Burner / Boiler Management Systems
Linkage-less Burner Controls

Linkage-less Burner Controls are gaining acceptance in Commercial and Industrial heating applications because they reduce energy consumption in the face of rising energy costs and reduce combustion emissions. Typical energy savings resulting from these systems are in the 5 to 15% range with payback in the 6 to 18 month range. Several major gas utilities are endorsing the application of these systems, in new and retrofit applications, by offering incentives.

COMBUSTION CONTROL BASICS
The primary function of combustion control is to deliver air and fuel to the burner at a rate that satisfies the firing rate demand and at a mixture (air/fuel ratio) that pro-vides safe and efficient combustion. Insufficient air flow wastes fuel due to incomplete combustion and can cause an accumulation of combustible gases that can be ignited explosively by hot spots in the furnace. Too much air flow wastes fuel by carrying excess heat up the stack. Combustion controls are designed to achieve the optimum air/fuel ratio, while guarding against the hazard caused by insufficient air flow.

Nearly all fuel burners use a common drive motor that is connected to the driven devices such as valves and damper with linkage rods. They work fine but they don't work as well as they could.

The efficiency of a modulating burner system is maximized by keeping the air to fuel ratio to a minimum to ensure complete combustion, across the firing rate, as the heating load changes. The inherent hysterisis of mechanical systems, that have traditionally involved cams, mod-motor and linkages to set the fuel- air ratio across the firing rate of a burner, have made achieving maximum efficiency a near impossibility. Burner mechanics armed with a combustion analyzer typically set the linkages at definite positions: low fire, high fire and a few points in between. At each point, an efficiency reading is made utilizing samples of O2, CO2and CO, with the goal of achieving efficiencies in the 80 to 85%range. The process is time consuming and efficiencies measured are not repeatable through the firing rate. The process becomes more complex with multi-fuel burner systems where the burner, for example, runs natural gas and methane at different times of the year. In these cases, the linkages would need to be set every time the fuel was switched from one to the other.

Figure A shows an example of the relation of the gas valve and air damper through different firing positions of a typical natural gas burner. In the example, we show that although the valve position may be linear with respect to the increasing load, the damper position is not. The burner mechanic is left with attempting to "finesse" the relationship between the gas valve position and that of the air damper. Burner efficiency is compromised.

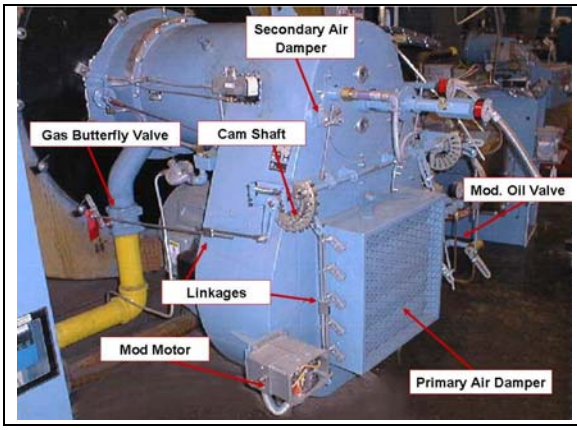
LINKAGE-LESS

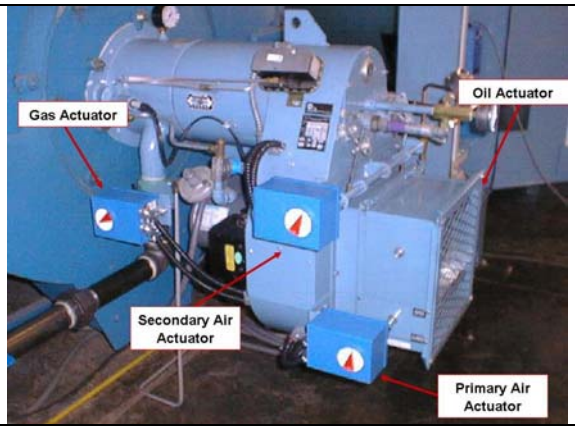
Boilers are more efficient and thus less costly to operate when the burner runs as well as it can. Several firms have developed microprocessor controlled burners that utilize servomotors to position vales and dampers.
New Linkage-less burner systems remove mechanical linkages and mod-motors and replace them with servomotors and microprocessors. With these systems, many more points of O2, CO2, and CO are measured and stored in a control which “memorizes” the position the of servo-motors at maximum efficiency across the firing rate. The positions and therefore the efficiency is infinitely repeatable and removes the guess work of setting the mechanical linkages.

Figure B shows how the savings between linkage-less and traditional mechanical systems. Energy saving estimates can be made by making reasonable assumptions about how long and at what efficiency the burner was running at various loads. More accurate estimates can be made by utilizing energy savings software available from linkage-less burner control manufacturers.

LINKAGE-LESS BURNER EXAMPLE

Figures C and D below show a burner before and after being retrofitted with a linkeage-less system





BEFORE AFTER

In the example, the actuators and linkage is gone, replaced with independent servomotors. There is no hysteresis so no compromise in set up and there is no mid-range efficiency problem since there are many points in the “fuel curve.” The positions of the valve and damper servo motor are saved in a controller resulting in efficiencies which are infinitely repeatable.

Considerable fuel savings in the 5 to 15% range can be expected for Linkage-less burner systems. As fuel costs increase and pressure mounts for reducing combustion emissions, customers are looking at linkage-less systems as an Energy Conservation Measure.

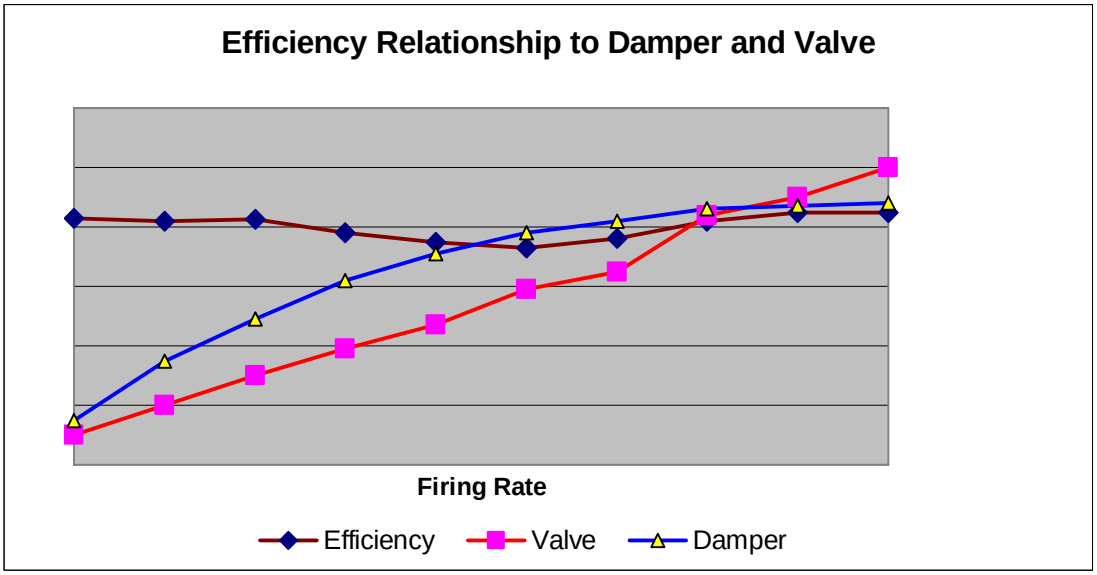


Figure A Above

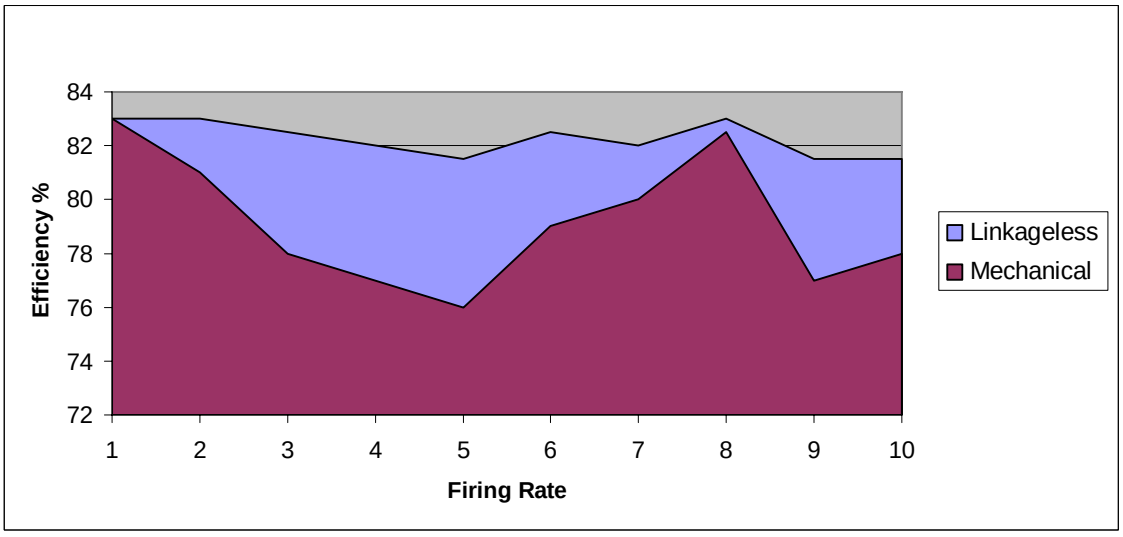


Figure B above