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**Federal Railroad
Administration**

Research Results

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Remote Coupling and Uncoupling of Freight Cars

SUMMARY

To increase the safety of freight railroad operations, the Federal Railroad Administration (FRA) has been funding research into three distinct freight car components that can be used together to couple and uncouple freight cars remotely. These three components are tri-coupler, remote-controlled angle cock (RCAC), and remote-controlled cut-lever (RCCL).

FRA funded Sharma & Associates, Inc.(SA) to research, develop and demonstrate the three items mentioned above. These components are planned for demonstration on another FRA-sponsored project, the Advanced Concept Train (ACT). The RCACs are installed on the train. The RCCLs will be installed at the same time as the tri-couplers. The tri-coupler is undergoing field-testing and will be installed on the ACT train as soon as the field operation is verified.

The benefits of implementing these items include the ability to drop off a car in a siding, uncouple and pull away without having to physically touch a coupler, an airbrake hose, an angle cock, or a cut-lever. Conversely, a locomotive engineer can couple a train to a car or string of cars remotely from the locomotive because the tri-coupler automatically connects mechanically, pneumatically (brake pipe), and electrically (electronically-controlled pneumatic (ECP) brakes, for example). The engineer or conductor would then simply push a button on the side of the car or send a signal from the locomotive to open the angle cock on the receiving car's end to charge the brake line of the new car or string of cars. In addition, the simple fact that a trainman would not have to walk between rail cars, greatly increases the safety benefits of these products and increases efficiency of operations.

This Research Results Report includes the tri-coupler, RCAC, and RCCL in one report because of the synergy and usefulness of applying these products together.

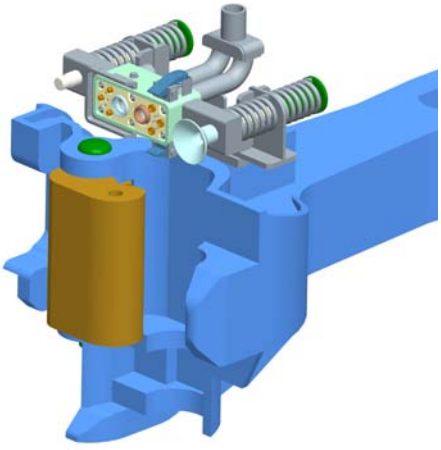

Figure 1 - CAD Model of Tri-coupler

BACKGROUND

Railroads have been coupling and uncoupling rail cars in the same manner for decades. Railroad cars have been coupled and uncoupled manually, which inherently creates risk for the operator. Therefore, a need exists to minimize this risk by physically getting the operator away from coupling operations.

FRA funded the research and development of the tri-coupler, RCAC, and RCCL with the end goal being application of these three products to increase railroad safety in coupling operations.

When uncoupling, individuals have to position themselves between two cars, grab the cut-lever and exert a force to lift the coupler's lock to allow release of the car's mechanical couplers. Subsequent to this, the air hose glad-hands automatically release upon car-to-car separation, and if brake pipe pressure exists, the hoses and glad-hands might react to the air release and can hit the individual. In this scenario, the individual is exposed to both physical stress and contact type injuries.

A need exists to manually close the angle cock on the car that will continue in the train consist. This is done to contain the needed brake pipe pressure to keep the train's brakes off for readiness of movement. The manual closing of the angle cock is done prior to the cut-lever actuation in the case that one of the cars will continue in train movement.

When coupling two cars together, an individual has to make sure the couplers are aligned and the coupler on the car to be picked up is open and ready to be coupled. Once the couplers are mechanically connected, the trainman has to go in between the cars to manually connect the air brake line, and/or the electric line in the case of ECP brakes. This action puts the individual in awkward positions and can be physically demanding. The individual then needs to slowly open the angle cock on the receiving car to allow air to flow and charge up the newly connected car.

Implementation of the tri-coupler, RCAC, and RCCL addresses all of these issues.

OBJECTIVES

Remote-Controlled Angle Cock

The RCAC design objectives are as follows:

1. Must keep all normal Association of American Railroads (AAR) functions including a manual override option;
2. Must be capable of receiving remote-controlled signals for operation;
3. Must be capable of supplying feedback information to the controller;
4. Must meet current brake pipe dimensions; and
5. Must be robust enough to handle the harsh railroad environment.

Remote-Controlled Cut-Lever

The RCCL design objectives are as follows:

1. Must keep all normal AAR manual functions, including a manual override that utilizes the standard cut-lever;
2. Must be capable of receiving remote-controlled signals for operation;
3. Must be capable of supplying lift/release feedback information to the controller; and
4. Must be robust enough to handle the harsh railroad environment.

Tri-coupler

The tri-coupler design objectives are as follows:

1. Must keep all normal AAR coupler functions;
2. Must connect mechanically, pneumatically, and electrically upon coupling;
3. Must comply to AAR specifications for vertical and lateral compliance in curves and in-train action;
4. Must be robust enough to handle the harsh railroad environment; and
5. Should include an automatic knuckle open feature that ensures the knuckle is completely open upon cut-lever lift. This maximizes the gathering range of the coupler, and thereby makes coupling operations easier.

RESULTS

Remote-Controlled Angle Cock

After much research into the suitability of commercial off the shelf equipment, SA found a valve with an electrical motor and actuator. The first version that was purchased did not have an easy way to manually override the valve. It also did not have a feedback feature. Therefore, further research ensued and the result was an angle cock that has an easy to use manual override feature and feedback lines that communicate opened/closed/unknown positions.

SA has also developed a printed circuit board interface card (PCBIC) that can interpret an electrical command and transfer it to the valve. The PCBIC is also designed to transmit feedback information from the valve for use in notifying the operator of the status of the angle cock.

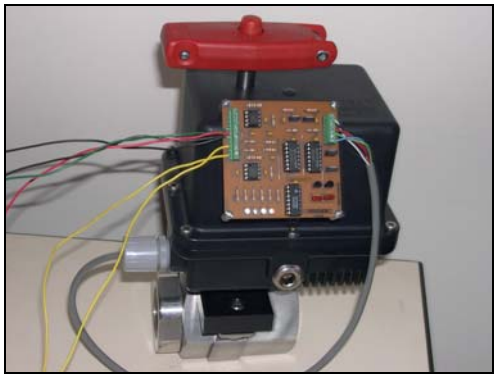

Figure 2 - Angle Cock and PCBIC

Remote-Controlled Cut-Lever

SA designed a system that uses an electrically controlled solenoid valve to direct train line air into an actuator that lifts the lock on a coupler. Care was taken to ensure that the system would work with brake pipe pressure as low as 50 psi. SA also designed a feedback system that indicates whether or not the lock is lifted (Figure 3).

Tri-coupler

The relative vertical movement between E-type couplers, when coupled, directed SA to adapt F-type couplers for tri-coupler use. The first and second versions utilized two connection pods for coupling pneumatic and electrical lines in a symmetrical fashion. Lab tests from both of these versions proved that the design was adequate. However, manufacturability and field-testing results demanded redesigns of the first version and the second version, respectively.

The current version consists of a single pod design that resides on top of the coupler. Field-testing has included using these couplers over yard track. The couplers have passed endurance coupling tests, curving tests, and in-train action tests. The couplers have had no air leakage or electrical continuity problems in yard curves about 20°, which is much tighter than seen in main-line service.

Figure 4 - Current Prototype Tri-coupler

CONCLUSIONS

Remote-Controlled Angle Cock

Eight RCACs are currently installed on the ACT consist and are ready for over-the-road in-service demonstration and testing. The final two will be installed upon completion of related control testing being done by other team members of the ACT project.

Remote-Controlled Cut-Lever

One RCCL is already installed and nine more are ready for installation on the ACT train. They will be installed with the tri-couplers. They are ready for over-the-road, in-service demonstration and testing.

Tri-coupler

Two prototype tri-couplers are ready for more extensive over-the-road testing. Once this testing is completed and operation is verified, 10 tri-couplers will be installed on the ACT train for demonstration and test.

FUTURE ACTION

Over the road testing of the Tri-coupler will occur in the near future at a participating Chicago-based railroad.

Complete application of the three products to the ACT train for demonstration and test is planned.

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