Electric powered equipment can have a positive effect due to reduced noise levels, no use of liquid fuels, night operation in residential areas and reduced air pollution.

Electric powered container handling has been used in Europe for the past 25 years and has proved to be the way to handle containers in a heavily populated community, and to provide reduced costs of handling goods. The advantages of the electric powered machine is found in the operation, efficiency, cost, and life.

The electric powered machine also has the capability to be engineered to the requirements of the Intermodal Terminal so that the required duty cycle of the machine (crane), speeds, acceleration and durability are designed for the through-put.

Benefits of Automation

The automation of the equipment that we use to handle containers and trailers has produced many improvements in the operation of an Intermodal Facility. Some of the advantages are:

Anti-Sway Reeving

During the normal operating movements of the crane, the load is restricted from moving from side to side by the geometry of the hoistering ropes. This provides accurate spotting of the spreader beam over the load and reduces the time required waiting for the beam to stop swaying.

Summary

The automation of the motions of the crane (although the operator can manually override the automation by moving the master switches) provides a system that is better able to consistently position the crane quickly and accurately since the drives always operate at maximum rates of speed and stop in minimum distance during automatic moves. The drives are not limited by visual parallax problems, nor do they become fatigued. The result is that the automated container/trailer handling gantry crane can position itself over the containers with greater speed and accuracy than an operator could consistently provide.

TRANSPONDER/INTERROGATOR SYSTEMS

BY
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Introduction

Transponder/Interrogator systems operate by sending radio frequency signals between an interrogator/antenna and transponders which are attached to objects or in particular locations. Transponder antennas are internal to the transponder itself and interrogator antennas are external to the interrogator.

One example of a transponder/interrogator system uses the interrogator antenna to send an unmodulated radio frequency signal in the direction of the transponder. The transponder is initialized by this signal, slightly modifies it and reflects a modulated signal back to the antenna. The interrogator receives this signal, processes it to determine the identity of the object or the position to which the transponder is attached and provides a serial output interface to the outside world. Transponder readings can either be stored in memory on tape or diskette by the interrogator for later reading or transmitted via radio frequency on a real time basis.

Transponders typically are precoded prior to installation with from 12 to 24 alphanumeric characters of information concerning the location or identification of the object to which the transponder is attached. Some transponders are programmable, and there are two basic types of transponder systems; passive and active.

Passive Transponders

Passive transponder systems consist of:

- A power receiver
- A logic data generator
- A RF transmitter

This type of transponder is inductively activated by a signal from the interrogator. The transponder converts the interrogator signal to a DC voltage, modulates the carrier signal,and transmits pre-coded data back to the interrogator. Once the return signal from the transponder is detected, the interrogator transmits a steady carrier output to provide sustained power source for the transponder.

Active Transponders

Active transponder systems consist of:

- A battery
- A logic data generator
- A RF transmitter

In this type of system the battery is normally in a quiescent state until activated by the radio frequency transmitted by the interrogator. Once activated, the transponder uses the battery for power to transmit pre-programmed information back to the interrogator. The batteries used in this type of system typically last from 10 to 20 years.

Frequencies

The frequencies used in transponder/interrogator systems vary from very low radio wave frequencies in the area of 100 kilohertz up to the high microwave frequencies some of which exceed 900 megahertz. In general, with low frequency systems the transponders must be closer to the interrogator antenna than in high frequency systems.

- Typically 1 to 3 feet for a low frequency system.

- Typically 5 to 100 feet for a high frequency system.

The transponder antenna is built into the transponder package. In general, lower frequency transponders have larger antennas and consequently are larger in overall size. Low frequency transponders will typically range from 15 to 30 inches in length, 8 to 15 inches in width and two to 10 pounds in weight. High frequency transponders will range from 2 to 9 inches in length, 2 to 5 inches in width, and less than 1 pound in weight.

Effects of the Environment

Most of the manufacturers have ruggedized transponders available which have been engineered to minimize or eliminate the effects of the environment on the system. These transponders are not affected by:

Ambient light or darkness
Vibration
Electrical noise
Interfering signals
Temperature
Fog
Rain/water
Snow
Chemicals
Sand, coal, ballast

Microprocessor Control

The interrogator is a microprocessor controlled electronic unit used to process the identification code programmed into the transponder and pass this information on to the outside world. The interrogators receive their data via the antenna which is mounted exterior to the interrogator in a strategic location so as to be able to read the transponders. The antenna is generally connected to the interrogator by coax. On some systems, more than one antenna can be connected to one interrogator.

Size and Weight

Interrogators are generally on a rack mounted chassis and range in size from 11 to 20 inches wide, 20 to 34 inches long and 3 to 9 inches high. The combined weight of the interrogators and their antennas will generally range from 15 to

50 pounds. Also, the lower frequency systems require a larger and heavier antenna. Some interrogators are mobile and can be attached to any movable object.

System Applications

This technology could potentially be applied in an intermodal terminal, through this type of system has not yet been developed. However, several companies are looking at various aspects of the system. The following is a description of an intermodal terminal yard inventory system based on ideal conditions. Some of the issues which need to be resolved before this system can be fully implemented and some of the peripheral applications which can be developed as a result of this system are discussed below.

The ideal system is predicted upon two basic assumptions:

A. All units flowing through the intermodal terminal would be equipped with transponders.

B. Interrogators would be placed within the yard and on any lift equipment to capture the movement of units throughout the terminal:

- At the gate
- At the rail/ship entrance to the terminal
- At strategic locations within the terminal such as individual lots.

At the Gate

All traffic entering or leaving the terminal would pass by an interrogator at the gate and the initial and number of the unit would automatically be entered into the yard inventory system and be displayed to the dispatcher. Depending on whether the movement was entering the terminal or exiting the terminal, the following would be the last activity record displayed on the screen to the dispatcher as shown in Figure 1.

Crane/Piggy Packer

All equipment unloaded from a ship or rail car by a crane or from a rail car by a piggy packer would automatically be entered into the terminal yard inventory. If a pre-arrival exists, this entry will automatically retrieve the appropriate information and place it into the yard inventory.

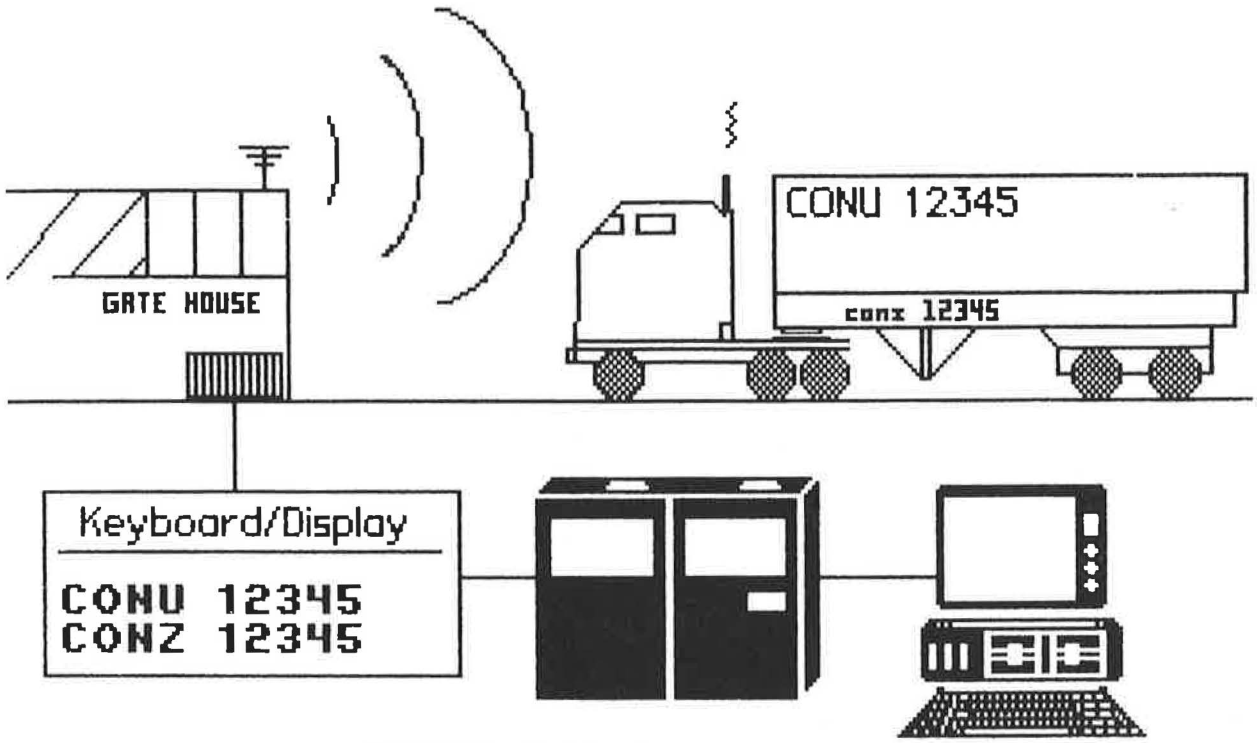

FIGURE 1. Gate house (terminal display)

All equipment loaded onto a rail car or ship would automatically be entered into the terminal yard inventory. If a pre-arrival exists, this entry will automatically retrieve the appropriate information and place it into the yard inventory.

All equipment loaded onto a rail car or ship would be automatically deleted from the inventory. An edit will be made to verify that the unit is destined outside the yard. If not, appropriate warning messages will be generated. In both cases, a computer date stamp will automatically be placed in the record.

Yard Location

Interrogators will be strategically placed in the yard to automatically detect the initial and number of each piece of equipment as it moves throughout the yard. Depending on the degree of accuracy required, interrogators could be placed at the entrance and exit points to the individual lots.

- As the equipment moves from one lot to another, the yard inventory will be automatically updated

- When drivers enter the terminal to pick up loads or empties, they will be directed to the appropriate lot

- The lot location will be automatically shown on the hostle lists

- Equipment unloaded from rail cars/ships will be directed to specific lots and can be monitored enroute to the specific lot

- When lots are at capacity, the yard inventory system will direct the equipment to different lots

- The mobile interrogator on a truck can be used to update inventory location if necessary.

Open Issues

There are several open issues that need to be resolved before a complete system of this type can be implemented:

- When a piece of equipment is lifted by a packer or crane, we need to be able to determine if that piece of equipment is entering the yard or departing the yard. When simultaneously loading and unloading, if a unit is encountered which is not in the pre-arrival inventory or the yard inventory, the computer will not be able to determine whether the unit is inbound or outbound.

- We need to determine how to handle non-tagged equipment which enters the yard. This might involve the use of magnetic serial coded transponders.

Additional opportunities can be derived from the use of a transponder/interrogator system. These include truck fuel inventory records, ramp/deramp/lift productivity records, and chassis inventory.

EXPANSION OF THE SOUTHERN PACIFIC RAILROAD'S DALLAS INTERMODAL FACILITY

BY
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Introduction

This project called for the expansion of SP's Dallas Intermodal Facility, a 30-acre freight exchange terminal a few miles south of downtown Dallas. This project can be broken down into basically three separate stages: pipeline installation and subgrade preparation, soil-cement subbase construction, and concrete pavement construction. This presentation focuses mainly on the design, the soil-cement, and concrete portions of the project.

Design

The pavement design considerations included traffic loadings and subgrade conditions. Current and projected traffic consisted of 18-wheel trucks, straddle cranes, and the side packer. Despite these heavy channelized traffic loads, we designed this intermodal paving system as a jointed plain concrete pavement using the latest Portland Cement Association design method. This method is based on non-reinforced concrete. In conjunction with the plain concrete, closer joint spacings on the order of 12 to 15 feet were used to control shrinkage cracking and to develop more efficient load transfer through tighter aggregate interlock.