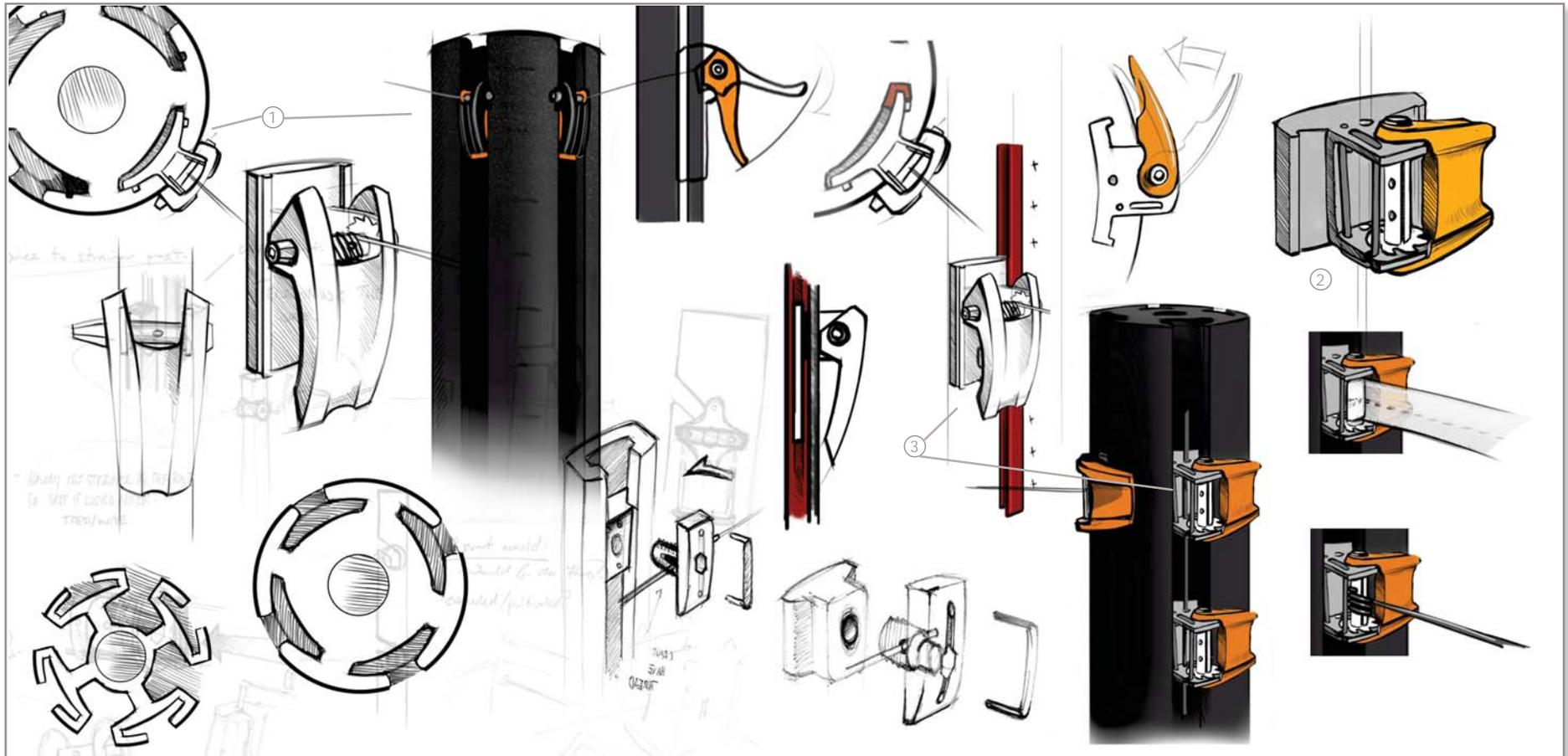


Aim: Develop concept. Refine the system, materials and aesthetic properties.

- ① Prototypes were constructed to test the auger and 'spade bit' installation method (See Prototypes testing). The concept proved a suitable foundation to counteract the pull force and lateral forces that would be inflicted upon the post.
- ② Fibreglass tube stays were deemed the fastest and strongest method of supporting the post. The stay aesthetics were styled to match/merge with the line post's appearance by applying the same profile.
- ③ Incorporating the buckle attachment to the stays, neatly unifies the strainer post's aesthetic with the rest of the assembly.

Fig. 057. Strainer post installation development.

## CONCEPT GENERATION: STRAINER ASSEMBLY



Aim: Investigate various methods of tensioning Wire/Tape and attachment to the strainer post.

- ① The strongest preliminary concept integrated an 'over centre' lock mechanism to tightly sandwich the strainer to a specific groove in the strainer post. The extruded groove concept matched the line posts function and aesthetic and looked visually tidy.
- ② As identified in the scenario analysis, wire linking needed to be an easier, more streamlined process. Integrating the linking system into the strainer proved to be the neatest and most effective way to resolve the issue.
- ③ Initially a metal 'contact strip' was explored to link the current to each wire, followed by threading a wire through each strainer.

Fig. 058. Strainer assembly concepts.

## CONCEPT DEVELOPMENT: STRAINER ASSEMBLY

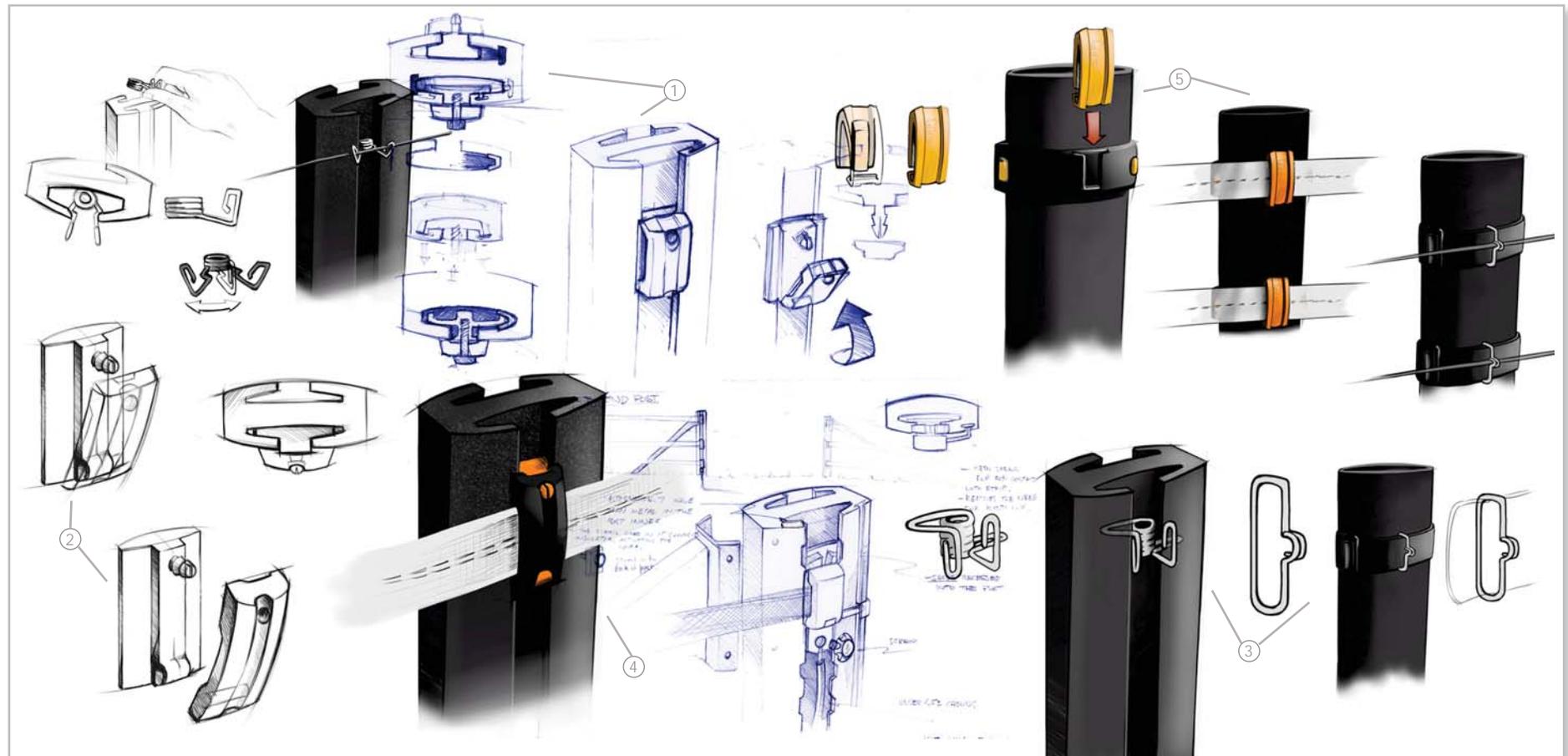


Aim: Further refine the concept focusing on the usability and function of the product. Create an aesthetic to suit the rest of the system.

- ① The groove method was deemed unable to withstand the potential force acting on post and so the development of an extruded tube design was undertaken.
- ② Over-centre locking buckles with nylon straps were investigated to hold the strainer tightly against the post. This design was effective as it allowed for multiple hardware to be attached on the same strap. The Gallagher 'banding' aesthetic was also visibly apparent.
- ③ The strainer design was also altered to tension both tape and wire whilst retain the 'linking wire' function.

Fig. 059. Strainer assembly development.

## CONCEPT GENERATION: LINE POST+ INSULATORS



Aim: Generate appropriate line post and insulator assembly concepts which respond to the research aim and fulfill the design criteria.

- ① The initial extruded post expressed the gentle curved form and the stripe or 'band' aesthetic attributed to the energizer products.
- ② The insulators were designed to slide down the posts length and snap tightly closed, sandwiching the rail walls to hold in place.
- ③ Cost effective methods to hold wires were explored, producing a series of 'torsion spring' clip concepts.
- ④ This was a highly regarded concept, yet later dismissed to match the strainer posts form, unifying the fence systems overall aesthetic.
- ⑤ An elliptical profile line post was introduced to resemble the strainer posts circular form, and provide direction along the fence line.

Fig. 060. Line post and insulators concepts.

## CONCEPT DEVELOPMENT: LINE POST+ INSULATORS



Aim: Develop the line post and insulator assembly concepts refining the functionality, usability and aesthetic properties.

- ① Exploration of methods to attach insulators to the elliptical extruded profile. Cost effective zip ties, clips and sleeves were scrutinised.
- ② Alternative methods of post installation were investigated, such as an fibreglass rod within the post sleeve to simply drive into the earth. However, whilst less strenuous to install, the cost would be greatly increased and significantly less environmentally friendly.
- ③ A hand driven extruded profile with post manufacture tapering was deemed the most appropriate solution. The polypropylene material accommodates easily hand screwed insulators, as well as height and wire markings to be branded in to the post walls.

Fig. 061. Line post and insulators development.



CONCEPT DEVELOPMENT: CUT-OUT SWITCH



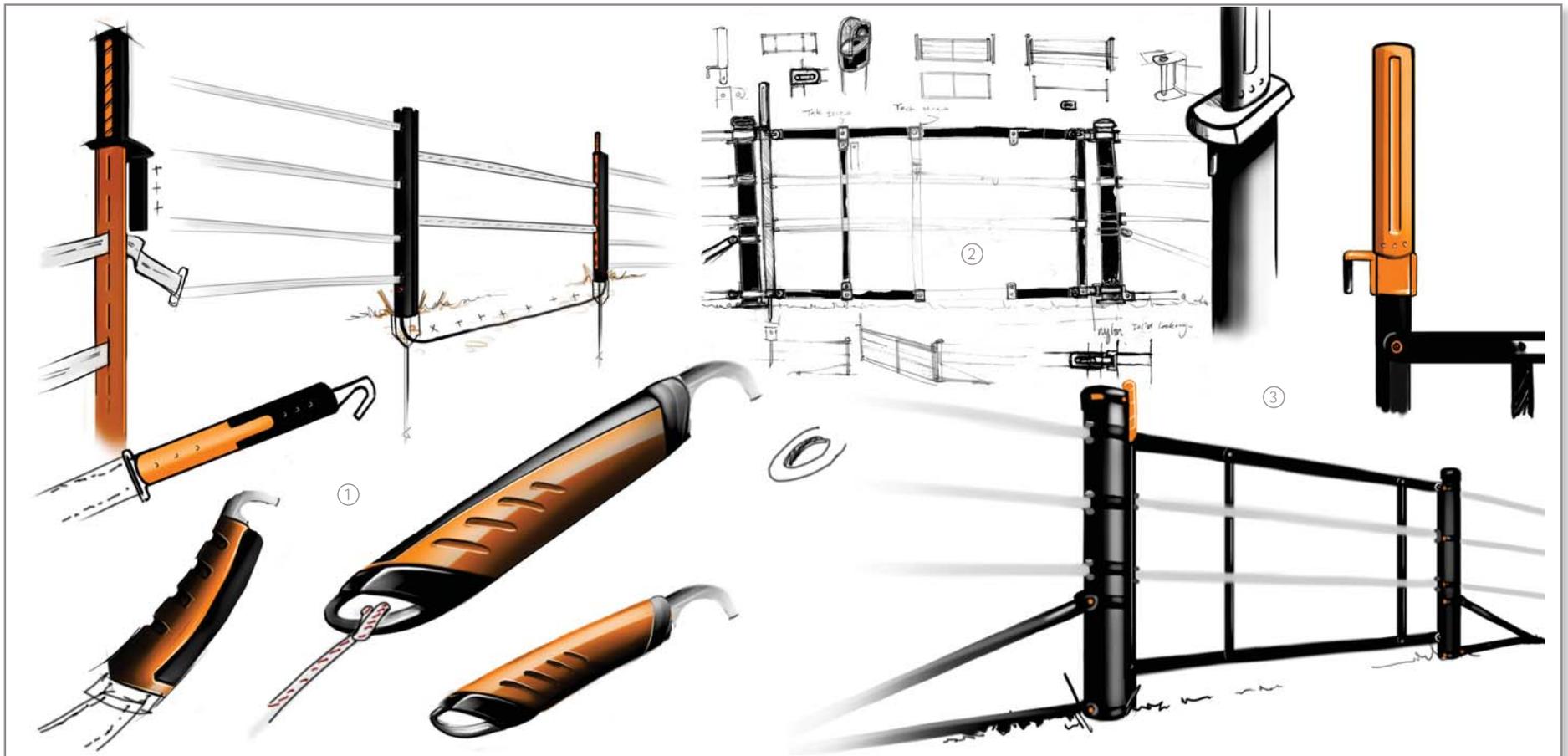
Aim: Aesthetically detail the switch to match the rest of the fence design. Refine the switch to function simply for manufacture and use.

- ① Different designs were explored to enhance the visibility of the cut-out switch's 'On/Off' power status.
- ② The leadout cable and linking wires are connected to the cut-switch by screw clamping them to separate terminals. Joining the terminals by twisting the switch to the 'On' position connects the current, twisting in the opposite direction disengages the current.
- ③ Controlling multiple fence lines from the cut-out switch is required. The solution having been achieved with placement of an additional metal strip (jubilee clip) which securely connects the linking wires.

Fig. 063. Cut-out switch development.



## CONCEPT DEVELOPMENT: GATE DESIGN



Aim: Develop a gate design that focuses on usability and functionality aspects, whilst retaining a visual unity with the rest of the fence system.

- ① Differing gate handles were explored in an attempt to add life to the current handles on the market.
- ② After the feedback at the International conference it was clear that a rigid gate was preferred rather than tape. Not only do they typically sustain less damage but are easier to use whilst handling livestock. Current rigid steel gates would apply excessive loading strain on this fence systems posts. To avoid the loading on the post hinges, a gate which acts similarly to a parallelogram was devised.
- ③ The parallelogram system prevents excess force on the hinges by transferring the weight of the gate to the user.

Fig. 065. Gate development.

### 8.3 PROTOTYPES/ TEST RIGS



Aim: Test how well the concepts physically function to determine which concepts are viable options for development.

- ① The auger concept was constructed with galvanized steel tube and tested by driving it into various soil types. The auger was surprisingly a lot easier to drive into the earth than expected, and would drive quickly and hold very firmly in the ground.
- ② The 'Spade bit' required more time to construct and test. Initially the first few test rigs were too large and wouldn't easily enter the ground. The smaller test rig with more angular auger fins proved more successful. The foundation took no more than 3 minutes to install.
- ③ Various post sizes were also tested to determine how well they went into the ground, and the most visually appropriate size of the strainer and line posts.

Fig. 066. Test rigs and prototype testing.

## 8.4 PROTOTYPE EVALUATION

### INTERNATIONAL CONFERENCE RESULTS

The annual Gallagher International conference was a 3 day event (19th-21st November, 2008) which featured a concept product launch demonstrating upcoming Gallagher products.

Attended by over 100 international Gallagher retailers, the conference was a great opportunity for the researcher to present a 'looks-like' prototype of the proposed fence design, and receive professional feedback from Gallagher international staff and farm owners.

This section provides a brief overview of the feedback received relating to the design throughout the presentations: (See Appendices for full International conference transcript)

- Predominately the fence design feedback was positive, with all spectators showing interest in the prototype.
- The overall systems aesthetic was well received, particularly the line posts form and detailing. A tapered end was viewed as an essential feature to assist driving the line posts into hard ground.
- The lead-out cable installation was preferable inside the Strainer post, rather than running up along the outside.
- The linking system was regarded as an innovative idea. Using wire only to connect the current would operate more successfully than tape, because the tape would be less reliable and could potentially 'burn' under the current.



Fig. 067. Prototype display at the Gallagher pavilion at Mystery Creek, Hamilton.

- Cut-out switch activation status needs to be visible from any angle. The aesthetic and function were highly regarded, yet can be further improved by adding grip details and an 'on/off' logo to improve the products semantics.
- The researcher's original intention was to incorporate a tape gate into the fence system, however tape gates are perceived as being an annoyance to use by many participants. The main reason was that tape gates are slower to open and close compared to rigid steel gates, and horses would balk when walking across tape gates which were still powered. Hence, the challenge arose to design a solid gate which didn't put undue stress on the Strainer/gate post, whilst being quicker and less complicated to use than a tape gate.



Fig. 068. Prototype display and presentation.

# the final design

## 8.5 FINAL DESIGN 1 : 1 SCALE MODEL

### DESIGN FEATURES >

The strainer post assembly gives the fence system its structural integrity, typically used at each corner of the field and gateways. Made from plastic coated fibreglass, the strainer post is lightweight, chemical resistant and all weather insulated for Europe's extreme weather conditions.

The lightweight posts and stays are easily transportable by hand, wheel barrow or trailer during the fence installation. The protective coating ensures the material won't splinter or fray, harming the user.

The black colour has been applied not only to signify Gallagher's brand identity, but to establish a connection to the black 'post-and-rail' fence aesthetic, most commonly attributed to horse studs. It is a very neutral, clean colour which would compliment the lush green fields of Europe.

The colour black also elicits a sense of strength and visual robustness in the post.

- ① Strainer post
- ② Brace platform
- ③ Stay
- ④ Stay assembly
- ⑤ Strainer
- ⑥ Linking wire
- ⑦ Cut-out switch



Fig. 069. The Final design's strainer post assembly.

## FINAL DESIGN 1 : 1 SCALE MODEL



### DESIGN FEATURES >

- ① The line post is formed from extruded polypropylene and doesn't require a lot of structural strength as it holds no wire tension. Polypropylene provides the post with a lot of flexibility, minimising the risk of breakages that could occur and it is also highly recyclable.

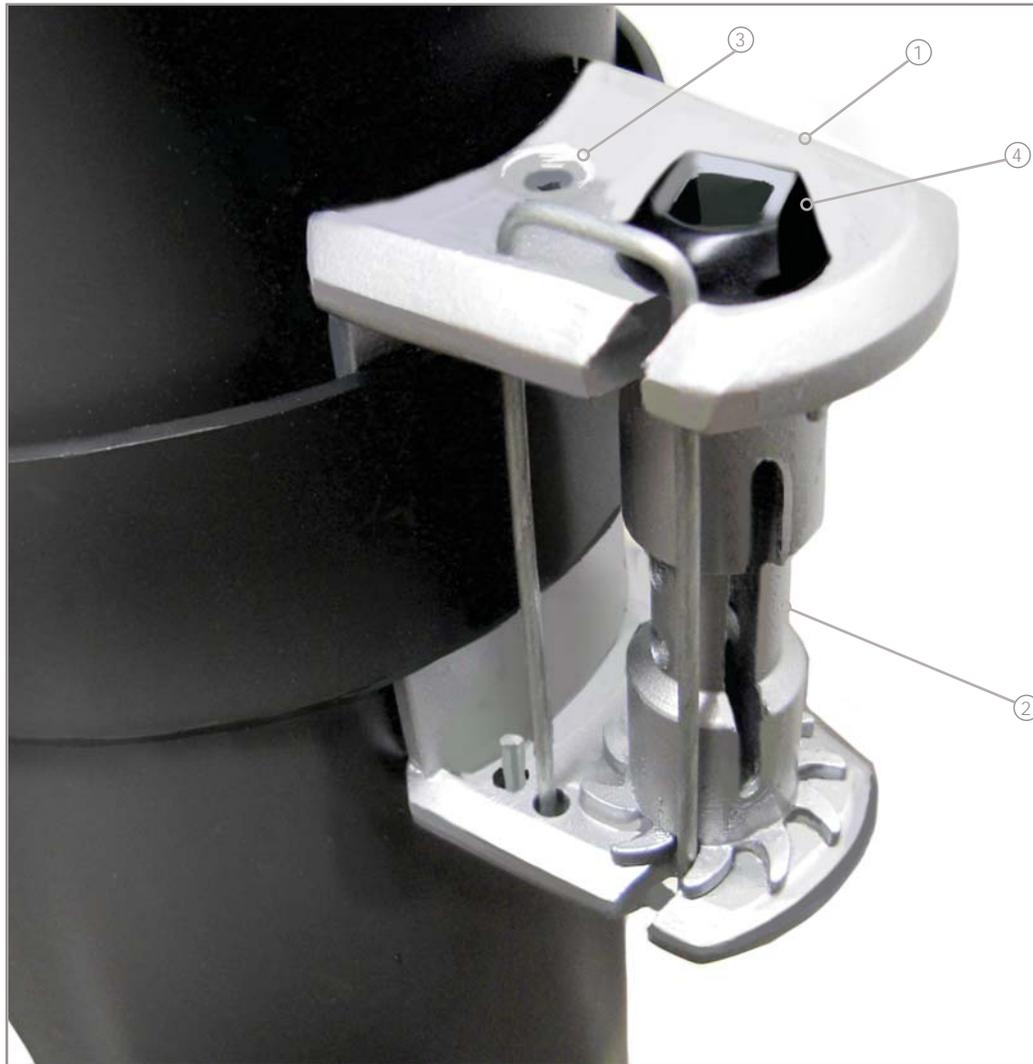
The line post adopts the same elliptical profile as the stays, which synthesizes the fencing system. The elliptical form makes the line post easier to install compared to current line posts as it is easily orientated against the fence line, whilst aesthetically conveying a strong sense of direction.

- ② The nylon straps run through the strainers and buckled with a HDPE over-centre latch, securing the strainers tightly to the post.

The straps can accommodate multiple strainers and are used to secure the stay connection assembly. The effect which the straps create, subtly elicit the Gallagher 'Banding' aesthetic, further unifying the fence concept with the rest of the Gallagher product range.

Fig. 070. The final design: Strainer post and line post.

## FINAL DESIGN - STRAINER



### > DESIGN DETAILS

- ① Galvanized steel body. Elongated circular form resembles the visual identity established in the cut-out switch, brace platform and strap buckles.
- ② Universal spindle which accommodates both tape or wire.
- ③ Designated hole to thread the 'linking wire' through. The electric current from the wire travels through the strainer to the spindle, activating the fence line.
- ④ Bolt head specially designed for the 'tensioning tool', or minor tension adjustments able to be made using a standard wrench.



'Tensioning tool' with an integrated clutch and set Tape/Wire settings to ensure the correct tension is has been placed on the fence line.

Fig. 071. The final design; Strainer.

## FINAL DESIGN - LINE POST

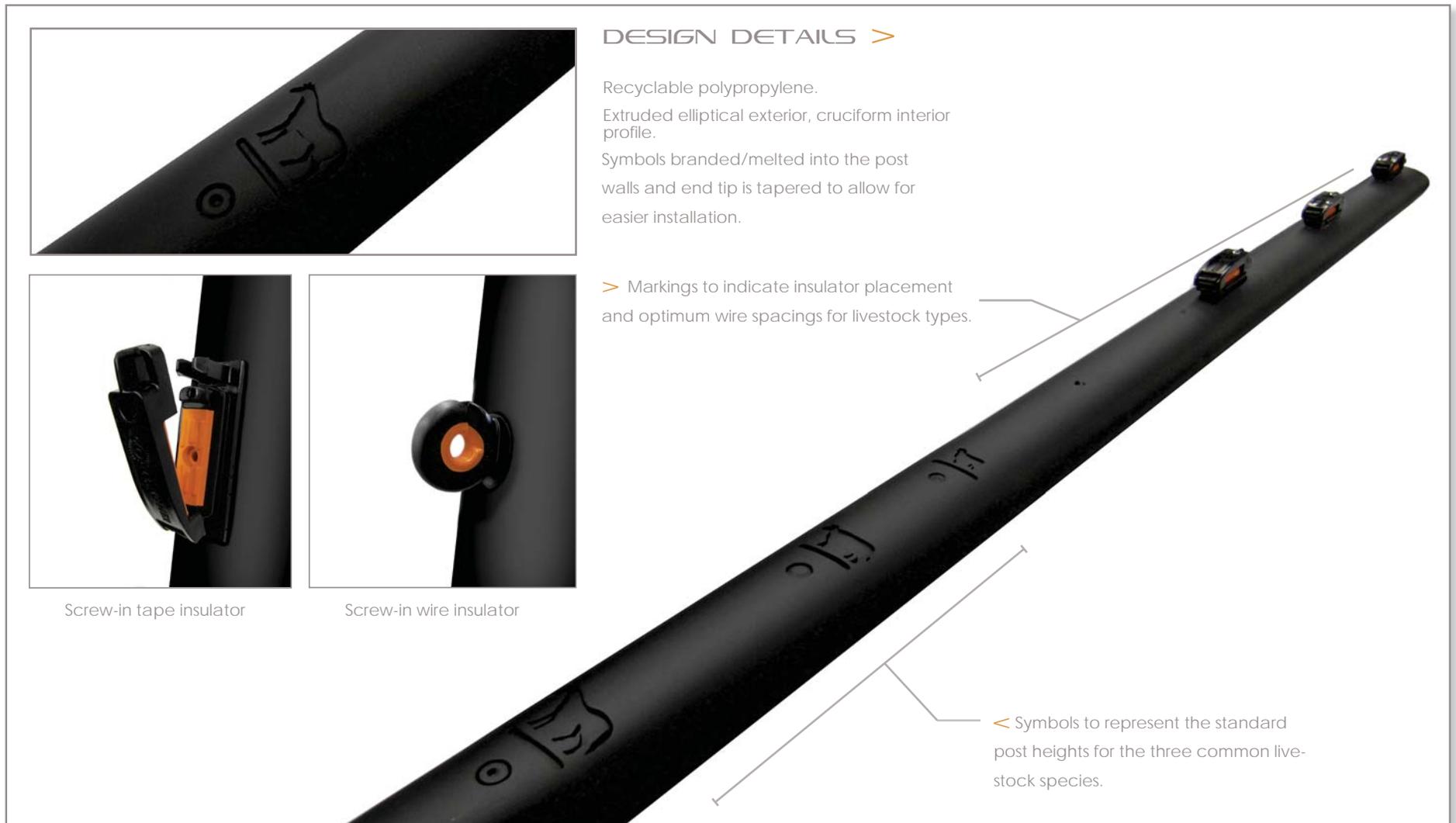
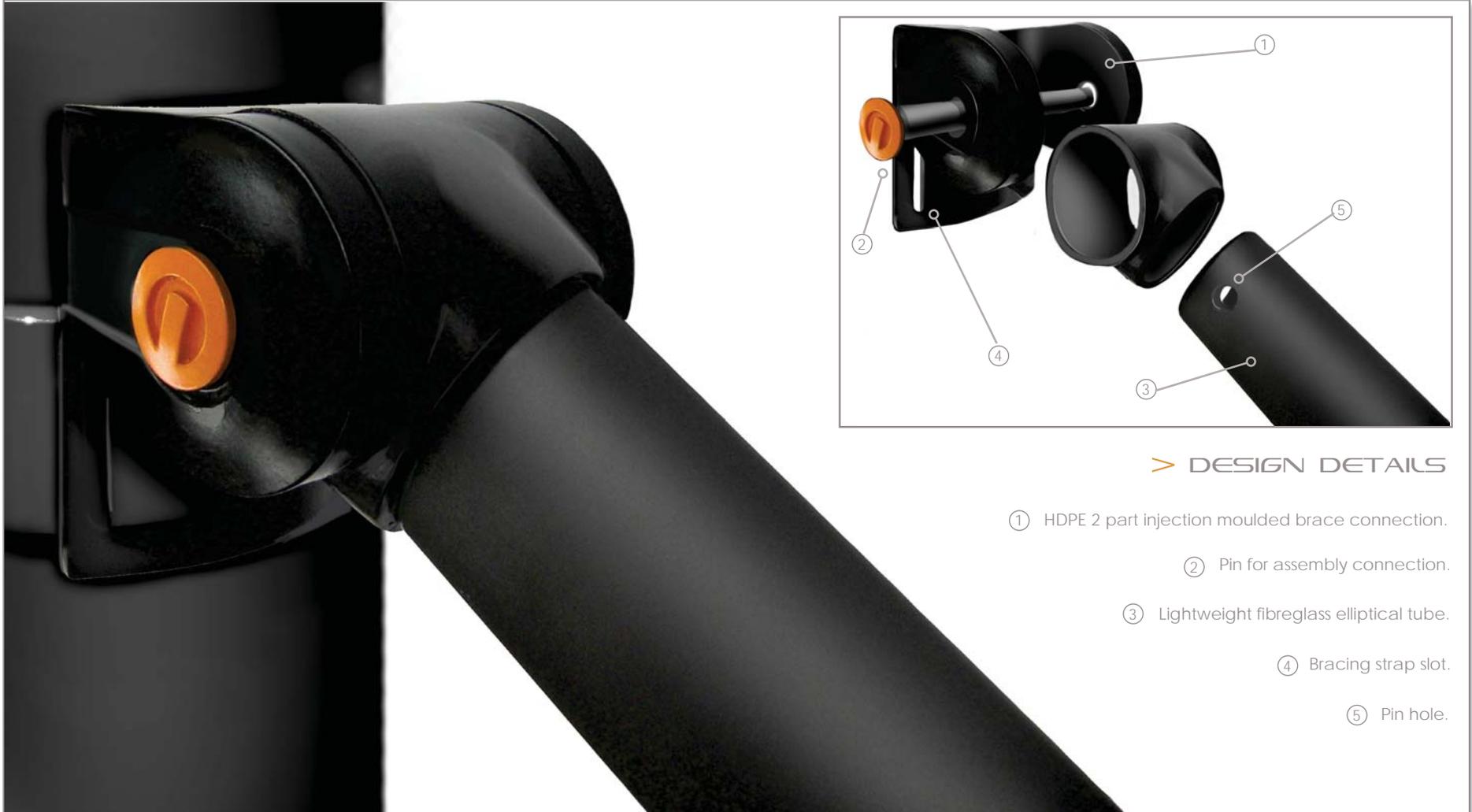


Fig. 072. The final design; Line post.

## FINAL DESIGN - STAY ASSEMBLY

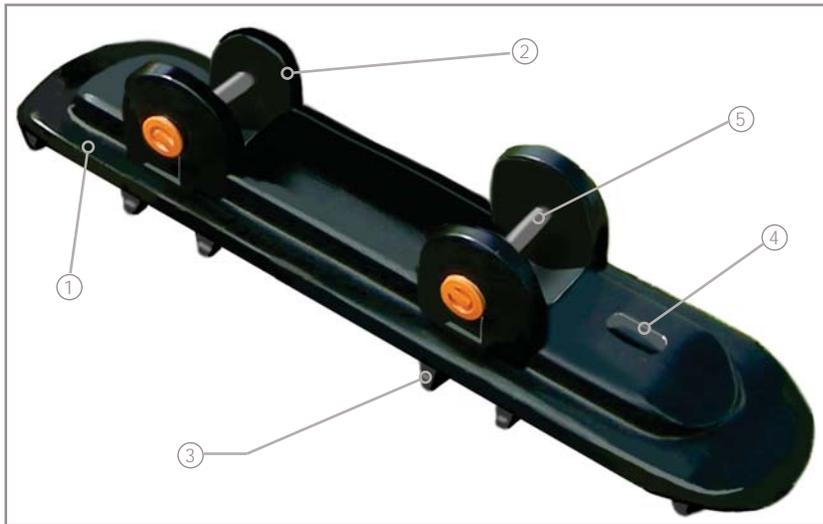


### > DESIGN DETAILS

- ① HDPE 2 part injection moulded brace connection.
- ② Pin for assembly connection.
- ③ Lightweight fibreglass elliptical tube.
- ④ Bracing strap slot.
- ⑤ Pin hole.

Fig. 073. The final design; Stay assembly.

## FINAL DESIGN - BRACING PLATFORM



### DESIGN DETAILS >

- ① HDPE 2 part injection moulded base.
- ② Semi-circular brace supports. Aesthetic matches the stay assembly connectors and compliments the posts circular form.
- ③ Sprigs for added resistance against platform movement.
- ④ Auger slot to secure in place at gateways.
- ⑤ Steel pin with 'banded aesthetic' HDPE caps.



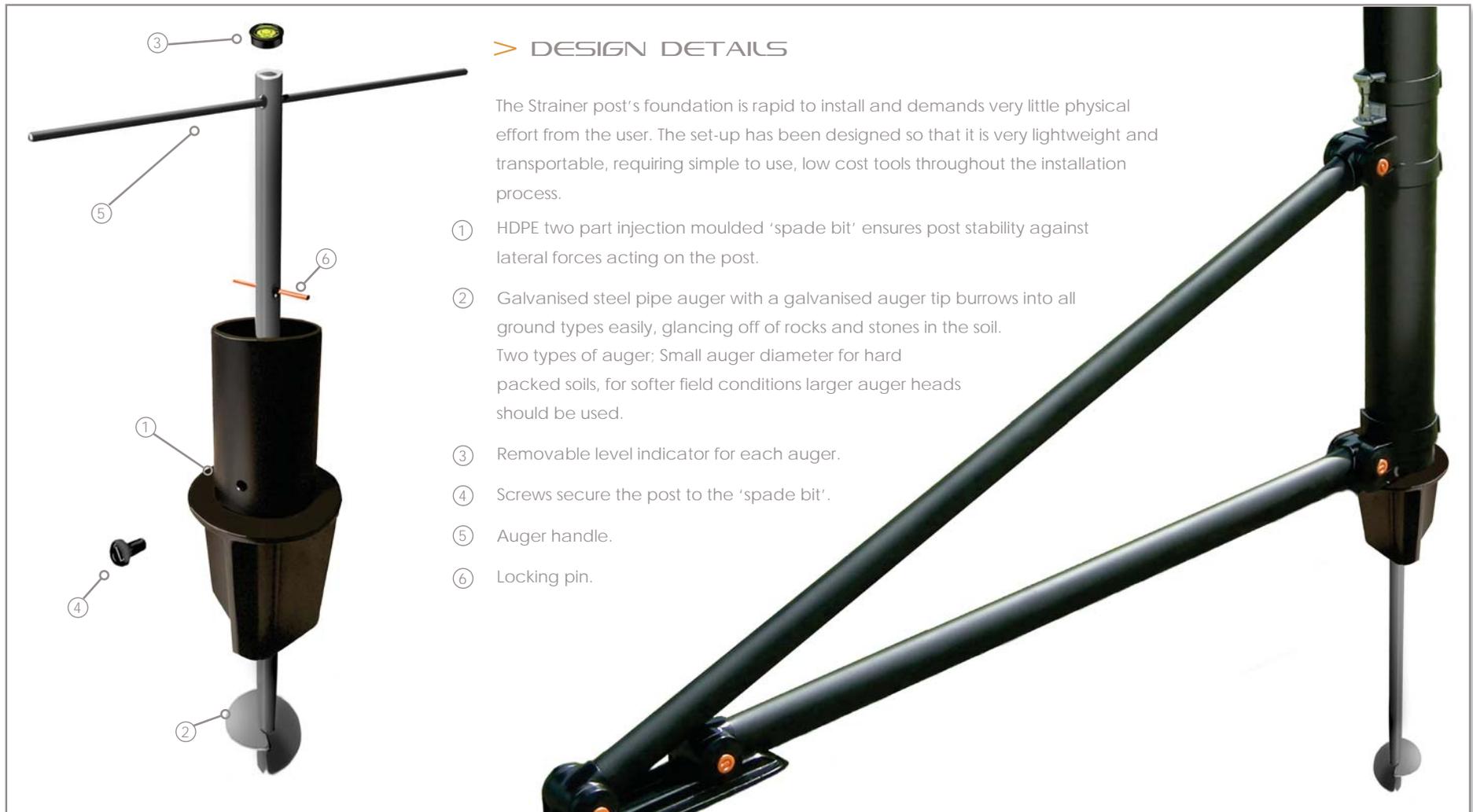
Fig. 074. The final design; Bracing platform.

## FINAL DESIGN - CUT-OUT SWITCH



Fig. 075. The final design; The cut-out switch.

## FINAL DESIGN - STRAINER POST FOUNDATION



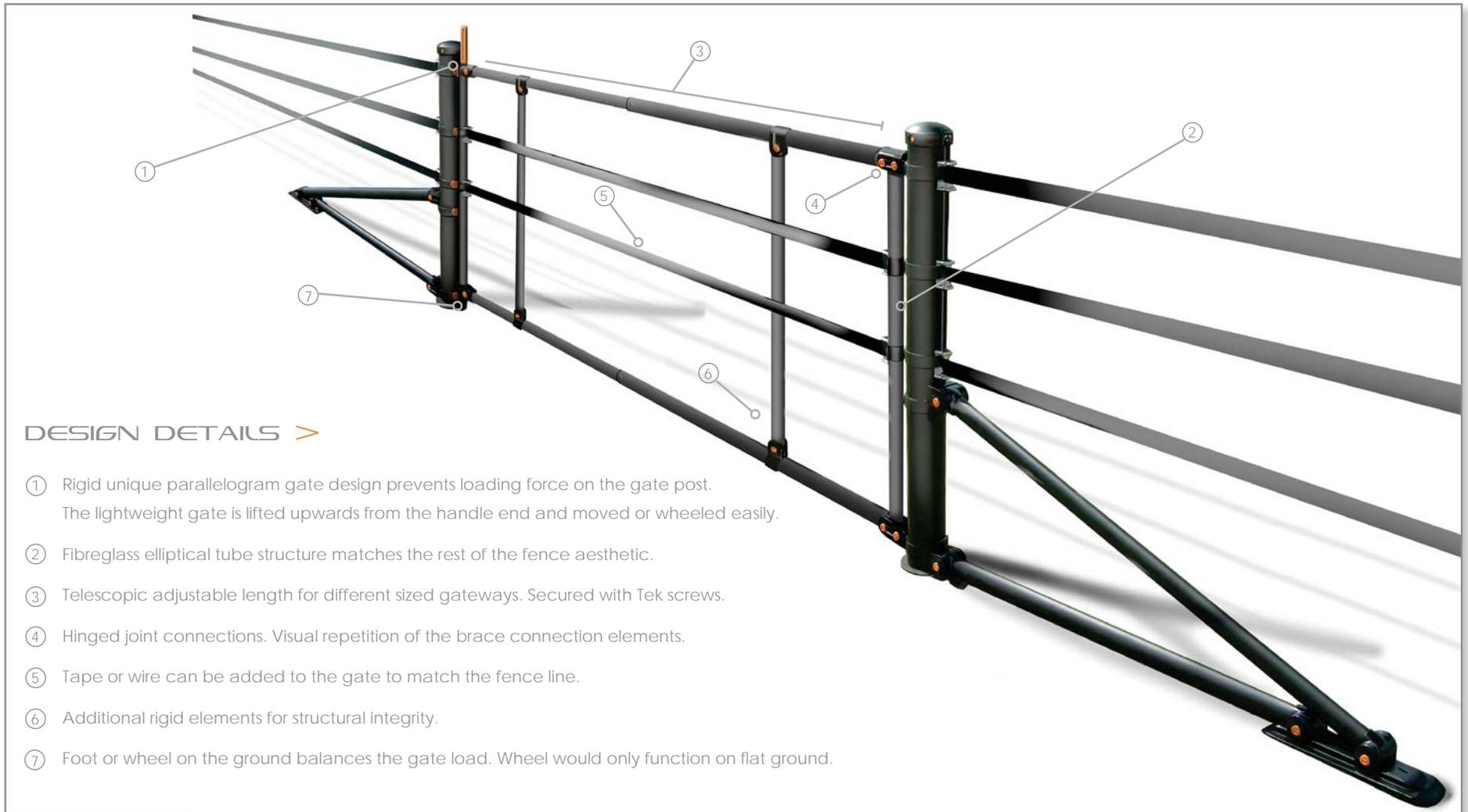
### > DESIGN DETAILS

The Strainer post's foundation is rapid to install and demands very little physical effort from the user. The set-up has been designed so that it is very lightweight and transportable, requiring simple to use, low cost tools throughout the installation process.

- ① HDPE two part injection moulded 'spade bit' ensures post stability against lateral forces acting on the post.
- ② Galvanised steel pipe auger with a galvanised auger tip burrows into all ground types easily, glancing off of rocks and stones in the soil. Two types of auger: Small auger diameter for hard packed soils, for softer field conditions larger auger heads should be used.
- ③ Removable level indicator for each auger.
- ④ Screws secure the post to the 'spade bit'.
- ⑤ Auger handle.
- ⑥ Locking pin.

Fig. 076. The final design; Strainer post foundation.

## FINAL DESIGN - GATE



### DESIGN DETAILS >

- ① Rigid unique parallelogram gate design prevents loading force on the gate post. The lightweight gate is lifted upwards from the handle end and moved or wheeled easily.
- ② Fibreglass elliptical tube structure matches the rest of the fence aesthetic.
- ③ Telescopic adjustable length for different sized gateways. Secured with Tek screws.
- ④ Hinged joint connections. Visual repetition of the brace connection elements.
- ⑤ Tape or wire can be added to the gate to match the fence line.
- ⑥ Additional rigid elements for structural integrity.
- ⑦ Foot or wheel on the ground balances the gate load. Wheel would only function on flat ground.

Fig. 077. The final design; The gate set-up.

## FINAL DESIGN - GATE

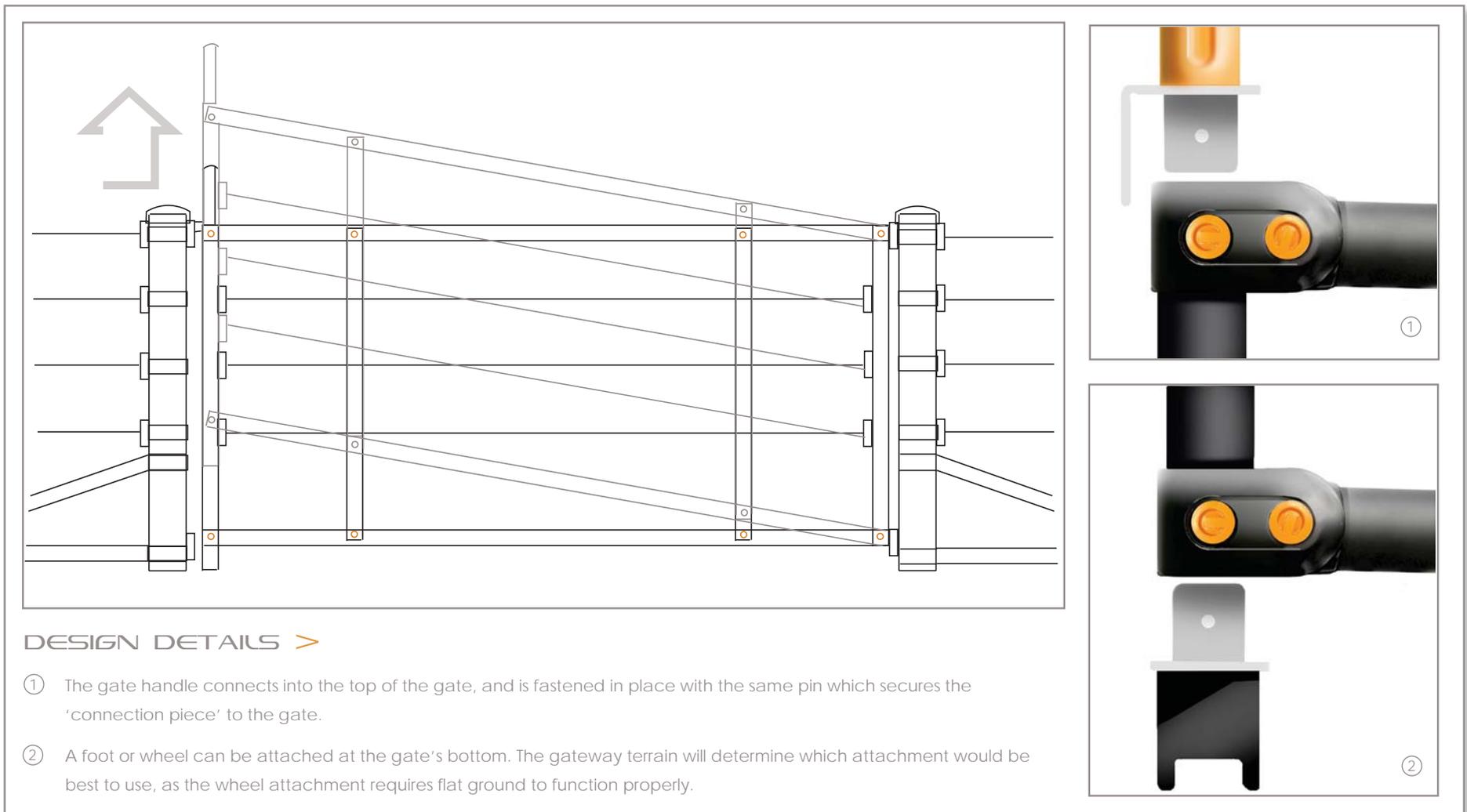


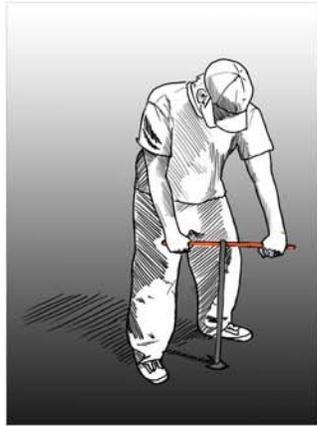
Fig. 078. The final design; Gate details.



## 8.7 FINAL DESIGN SCENARIO

The final design's scenario (Fig. 80, 81) provides a detailed storyboard illustrating how the fence system is installed, assembled and intended for use.

## 8.7 FINAL DESIGN SCENARIO



1 Run the **Auger handle** through the hole at the augers end. With both hands and the users body weight, turn the handle to screw the **Auger** in to the earth.



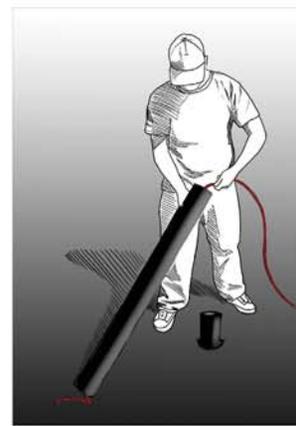
2 When the **Auger** has been driven part way into the earth, drop the **Spade bit** over the auger shaft.



3 Place the **Auger pin** in to the allocated pin hole in the shaft. Insert the **level** into the top of the auger shaft.



4 Resume winding the handle. The **Auger pin** drags the **Spade bit** down until it is flush with the ground level. The **Line post rammer** may be used to drive the spade bit into hard packed soil.



5 It is recommended that the energizer lead out cable is threaded through the **Strainer Post** for connection to the **Cut-out Smart Switch**. (step 13)



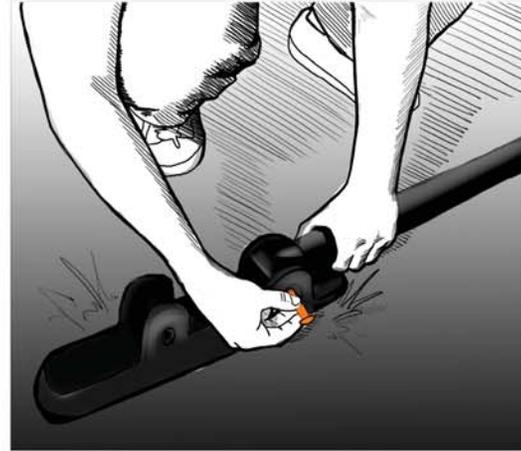
6 Fit the **End Strainer post** over the **Spade bit**.



7 Secure the **Strainer Post** to the **Spade bit** by pushing the **Security pins** into the allocated pin holes.



8 The shorter **stay** is attached to the **Strainer post** using the **Fast Fit strap**. The strap is simply threaded through the **stay** hardware and snapped closed to lock in place.



9 The other end of the **Stay** is placed in to the **foot piece** and secured using the **Bracing screws**.



10 Repeat step 8 and 9 with the longer brace. The **Stays** position on the post is determined by its surrounding terrain.

Fig. 080. The final design; assembly storyboard.

## 8.7 FINAL DESIGN SCENARIO

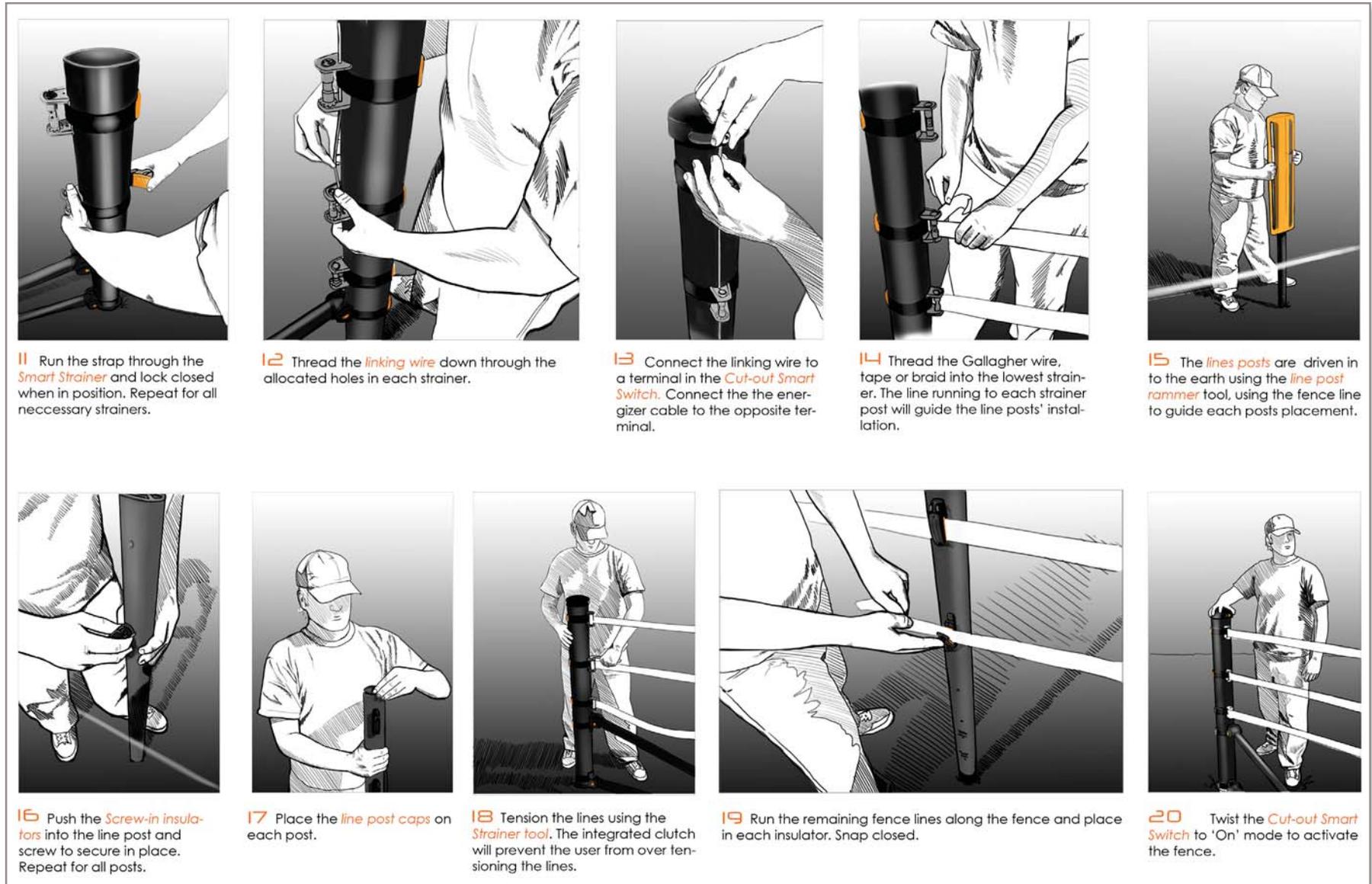


Fig. 081. The final design: assembly storyboard.

## 9.0 DESIGN EVALUATION

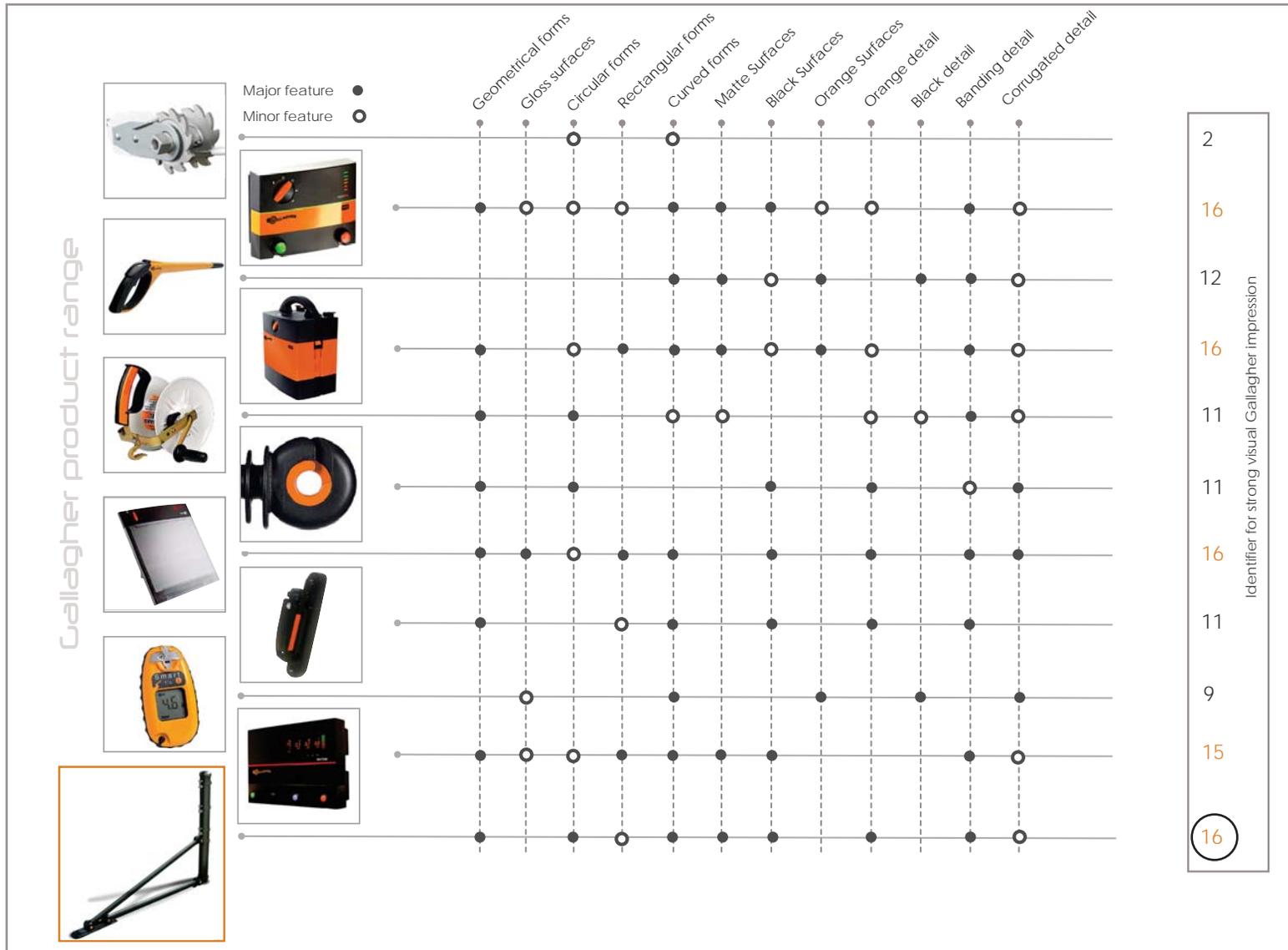
Evaluation was required to test whether the electric fence system's proposed design had successfully fulfilled the design criteria, and thus fulfilled the aim of this research.

This section focuses on an internal evaluation of the electric fence design proposal. Emphasis is placed on determining whether the fence design fulfilled each individual experience and performance design criteria which was outlined in Section 3.5 and section 7.0.

Each decision is based on the knowledge which was gained as a result of the investigation's research.

The results from this method are illustrated in tables 12, 13,14,15.

## 9.1 FORMAT ANALYSIS MATRIX: FINAL DESIGN



Comments:

The proposed fence design successfully possesses a large amount of visual traits inherent within the Gallagher product range.

Using the format analysis matrix (Warell, 2006) it is clear that the proposed design's aesthetic matches the Gallagher visual identity.

The matte black surfaces, the 'banding' aesthetic, and geometrical forms are the primary visual identifiers, whilst the orange details and corrugations are classed as the secondary identifiers. (Warell, 2006)

Table. 011. The final design: Format analysis matrix.

## 9.2 DESIGN EVALUATION - PERFORMANCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Future proofed to allow for further modifications or additional hardware.		The hollow strainer post provides a lot of room for additional hardware to easily be integrated into the system. ie Housing the energizer within the strainer post, combining the earthing system with the auger foundation. 		
Foolproof system to ensure correct, safe assembly and installation.			 The parts and hardware have been successfully designed so that they cannot be assembled in an incorrect way.	
Posts erected and assembled without expensive tools or machinery.			 The system officially requires no machinery to install, and very few simple, low cost tools to install and maintain the fence.	
A system that is competitively priced comparative to existing permanent fence systems.		Hard to discern at this stage accurately. It can be anticipated that the system will be more expensive than current fences, yet money is saved with self installation, and no machinery/tool hire is required. 		
Safe for the user and the targeted livestock.	 Contains no materials, forms or edges which could harm the user or the livestock.			
A specialised Gallagher only proprietary system.	 The fence design introduces entirely new assembly elements and hardware which couldn't be used in conjunction with competitor's products.			
One system suitable to contain all of the specified livestock.			 The system caters for all targeted livestock.	
Fast installation in comparison to current systems.			 Approximately as fast as the 'Speed-Brace,' the strainer post assembly is significantly faster to construct compared to other systems.	
Environmentally friendly materials used.		The line posts, which usually constitute 90% of a typical fence set-up, are made from recyclable polypropylene. An environmentally friendly replacement for the fibreglass would be preferable whilst retaining the strength/weight/cost ratio properties. 		

Table. 012. Design evaluation of the performance criteria.

## DESIGN EVALUATION - PERFORMANCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Durable against the European climate and potential livestock damage	 The posts material is insulated against hot/cold temperatures, water resistant and UV stabilized. The posts flexible nature can sustain considerable pressure before any damage occurs.			
Lightweight and easily transportable		 Lightweight fibreglass, HDPE and polypropylene provide strength but are considerably lighter and easier to transport compared to existing products.		
Must accommodate the existing Gallagher fence line products (ie. Equi-wire, braid, tape, HT wire and under-gate cabling)				
Materials and assembly that will last 15-20 years minimum	 The materials and design will sustain any typical damage. Any potential weather related degradation of the material wouldn't affect the product use.			
Use existing technologies and materials	 All materials and processes required to manufacture the fence system are currently feasible for production.			
No complicated wire tying		 Wire tying of any sort has been abolished. The fencing system requires no previous experience or skills to construct.		
Suitable for the majority of farm soil conditions; sandy, clay, hard packed soil and rocky soil.		 The auger system burrows very effectively in all conditions. It naturally glances off of rocks/ stones and maintains a solid hold in softer soils.		
Wire tension indicator	A tensioning tool was designed to provide the correct amount of tension on the fence line, rather than having a costly addition on each strainer.			

Table. 013. Design evaluation of the performance

## DESIGN EVALUATION - EXPERIENCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Original aesthetic/materials which noticeably differentiates itself from other products in the market.	 Distinct visual identity separates itself from other systems through its unique application of materials, form and colour.			
Aesthetic styling that will last 15-20 years without out-dating.	The use of classical geometric forms and the neutral black colour are timeless features, utilised to sustain the products visual style. 			
Conveys a sense of professionalism, both aesthetically and functionally.		 The purpose built components, clean styling and innovative features all elicit a sense of professionalism in the product.		
Product architecture has a strong sense of belonging within the Gallagher product range.	 The fence design embodies the five most prominent Gallagher product traits, unifying the fence system design with the Gallagher product family.			
Design conveys a sense of safety for the user and livestock, through the visual styling and materials.		 The forms gentle edges and materials create a smooth appearance to express that the product is safe to use.		
Must appear and feel structurally strong and durable.		 The strainer post and component proportions elicit robustness, coupled with the stays, which communicate balance and structural integrity to the fence assembly.		
Visually appropriate aesthetic, which doesn't impede/disrupt the landscape.	The even use of colour and details, and geometric forms create a pleasant visual, similar to the post-and-rail fence aesthetic. 			

Table. 014. Design evaluation of the experience

## DESIGN EVALUATION - EXPERIENCE CRITERIA

CRITERIA	Required	Desirable (High)	Desirable (Moderate)	Desirable (Low)
Overall form must look tidy, and not overly complex.			<p>The strainer post portrays a sleek appearance due to the limited number of components used, and the absence of wires and cables.</p> 	
Intuitive assembly/installation procedure, requiring minimal instruction.			<p>Realistically this aspect cannot be fulfilled until a full scale 'looks-like' and working prototype is made. What we do know is that the components can only be assembled in specific way to function, and no special skills or experience with fencing is required throughout the set-up.</p> 	
Design elements styled to reference traditional fences.			<p>The fence aesthetic is intrinsically recognisable, retaining the same basic elements which typically constitute a fence.</p> 	
No parts are to stress/scare the livestock.		<p> The fence contains no moving parts which may cause stress to the livestock.</p>		
Visible to the user and stock, for safety reasons.			<p>The solid, black fence posts are easily identifiable in all environments and weather conditions to minimise the risk of accidental collision with the fence. (As stated in Section : Human safety.)</p> 	

Table. 015. Design evaluation of the experience

### 9.3 DESIGN EVALUATION

The results of this evaluation method are summarised in Table 016.

As illustrated 27 out of 29 design criteria were fulfilled by the proposed electric fence system’s design. The results indicate that the fence design successfully embodied the desires and requirements of the design criteria.

The results also illustrated two design criteria that were not completely fulfilled:

- Intuitive assembly/installation procedure, requiring minimal instruction.
- Environmentally friendly materials used.

Explanations as to why these criteria were not fulfilled are outlined in tables 012 and 015. Their exclusion can be summarised by the identification of unforeseen design issues making them inappropriate or not possible to achieve. This also implies that these design criteria were based on inappropriate assumptions made during the investigation.

As mentioned in table 15, a full working and aesthetic prototype would be required to accurately determine how intuitive the fence system is to assemble. Design principles were applied throughout the design process to ensure many of the fence components were intrinsically comprehensible for the user to assemble, particularly the designs product language and forms which correlate to their specific placement on the fence, and that each component would only function when assembled correctly. However, despite the application of these design principles, extensive usability testing is required to provide conclusive proof of the criteria’s fulfillment.

TYPE OF CRITERIA	FULFILLED	UNFULFILLED
<b>PERFORMANCE:</b>		
Requirement	6	
Desirable (High)	7	
Desirable (Moderate)	3	1
Desirable (Low)		
<b>EXPERIENCE:</b>		
Requirement	3	
Desirable (High)	3	1
Desirable (Moderate)	4	
Desirable (Low)	1	

Table. 016. Design evaluation of the criteria.

Environmental impact that unsustainable products can cause is an increasing concern for consumers globally. It was the researcher's intention to produce a fence which not only differentiated itself from competitors products through form, usability and aesthetics, but additionally produce a more eco-friendly alternative to consumers. This was greatly achieved with the use of recyclable plastics (Polypropylene, HDPE ) but finding a material that possessed a similar strength/cost/weight ratio which fibreglass has, proved to be very difficult. Whereby the choice of a lesser material would compromise the superior criteria objectives.

Evaluating the fence design proposal against performance design criteria was a straight forward task due to the quantifiable nature of the performance criteria. The investigation benefitted from the focus groups expert knowledge regarding the structural qualities of the fence design, and test rigs were utilised to validate the remaining design criteria, thus ensuring that the majority of the performance criteria could be fulfilled.

Unexpectedly, evaluating the experience criteria and their subjective qualities, proved similar in ease to the performance criteria. Much of this is contributed towards the use of the PPE framework, where its strong analytical structure supported much of the experience criteria; discerning the level of similarity that the design had with Gallagher's product family, and what major product characteristics were expressed within the design's product language.

## 10.0 CONCLUSION TO THE STUDY

This investigation set out with the aim of developing a more desirable live-stock electric fencing system. Through the research undertaken it was made apparent what aspects of the fence system would create a more desirable product and product experience for the hobby farmer. The *desirable* experiential and performance attributes were outlined into design criteria (4.0) which the development of the proposed fence design was based upon.

The electric fence design targeted the hobby farming market by creating a system that required no machinery to install or operate, nor previous experience attributed with constructing a fence.

- It needed to be desirable in a way that the system was less arduous to construct and require less time involved throughout the process.
- The basic 'utilitarian' functions of structural integrity, user and livestock safety needed to be achieved, whilst propelling the design experience and 'hedonic' aspects further to create a desirable experience. (Chitturi et al. 2007)
- The product identity had to resemble Gallagher's product family and their specific brand identity, as well as signify a *professional* aesthetic that was visually appropriate for the targeted European environment.

Through an iterative design process, the proposed fence design was developed in response to the design criteria.

Internal 'design evaluation' (Section 9) illustrated that the fence design proposal fulfilled the majority of the design criteria particularly improving the cur



Fig. 082. The final electric fence design.

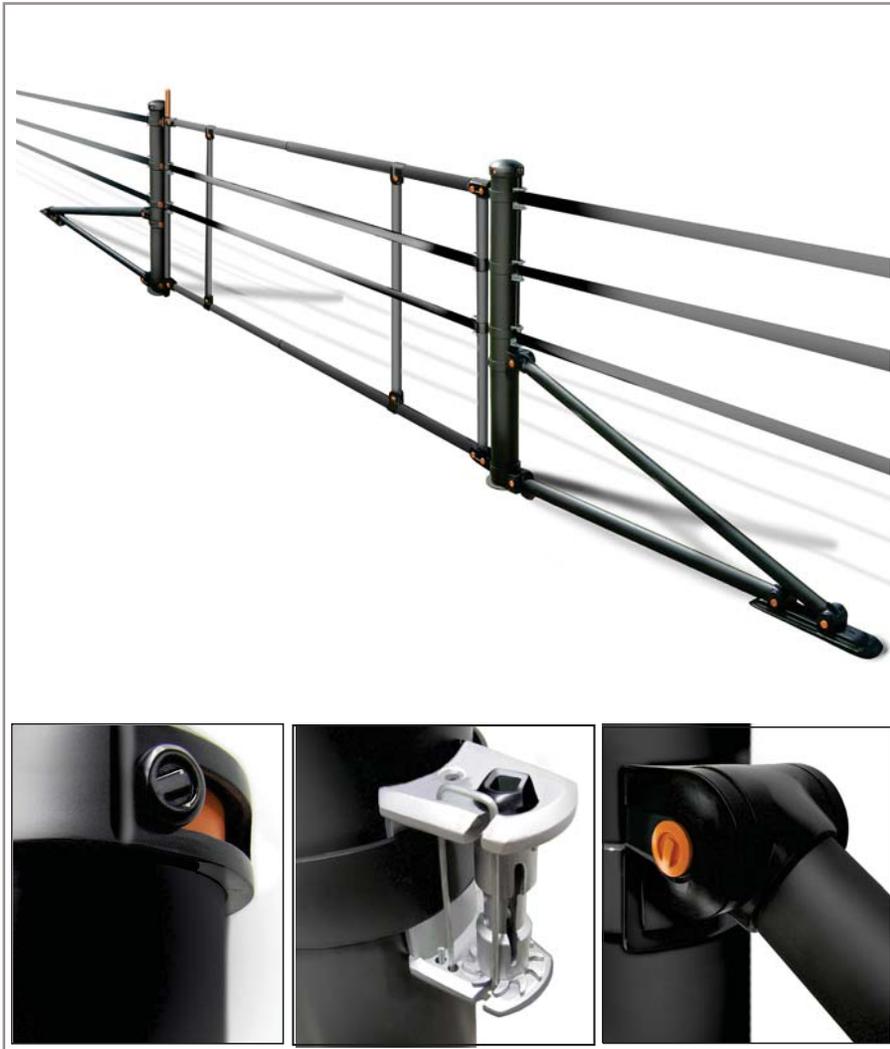


Fig. 083. The final electric fence design details.

rent system's usability and utility, whilst providing increased intuitive assembly and decreased construction time, all without requiring prior fencing experience or fencing machinery.

The results from the evaluation identify aspects of the fence design which would benefit from further design, testing and validation.

Usability testing of the system's cognitive functions, in conjunction with the design principles currently employed, would determine the success of the design's more 'intuitive' features. Testing of a full scaled functional prototype would be the next logical step to accurately verify the proposed design.

Another design validation concern, is the overall aesthetic and materials used for the fence design. Replacing the traditional timber post with man-made materials boldly asserts Gallagher Ltd's brand identity and innovative attributes, yet it may meet opposition by those farmers who prefer the traditional aesthetic and use of natural materials. This particularly subjective aspect may require further investigation to satisfy a wider range of users, without compromising the system's beneficial utility or usability functions which have been successfully achieved.

Overall the results from the evaluation indicated that the proposed fence design fulfilled the experiential and performance related attributes which create a desirable electric fence system, thus, fulfilling the aim of this research investigation.

## II.O RECOMMENDATIONS FOR FUTURE WORK

The following are potential areas for further research in future studies:

- Further explore the potential of adding graphics and 2-D devices to the systems strainers, posts and accessories to further elicit the systems cognitive functions.
- Explore the addition of an integrated solar/battery energizer within the strainer post. Ideally suited for fences situated a long distance from a mains power source.
- To further create an all encompassing fence system, the proposed design's auger foundation could potentially have a secondary function as earthing stakes.
- Construct a full scale working prototype suitable for usability testing. Thorough participant testing would accurately determine how intuitive the design is, and indicate areas requiring further improvement.
- Research new environmentally friendly materials which could replace the fibreglass elements of the fence design.

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APPENDIX  
TRANSCRIPTS

## SEMI-STRUCTURED INTERVIEW

Ross. W and Ivan. K. 12/05/2008- 13/05/2008

Researcher: MM.

Transcribed by Megan Hine. 02/06/008

Ross. W: That first wire's run out as a guide wire to keep it nice and straight when installing the posts in.

MM. Ok when did you install these?

Ross. W: Yesterday. On your post there's 8 holes in the post for the wires at even spacing. They are in about 650mm. Depth depending on the animals contained. I can't actually remember how deep exactly now, it's been so long since I read up about it.

MM. So it's all by eye for you now is it?

Ross. W: Yeah, definitely. I seem to get it right, haha.

MM. So how long have you been doing it (fencing) for?

Ross. W: Uh, well I started off with the Gallagher book and insul-timber in 1978. With the insul-timber posts.

MM. Do you still use it (insul-timber)?

Ross. W: No. The greenies stopped it. It's an Australian hardwood.

MM. Oh ok. So if you don't use that now what do you use?

Ross. W: Well we've had to go back to posts. Warratahs and things, Insul-timber actually broke down over the years, when it got damp. It got a bit more conductive and would trickle energy out. It wasn't really strong stuff but you could knock it 'round for a bit.

MM. A typical fence can you just do it by yourself?

Ross. W: Yeah. Once it's all marked up. You can have other guys. Another guy I worked for had 20 different guys. He does really big contracts.

MM. So that's not typical is it having that amount of fencers?

Ross. W: No not at all. Just the big stuff.

MM. So the clients would like to have the fence to look good?

Ross. W: Yeah definatley.these are pretty good. It all depends, cockys will look at the cost. Straight off. Cost and strength.

MM. And if it does that fine-then they'd go for the nice looks?

Ross. W: Yeah mainly cost though. If you can make them light.

MM. And the other good thing about plastic posts is you don't need insulators do you?

Ross. W: No, you could just tack it on.

Ross. W: Or just have holes in them. Take your wire gauge off of this post. Everyones used this same gauge for years.

MM. Why is that?

Ross. W: Someone made it up at the beginning and everyone thought 'that's pretty good it'll do' and they stuck with it.

MM. Do they need to adjust or add new wires very often?

Ross. W: No not really. You mean put another one on? You can with your wooden posts you can, if you're running goats and things.

MM. Yeah because I'm wondering if my euro farmers want to have multiple animal types they may want to.

Ross. W: Yeah well this standard will do the lot. Two wires for cattle.

MM. So how many wires do you need for horses?

Ross. W: 1 or two wires. Same with cattle.

Ross. W: Good fences new. They're expensive.

Ross. W: And what I've seen in Germany... their fences are bloody shocking. New Zealand has the best fencing. Some of their horses worth thousands of dollars and they'd just have poly wires strung out with a few warratahs, or whatever they could get. Or they'd have post-and-rail.

MM. And why do you have those batons just sitting there?

Ross. W: Well you've got your tension on the other posts... and the batons just float there and stop the sheep putting their heads through. And keeping the wires the same. A lot of people have gone away from using them now because they cost \$1.25 a post now.

MM. So do you need them now? If they didn't cost anything figuratively speaking, would you need them?

Ross. W: No, not with the quality of the electrics now. You can run a top wire top and bottom and it stops them putting their heads through.

Ross. W: I still have a mate at Tutuara who hasn't got an electric fencing on his property. He looked after his brother's farm overseas that had a bit of electric fencing on it and thought 'don't want that shit, its rubbish.' But he didn't know anything about and that was his attitude and wasn't willing to change.

MM. Just because he couldn't get used to it?

Ross. W: Yep.

-

Ross. W: With dairy farmers they mainly just care about production.. everything's done in a hurry. Whereas sheep and cattle farmers they like everything neat and tidy... mostly.

MM. Yeah I want my fence to look nice right next to the house.

Ross. W: Yeah, a lot of these lifestylers think they can put up a fence, they give it a go and don't know what they are doing. And it looks bloody terrible.

Ross. W: Yeah they wouldn't have the know how.

Ross. W: Yeah they put a strainer in and the stay's meant to be one third from the top, and they put it right at the top, which acts as a lever. And they don't put a foot on it.

MM. Yeah I'd be just a useles.

Ross. W: Yeah well if you don't know what you're looking for.

MM. Do you do many small lifestyle farms?

Ross. W: Yep. It's a common thing.

MM. Are they fairly fresh to it? Mainly horses?

Ross. W: Yeah horses, cattles beasts. Maybe a donkey. And then they call it famring.

Ross. W: There's quite a turnover in lifestyle blocks. They get out there and think its all nice and easy...then they find they are working all weekend. It's not just a matter chucking the stock in the paddock and leaving them, and then it becomes hard work.

MM. How big usually are they?

Ross. W: A couple acres. Some get up to 80, 90, 100 acres. Some start with 6 acre blocks or so with big plans but find out it's hard work. It's hard work without the facilities like to round them up in the yards.

MM. For drenching and things?

Ross. W: Yeah they just put them in a pen. Dock the lambs, dress the ewes. Attend to bad feet. Anything like that ya know.

MM. So how long did it take to put the posts in?

Ross. W: 'Bout 8 to midday.

-

MM. How do you get rid of the growth on the fenceline?

Ivan. K. Spray it usually. It doesn't actually bleed a hell of a lot of power out. Everyone sees the vegetation on the wire and says 'oh you've got vegetation that's killing the bloody power' it's not. It's where the bloody wire touches the ground or puts a pigtail in the ground. That doesn't help the power! Haha. Or when one of my staff puts one end of the hot wire to a standard fence. It's gone! That's more of a problem.

MM. How often do you spray it?

Ivan K Once a year. Just once a year in October or so.

-

Ross. W: The distance between the posts. I'd laid them out...he's wanted them 20m apart, and he stepped them out and I had them right to the last post. Ya just get used to it.

MM. For the gates do you dig a trench by hand?

Ross. W: Yeah.

MM. Does that take long?

Ross. W: Nah. We do a lot by hand. Sometimes the diggers come in and do it.

MM. It'd be nice for you to not dig a trench.

Ross. W: Yeah something to think about.

MM. Do you use Tru-test? No well Gallagher seem to have the best all round supply and the reps you can ask them any near anything.

Ross. W: There's this American company Red Snapper. Got some of their insulators, and they were absolutely useless.

Ross. W: You don't need to pull your electric very tight, because it can flog out ya insulators with this sun. hot and cold if you've got them too tight.

MM. How tight do you need the wire?

Ross. W: On an electric it's a 100kgs.

MM. And tape?

Ross. W: Hand tight. Just pull it by hand.

Ross. W: Yeah a lot of lifestylers use tape or Polywire.

MM. Is it more expensive than wire?

Ross. W: No. but it can break down in the heat. And it gets little burn marks in it.

MM. What (tools) do you require usually?

Ross. W: Hammer, fencing pliers, small bolt cutters. I've got easy pulls, for pulling staples out. They are really good.

-

Ross. W: With the guide wire you need one with the tractor, and another one up top if you are doing it by hand.

-

MM. Why do they use the tape?

Ross. W: Convenient to use really.

-

MM. Normal fence posts are pine are they? If you had to choose what would you prefer?

Ross. W: Yeah pine. They don't make anymore concrete ones, these ones would be 30 -40 years old. They do last.

MM. So pine pretty much then.

Ross. W: Fiberglass breaks and frays. Metal warratahs are expensive.

Ross. W: There's an opportunity for what you're looking at. As long as it didn't cost too much he wouldn't care about how heavy it was. They just transport them in the tractor.

Ross. W: Sheep need a lot of wires because they dive through. They need 5 wires. They can dive through like a dog and it'll ruin the fence.

MM. So then what do you have to do?

Ross. W: You join that section. Cut it, put new posts in and fix that section.

MM. How often does it happen?

Ross. W: Not a lot. With Friesian bulls they scrap enemies in neighboring fields and like to smash up the fence.

Ross. W: 600kgs on a fence just totals it. Couples of posts, stretch all the wires, smash the batons.

MM. So would that cost a lot to repair?

Ross. W: Yeah 3 or 4 hours work plus the posts, batons. 'Bout \$120 bucks.

MM. Would they take down a whole fence?

Ross. W: Yeah depends how long you leave them to it. They will take the whole fence down.

Ross. W: You've just got to have the power on.

-

MM. Do they graze the properties off on lifestyle farms?

Ross. W: You can, it's the way to do it. If you've got them in small sections they tidy up the paddock.

-

Ross. W: With the insulators you cant have it holding the wire tight otherwise it cant be tensioned. It can also take the galvanized coating off.

Ivan.K: Those volt meters are brilliant. The fault finders. You can save yourself a lot of time. I get a lot of faults rapidly. I get them a lot because of my staff they've got very little understanding about it all. And that's the main issue. It's not actually the fences, it's not actually the technology it's the

people understanding the technology. And those videos are really good to show them how to do it.

Ross. W: There are videos out for fencing that these lifestylers should take note of. They think it's a pretty easy job and that's the way it's been looked at over the years. They think 'oh shit that's pretty easy, ya don't need a qualification for that,' but they stuff it up.

-

Ross. W: If you can give your post a good beating and if they are harder and lighter. That'd be fine.

## INTERNATIONAL CONFERENCE

*Transcribed by Megan Hine. 11/12/08*

*Many participants. Gallagher: Graham J.*

*Researcher: Matt M,*

*These things are going though the 3mm holes.*

*It looks very difficult and doesn't look very nice. Its got to look beautiful like this one. So the insulators aren't that necessary in this one?*

*MM. No cause its polyprop. Its already insulated in the ground. We are doing it as a permanent piece not as a temporary piece.*

*G.J. Once you said about all the predicaments we talked about screwing these into it place*

*No not necessary. We have discussed it with one other about clipping them over the top. I had to take the profile down.*

*MM. Yeah there is going to be a profile crucifix thing in the inside, and that will be pierced in and wound in. so there's not a lot of winding and it holds it in place.*

*It's a solid post?*

*MM. Yeah*

*Are they rammed in?*

*MM. Yeah just rammed in the ground with whatever you have got or preferably a Gallagher rammer.*

*How tough will they be?*

*MM. Well, you can do it with the eco-post*

*Is the eco-post solid?*

*G.J Yeah it is. They are solid pieced posts. They would use it in Europe and in the north. they used timber clips on them as well I believe.*

*Yeah the way it works is just like the insul-timber posts. In the north of Europe you can use that because the ground is soft.*

*Are the eco-post taped at the bottom so when you drive them?*

*Yes, bearing in mind that they can only be used in the north of Europe cause of the soft ground. As soon as the ground hardens you have no chance what so ever to get a eco-post in there. Even insul- timber.*

*MM. This is the end post or the corner post, I was saying before this is the cut out switch, so you take your cable and run it up through here past the over centre lock and connect to the terminal here. Inside that, this is the double wire that the metal connects to this one here that you are linking up. So I got rid of all the linking of wires there, trying to make it more stream lined and easier. So you just tread the wire or tape through here. Simply turning off and on the cut off switch here. When its black its off and when its orange its on. With the stays, they are really easy to adjust just by sliding the brace up on and off, and the latch down.*

*MM. Its really quick and easy. As I was saying this is the spade bit that we had, which is the cruciform profile. So you put the auger bit in, then the cruciform spade bit in over the top, and all you do is put this hollow pipe over the top and bolt it in*

*MM. So that's hollow. So there is actually an opportunity to install, say, a battery energizer in there, so its all contained in the one piece*

*So you can build it stronger to hold that?*

*MM. Yeah that's one thing. I haven't got it in this model as it a look like model. We have the little screw holes here to put wire and things through there and to latch it up.*

*So would you use two of these in the centre?*

*MM. Yeah you would use two latches*

*And that one there you wouldn't have to dig a hole? (the stay and foot)*

MM. Yeah that one just sits there.

MM. Yeah the other good thing about this product is that I tried to make small. So you can just put the auger in and everything on and the brace just sits on the ground like that. I was thinking about using a clutch just to wind it up (strainer). You wont need it with tape, but mainly with high-tensile wire.

What would the main strain capacity be of that?

MM. 100kgs

Do you think it would matter if these things were individualised so for the different types of fence you would have, one tape one wire?

MM. Originally with the concept I wanted one design for everything

So it does everything?

MM. Correct.

One thing, Europe has is that it has a lot of problems with earthing systems, is there any options that we have talked about putting something integrated with the foot. I mean like 30cm or something. But obviously it would be steel and in the ground and 5 of them.

MM. We did consider that as well.

Yeah its always a difficult thing, you don't want people to have not enough, but if you just think about it. Putting something in there. It could give you up to 2 metres.

What about if a small gate swung off it or something?

MM. We were thinking about tape gates for this type of thing but its pretty easy, in terms of just adding a new strap.

G.J. There is potential to expand the system, so this is a gate and fence its needs users stability so they can use the gate and its not over engineered

It pretty neat.

G.J. This ones been gallagherised as well a lot of orange in there with a Gallagher look to it

MM. Yeah I wanted a fence system that says Gallagher

MM. Ya know if your driving down the road it's obviously a Gallagher fence.

MM. And bringing more of an aesthetic style to it . Bring the design of the energizers in that to match the system in the strainers and things.

Congratulations great job.

-

MM. For security it could just be a matter of adding a lock to the switch

How would you solve the problem with frost and snow

Water would get in there snow would press up against it ?

MM. Its just a concept so that's considerations we'd consider later with the engineers.

Other ways for the insulator clipping on?

MM. We were looking at clip systems for the line post but its hard to get it cheap and practical to install.

I love this line post design, that's really hot.

-

MM. I originally got the idea from 4wd anchors (for the auger) where they use anchors to pull themselves out of mud.

MM. I was thinking of using the energizer system with the post and the auger system could provide the earthing system

G.J. Also note here you've got an orange mark here to show that its on

MM. Yeah and an over centre buckle to lock it down

MM. Same for the bracing and you can just keep adding more components

*MM. The whole thing could be metal to shock anyone who wants to steal it haha*

*In SA if they can steal it they will*

*MM. That's an interesting point I never thought that people would steal a fence.*

*Yeah we get it all the time*

-

*What are you thinking of earthing ?*

*MM. Well with the earthing you've got your spade bit there in the ground which is metal*

*That could potentially act as an earth.*

-

*MM. The idea is to make the strainer act as a universal one to wire or tape so its easier*

*MM. We are still investigating the types of materials that could replace the fibreglass*

*What were you thinking for the gates?*

*MM. Probably just a tape gate for it's lightweight.*

*Tape gates are not good. They are really hard to open when you are holding horses. They hate the tape on the ground. They get spooked when walking over the tapes.*

## FOCUS GROUP PHONE CONFERENCE

Page 1

*I took the first concept and developed it some more, the strainer now upright to hold tape and wires, it also fits nicely in the extrusion and the lock to hold in place vertically this could be made from bent plate also.*

*Did some research into other materials for this end post, was thinking maybe aluminium would be stronger or glass reinforced plastics?*

*The linking wire tightly runs through the metal base for connection...*

*We like the General Concept you have here*

*Comments:*

*Ratchet handle looks like it could foul the tape/wire. It looks similar to a ratchet tie down but with a ratchet tie down the tape would sit between the orange buckle and the post*

*What could be made out of bent plate? Is it the part that slots into the post?? If so could it be molded out of a high strength plastic?*

*How does the handle turn the spool and what holds the handle closed?*

*The linking wire connection will require pressure to create a viable electrical contact.*

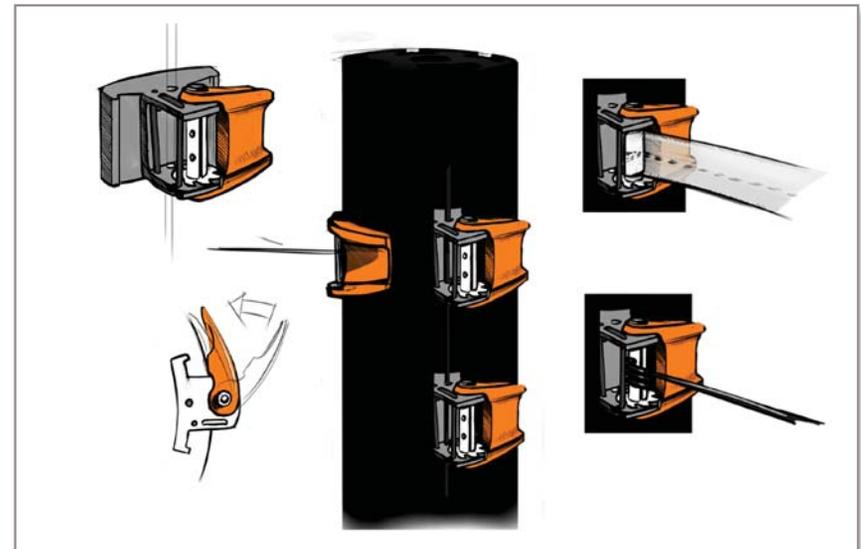
*No need to have ratchet to tension 40mm horse tape, maybe look at self locking device like the locking system on vertical blinds??*

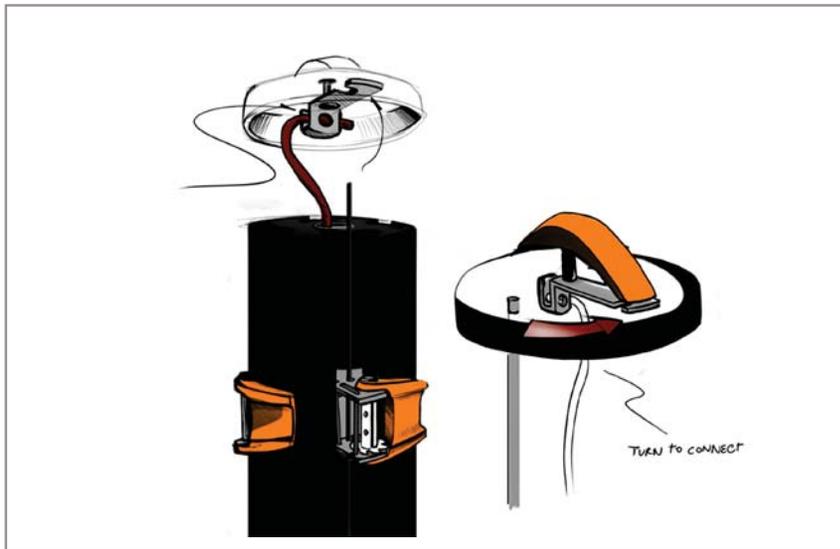
*Great idea for HT wire though.*

*Cost per insulator is high due to amount of components and assembly time*

*An aluminum post is conductive and would NOT suit these devices if made out of bent plate as the tracking distance would be very low. The standard tracking distance we use is 30mm.*

*The Post will need to be strong if End Post.*





Page 2

...into the cut out switch with fits over the posts top. Turn the switch so the wire contacts the metal strip/plate inside the lid. The energizer cable would just be threaded through the post and screwed to the plate.

Comments:

As above the linking wire/switch connection requires pressure to create a viable electrical contact.

At this stage this concept is looking like a trap for water, insects and mold due to it being open to the elements. Our current Cut Out Switch is a sealed unit.

We like this concept also but it would need some more design work to make it work

Page 3

The line post that you've already seen.

Comments

Cost (high)

With the shape of the post it looks difficult to drive?

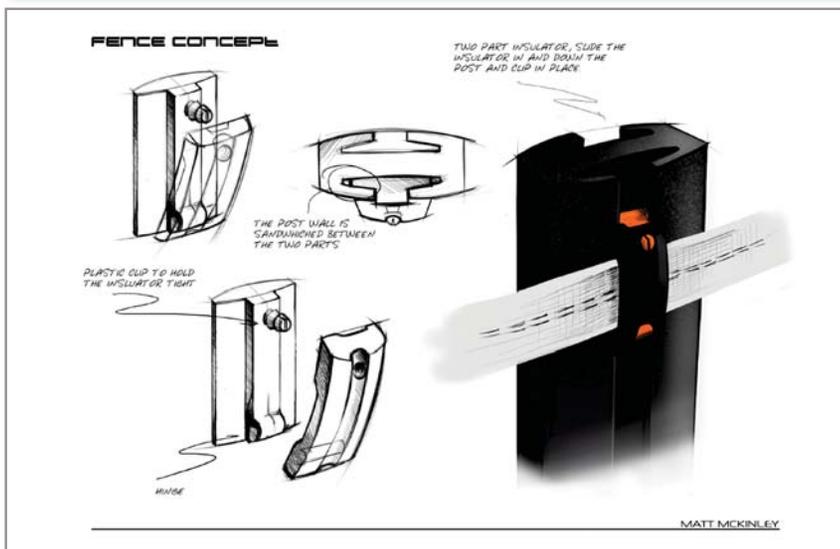
Not sure on vertical locking mechanism of the clip?

The clip on the Insulator would need to be similar to the orange and black tape insulator so that it can be unclipped to take the tape out if necessary.

If the post was to be made from the Ecopost material (recycled plastic) the insulator would more than likely pull out if an animal ran through it?

Page 4

Cheap wire clip/torsion spring. I was thinking if the arms of the clip are tucked back into the post it won't come out when the wires pushed from behind because the spring would have to bend in the other direction.



Comments

Clip design is good (cheap and simple) like a wire version of the W-insulator.

How easy to drive this post – any material that is rigid enough may be expensive.

Page 5

Tube with bands around the outside (as discussed), the strainer slides around the band and clipped in. was thinking the wire for linking would have to go through the end strainer to maintain contact. If it was hugging the inside of the band it may lose contact when tension is applied to the strainer.

Comments

The latch design would need to be an over centre assembly similar to those on the Ski Boots for it to work.

Tube is good – fiberglass extrusion?

Link wire could be sandwiched.

Strap in metal or GF nylon.

Page 6

Line post band concept. Probably the cheapest way to do this is using a zip-tie to tighten vertically in place (worried it could be perceived as too cheap?) and insulator clip to hold tape in place.

Comments

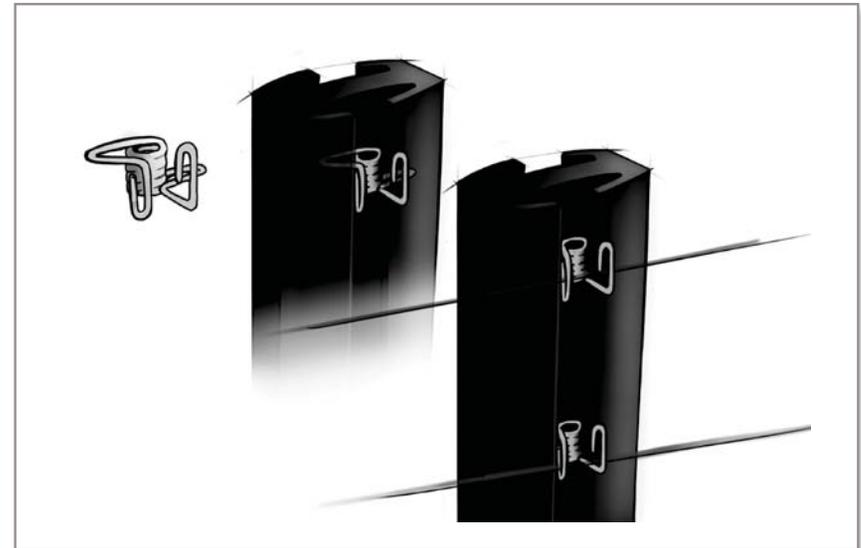
Not adjustable.

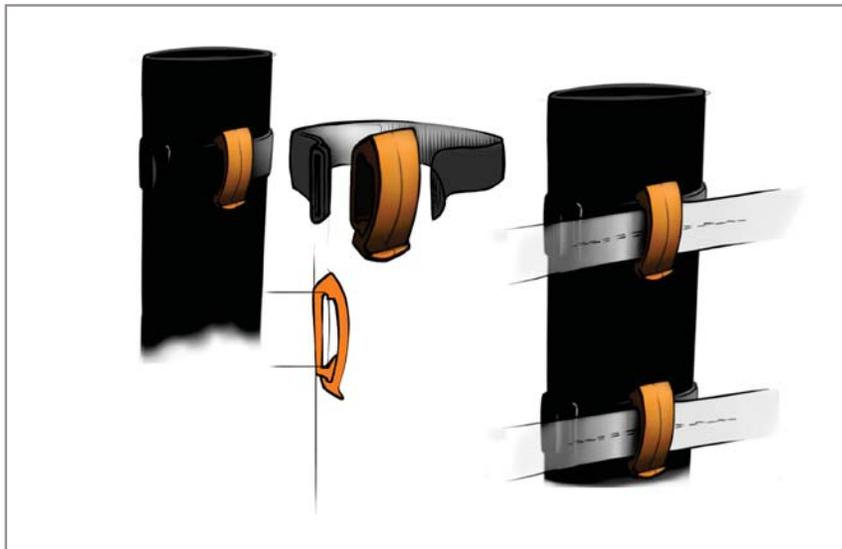
Might need a custom cable tie and depending on the diameter of the post it could be costly.

It will require a very wide zip tie.

The temperature variation on the post will affect this design due to shrinkage in cold weather. (Tie will slip)

Page 7





*Again another concept with the clip, but another clip to hold the insulator vertically also. It's a bit more complex than the extruded line post (page3), and visually not as pleasing in my opinion.*

*Clip design looks good*

*Difficult to ensure the insulator clipping to the strap is secure.*

*Cost per insulator too high for line post.*

*Maybe look at the strap being a little thicker with grooves on the back so that insulators can be slotted down the back and therefore when the strap tightened the insulator is held tight against the post??*

*This strap could also be used in other areas maybe for your buckle idea as well??*

*Page 8*

*Metal wire (to keep cost down for farmers) to hold wire around a zip tie.*

*Requires very wide (custom?) zip tie*

*Clip needs to retain wire more securely.*

*Any vertical force would test this clip.*

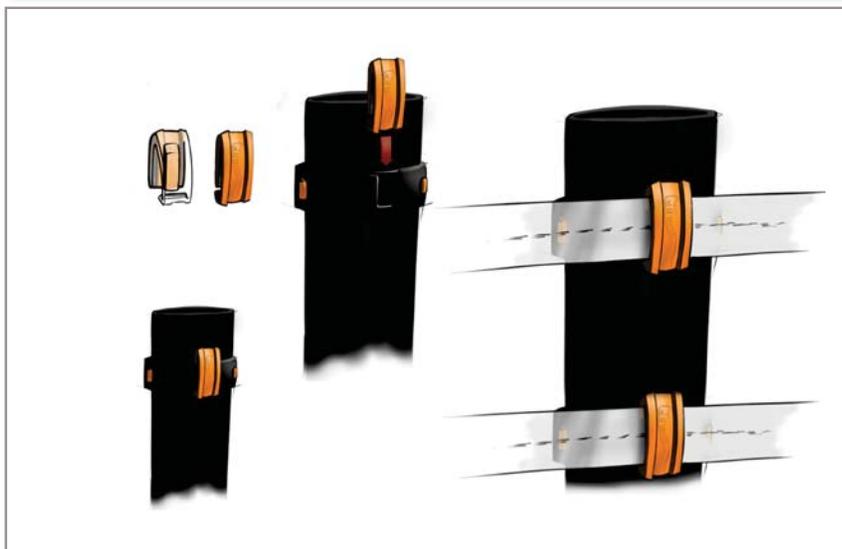
*As above the temperature variation on the post will affect this design due to shrinkage in cold weather. (Tie will slip)*

*Page 9*

*Bracing*

*Brace joint slides onto band into place and band is locked. Thinking this will need to be strong to hold in place. Fibreglass tube inserted into brace and bolted right through to hold.*

*Nylon/GF nylon strap and joint parts would work well to take loads as would the fiberglass post/stay elements. One strap design for all devices that mount onto it, see comment above (Page 7)*



*Possibly try to make a universal part to join stays and other parts.*

*Round fiberglass strainer/corner post is good.*

*The foot of the bracing: same system of locking the brace arm into the brace. Keep in mind for all the products shown, the aesthetics are rough at this stage.*

*Connection to bracing foot is nice – need to elaborate on how it anchors into ground.*

*Craig is going to add to the P&P Calculator to accommodate calcs on the horizontal stay post to see how this will react to force.*

*The rest is all self explanatory.*

*Switch/cap on top is all feasible.*

*It's looking good though!!!*

*I was thinking using a plastic more recyclable line post would be a better option over every line post being fibreglass. everyone's well aware of the whole green issues and its a trend that's on the rise, so consumers would be far more likely to opt for a greener product that does the same thing. it would also help to set the product apart from other products and promote a good image for the company.*

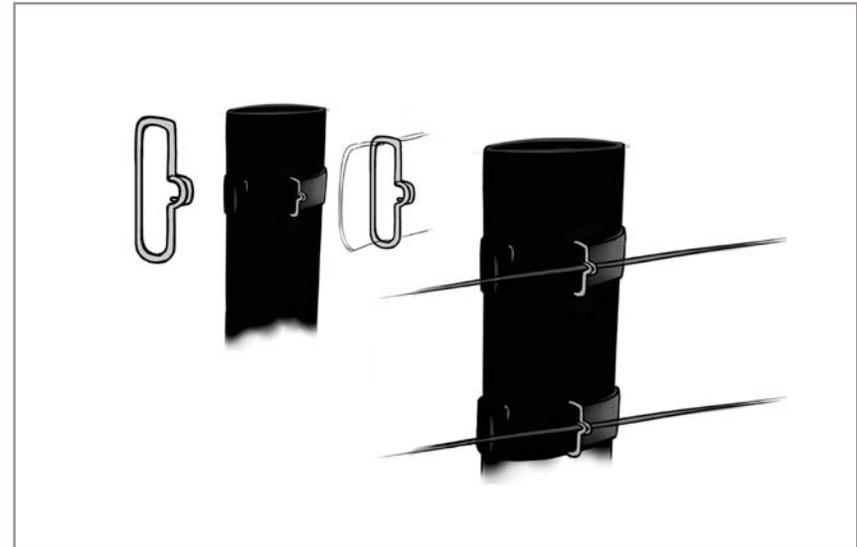
*I'm sweet with fibreglass being used as bracing and end/strainer posts because obviously there will be less made and the strength fibreglass provides is needed more in these products.*

*Recyclable post would need to perform as well as fibreglass and would need to consider cost.*

*Fiberglass is strong and easy to drive into ground – is there a 'green' form of fiberglass?*

*Page one, two; the third concept of having the h-brace style post with the insulators hugging the outside and a separate part which clips on and when locked down puts pressure against the post to hold in place.*

*Not sure if this would give us a positive close??*



3; also the idea that was brought up in Hamilton of an added rod in the post centre to bash into ground rather than bashing the line post itself into the ground. i was wondering whether this would hold firmly enough in the ground?

Like this idea with 10mm fibreglass post but likely to be to expensive??



Also got a few pics of aluminium profiles the ones at the back were kind of what I was thinking for end/strainer posts.

Cost per m???

Tube pipe for main post.

Needs to integrate with anchor system.

And I threw in some images of snowboard bindings and my ski boots for potential ideas for the bracing clips for the bracing bands shown in yesterdays email. The ski boots have a really easy lock system where the lever pivot on the buckle moves to make it easy to snap closed.

The locking system on the ski boot looks as if it could have wheels